Traffic Bridge Needs Assessment and Functional Planning Study Final Report

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Executive Summary

In May 2010 the City of Saskatoon commissioned Stantec Consulting Ltd. and Fast Consulting to conduct a Needs Assessment and Functional Planning Study of the Traffic Bridge. This study involved developing options for the future of the Traffic Bridge and its potential to accommodate a variety of pedestrian, cyclist, transit, vehicular and community functions. The scope of work included:

- An assessment of current traffic conditions;
- An assessment of current structural conditions;
- A review of the heritage significance;
- An analysis of future traffic conditions;
- Development of preliminary options; and
- An analysis of the preferred options.

The project also included an extensive stakeholder consultation and public participation program, including three public open houses and on-line forums, to ensure that the public was given an opportunity to express their views and help guide the development of potential alternatives.

Originally built in 1907, the Traffic Bridge was Saskatoon's first bridge to carry vehicular traffic. The Traffic Bridge was designed as a 5-span Parker through truss, and came into being when residents of the Village of Nutana agreed to merge with the Town of Saskatoon and the Village of Riversdale to form the City of Saskatoon. The heritage value of the Traffic Bridge resides in the following character-defining elements:

- Those elements which speak to its status as a landmark in the community, including its form and massing and its location on its original site;
- Those elements that reflect the property's engineering technology, such as the Steel truss architecture; and
- Those elements that reflect the development of Saskatchewan's early concrete quality-control testing methods as demonstrated by the original large concrete piers and abutments.[1]

An analysis of future traffic conditions on the Buckwold, Traffic and Broadway Bridges was undertaken for the 2029 planning horizon at which time Saskatoon is projected to have a population of 300,000. This analysis was undertaken to determine the traffic advantages and disadvantages of the following four generalized treatment options:

1 "Statement of Heritage Significance: Traffic (Victoria or 19th Street) Bridge, Saskatoon", Ross Herrington, written for the Heritage Resources Branch, Province of Saskatchewan, March 2, 2008.

- Existing Traffic Bridge with narrow lanes;
- Two lane bridge with standard width lanes;
- Four lane bridge with standard width lanes; and
- Bridge closed to vehicular traffic.

The traffic analysis provided the following findings:

- **Existing Bridge –** Traffic on the Buckwold, Traffic and Broadway Bridges will operate under acceptable conditions during the weekday morning and afternoon peak hours at the 2029 planning horizon. Some traffic movements at the intersection of Broadway Avenue/12th Street (top of the Broadway Bridge) may experience long delays and queue lengths which may result in unstable traffic flow.

- **Two Lane Bridge with Standard Width Lanes –** Traffic conditions on the Buckwold, Traffic and Broadway Bridges will operate marginally better during the weekday morning and afternoon peak hours at the 2029 planning horizon.

- **Four Lane Bridge with Standard Width Lanes –** Traffic conditions on the Buckwold and Broadway Bridges improve slightly under this option as traffic is attracted away from these corridors to the Traffic Bridge. Due to increased traffic the intersection of 3rd Avenue/19th Street (on the north side of the Traffic Bridge) experiences increased delays, queue lengths and will experience unstable traffic flow.

- **Traffic Bridge Closed to Vehicles –** Traffic conditions at the intersection of Broadway Avenue/12th Street experience increased delays and queue lengths with some movements operating at an unstable/low level of service. During periods when movements on other bridges are restricted for maintenance unstable traffic flow may occur.

The public participation process included three open houses and an online forum was developed to obtain effective community engagement that was inclusive to all, providing a balance of information regarding the project and effective means of capturing public sentiment.

Approximately 250 to 300 people attended the first open house on June 22, 2010. Approximately 125 persons attending the open house completed comment forms, and another 420 people responded to the survey at the online community forum open until mid July. From this input it was noted that the majority of respondents would like to see the Traffic Bridge rehabilitated. In terms of how the bridge should be rehabilitated, respondents were divided between a pedestrian/cyclist bridge only or rehabilitating the existing bridge to its current usage which includes vehicular traffic as well as pedestrian and cyclists. A small percentage of respondents would like a new bridge and very few support demolition of the existing bridge with no replacement. There was also limited support for rehabilitating the bridge for transit.

After the first open house, ten preliminary options based on the results of the traffic analysis, structural analysis, and the public consultation were developed. These options included:

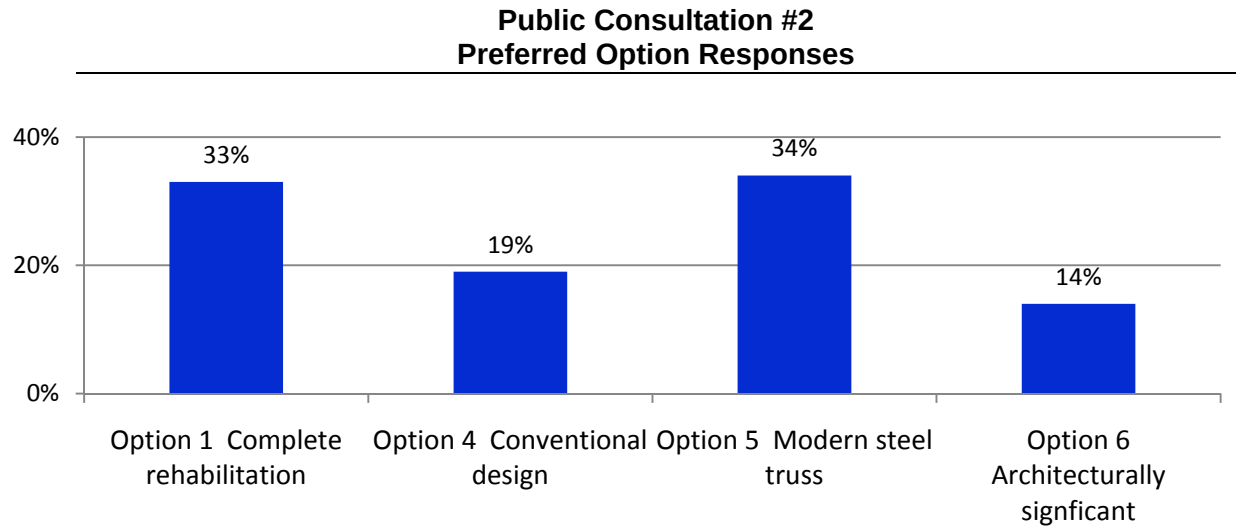
1. Complete rehabilitation for vehicle, pedestrian and cyclist use;
2. Complete rehabilitation for pedestrian and cyclist use only;
3. Complete rehabilitation for pedestrian and cyclist use only, a “bridge park”;
4. Replace with a conventional structure for vehicle, pedestrian and cyclist use;
5. Replace with modern steel truss for vehicle, pedestrian and cyclist use;
6. Replace with a “modern signature bridge” for vehicle, pedestrian and cyclist use;
7. Replace with a conventional structure for pedestrian and cyclist use only;
8. Replace with a conventional structure with aesthetic features for pedestrian and cyclists only;
9. Replace with a “modern signature bridge” for pedestrian and cyclist use only; and
10. Demolish and remove with no replacement.

It was intended that the above options would be presented to the public at a second open house and through the online forum in September 2010.

A comprehensive structural inspection and an updated load analysis of the Traffic Bridge were performed in late August 2010. The inspection revealed that the rate of corrosion that occurred since the last inspection in 2005 had been higher than anticipated. Several components of the bridge that were not identified as being in poor condition in 2005 were found to be in a very advanced state of corrosion. Due to these factors the structural integrity of the bridge became highly questionable and the decision was made to immediately close the bridge to both vehicles and pedestrians. The condition of some critical elements was so poor that there could be no certainty that the bridge would support its own weight within an acceptable margin of safety.

The unexpected closure of the Traffic Bridge on August 24th 2010, coupled with the reduction in capacity of the Buckwold Bridge due to maintenance, reinforced the significance and value of the Traffic Bridge for vehicles, pedestrians, and cyclists. As such, the above options that included pedestrian/cyclist only and complete demolition were removed from further consideration. Therefore, only above Options 1, 4, 5 and 6 were taken forward from this point.

The second public open house was held on September 15, 2010. At this open house the public was asked to provide input on the four remaining options: rehabilitation of the existing bridge; replacement with a modern steel truss bridge; replacement with a conventional bridge; and replacement with a signature bridge. Comment forms were filled out by 360 of the more than 400 people who attended the open house. In addition, over 600 people responded to the survey posted on the online forum. The results of the “which is your preferred option” question is shown below:



After the second open house, Options 1, 4, 5 and 6 were revisited and revised based on the qualitative community input received. Option 1 was carried forward to the next phase of the project. Option 4 was carried forward with the potential for enhanced aesthetics. Option 5 was carried forward with the potential of providing increased lane widths. Option 6 was dropped from further consideration. Options 1, 4 and 5 were refined to a higher level of detail to establish more accurate opinions of cost, and to refine the renderings to present a truer picture of each option. The following describes each option:

Option 1

- Complete rehabilitation for vehicle, pedestrian and cyclist use.
- Maintaining existing form and function, providing **2.9m** traffic lanes and **3.0m** pedestrian/cyclist walkways on each side.
- Where possible existing heritage aspects are preserved.
- Bridge finish will consist of a painted steel truss.
- 80 year design life.
- Capital Costs = **$24M-$34M**.
- Operating Cost = **$150,000/year**.
- Time to Construct = **24-36** months.

Option 4

- Replace with a modern structure for vehicle, pedestrian and cyclist use.
- Structure would provide 3.7m traffic lanes, 1.5m shoulders/cyclist lanes, and 3.0m pedestrian/cyclist walkways.
- Aesthetic details and finish depend on budget.
- 80 year design life.
- Capital Costs = **$26M - $35M**.
- Operating Cost = **$16,000/year**.
- Time to Construct = **18-24** months.

Option 5

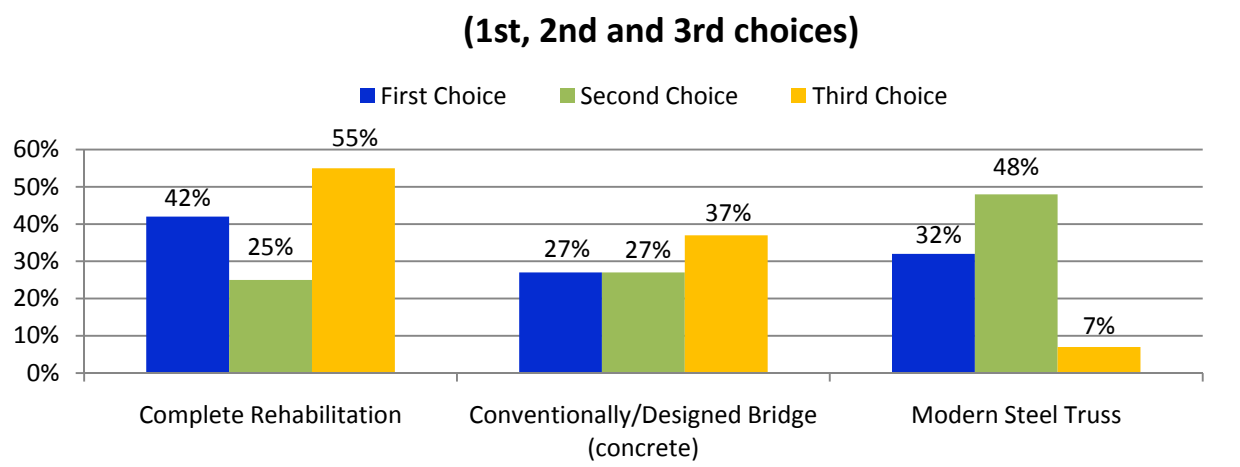
- Replace with a modern steel truss of similar form to the existing bridge for vehicle, pedestrian and cyclist use.
- The structure would consist of weathering steel.
- The bridge could be designed with wider lane widths as follows:

Option	Traffic Lane	Pedestrian/ Cyclist	Shoulder/ Cyclist	*Capital Cost*
5A	3.3m	3.0m	-	$25M-$33M
5B	3.7m	3.0m	-	$27-$34M
5C	3.7m	3.0m	1.5m	$29-$37M

- 80 year design life.
- Operating Cost = **$15,000 - $20,000/year**.
- Time to Construct = **18-24** months.

The above Options were presented at a third open house held on October 20, 2010. Approximately 150 people attended the open house, of which 105 completed comment forms. Another 180 people completed the on-line survey. The feedback provided in terms of preferred option is summarized below:

Public Consultation #3
Preferred Option Responses



Based on the public consultation process, traffic analysis and structural analysis, the final three options each represent a viable solution for the future of the Traffic Bridge. As such each option maintains its own unique set of opportunities to form part of Saskatoon's future.

Option 1 – Rehabilitate Existing Bridge

Members of the public that prefer Option 1 value the heritage and character of the existing bridge. They generally do not want to compromise these features by building a new structure. Option 1 preserves the heritage of the bridge for future generations. It maintains its existing narrow traffic lanes which also act as a traffic calming measure thus keeping traffic on this bridge and on Victoria Avenue relatively low. Option 1 is a viable option. Of all the options presented, Option 1 includes the most risk and uncertainty in terms of construction, schedule and cost. Option 1 has the highest annual maintenance cost of all options due to the need for ongoing re-painting.

Elements such as safety, convenience, linkage, tourism and traffic calming (from keeping narrow lanes) are important to people relative to rehabilitating the existing bridge. Values that supporters of Option 1 attach to the existing bridge, and that run through much of the feedback from the first open house: include linkage of the City's present with its past; and the pivotal role that Saskatoon's first bridge played in amalgamating Saskatoon, Nutana and Riversdale; as well as the sense of 'character', 'authenticity' and 'human scale' that the bridge encapsulates for them.

Option 4 – Conventional Bridge

The key issue for open house and online participants who prefer Option 4 is function. They want a new bridge with wider lanes to handle Saskatoon's growing traffic volumes, they want it built inexpensively and quickly and they see this option as fulfilling those needs. It appears to be a common perception among the public that the conventional option will be the fastest to build. Some participants describe this choice as 'putting their emotions aside' regarding rehabilitating the existing bridge and making what they see as the most practical choice.

Option 4 could be expanded to include the possibility of a "modern signature bridge". Option 4 in its base scenario will have relatively low maintenance costs, less risk, and a short construction period.

Option 5 – Modern Steel Truss Bridge

Supporters of Option 5 feel that it provides the best compromise between preserving the heritage feel and memory of the existing bridge, and the overall look of the riverscape. For them it offers the best of both worlds – the look of the original bridge with better functionality from wider lanes and longer life expectancy. They also see this option as being more accommodating for pedestrians and cyclists as a result of wider lanes on the bridge as well as on the sidewalks.

They tend to have strong attachments to the visual profile of the bridge. Option 5 has the potential to provide a wider variety of lane widths. The bridge will maintain the existing profile but will differ in the type of members and finish as Option 5 consists of weathering steel which will require less maintenance costs in the future. Option 5 will have relatively less risk, and a short construction period.

Conclusions

At the end of the third round of public consultation, the results from participants that attended the open house or the online community forum and that indicated their option preference in the comment forms available at both, suggest that they are divided between preference for rehabilitating the existing bridge (42%), replacing the bridge with a conventional (concrete) design (27%) and replacement with a modern steel truss (32%). These quantified results are an aggregate summary of the opinions of the people attending the pubic and online forums.

Supporters of rehabilitating the existing bridge emphasize the importance of a safe bridge that accommodates vehicles, pedestrians and cyclists, but also one that stands as a reflection of the link to the core of Saskatoon's heritage, the downtown and River Landing. Supporters of the replacement bridge options also indicate their priorities are for a bridge that provides safe, easy access to cross the river for vehicles, pedestrians and cyclists, as well as a somewhat quicker build time and lower maintenance costs.

In summary, each of the three options has a significant contingent of community support. All three options address City Council's directive that vehicular, cycling and pedestrian traffic

modes all be accommodated. The main differences between the options lie in the estimated capital and operating costs, the heritage value, level of function, and aesthetics.

1.0 Introduction

In May 2010 the City of Saskatoon commissioned Stantec Consulting Ltd. and Fast Consulting to conduct a Needs Assessment and Functional Planning Study of the Traffic Bridge. This study involved developing options for the future of the Traffic Bridge and its potential to accommodate a variety of pedestrian, cyclist, transit, vehicular and community functions. The scope of work included:

- An assessment of current traffic conditions;
- An assessment of current structural conditions;
- A review of the heritage significance;
- An analysis of future traffic conditions;
- Development of preliminary options; and,
- An analysis of the preferred options.

The project also included an extensive stakeholder consultation and public participation program, including three public open houses, to ensure that the public was given an opportunity to express their views and help guide the development of potential alternatives.

1.1 BACKGROUND

Originally built in 1907, the Traffic Bridge was Saskatoon's first to carry vehicular traffic (shown in Figure 1.1). It was originally built for horses and carriages to cross, and later cars and buggies. Prior to construction, the only way to cross the South Saskatchewan River was on an unreliable ferry or a difficult walk across the QLLS (later CNR) railway bridge which crossed the river at the location of the current Sid Buckwold Bridge. Designed as a 5-span Parker through truss, the Traffic Bridge came into being when residents of Nutana agreed to merge with the town of Saskatoon and the village of Riversdale to form the City of Saskatoon. The 1.5 metre-wide pedestrian walkway was added on the upstream side of the bridge in 1908. In 1961, the southern end of the bridge was raised to reduce the slope on Victoria Avenue and to improve traffic flow, allowing Saskatchewan Crescent to pass underneath the bridge.

Beginning in the 1980s, the bridge started to show its age and needed to be closed periodically for refurbishment. The first major upgrade occurred when a City street sweeper punched through the timber deck. This localized failure precipitated the first of a series of repairs and engineering analysis to the structure required to ensure public safety. Initial assessments completed in the late 80's indicated that significant coating and structural upgrades were required for the structure to remain functional. Some of the upgrades were completed related to bearing replacements and expansion joint modifications. However, major upgrades related to the deck and truss coatings were delayed as the belief at the time was that once the South River Crossing was completed that this structure would no longer be required for traffic purposes. Therefore, based on this approach, minimal work was scheduled for the bridge,

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Stantec

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Client/Project
CITY OF SASKATOON
TRAFFIC BRIDGE NEEDS ASSESSMENT
AND FUNCTIONAL PLANNING STUDY

Figure No.
1.1

Title
TRAFFIC BRIDGE PHOTOGRAPHS

however, inspection frequency was increased so that any major issues with the bridge could be identified and repaired while maintaining public safety.

During a routine annual inspection in 2005, the bridge was found to have major structural defects related to corrosion and section loss of the main truss elements. The bridge was immediately closed to traffic and repair work was planned and performed to upgrade the trusses. Additional studies were performed to determine if the sub-structure components were adequate for the intended loads given that the trusses were planned to be restored. This study revealed that the piers were in adequate shape and would remain so for the duration of the truss repair life. However, engineering studies completed at the time indicated that while the trusses had been restored, that due to the age of the bridge other components may require repair the most notable of which was the timber deck which was beginning to show signs of localized failure due to wood rot. After the repairs completed in 2006, the structure has performed safely until August 2010.

The Traffic Bridge served as a “neighbourhood” bridge carrying approximately 7,000 vehicles per day. However, the Traffic Bridge is a critical by-pass route or “release valve” when other nearby bridges are closed or under reduced capacity due to repairs and maintenance. The Traffic Bridge also forms part of a very important pedestrian and cyclist linkage crossing the South Saskatchewan River connecting the community of Nutana with Saskatoon’s River Landing. With the deteriorating superstructure of the existing bridge in disrepair, the need to plan for the future is evident.

1.2 STUDY SCOPE AND OBJECTIVES

As identified in the project Terms of Reference (Appendix A), the scope of this study is to assess the current Traffic Bridge and establish technically feasible alternatives for a City of Saskatoon population of 300,000.

The study is comprised of three workstreams as follows:

Project Visioning – This process was key in identifying possible opportunities and challenges, and developing project goals that are reflective of not only transportation needs, but also of community values. It also allowed the development of design criteria that are context sensitive uniquely to Saskatoon. The Project Visioning workstream included the following:

- Existing Traffic Conditions Assessment;
- Existing Structural Conditions Assessment;
- Review of Heritage/Historical Significance; and
- Extensive Public Consultation.

Concept Development – Data gathered from the initial traffic assessment, structural assessment and heritage assessment in concert with community needs and values established at the initial open house formed the basis of preliminary options. The Concept Development workstream included the following:

- Traffic Analysis of Future Conditions;
- Development of Preliminary Options; and
- Extensive Public Consultation.

Preferred Option Analysis – Upon the completion of the above workstream, the initial options presented were short-listed and revised based on the feedback and suggestions of the community. At this stage of the process further analysis was completed on each of the remaining options to obtain workable engineered solutions. The preferred options were then presented for further feedback to be incorporated into any future detail design activities. The Preferred Option Analysis workstream included the following:

- Preferred Option Analysis; and
- Extensive Public Consultation.

Findings of the above workstreams including the qualitative and quantitative public consultation for each of the preferred options are then summarized in this report.

2.0 Project Visioning

Project Visioning is founded on wholly understanding the existing conditions and challenges that the Traffic Bridge faces. The project goals in this stage should range across the board and take in many aspects of the context sensitive design, namely: mobility, safety, economic revitalization, creating/maintaining a sense of place, enhancing transit service, enhancing cyclist facilities, aesthetics, facilitating pedestrian circulation etc. Identifying the right goals and challenges to be addressed from the beginning is essential to a successful project outcome.

2.1 TRAFFIC ANALYSIS

The Traffic Bridge crosses the South Saskatchewan River connecting Victoria Avenue to 3rd Avenue in Downtown Saskatoon. Figure 2.1 illustrates the roadway network adjacent to the Traffic Bridge. The detailed traffic analysis is included in Appendix B.

Traffic analysis was completed for key intersections and roadways within the study area as shown in Figure 2.1. Traffic analysis was completed at this stage to understand the current and future limitations and opportunities surrounding the Traffic Bridge now and as Saskatoon moves forward. To establish these boundaries traffic analysis was conducted for the weekday AM and PM peak hours for the following scenarios:

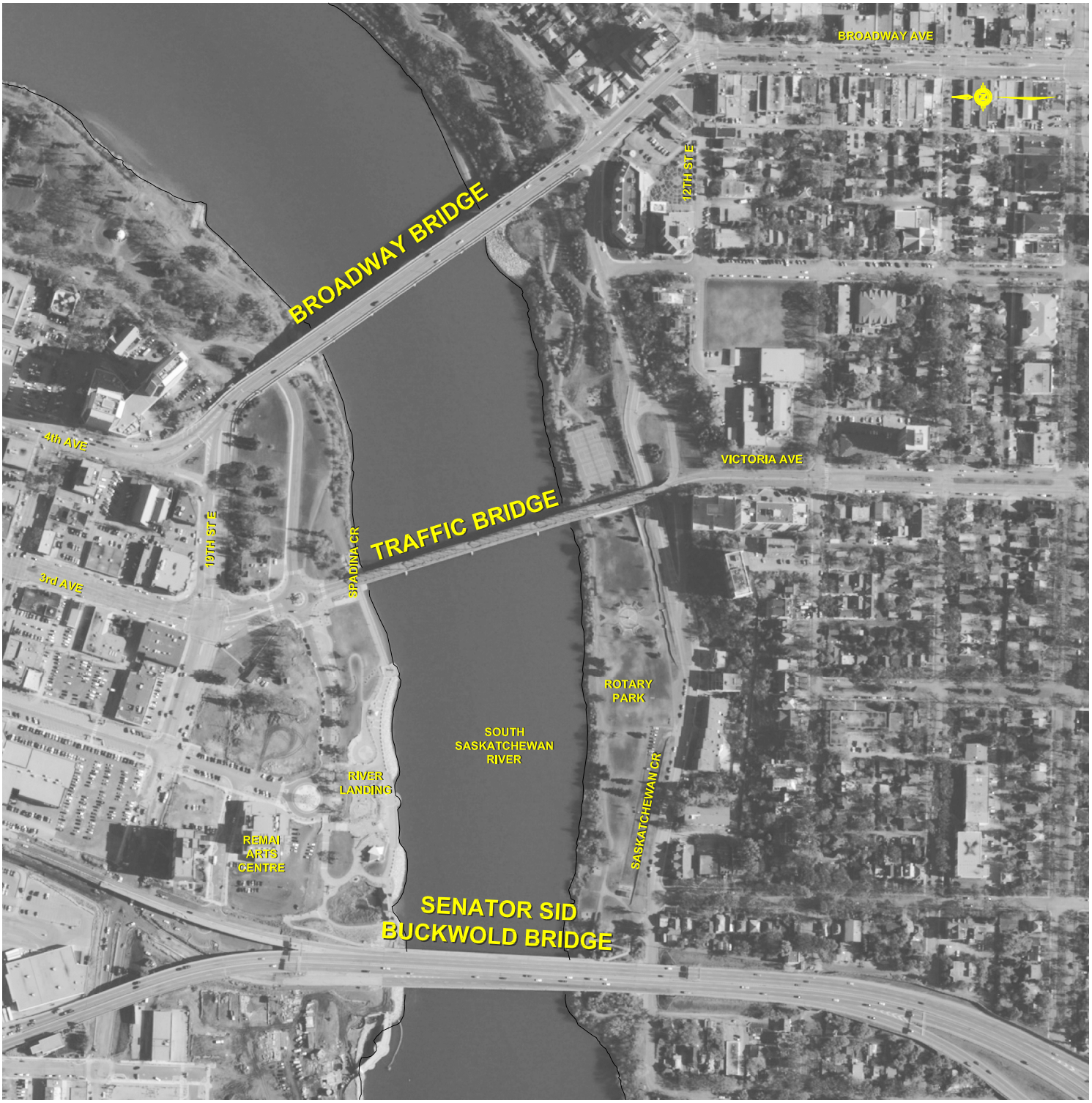
- 2010 Conditions with Traffic Bridge;
- 2029 Conditions with Traffic Bridge;
- 2029 Conditions without Traffic Bridge;
- 2029 Conditions with full width two lane Bridge; and
- 2029 Conditions with four lane Bridge.

2.1.1 Conclusions

The following conclusions are based on the completed analysis:

- **Existing Bridge –** Traffic on the Buckwold, Traffic and Broadway Bridges will operate under acceptable conditions during the weekday morning and afternoon peak hours at the 2029 planning horizon. Some traffic movements at the intersection of Broadway Avenue/12th Street (top of the Broadway Bridge) may experience long delays and queue lengths which may result in unstable traffic flow.

- **Two Lane Bridge with Standard Width Lanes –** Traffic conditions on the Buckwold, Traffic and Broadway Bridges will operate marginally better during the weekday morning and afternoon peak hours at the 2029 planning horizon.



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Stantec

Client/Project
CITY OF SASKATOON
TRAFFIC BRIDGE NEEDS ASSESSMENT
AND FUNCTIONAL PLANNING STUDY

Figure No.
2.1

Title
ROADWAY NETWORK

- **Four Lane Bridge with Standard Width Lanes –** Traffic conditions on the Buckwold and Broadway Bridges improve slightly under this option as traffic is attracted away from these corridors to the Traffic Bridge. Due to increased traffic the intersection of 3rd Avenue/19th Street (on the north side of the Traffic Bridge) experiences increased delays, queue lengths and will experience unstable traffic flow.

- **Traffic Bridge Closed to Vehicles –** Traffic conditions at the intersection of Broadway Avenue/12th Street experience increased delays and queue lengths with some movements operating at an unstable/low level of service. During periods when movements on other bridges are restricted for maintenance unstable traffic flow may occur.

2.2 EXISTING STRUCTURAL CONDITIONS

Past investigations of the Traffic Bridge were carried out in 1986, 1991, 1995, 2002, and 2005. A summary of past repairs and maintenance is as follows:

- 1960 – Raised south spans, replaced original abutments and installed timber approach spans
- 1978/79 – New coatings on truss bottom chords and steel deck support members
- 1985 – New exterior deck stringers and timber deck repairs in isolated locations
- 1992 – New steel traffic guardrails and pedestrian handrail on walkway
- 1995 – New concrete bearing pedestals, bearings, expansion joints and local repair of damaged truss members from collisions
- 1995 – New timber sidewalk
- 1996 – Pile upgrades in timber approaches
- 2001 – Asphalt wearing surface replaced
- 2003 – Repair of impact damaged bottom chord members over Sask. Crescent
- 2006 – Bottom chord and panel point strengthening

A detailed structural inspection of the Traffic Bridge was performed on all components of the bridge by Stantec personnel during the week of August 23, 2010. This inspection was part of a separate project that included a detailed inspection of the bridge and an updated load rating analysis. Professional climber bridge inspectors from the Stantec office in Denver, Colorado were brought to Saskatoon to undertake the most exhaustive inspection ever performed on the Traffic Bridge below the deck. Great efforts were utilized to remove debris and rust buildup on the structural steel members in order to collect the most complete inspection data on the bridge to date.

Although a visual inspection of the bridge is performed annually, the last comprehensive inspection of the bridge that employed climbers was in 2005. Among the conclusions of the 2005 inspection were that the bottom chords of the trusses had experienced very significant material losses due to corrosion and all of the steel below the deck had experienced severe coating loss and were undergoing significant deterioration from corrosion. A load rating analysis of the bridge determined that several immediate steel repairs were required before the bridge

could be returned to service. Conversely, the existing piers were found to be in relatively good condition and even had reserve capacity for additional loading.

A repair plan was designed by Wardrop Engineering Inc. and implemented in 2006 that would allow the bridge to reopen. Based on the information from the 2005 inspection and the anticipated rate of corrosion, the repairs were expected to extend the life of the bridge for another twenty years.

During the course of the 2010 inspection, it was immediately clear that the rate of corrosion that was occurring since 2005 had been higher than anticipated. Also, several elements of the bridge that were not identified in 2005 as being in poor condition were found to be in a very advanced state of corrosion. As a result, the structural integrity of the bridge became highly questionable and the decision was made to close the bridge to both vehicles and pedestrians. The condition of some critical elements was so poor that there could be no certainty that the bridge could even support its own weight within an acceptable margin of safety.

A load rating calculation of the structure was then performed using the information obtained from the 2010 inspection. The analysis concluded that there were many critical elements of the bridge that no longer had sufficient structural capacity to carry the bridge traffic/pedestrian loading and there were other elements that did not have sufficient structural capacity to carry the self-weight of the bridge within an acceptable margin of safety. Thus, the analysis justified the closure of the bridge in the interest of public safety.

The following is a summary of the recommendations from the detailed inspection and analysis report. The full body of the report can be found in Appendix C. It should be noted that the results from the structural assessment were not available at the start of the public consultation process.

- All vehicle and pedestrian loads must remain off the structure until repairs are completed.
- Temporary shoring must be installed on the trusses over the Meewasin Valley trail and the Saskatchewan Crescent East or the traffic accommodated by these facilities must be directed to alternate accesses.
- If the repairs are implemented, the extent of repair must be increased to address all components of the bridge. At this time, we believe that the only viable future option for this structure is to either replace the bridge with a new facility or to completely remove the lower portions of the truss and the entire deck structure system and replace with new.

2.3 HERITAGE SIGNIFICANCE[1]

The heritage value of the Traffic Bridge lies in its status as a prominent feature of Saskatoon's urban landscape and an important community landmark. This structure was the first vehicle bridge over the South Saskatchewan River within Saskatchewan and was the catalyst in the creation of the Saskatoon Board of Trade and Saskatoon itself. In 1905, the Town of Saskatoon proposed to the Villages of Nutana and Riversdale that the three communities amalgamate to

[1] "Statement of Heritage Significance: Traffic (Victoria or 19th Street) Bridge, Saskatoon", Ross Herrington, written for the Heritage Resources Branch, Province of Saskatchewan, March 2, 2008.

become a city. Nutana ratepayers insisted that a traffic bridge across the river be built as soon as possible otherwise they saw no benefit to amalgamation. Funding of the bridge was approved at the first session of the provincial legislature in 1905 when Saskatchewan became a province. Without this bridge, the city of Saskatoon could not have developed as quickly as it did.

The heritage value of the structure also resides in its technology. The bridge was constructed in 1907 from plans provided by the Canadian Bridge Company. It is the oldest surviving steel Parker through-truss in the province and at the time of construction, it was the longest purely traffic bridge in existence in either Saskatchewan or Alberta. Steel through-trusses made their appearance in Saskatchewan in 1900 and represented a significant engineering advance over earlier timber bridge structures. The structure remains largely unchanged and except for short periods for rehabilitation, the bridge has been in continual use by vehicles and pedestrians since its completion in 1907.

The heritage value of the bridge is also connected to the establishment of a scientifically-based, cement-testing laboratory by the provincial government. Previously, contractors supplied their own cement and there were no quality control procedures in place. This testing facility ensured that only first-class cement would be used in future provincially-funded projects, including the replacement of piles under steel bridges with concrete piers, and the construction of many public buildings throughout the province.

[In summary] the heritage value of the Traffic Bridge resides in the following character-defining elements:

- Those elements which speak to its status as a landmark in the community, including its form and massing and its location on its original site;
- Those elements that reflect the property's engineering technology, such as being the Steel truss architecture; and
- Those elements that reflect the development of Saskatchewan's early concrete quality-control testing methods as demonstrated by the original large concrete piers and abutments.

2.4 PUBLIC CONSULTATION #1 SUMMARY

On June 22nd, 2010 Fast Consulting and Stantec organized and facilitated the first of three public consultations at Nutana Collegiate Library. Saskatoon residents were able to attend the come and go open-house between 6:00pm and 9:00pm. There was representation at the open-house from Stantec and the City of Saskatoon to help answer any questions about the Traffic Bridge, while Fast Consulting was there to facilitate the process. Additional information regarding the public consultation and community engagement can be found in "Public Consultation Summary" completed by Fast Consulting in Appendix D.

The initial open-house was facilitated to obtain effective community engagement with regards to the future of the Traffic Bridge. An estimated 250 to 300 people attended the open-house; approximately 125 people completed the on-site survey and comment sheet.

In addition to the open-house, an online community forum was developed to mobilize a broad range of opinions and engage as large a group of the public as possible. The online community forum was available from June 23rd, 2010 and extended to the end of July. It hosted comments and views from approximately 240 visitors. In addition to these comments, approximately 420 surveys were also completed at the online forum, which demonstrated the success of this forum as a means of providing an access point for people to share their opinions on their own schedule/time.

From the first of three public consultations around the Traffic Bridge - it was clear that the majority of people from the public open-house and respondents to the survey hosted as part of the online community forum discussion wanted to see the existing Traffic Bridge rehabilitated.

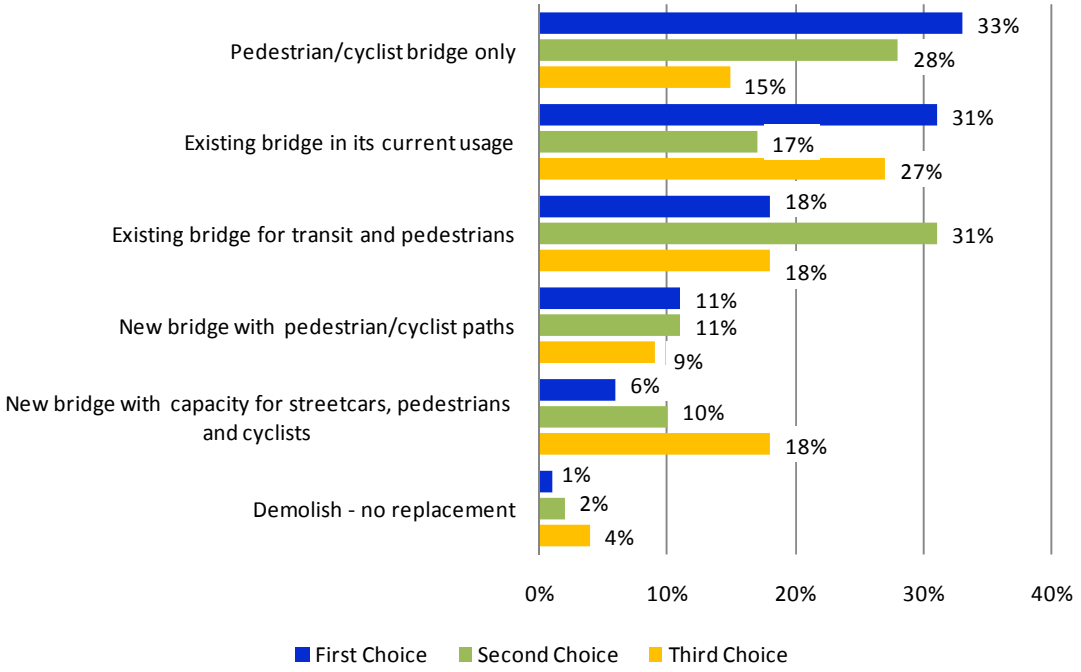
There are rational elements such as safety, convenience, linkage and tourism that people expressed as important to them relative to keeping the existing bridge. Convenience references the access the bridge provides to the city's downtown core as well as River Landing, the Farmer's Market, Persephone Theatre, Meewasin Trail, etc. Regular users of the Traffic Bridge were proportionately overrepresented in the open house and online community forum survey results, so for many residents the Traffic Bridge is also a convenience for them relative to where they live[2].

There are also emotional values that run through much of the feedback from the first open house: linkage of the City's present with its past and the pivotal role that Saskatoon's first bridge played in amalgamating the towns of Saskatoon, Nutana and Riversdale. There is, for many of the participants in the first open-house and online forum, a sense of 'character' that the bridge encapsulates for them. Comments around the character of the bridge differ from heritage comments in that they speak to the individuality of the Traffic Bridge, its rare truss construction and 'authenticity', its 'human scale' as a result of being so close to the water of the river it spans, and the quirkiness of its narrow road lanes and the memories that people associate with the experience of driving on it. The emotional values that people attach to the Bridge, subscribe to an inherent desire to see it remain part of the cityscape.

People attending the first open house and online forum were divided on the issue of how the bridge should be rehabilitated. For about a third of the participants at the first open house, the first choice would be for a pedestrian/cyclist bridge only. Another third of participants, however, said their first choice would be to rehabilitate the existing bridge in its current usage and that the City cannot ignore that vehicles are an important mode of transport even as we try to encourage more walking and cycling. Results from the preliminary list of options to be investigated are shown below in Figure 2.2.

[2] 44% of the people that attended the pubic open-house at Nutana Collegiate and 36% of respondents to the online survey option indicate that they used the Traffic Bridge on a daily basis.

Public Consultation #1 – Figure 2.2
Preferred Option Responses



3.0 Development of Options

With data gathered from the initial traffic assessment, structural assessment and heritage assessment and with direction from the community needs and values, Stantec developed ten preliminary concepts. The concepts represent an array of different forms, and functions of the future of the bridge incorporating existing and new structures, with traffic/pedestrian/cyclist and pedestrian/cyclist only user groups.

It was during this phase of the process that the concurrent structural inspection of the Traffic Bridge recommended closure of the bridge to vehicular and pedestrian travel both on and under the existing bridge. On August 24th 2010 the Traffic Bridge was indefinitely closed. During this same time period, bridge deck maintenance had reduced capacity on the Buckwold Bridge, increasing traffic volumes and delays on the remaining Broadway Bridge.

Traffic analysis completed above coupled with feedback from the public led to the development of options that featured the closure of the Traffic Bridge to vehicular traffic. Again, the traffic analysis completed above for the future conditions of the Traffic Bridge and the various generalized options were considered for the average weekday operating conditions and do not represent conditions when other bridges are at reduced capacity.

Preliminary opinions of cost at this stage were considered to be order of magnitude costing and were developed based on the preliminary understanding of each option. These estimates were intended to provide a means to compare the relative costs of each option so that it could clearly be seen which options would be expected to be of similar costs and which options would be significantly higher or lower cost than the others.

3.1 PRELIMINARY OPTION DESCRIPTIONS

The following section briefly outlines the main attributes of each of the 10 preliminary options that were developed in this Phase. All options described below utilize the existing piers of the Traffic Bridge and cost estimates include the rehabilitation of these piers.

3.1.1 Option 1

Option 1 features complete rehabilitation of the existing Traffic Bridge for vehicular, pedestrian, and cyclist use. The bridge will be maintained in its existing form and function providing narrow traffic lanes (2.9 m). The existing 1.5 m pedestrian walkway on the west side of the bridge will be replaced by standard 3.0 m walkways on each side. All heritage aspects of the existing structure will be preserved if possible and new elements will be constructed in likeness of the existing elements. The preliminary opinion of probable cost for this option is $27 M. Option 1 is shown in Figure 3.1.

Option 1 - Rehabilitation With Vehicular Bridge

Description

- Complete rehabilitation for vehicle, pedestrian and cyclist use: Maintain the bridge in its existing form and function, providing narrow traffic lanes but replace the existing separate pedestrian walkway on the west side of the bridge with two standard width walkways on both sides.
- All heritage aspects of the existing structure are preserved if possible and new elements are constructed in likeness of existing elements.
- Preliminary opinion of probable cost - $27M

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Figure No.
3.1

Title
PRELIMINARY OPTION 1

Option 1 – Complete Rehab

- Maintaining the existing bridge structure's form and function;
- Accommodates vehicles, cyclists, pedestrians;
- Removing the existing 1.5 m walkway and adding a new 3.0 m wide timber walkway on each side of the bridge;
- Maintaining all heritage aspects of the bridge if possible;
- All structural elements below the deck are assumed replaced;
- Deck replaced with new concrete and asphalt;
- Local repair and replacement for various truss elements above the deck; and
- New bridge bearings.

3.1.2 Option 2

Option 2 features complete rehabilitation of the existing Traffic Bridge for pedestrian and cyclist use only. The bridge will be maintained in its existing form using the main bridge deck to provide a pedestrian / cyclist linkage. The existing walkway would be removed. All heritage aspects of the existing structure will be preserved if possible and new elements will be constructed in likeness of the existing elements. The preliminary opinion of probable cost for this option is $23 M. Option 2 is shown in Figure 3.2.

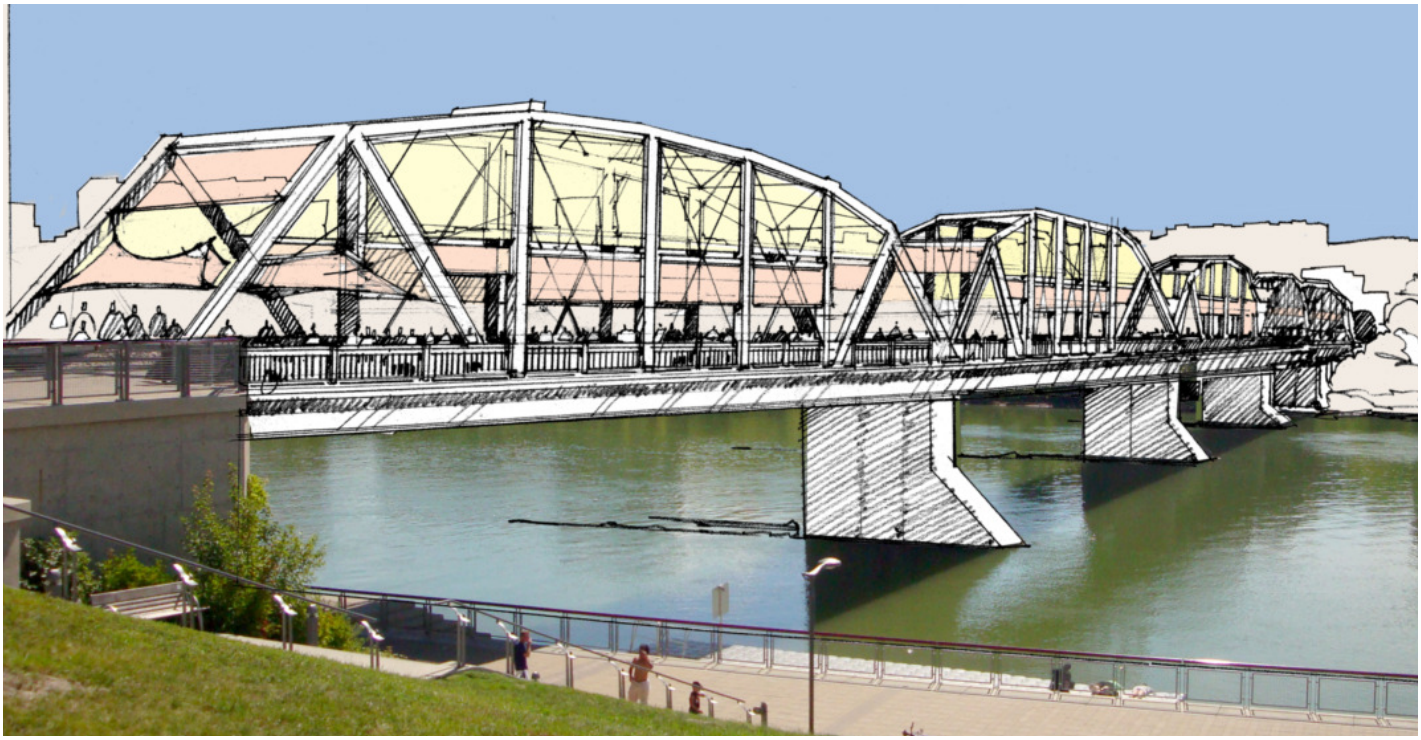
Option 2 – Rehab for Pedestrian and Cyclist only

- Remove existing walkway;
- All structural elements below the deck are assumed replaced;
- Deck replaced with new concrete and asphalt;
- Local repair and replacement for various truss elements above the deck; and
- New bridge bearings.

3.1.3 Option 3

Option 3 features complete rehabilitation of the existing Traffic Bridge for pedestrian and cyclist use only while providing a unique "bridge park". The bridge will be maintained in its existing form using the main bridge deck to provide a pedestrian / cyclist linkage with added landscaping and aesthetic features. The existing walkway would be removed. All heritage aspects of the existing structure will be preserved if possible and new elements will be constructed in likeness of the existing elements. The preliminary opinion of probable cost for this option is $31 M. Option 3 is shown in Figure 3.3.

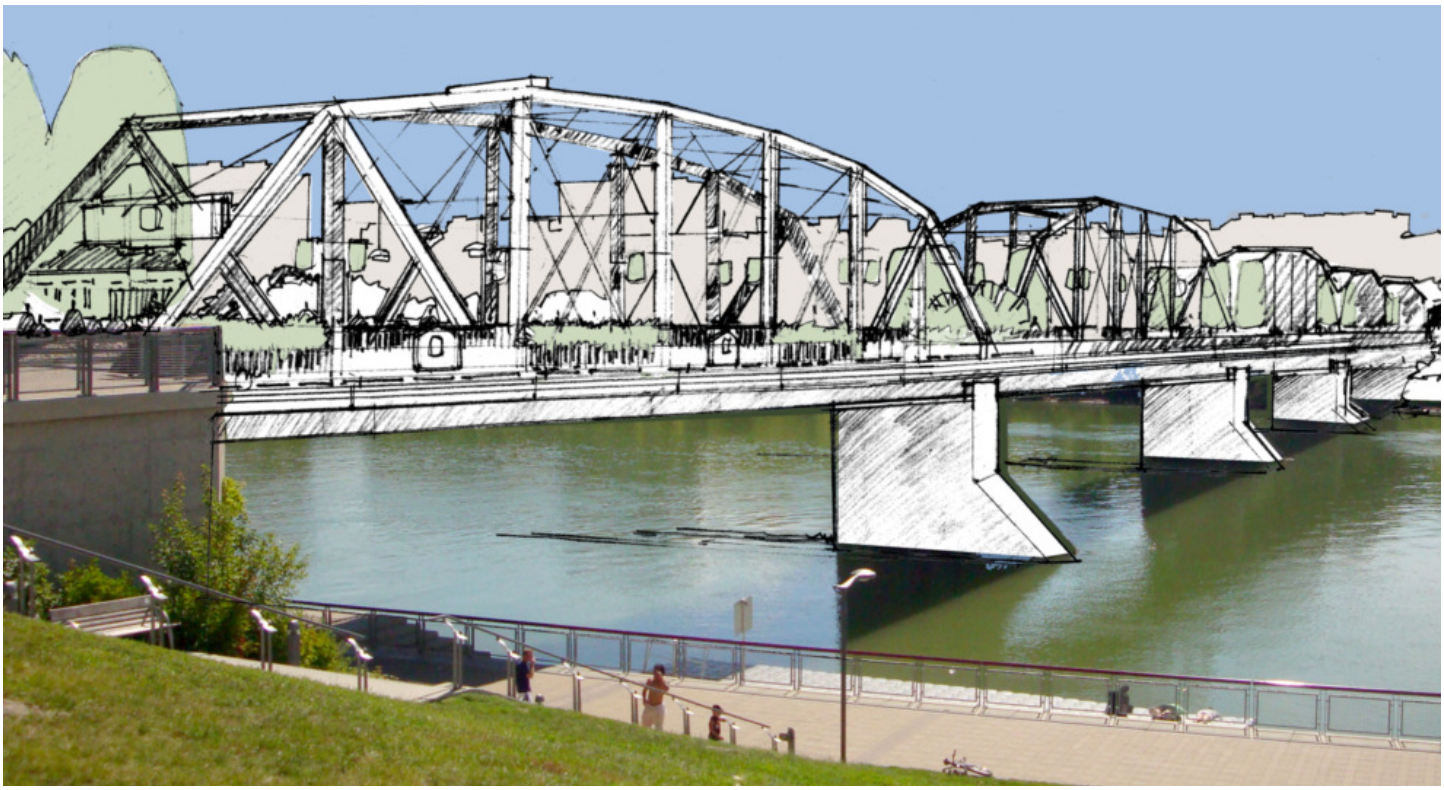
Option 2 - Rehabilitation Without Vehicular Traffic



Description

- Complete rehabilitation for pedestrian and cyclist use only: Maintain the bridge in its existing form using the main bridge deck to provide a pedestrian / cyclist linkage. The existing walkway would be removed.
- All heritage aspects of the existing structure are preserved if possible and new elements are constructed in likeness of existing elements.
- Preliminary opinion of probable cost - $23M

Option 3 - Rehabilitation As A Bridge Park



Description

- Complete rehabilitation for pedestrian and cyclist use only, a "bridge park": Maintain the bridge in its existing form using the main bridge deck to provide pedestrian / cyclist linkage with landscaping. The existing walkway would be removed.
- All heritage aspects of the existing structure are preserved if possible and new elements are constructed in likeness of existing elements.
- Preliminary opinion of probable cost - $31M

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Figure No.
3.3

Title
PRELIMINARY OPTION 3

Option 3 – Rehab for Bridge Park

- Remove existing walkway;
- All structural elements below the deck are assumed replaced;
- Deck replaced with new concrete and asphalt;
- Local repair and replacement for various truss elements above the deck;
- Local reinforcement and upgrade of various truss elements as required to handle the increased loading from landscaping, soil, and vegetation; and
- New bridge bearings.

3.1.4 Option 4

Option 4 features the replacement of the existing Traffic Bridge with a conventionally designed structure (girder & deck) for vehicle, pedestrian, and cyclist use. The new structure would provide two standard 3.7 m traffic lanes, two 1.5 m shoulders/cyclist lanes on the deck, and two 3.0 m pedestrian/cyclist walkways on each side of the bridge. The preliminary opinion of probable cost for this option is $26 M. Option 4 is shown in Figure 3.4.

Option 4 – Replace with New Modern Bridge

- Conventional design to present standards for traffic lane width;
- Accommodates vehicles, cyclists, pedestrians;
- 2 – 3.7 m wide traffic lanes;
- 2 – 1.5 m wide shoulders;
- 2 – 3.0 m wide walkways; and
- Replacement of pier caps to accommodate wider bridge structure.

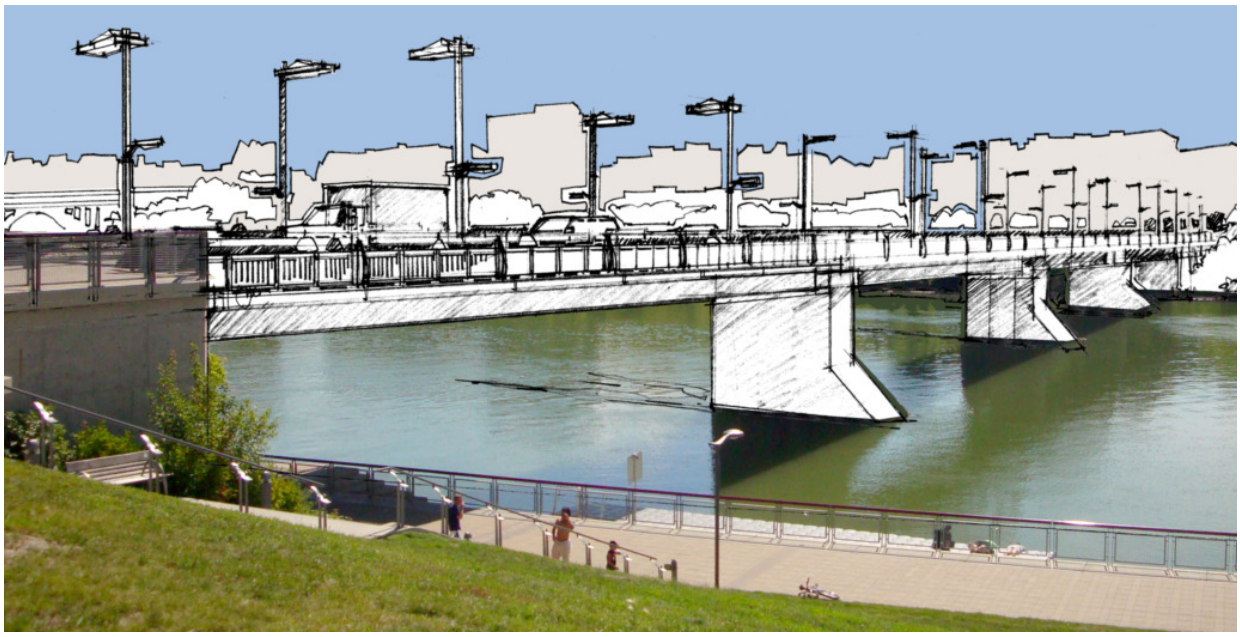
3.1.5 Option 5

Option 5 features the replacement of the existing Traffic Bridge with a modern steel truss with similar form for vehicle, pedestrian, and cyclist use. The new structure would provide two non standard 3.3 m traffic lanes without shoulders and two 3.0 m pedestrian/cyclist walkways on each side of the bridge. The preliminary opinion of probable cost for this option is $25 M. Option 5 is shown in Figure 3.5.

Option 5 – Replace with New Truss Bridge of Similar Form to Existing Bridge

- Accommodates vehicles, cyclists, pedestrians;
- 2 – 3.3 m wide traffic lanes;
- 2 – 3.0 m wide walkways outside of trusses;

Option 4 - New Conventional Bridge With Vehicular Traffic



Description

- Replace with a conventionally designed structure (girder & deck) for vehicle, pedestrian and cyclist use: A new structure providing two standard width traffic lanes and separate three metre shared walkways on both sides.
- Preliminary opinion of probable cost - $ 26M

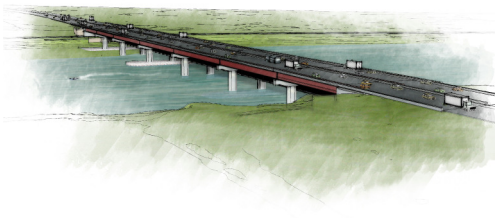


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Figure No.
3.4

Title
PRELIMINARY OPTION 4

Option 5 - New Truss Bridge With Vehicular Traffic

Description

- Replace with a modern steel truss or similar form to the existing bridge for vehicle, pedestrian and cyclist use: A new structure providing two non-standard width traffic lanes, no shoulders and separate three metre shared walkways on both sides.
- Preliminary opinion of probable cost - $ 25M

- Constructed from self-weathering steel which does not require repainting; and
- Solid I-beam construction.

3.1.6 Option 6

Option 6 features the replacement of the existing Traffic Bridge with an architecturally significant structure for vehicle, pedestrian, and cyclist use. Option 6 represents a “modern signature bridge”. The new structure would provide two standard 3.7 m traffic lanes, two 1.5 m shoulders/cyclist lanes on the deck, and two 3.0 m pedestrian/cyclist walkways on each side of the bridge. The preliminary opinion of probable cost for this option is $60 M. Option 6 is shown in Figure 3.6.

Option 6 – Signature Bridge

- Accommodates vehicles, cyclists, pedestrians;
- 2 – 3.7 m wide traffic lanes;
- 2 – 1.5 m wide shoulders; and
- 2 – 3.0 m wide walkways.

3.1.7 Option 7

Option 7 features the replacement of the existing Traffic Bridge with a conventionally designed structure (girder & deck) for pedestrian, and cyclist use only. The new structure would provide a 6 m wide pedestrian / cyclist linkage. The preliminary opinion of probable cost for this option is $17 M. Option 7 is shown in Figure 3.7.

Option 7 – Replace with New Modern Bridge- Pedestrian/Cyclist Only

- 6m wide.

3.1.8 Option 8

Option 8 features the replacement of the existing Traffic Bridge with a conventionally designed structure (girder & deck) for pedestrian, and cyclist use only. The new design would provide a more complex 6 m wide pedestrian / cyclist linkage with various aesthetic features. The preliminary opinion of probable cost for this option is $22 M. Option 8 is shown in Figure 3.8.

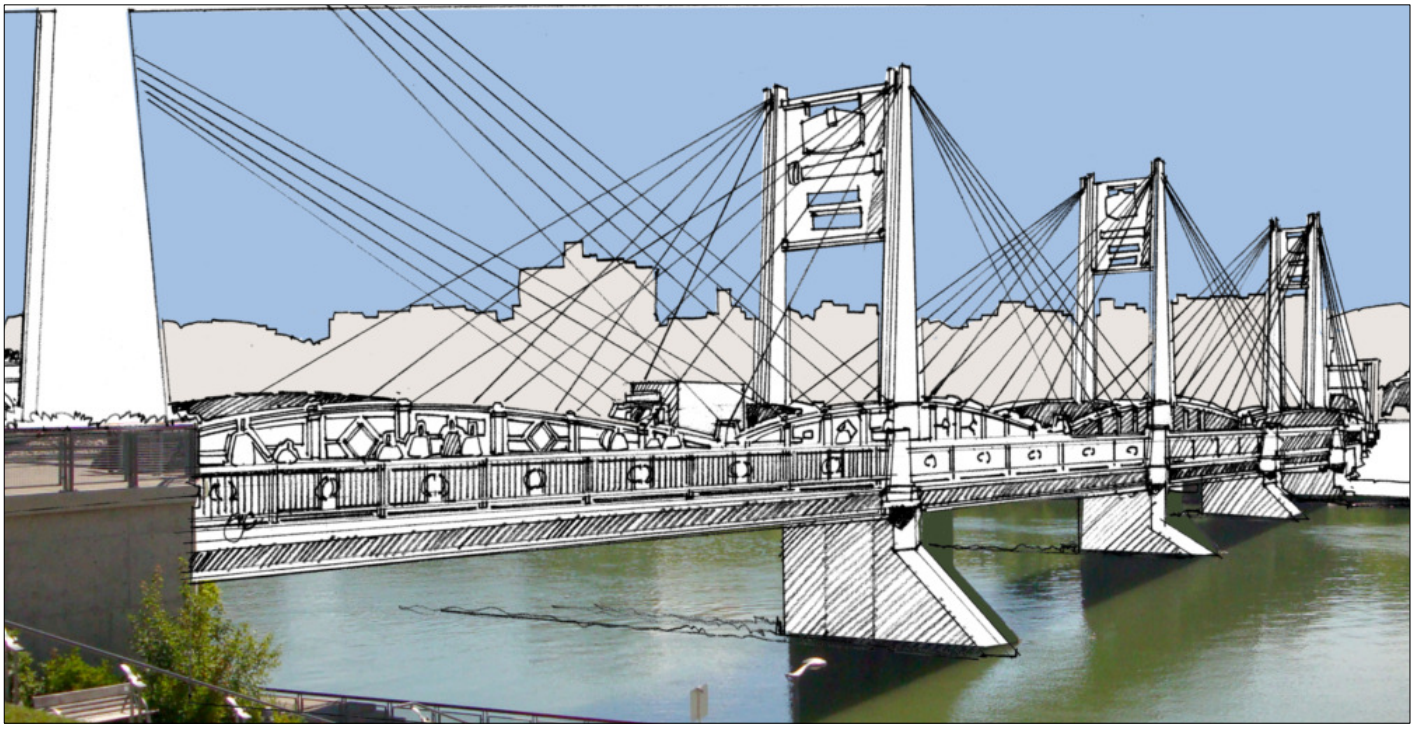
Option 8 – Replace with New Modern Bridge with Aesthetic Features- Pedestrian/Cyclist Only

- 6m wide.

3.1.9 Option 9

Option 9 features the replacement of the existing Traffic Bridge with an architecturally significant structure for pedestrian and cyclist use only. Option 9 represents a “modern signature bridge".

Option 6 - New Signature Bridge With Vehicular Traffic



Description

- Replace with an architecturally significant structure for vehicle, pedestrians and cyclist use, "a modern signature bridge": A new design providing two standard width traffic lanes and three metre shared walkways on both sides.
- Preliminary opinion of probable cost - $ 60M

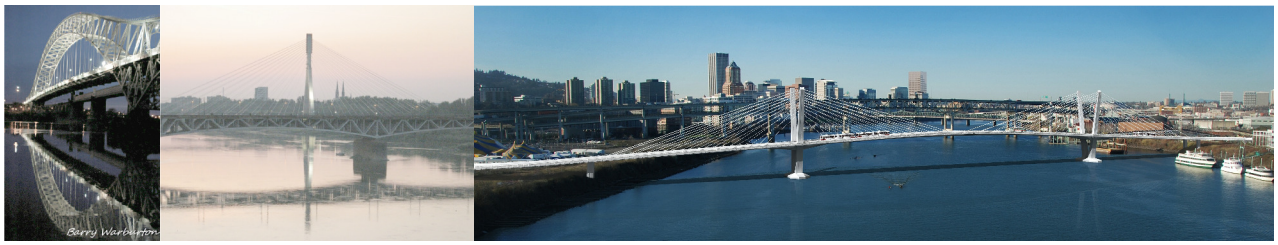


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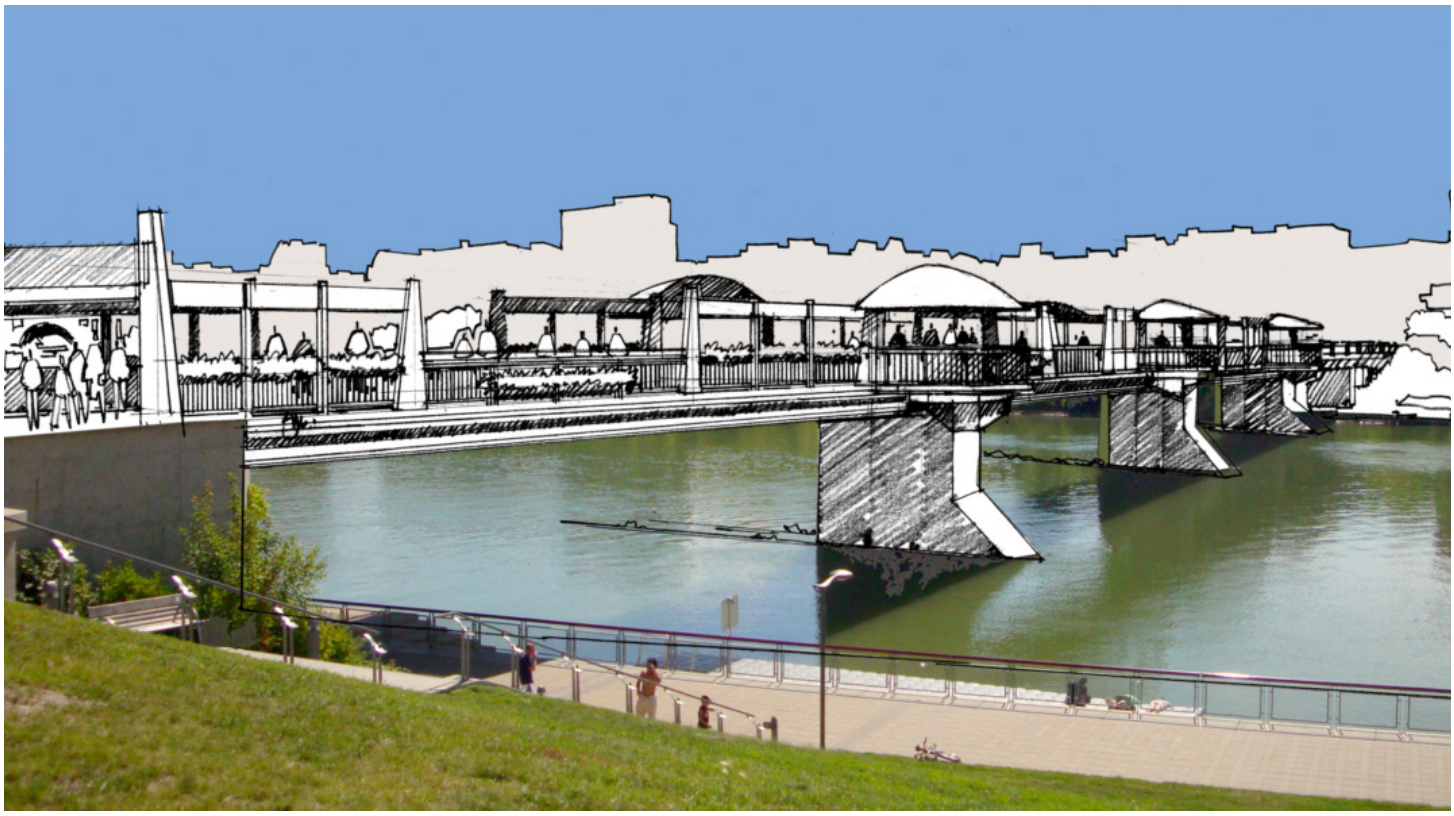
Figure No.
3.6

Title
PRELIMINARY OPTION 6

Option 7 - New Conventional Bridge Without Vehicular Traffic



Description

- Replace with a conventionally designed structure (girder & deck) for pedestrian and cyclist use only: A new structure providing a simple six metre pedestrian / cyclist linkage.

- Preliminary opinion of probable cost - $ 17M

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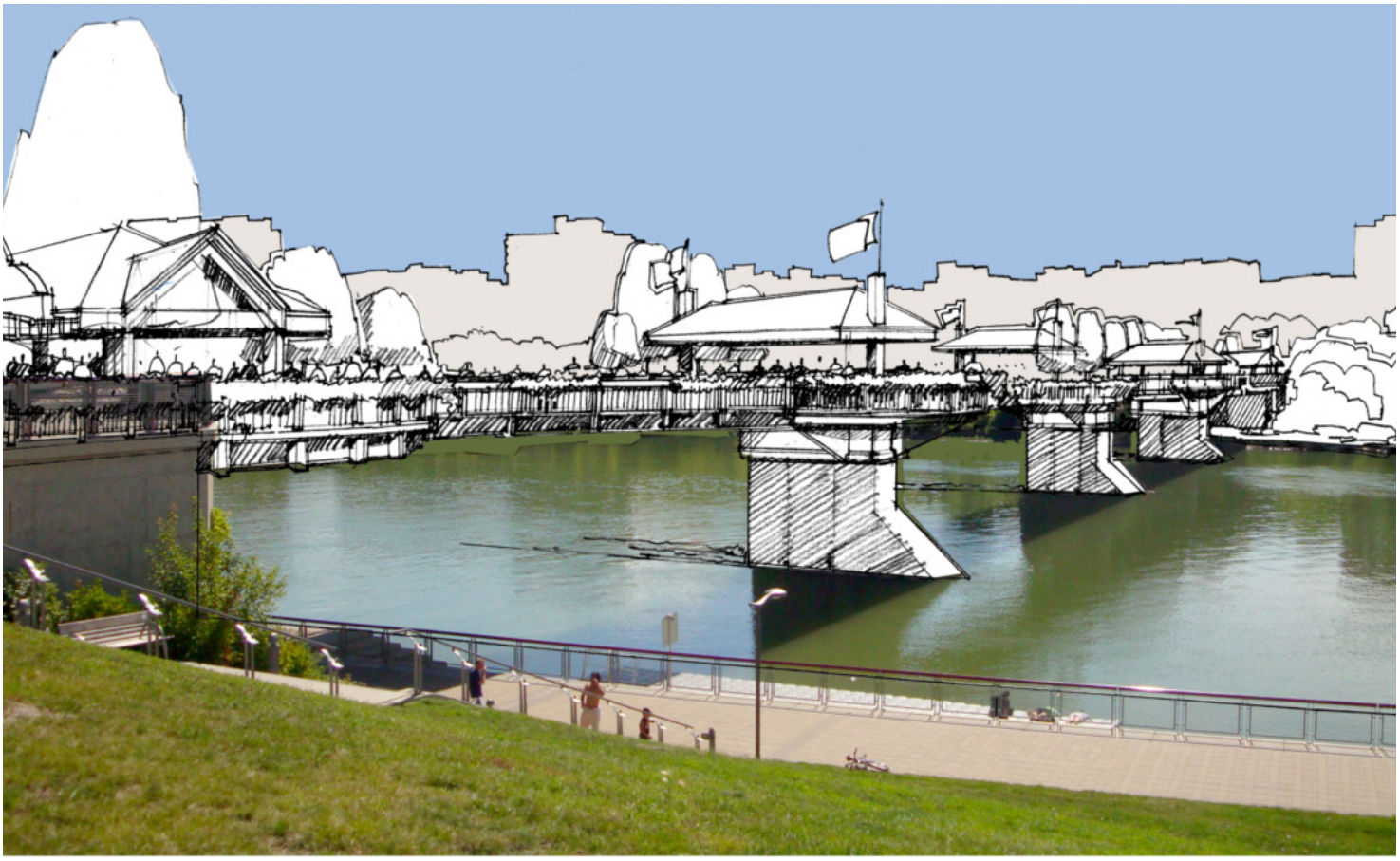
Figure No.
3.7

Title
PRELIMINARY OPTION 7

Option 8 - New Bridge Park



Description

- Replace with a conventionally designed structure (girder & deck) for pedestrian and cyclist use only: A new design providing a complex six metre pedestrian / cyclist linkage with aesthetic features.

- Preliminary opinion of probable cost - $ 22M

The new design would provide a more complex 6 m wide pedestrian / cyclist linkage. The preliminary opinion of probable cost for this option is $34 M. Option 9 is shown in Figure 3.9.

Option 9 – Signature Bridge – Pedestrian/Cyclist Only

- 6m wide.

3.1.10 Option 10

Demolish existing Traffic Bridge with no replacement. The preliminary opinion of probable cost for this option is $4 M. Option 10 is shown in Figure 3.10.

On September 13, 2010 the above ten preliminary options for the future of the Traffic Bridge were presented to Saskatoon City Council. As mentioned above, the unexpected closure of the Traffic Bridge on August 24th 2010 reinforced the significance and value of the bridge for all three modes of transportation: vehicles, pedestrians, and cyclists. As such, the above six options that included pedestrian/cyclist only, and complete demolition, were removed from consideration in Council's motion, "That as the Administration moves forward with the Open Houses, only Options 1, 4, 5 and 6 be considered."

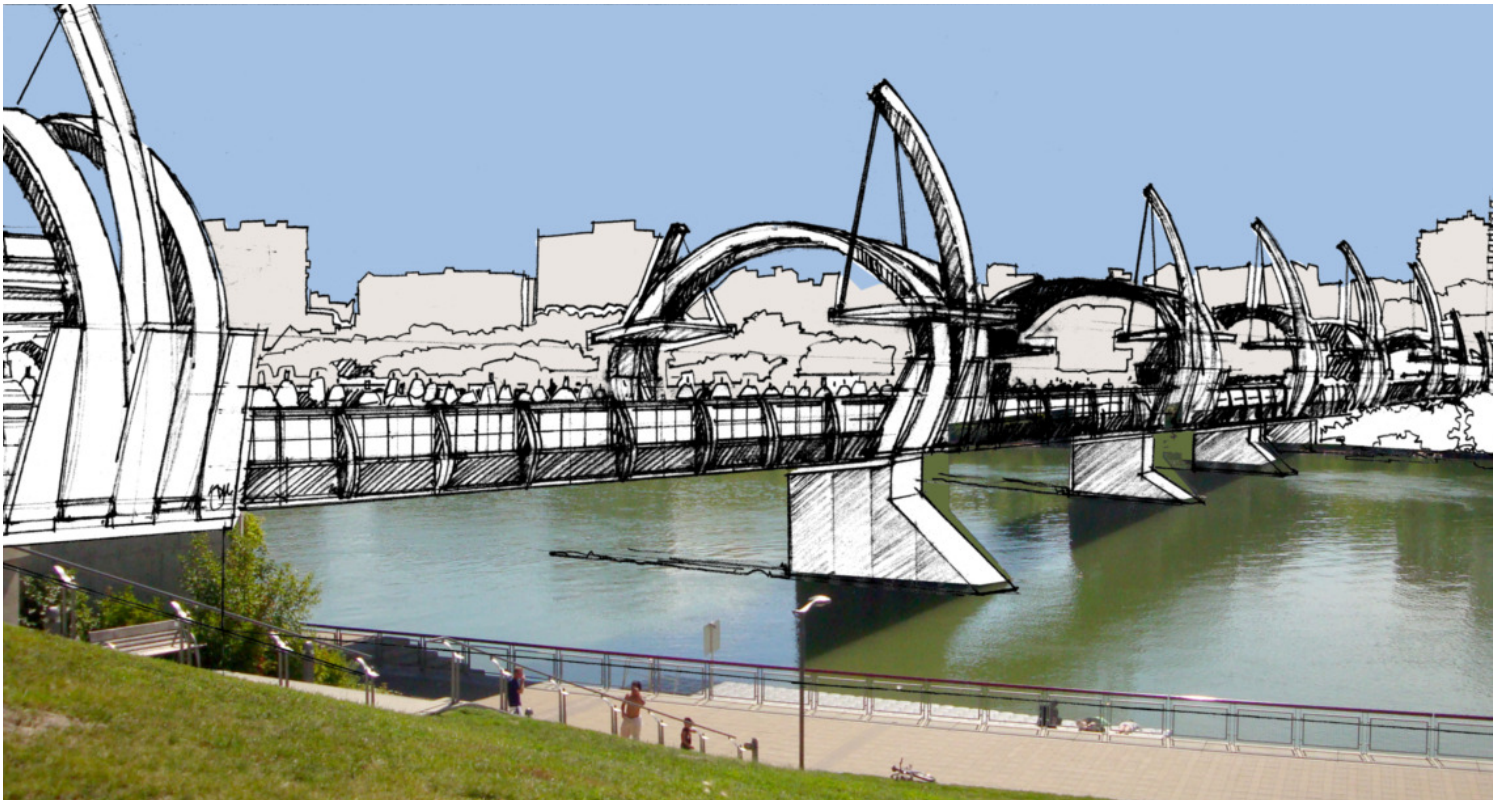
As a result of the above decision, the remaining four options for the future of the Traffic Bridge which accommodate vehicles, pedestrians, and cyclists were presented at the second open house and in the online forum.

3.2 PUBLIC CONSULTATION #2 SUMMARY

On September 15, 2010 Fast Consulting and Stantec facilitated the second open house at Victoria School Gym. In the second round of public consultation the public was asked to provide input on four multi-use options: rehabilitation of the existing bridge, replacement with a modern steel truss bridge, replacement with a conventional bridge, and replacement with a signature bridge. There were comment forms filled out by 360 of the more than 400 people who attended the Traffic Bridge public open-house as well as over 600 people who responded to the comment form posted on the online community the Traffic Bridge forum between September 16 and 30, 2010.

The level of public engagement on this issue is a reflection of how important it is to many residents of Saskatoon, and their desire to both learn more about the issues around options associated with the Traffic Bridge, and to share their opinions and thinking in terms of rehabilitating the existing bridge, or replacing it, either with another (modern) steel truss bridge, conventional (concrete) bridge or a modern signature bridge. Results from the second open house and online forum are shown below in Figure 3.11

Option 9 - New Signature Bridge Without Vehicular Traffic



Description

- Place with an architecturally significant structure for pedestrian and cyclist use only, a "modern signature bridge": A new design providing a six metre pedestrian / cyclist linkage.

- Preliminary opinion of probable cost - $ 34M

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Figure No.
3.9

Title
PRELIMINARY OPTION 9

Option 10 - Demolition / No Replacement

Description

- Demolish and remove with no replacement.
- Preliminary opinion of probable cost - $ 4M

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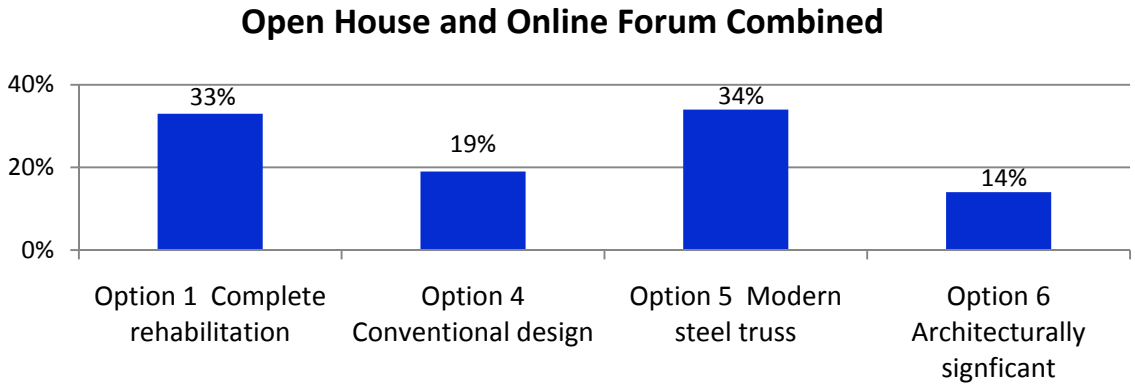
Figure No.
3.10

Title
PRELIMINARY OPTION 10

Public Consultation #2 – Figure 3.11
Preferred Option Responses



4.0 Preferred Option Analysis

In this phase of the project, it was decided that option 6 would be eliminated so that efforts could be more focused on refining the options most preferred by the public. Based on additional engineering work, public feedback and discussions on what are the key aspects of each option, the three remaining options were refined to a higher level of detail so that the advantages and challenges of each option could be greater understood.

As the scope of the options became more clear, the opinions of cost were also taken to a higher level so that the estimated cost could be determined with more accuracy. The revised opinions of probable cost reflect a much greater understanding of the project scope and also take into account risks associated with the tender process.

4.1 REFINED OPTION DESCRIPTIONS

4.1.1 Option 1

Option 1 as shown at the third public open house is shown in Figure 4.1. The key aspect of this option is heritage and some refinements to this option were made to reflect this priority, such as:

- Walkway surface would now be presented as timber instead of concrete; and
- Walkway handrails would now be presented in the original criss-cross style that has existed to this day.

Since the structural inspection and load rating of the bridge had now been completed at this stage, the amount of expected structural work necessary to extend the life of the bridge for 80 years could be estimated more accurately. It is anticipated that the deck and all steel below the deck would have to be completely replaced with new. The majority of steel elements above the deck are likely to remain depending on the extent of corrosion and the feasibility of repair compared to complete member replacement. A new 225mm concrete deck with 80mm asphalt wearing surface would make up the traffic deck.

All of the remaining existing steel would require sandblasting and repainting with a high quality modern coating system. The finish coat is assumed to be black to be consistent with the historical look of the bridge. Galvanizing or weathering steel was not considered to be a viable option for the replacement steel as it would create the potential for concentration cell corrosion which would accelerate the deterioration of the remaining existing steel.

The design vehicle for this option is assumed to be an MS50 truck which is a dual axel vehicle that weighs a total of 5000kg. Thus, the present load limit on the bridge would remain unchanged.

Option 1 - Complete Rehabilitation

Description

- Complete rehabilitation for vehicle, pedestrian and cyclist use: Maintain the bridge in its existing form and function, providing 2.9m traffic lanes and replacing the existing pedestrian walkway on the west side of the bridge with 3.0m walkways on each side. Where possible existing heritage aspects are preserved. Bridge finish will consist of a painted steel truss.
- 80 year design life
- Bridge width

  2.9m traffic lanes (2)

  3.0m pedestrlan / cyclist lanes (2)
- Capital Costs = **$24M-$34M**
- Annualized 80 year Operating Cost in 2010 dollars = **$150,000**

  (Operatlng Costs for the 80 year deslgn llfe lnclude: re-palntlng of steel members, deck malntenance, asphalt maintenance, timber deck maintenance). Majority of cost is for repainting.
- Tlme to be constructed: 24 - 36 months

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Figure No.
4.1

Title
OPTION 1

Reinforcing, replacing, and repainting the existing steel in place creates many construction challenges but has been accomplished successfully in other bridge rehabilitation projects, such as the Edmonton Low Level bridge, which is a bridge over 100 years old and of similar construction to the Traffic Bridge.

Potential Advantages:

- Heritage of the bridge is preserved for future generations;
- Less impact on traffic flows and roadwork on either side of the bridge; and
- Narrowness of bridge forces traffic to slow down.

Potential Challenges:

- High maintenance costs compared to other options;
- More uncertainty and risk for the contractor;
- More future bridge closures for maintenance (e.g., painting structure every 15 years); and
- Longer construction period.

4.1.2 Option 4

Option 4 as shown at the third public open house is shown in Figure 4.2. The key aspect of this option is functionality. This option was refined to be presented with no aesthetic enhancements or amenities. This was done to establish a baseline condition for cost estimating and so that the public would not focus on features that may not necessarily be included in the final design (eg. benches, lookouts, architectural features). However, the actual detailed design of this option could include such features but at an increased cost.

This option has the potential to significantly affect the road works on either side of the bridge. Since the lanes would be wider than the existing bridge, the approaching roadways would need modifications to maintain safe traffic flow. In addition, by using a girder support system, the depth of the bridge below the deck is greater than a truss system. This means that the approaching roadways and bridge deck level would have to be raised in order to maintain proper clearance beneath the bridge. Due to the large width of the bridge deck, the existing piers would likely require extensive work to the top in order to widen them to support the bridge.

The design vehicle for this option is assumed to be a CL-625 truck which is the standard vehicle for bridge design in Canada. It consists of a five axel truck with a total weight of about 64,000kg.

Potential Advantages:

- Wider lanes resulting in improved comfort and safety for drivers and cyclists;
- Less uncertainty and risk for the contractor;

Option 4 - New Conventional Bridge

Description

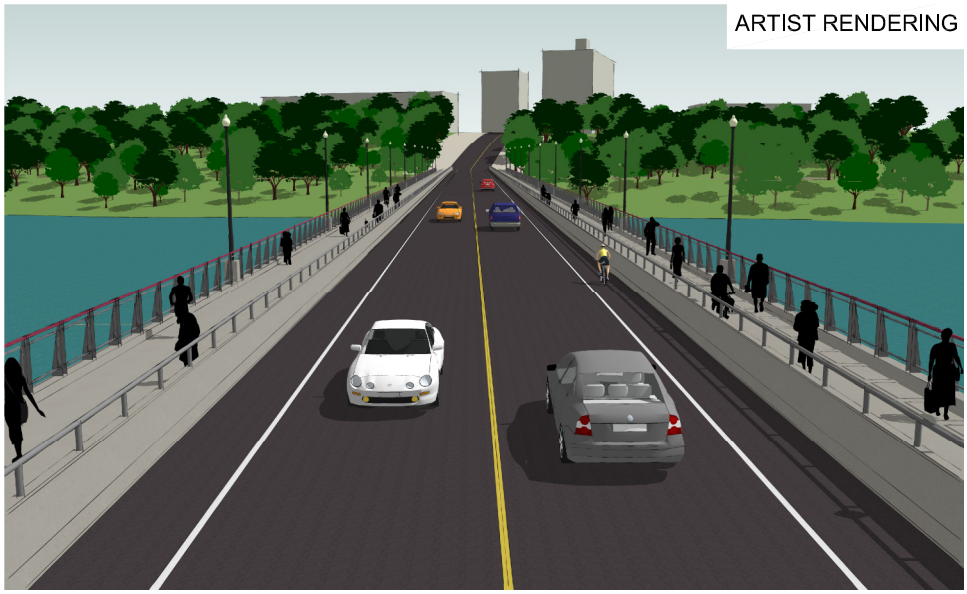
- Replace existing structure with a modern structure for vehicular, pedestrian and cyclist use. The structure would provide 3.7m traffic lanes, 1.5m shoulders/cyclist lanes and 3.0m pedestrian/cyclist walkways on each side. Aesthetic details depend on budget. Architectural features that could be added include but are not limited to: bench bays at piers, lookouts, railing enhancements, lighting enhancements, aesthetic structural enhancements and upgraded finishes.
- 80 year design life
- Bridge width

  3.7m traffic lanes (2)

  1.5m shoulder / cyclist lanes (2)

  3.0m pedestrian / cyclist lanes (2)
- Capital Costs as shown = **$26M - $35M**
- Annualized 80 year Operating Costs in 2010 dollars = **$16,000**

  (Operating Costs for the 80 year design life include: deck maintenance, asphalt maintenance)
- Time to construct: 18 - 24 months



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AND FUNCTIONAL PLANNING STUDY

Figure No.
4.2

Title
OPTION 4

- Lower maintenance cost than rehab option;
- Fewer future bridge closures; and
- Shorter construction period.

Potential Challenges:

- Heritage of the existing bridge is not preserved;
- Change in sky-line;
- Elevation of bridge deck will likely need to be raised resulting in more roadwork on either side of the bridge; and
- Vehicular traffic speeds could increase. Roadways may require modification at the ends of the bridge to accommodate higher traffic flow rates and speeds.

4.1.3 Option 5

Option 5 as shown at the third public open house is shown in Figure 4.3. This key aspect of this option is to create a compromise between options 1 and 4. Respect is given to the heritage by duplicating the overall form of the existing bridge. However, in order to add functionality, the traffic lanes may be widened and the bridge would be constructed from modern materials that require little maintenance.

While some members of the public saw the narrowness of the existing bridge as a heritage feature that should be maintained, others considered it to be a disadvantage and wanted to see the lane widths increased for added functionality and driver/cyclist comfort. As a result, this option was refined to include sub-options for the various potential traffic lane widths.

With this option, the overall form of the existing bridge would be maintained, but the individual steel components that make up the structure would be solid steel sections as opposed to built-up laced members that comprise the existing truss. It is anticipated that the vertical and diagonal members that are the most visible elements of the truss to pedestrians would be about 14 inches in depth. This is not significantly different than the overall depth dimension of the built-up vertical members of the existing truss.

Concrete sidewalks were assumed in the cost analysis although the timber is also an option to be considered in the detailed design stage. With increased lane width, more modifications to the tops of the existing piers and to the road works on either end of the bridge would likely be required.

The design vehicle for this option is assumed to be an HS-20 truck which is a three axel truck that weighs a total of about 32,800kg. This design vehicle would allow for emergency vehicles such as fire trucks as well as public transit vehicles.

Option 5 - New Modern Steel Truss Bridge

Description

- Replace existing structure with a modern steel truss of similar form to the existing bridge for vehicle, pedestrian and cyclist use: The structure could be designed for wider lane widths to accommodate traffic and would provide 3.0m walkways on each side. Bridge finish will consist of weathering steel with solid members on existing piers.
- 80 year design life
- How wide could it go? Widths suggested from last open house.

Options	Traffic Lane	Pedestrian / Cyclist	Shoulder / Cyclist	Capital Cost
5A	3.3m	3.0m	-	**$25M - $33M**
5B	3.7m	3.0m	-	**$27M - $34M**
5C	3.7m	3.0m	1.5m	**$29M - $37M**

- Annualized 80 year Operating Costs in 2010 dollars = **$15,000 / $18,000 / $20,000**

  (Operating Costs for the 80 year design life include: deck maintenance, asphalt maintenance)

- Time to construct: 18 - 24 months

Potential Advantages:

- Heritage is preserved in the overall form of the bridge;
- Sky-line is maintained;
- Wider lanes resulting in improved comfort and safety for drivers and cyclists;
- Less uncertainty and risk for the contractor;
- Lower maintenance cost than rehab option;
- Fewer future bridge closures; and
- Shorter construction period.

Potential Challenges:

- Many heritage characteristics of the existing bridge are not preserved;
- Color and finish of the bridge will change; and
- Vehicular traffic speeds could increase. Roadways may require modification at the ends of the bridge to accommodate higher traffic flow rates and speeds.

4.1.4 General Conclusions

- All of the options would improve the comfort of pedestrians and cyclists;
- Under typical traffic conditions both at present and in the future the effect of removing vehicular traffic from the Traffic Bridge is minimal with respect to the other river crossing bridges. Therefore, the bridge is not needed for vehicular traffic assuming that all other river crossings are operating normally;
- The opinions of probable capital cost are quite comparable between all three options given accuracy in the level of estimating that was performed; and
- In addition to higher maintenance costs, any option to rehabilitate the bridge carries more risk and uncertainty than other options.

4.2 PUBLIC CONSULTATION #3 SUMMARY

The third and final round of the Traffic Bridge public consultation was held on October 20, 2010 at the Royal Canadian Legion Branch 63, and was attended by more than 150 people. The open house narrowed the options to three and displayed more detailed concepts regarding; rehabilitation of the existing bridge, replacement with a (modern) steel truss bride and replacement with a conventional (concrete) bridge. These more detailed concepts provided participants with information around lane widths, construction build times, and maintenance costs.

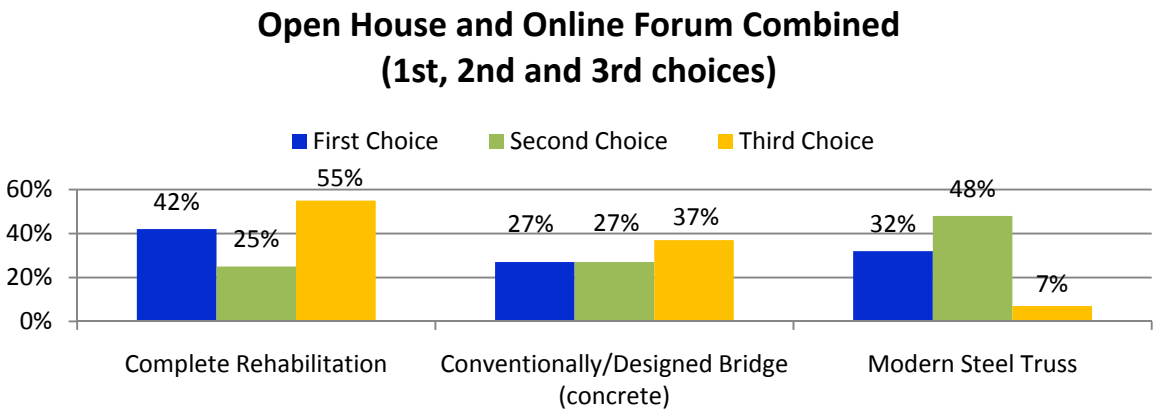
The general feeling among participants at the second and third open houses and online forums appeared to be that a multi-use bridge is necessary. The primary drivers of this opinion appear

to be heavy traffic congestion resulting from the closure of the bridge, and the inability to justify to taxpayers the cost of fixing the bridge for pedestrians and cyclists only, although there was strong support for enhanced cyclist facilities going forward.

The comments and discussion at the final open houses and online forums appear to suggest that most people favor a multi-use bridge for vehicles, pedestrians and cyclists. The decision to remove the pedestrian-cyclist only option for consideration in the second round of public consultation was a sore point for those who continue to believe in a pedestrian-cyclist only option and there were comments at the second open house that illustrated their wonder if their voices were heard. There were also participants at the second and third rounds of the public consultations, however, that supported the decision for not requesting feedback on pedestrian-cyclist only options.

At the end of the third round of public consultation, the results from participants that attended the open house or the online community forum and that indicated their option preference in the comment forms available at both, suggest that they are divided between preference for rehabilitating the existing bridge (42%), replacing the bridge with a conventional (concrete) design (27%) and replacement with a modern steel truss (32%). These quantified results are an aggregate summary of the opinions of the people attending the pubic and online forums and are shown in Figure 4.4

Public Consultation #3 – Figure 4.4
Preferred Option Responses



5.0 SUMMARY OF PUBLIC INPUT

Each option is described below again outlining the quantitative and qualitative feedback provided by the public consultation process.

Option 1

There are a significant number of people who support Option 1 (42%), rehabilitation of the existing Traffic Bridge, and their fear is that a short-sighted approach to solving traffic problems will result in the irrevocable loss of a piece of history.

Perceptions regarding structural safety, functionality and longevity are the main reasons given by those that are not supportive of this option. Some people comment that while rehabilitation would be their preferred option, the level of corrosion and deterioration of some parts of the bridge make them feel the existing structure is beyond saving, that a rehabilitated bridge would not last as long as a replacement bridge, or that rehabilitation has limited practicality for the next 80 years because of its narrow lanes.

There is also a segment of the public who do not place a high level of importance on the heritage value of the existing structure. And for some, beauty is in the eye of the beholder, and these people support replacement with a conventional design because it is more aesthetically pleasing to them.

Option 4

The key issue for open house and online participants who prefer Option 4 (27%), the conventional bridge, is function: they want a new bridge with wider lanes to handle Saskatoon's growing traffic volumes, they want it built inexpensively and quickly and they see this option as fulfilling those needs. It appears to be a common perception among the public that the conventional option will be the fastest to build, despite information at the open house forum indicating that build times could be potentially similar; the rehabilitation option would require 24 – 36 months, while the other two replacement options would require 18 – 24 months. Some participants describe this choice as 'putting their emotions aside' and making what they see as the most practical choice.

The human scale that many open house participants value about the Traffic Bridge, as a result of its smaller dimensions are that the 'closeness to the river' and more intimate connection to the environment would be lost with a conventional bridge according to detractors of this option. Others that are opposed to a conventional replacement bridge feel that 'a plain girder and deck bridge has as much aesthetic value as an overpass', and that it would detract from the gateway to the downtown and River Landing.

Finally, there is a general sense that a conventional bridge with standard width traffic lanes will be more attractive to drivers, and therefore lead to more traffic; this is a positive aspect of a new bridge for some residents, and a negative aspect for others at the same time in that they are concerned with more residential traffic in the neighborhoods surrounding Victoria Avenue and the possibility of heavier vehicular truck traffic that would now be able to access a new bridge.

Others that prefer this option may wish to see a new bridge but with the addition of architectural features to enhance the aesthetic appeal.

Option 5

Supporters of Option 5 (32%), modern steel truss replacement bridge, feel that it provides a compromise between preserving the heritage feel and memory of the existing bridge, and the overall look of the riverscape. For them it offers 'the best of both worlds – the look of the original bridge with better functionality from wider lanes and longer life expectancy. They also see this option as being more accommodating for pedestrians and cyclists as a result of wider lanes on the bridge as well as on the sidewalks.

There are also some people, however, that would prefer a totally new structure, but one that replicates the design of the current bridge including its narrow lanes, as this would be more authentic and deter increased traffic and large vehicles.

People who are not supportive of the modern steel truss replacement option are concerned that it will have the same challenges with rust and maintenance as the original bridge. They are also concerned that people may not appreciate how different a modern steel truss bridge might actually look after it is built compared to the existing structure because some of the original historical construction and design techniques would not be employed in modern truss construction.

5.1 GENERAL CONCLUSIONS

There is a relatively even split in public support for all three options and it may be impossible to satisfy the majority of the public with any one of the options. Different members of the community put different values on the key aspects of the options and this determines their option preference.

In summary, each of the three options have significant contingent of community support. All of the options described are feasible, workable solutions. All three options address City Council's directive that vehicular, cycling and pedestrian traffic modes all be accommodated. The main differences between the options lie in the estimated capital and operating costs, the heritage value, level of function, and aesthetics.

6.0 ACKNOWLEDGEMENTS

6.1 STEERING COMMITTEE

The Consulting Team would like to thank members of the Steering Committee for their valuable assistance and guidance through the study process:

- David LeBoutillier, Planning and Design Engineer, Transportation Branch;
- Don Cook, Planning and Design Engineer, Transportation Branch;
- Brad Walter, Bridge and Project Engineer, Strategic Services;
- Jeanna South, Urban Design Manager, Land Branch;
- Nikki Newenham-Kahindi, Heritage Coordinator, Planning and Development Branch; and
- Wendy McLeod, Communications Officer, City Manager's Office.

We would also like to thank members of the Municipal Heritage Advisory Committee and the Meewasin Valley Authority committees for their input, as well as civic staff and members of the public who attended the public open houses and also provided comments on the on-line forum.

6.2 CONSULTING TEAM

Stantec Consulting Ltd.:

- Brad Zurevinski, Transportation Engineer/Project Manager;
- Brad Cook, Principal Transportation Engineer;
- Jim Zacaruk, Principal Structural Engineer;
- Dale Martens, Senior Structural Engineer; and
- Cam Patterson, Senior Landscape Architect.

Fast Consulting:

- Doug Fast, Principal; and
- Kathryn Thompson, Research Consultant.

APPENDIX A
TERMS OF REFERENCE

Request for Proposals

Needs Assessment, Functional Planning Study and Structural Assessment
Traffic Bridge Replacement

Terms of Reference

Transportation Branch, Infrastructure Services Department, City of Saskatoon

1.0 Introduction

The Traffic Bridge connecting the Nutana neighbourhood to Saskatoon's downtown is over 100 years old. It's historical significance aside; it currently serves a minor traffic role on a daily basis, but serves as a vital bypass route when other bridges are closed. It also serves as a very important and well-used pedestrian and cyclist crossing of the South Saskatchewan River. Unfortunately, the superstructure of the existing bridge will need to be replaced in the future. The primary purpose of this study is a needs assessment for that future bridge.

This project includes: the assessment of current traffic, pedestrian and cycling usage; recommendations for the number of lanes if it is to remain a traffic bridge; what changes would be necessary to increase its utility as a traffic bridge; how the bridge might be configured as a transit-only or pedestrian/cyclist-only facility. The feasibility of each transportation option should also have a matching structural evaluation of the bridge. A public consultation component is required.

2.0 Scope and Study Objectives

The scope of the project is to assess the current Traffic Bridge and the proposed replacement bridge at a City of Saskatoon population of 300,000.

Figure 1 shows the plan and profile of the existing Traffic Bridge.

2.1 Technical requirements:

- Assess current use of the Traffic Bridge
- Evaluate the transportation and structural implications of a wide range of options, for example:
    - Re-use existing bridge
    - 2-lane traffic bridge, with wide pedestrian/cyclist paths
    - 4-lane traffic bridge, with wide pedestrian/cyclist paths
    - Transit-only bridge, with wide pedestrian/cyclist paths
    - No replacement (demolition options/configuration)
    - Pedestrian/cyclist only structure
    - 2-lane traffic bridge with structural capacity for streetcars, with wide pedestrian/cyclist paths
- Each transportation option examined must have a matching structural evaluation:
    - Assuming the current superstructure & piers,
    - Assuming the current piers,
    - Assuming a complete replacement

    - Each structural evaluation should include feasibility, cost, required structural repairs and/or replacement and so on
- Functional evaluation of current access points and connecting roadways; and required access to support recommended option
- Conduct a public consultation (open house and web-based forum) to solicit comments about the replacement of the Traffic Bridge and requirements of that replacement. The web-based public consultation is expected to be innovative and inviting; a large volume of public comment should be expected
- Conduct a second public consultation (open house and web-based forum) for discussion of the recommended plan
- The final report should summarize the results of the public consultation efforts, as well as present a recommended plan and cost estimates of that plan.

2.2 Study Area

The study area is identified on the attached plan.

3.0 Study Administration

This study will be directed by a steering committee consisting of:

David LeBoutillier, Planning & Design Engineer, Transportation Branch, City of Saskatoon,

Don Cook, Planning & Design Engineer, Transportation Branch, City of Saskatoon,

Brad Walter, Bridge & Project Engineer, Strategic Services, City of Saskatoon

4.0 Services to be Provided by the Consultant

The consultant is expected to deliver a comprehensive functional plan based on current needs and projected needs as the City grows.

The study should include:

- Consultation with Transportation Branch;
- Consultation with Strategic Services Branch;
- Consultation with the Public Works Branch;
- Consultation with Saskatoon Transit;
- Consultation with the Planning & Development Branch, Community Services;
- Consultation with the Meewasin Valley Authority;
- A summary of study issues, design considerations and design criteria;
- A recommended functional design for the future bridge and connecting roadways, and pedestrian walkways and trails;
- An evaluation and analysis of alternatives including cost estimation;
- Public consultation in the form of open houses and web-based forums;
- Preparation of recommended functional and structural plans.

5.0 City's Obligation

As a part of the study, the City will provide the following:

- Digital mapping information,
- All relevant reports on the study area,
- All inspections and reports relating to the Traffic Bridge,
- Existing traffic volume data,
- Copies of VISUM 11.0 PrT (car-only) transportation models:
    - PM & AM Peak Hours for base year (2006), population 205,000,
    - PM Peak Hour for city populations 300,000 and 400,000,
    - Supporting documentation.
- Access to all relevant existing City records and data.

6.0 Products or Deliverables

The consultant will provide:

- 5 copies of the draft final report,
- 5 copies of the final report,
- An electronic copy of the final report in PDF format,
- All drawings compatible with AutoCAD format,
- Electronic copies of all media created and gathered during the public consultation component of this project.

7.0 Standard Clauses for Proposal Preparation and Acceptance

7.1 Cost of Preparation/Proprietary or Intellectual Property Rights

All costs incurred by a proponent in the preparation of its RFP submission or in providing additional information necessary for the evaluation of its submission shall be borne by the proponent.

7.2 Intention of the City

It is the intention of the City to obtain a proposal most suitable to its interests and what it wishes to accomplish. Therefore, notwithstanding any other term or condition, express or implied, of this RFP, the City has right to:

(a) Waive any irregularity, insufficiency or non-compliance in any proposal submitted;
(b) Accept or reject all or part of any proposal;
(c) Negotiate with a proponent to modify its proposal to best suit the needs of the City;
(d) Accept the proposal, which it, in its sole discretion, determines to be most favorable to the interests of the City;
(e) Reject any or all proposals.

Furthermore and for greater certainty, the City reserves the right to determine, in its sole discretion, whether a proposal is compliant, non-compliant, regular or irregular.

7.3 Rejection of Proposal

Without limiting the City's rights under Intention of the City (Article 7.2 above), the City reserves the right to reject any proposal which:

(a) Is incomplete, obscure, irregular or unrealistic;
(b) Has non-authorized (not initialed) erasures or corrections in the proposal offer or any schedule thereto;
(c) Contains a defect or fails in some way to comply with the RFP;
(d) Omits or fails to include any one or more items in the proposal offer for which a price is required by the RFP;
(e) Fails to complete the information required by the RFP to be furnished with a proposal or fails to complete the information required whether the same purports to be completed or not;
(f) Is accompanied by an insufficient or irregular bid or proposal security in an unsatisfactory form or insufficiently executed or of an insufficient amount may be rejected by the City.

Further, a proposal may be rejected on the basis of a proponent's completion schedule and/or non-compliance with federal, provincial and municipal legislation.

7.4 Use of Discretion

Where expressly or by implication, the City is entitled or required to exercise its discretion, and for greater certainty the use of the word "may" is deemed to confer such a discretion, the City is entitled to exercise such a discretion without any obligation of any kind whatsoever to any or all proponents. A proponent is not entitled to assume that the City will conduct itself in a particular manner or in accordance with any set of principles or guidelines or any industry custom or practice. The City's evaluation of a proposal is final. The manner in which the City evaluates a proposal or reaches its decisions is not subject to any form of review or appeal unless otherwise expressly provided.

8.0 Proposal Selection

8.1 Step 1: Mandatory Requirements

Proposals, which do not comply with the mandatory requirements, may be disqualified.

8.2 Step 2: Rated Criteria Evaluation

The City will only award points in accordance with the evaluation matrix in Table 1 below. The City will consider the following in applying the evaluation criteria and allocating available points:

Table 1: Evaluation Matrix	Maximum Available Points
Project methodology and technical approach	10
Clear understanding of the project requirements	10
Qualifications of designated project manager	5
Qualifications of transportation engineering personnel and relevant experience	10
Qualification of structural engineering personnel and relevant experience	10
Documented experience with public consultation and development of web-based resources	10
Integration and compatibility of the various elements of the proposal	6
Adaptability and flexibility of the proposal	8
Degree of innovation to problem solving	6
Project schedule, milestones and controls	5
General quality of proposal, including completeness, readability and layout	5
TOTAL MAXIMUM AVAILABLE POINTS	**85**

8.3 Step 3: Price Evaluation

All prices and amounts supplied by the proponent are deemed to be the basis of the proponent's offer and shall be binding on the proponent. Price will be assigned a maximum of 15 evaluation points. The points scored by each proposal will be based on a proportional formula in Table 2 below.

Table 2: Price Evaluation Formula	Maximum Available Points
15-[15x(This proposal's guaranteed maximum price–Lowest guaranteed maximum price)/Lowest guaranteed maximum price]	15

Example: Consider two proposals; A and B. Proposal A has the lowest guaranteed price of $100,000. Proposal B's price is $125,000. Proposal A having the lowest price will be awarded the full 15 points, while points earned by proposal B will be calculated based on the formula below:
Earned Points = 15 - [15 x (125,000 - 100,000) / 100,000] = 15 - 3.75 = 11.25

8.4 Step 4: Final Evaluation

The final scoring of each proposal will be determined in accordance with the evaluation matrices. The proposal with the highest total score as calculated on Table 3 will be deemed to be the preferred proposal.

Once the preferred proponent has been identified, the City may enter into discussions with that proponent to clarify any outstanding issues and to identify and finalize those portions of the proposal, including negotiation of any changes, which will form part of the agreement.

If discussions are unsuccessful, the City reserves the right to enter contract discussions with the next highest rated proponent or to decide not to award a contract.

Table 3: Final Evaluation	Maximum Available Points
This is a total number of points earned in Step 2 and Step 3	100

8.5 Proposal Acceptance Period

All proposals shall be kept open for acceptance by the City for ninety (90) days after the date of submission unless subsequently revised by addendum.

8.6 Confidentiality

The City acknowledges that proposals may contain information in the nature of a proponent's trade secrets or commercial, financial, labour relations, scientific or technical information of or about a proponent. The City acknowledges and agrees that proposals in response to this RFP are provided in confidence and protected from disclosure to the extent permissible under law.

The City is bound by the Local Authority Freedom of Information and Protection of Privacy Act (Saskatchewan) and all documents submitted to the City will be subject to the protection and disclosure provisions of this Act.

8.7 City Clarification

The City reserves the right to seek proposal clarification from the proponent to assist in making evaluations. Failure to provide an adequate written response within the period specified in writing by the City upon receiving a request for clarification from the City may, at the sole discretion of the City, result in disqualification of the proposal.

8.8 Negotiations

The City reserves the right to negotiate with the preferred proponent.

8.9 Acceptance of Proposal

No act of the City other than a notice in writing constitutes an acceptance of a proposal. Such acceptance shall bind the successful proponent to execute in a manner satisfactory to the City Solicitor where applicable the contract documents constituting the agreement, to furnish the bonds and insurance material required by the contract documents or to be responsible for the damages provided in the proposal form herewith. Where applicable, the other rights and obligations contained in the provisions of the RFP documents shall ensure for the benefit of and be binding upon the parties only with the formal execution of the agreement.

8.10 Formal Agreement

The successful proponent will be required to enter into an Engineering Services Agreement with the City. Such an agreement will be prepared by the Office of the City Solicitor.

The Engineering Services Agreement shall consist of:

- Request for Proposals,
- Proposal submitted by the successful Consultant,
- The schedule of fees and/or maximum upset cost of the Engineering Services rendered.

The successful consultant shall ensure that all the Professional registration requirements (Engineering, Consulting and other) in the Province of Saskatchewan are met. As well, prior to the signing of the Engineering Services Agreement, the consultant must provide proof of public liability, and professional liability insurance.

9.0 Other Information

9.1 Invited Consultants

The following firms have been invited to submit a proposal for this project:

- **AECOM Canada Ltd.**
- **Associated Engineering**
- **Hatch Ltd.**
- **MMM Group**
- **Wardrop Engineering Ltd.**
- **AMEC**
- **CH2M Hill**
- **March Consulting Associates Inc.**
- **Stantec Consulting Ltd.**

9.2 Schedule

The goal is to have completion by **October 31, 2010**; proponents are to outline if that is reasonable.

9.3 Estimated Project Cost

The estimated project cost for this project is $275,000; proposals should address this estimate. If this project cannot be completed within that estimated cost, proponents should discuss the work that will not be completed, as well as propose and justify the additional work and costs.

9.4 Approval

City Council must approve the awarding of contracts in excess of $100,000.

10.0 Submission of Proposals

Consultants are required to submit five (5) copies of their proposal, which should include the following items and other requirements:

- A one page executive summary of the clear advantages and strengths of the Consultant or team of Consultants that would differentiate it or the team from the other proponents.
- Full name, address and telephone number of the submitting office of the Consultant, and if applicable, the name, address and telephone number of any branch office or affiliate which will assist in the project.
- A detailed work plan and schedule.
- A detailed discussion of the proposed methodology and benefits of that particular approach.
- A detailed organizational chart of the key personnel who will be involved with the project and a description of how their work relates to the project.
- A clearly stated maximum cost for the proposed Engineering Services.
- The proposal should not exceed ten (10) pages.

Consultants are also required to submit one (1) copy of their corporate and team resumes as a separate document.

10.1 Deadline for submission of proposals:

4:00pm Friday April 30, 2010

10.2 Submit proposal, in writing to:

David LeBoutillier
City of Saskatoon, Infrastructure Services Department
222 – 3rd Avenue North
Saskatoon, SK S7K 0J5

10.3 For more information or clarification please contact:

David LeBoutillier, P.Eng.
Planning & Design Engineer, Transportation Branch
City of Saskatoon, Infrastructure Services Department
222 – 3rd Avenue North
Saskatoon, SK S7K 0J5

Phone: **(306) 975-1451**
FAX: **(306) 975-2971**
Email: **david.leboutillier@saskatoon.ca**

APPENDIX B
TRAFFIC ANALYSIS

1.0 Traffic Analysis

The Traffic Bridge crosses the South Saskatchewan River connecting Victoria Avenue to 3rd Avenue in Downtown Saskatoon. Figure B.1 illustrates the roadway network adjacent to the Traffic Bridge.

Traffic analysis was completed for key intersections and roadways within the study area as shown in Figure B.1. Traffic analysis was completed at this stage to understand the current and future limitations and opportunities surrounding the Traffic Bridge now and as Saskatoon moves forward. To establish these boundaries, the following scenarios were analyzed under 2010 conditions and 2029 conditions:

- Maintain existing Traffic Bridge
- Two lane bridge with standard with traffic lanes
- Four lane bridge with standard width traffic lanes
- Bridge closed to vehicular traffic

The above scenarios will help form the foundation in which futures options are developed.

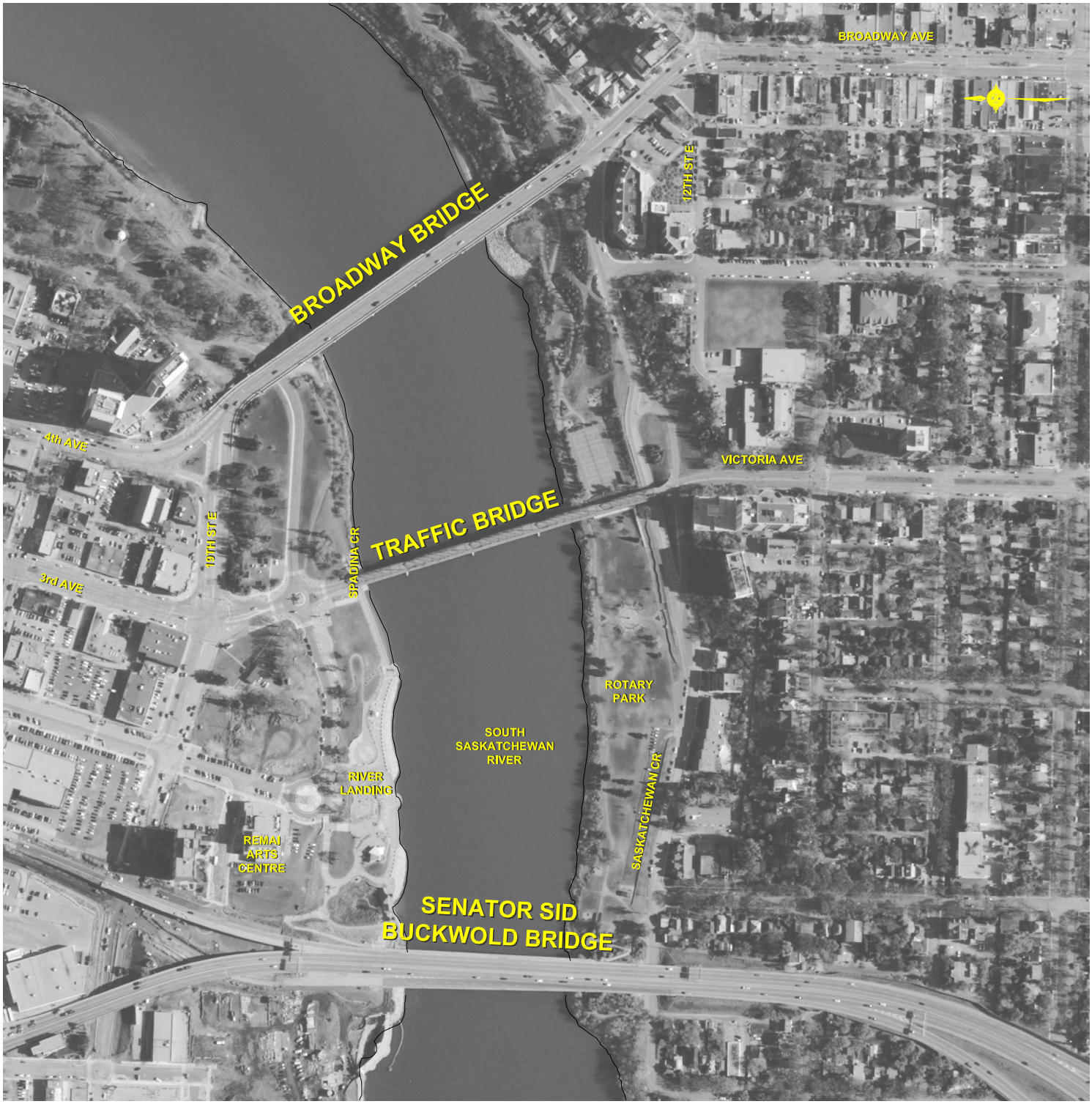
1.1 STUDY AREA ROADWAYS

The following roadways/bridges in the vicinity of the Traffic Bridge may be impacted by changes to the existing function of the Traffic Bridge:

- **Traffic Bridge –** is a two lane undivided collector roadway with 2.9 m traffic lanes and a 1.5m pedestrian/cyclist path on the west side of the bridge. The Traffic Bridge connects Victoria Avenue to 3rd Avenue in Downtown Saskatoon. The roadway has a posted speed limit of 50 km/hr within the study area;
- **Broadway Bridge –** is a four lane undivided major arterial roadway with 3.3 m traffic lanes and a 2.4 m shared pedestrian/cyclist paths on each side of the bridge. The Broadway Bridge connects Broadway Avenue to 4th Avenue and 19th Street in Downtown Saskatoon. The roadway has a posted speed limit of 50 km/hr;
- **Sid Buckwold Bridge –**is a six lane divided local urban freeway with 3.6 m traffic lanes and a 2.4 m shared pedestrian/cyclist path on the east side of the bridge. The Sid Buckwold Bridge connects the Idylwyld Freeway across the South Saskatchewan River. The roadway has a posted speed limit of 70 km/hr.

1.2 STUDY AREA INTERSECTIONS

The following major signalized intersections are in the vicinity of the Traffic Bridge and may be impacted by changes to the existing function of the Traffic Bridge:



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2011-01-06 09:31AM By: kcholodnuik

Jan, 2011
113154409

ORIGINAL SHEET - ANSI A

Legend

Stantec

Client/Project
CITY OF SASKATOON
TRAFFIC BRIDGE NEEDS ASSESSMENT
AND FUNCTIONAL PLANNING STUDY

Figure No.
B.1

Title
ROADWAY NETWORK

- **Broadway Avenue/12th Street** – is a signalized "T" intersection. Northbound, Broadway Avenue features a through lane and a shared through + right turn lane. In the southbound direction Broadway Avenue consists of two through lanes and a dedicated left turn lane. Westbound, 12th Street consists of separate left and right turn lanes.
- **Broadway Avenue/4th Avenue/19th Street** –is a signalized three leg intersection. Northbound, Broadway Avenue features a "free flow" lane exiting to 4th Avenue and a signalized lane exiting westbound to 19th Street. Eastbound, 19th Street consists of two through lanes to Broadway Avenue and a separate left turn lane northbound to 4th Avenue. Southbound, 4th Avenue consists of two through lanes to Broadway Avenue and a separate right turn lane westbound to 19th Street
- **3rd Avenue/19th Street –** is an signalized intersection. Northbound, 3rd Avenue consists of a separate left turn lane, a through lane and a shared through + right turn lane. Southbound, consists of a separate left turn lane, through lane, and separate right turn lane. Eastbound and westbound legs both feature a separate left turn lane, through lane, and shared through + right turn lanes
- **3rd Avenue/Spadina Crescent –** is four leg roundabout.

1.3 TRAFFIC VOLUMES

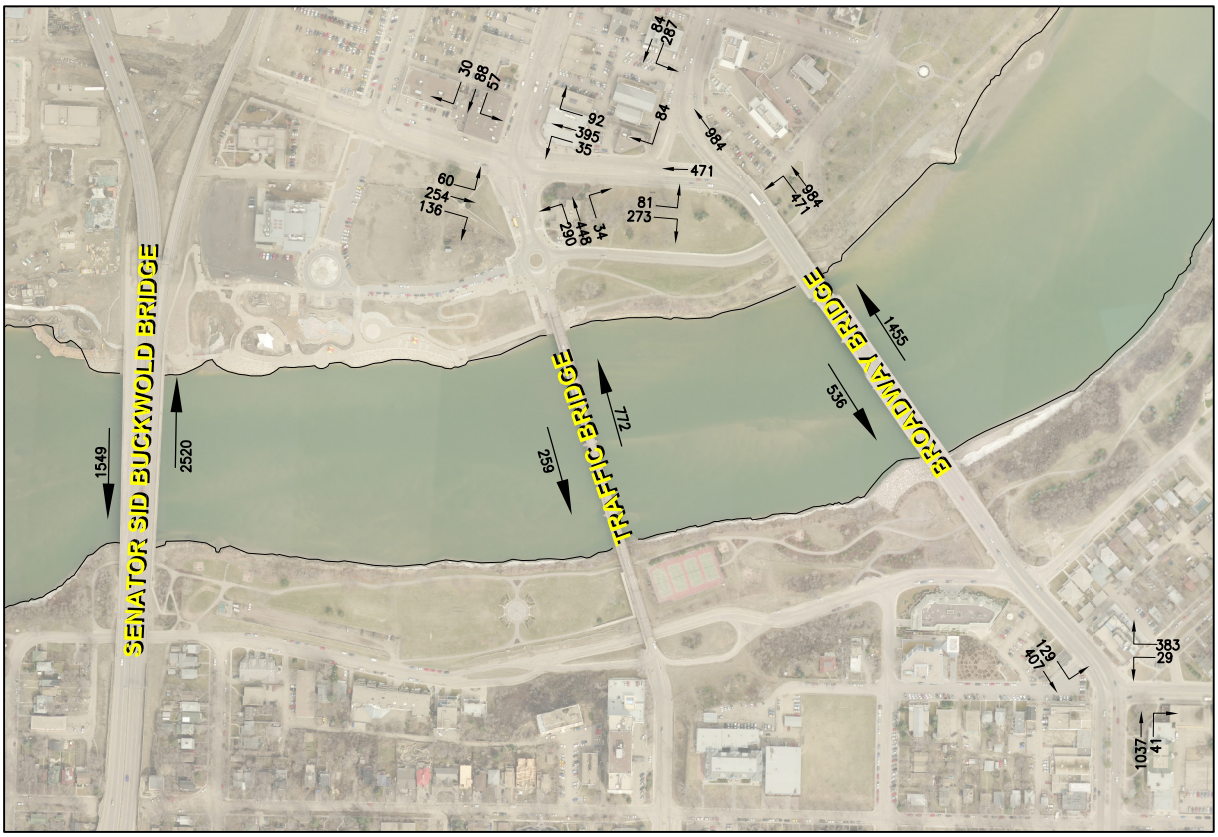
Existing Traffic Volumes

Turning movement counts were compiled by Stantec for the following intersections for the weekday AM and PM peak periods. The recorded volumes are shown on Figure B.2.

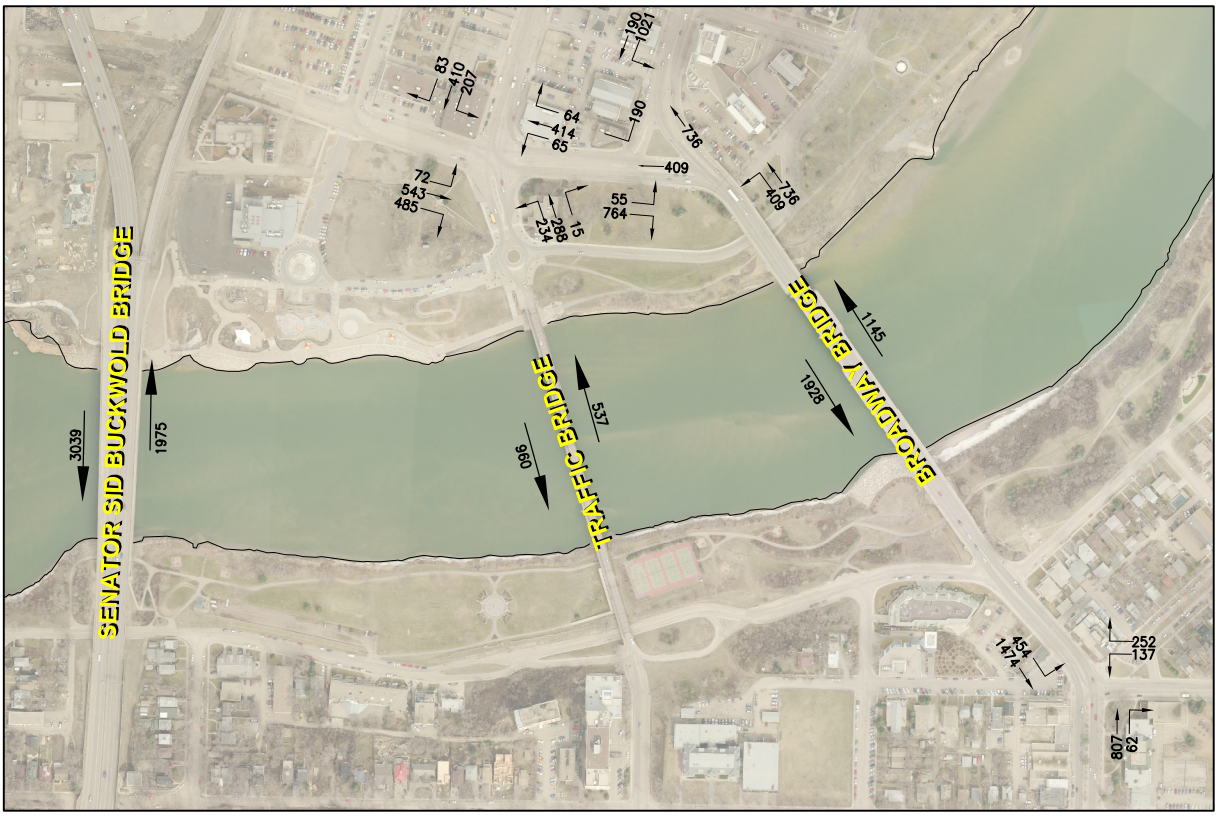
2029 Traffic Volumes

2029 Traffic Volumes represents conditions at the time Saskatoon reaches a population of 300,000. 2029 peak hour traffic volumes were again predicted using the City of Saskatoon's transportation planning model. Predicted volumes are shown on Figures B.3, B.4, B.5, and B.6.

Weekday Morning Peak Hour



Weekday Afternoon Peak Hour



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2011-01-06 09:33AM By: kcholodnuik

Jan, 2011
113154409

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Stantec

Legend

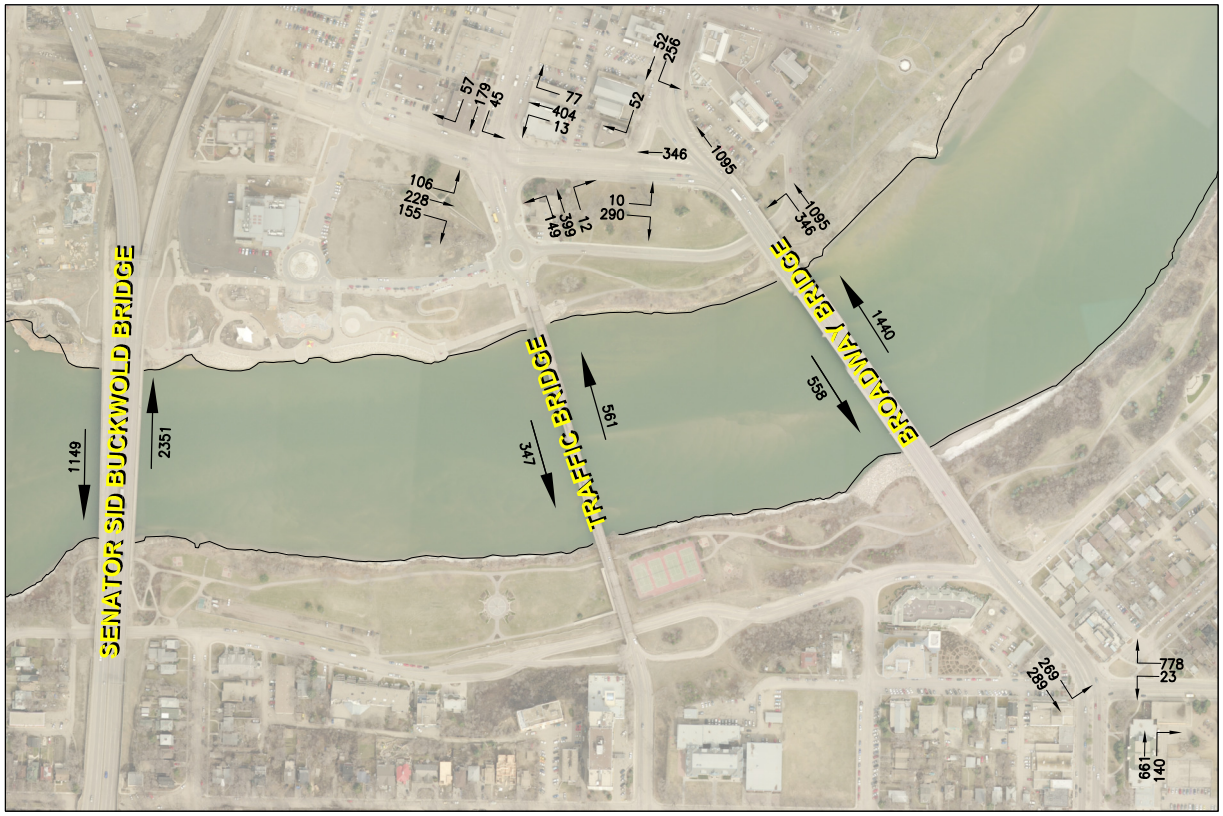
XXX Peak Hour Traffic Volume

Client/Project
CITY OF SASKATOON
TRAFFIC BRIDGE NEEDS ASSESSMENT
AND FUNCTIONAL PLANNING STUDY

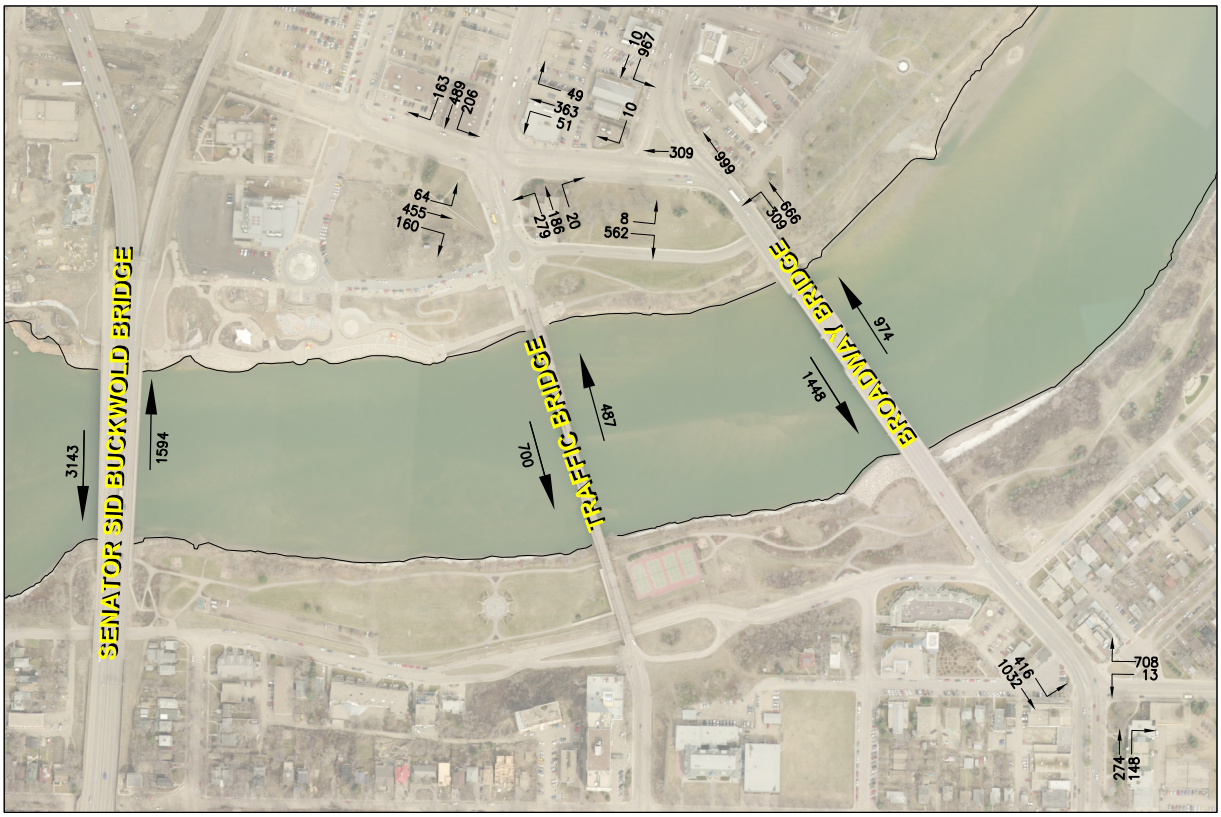
Figure No.
B.2

Title
2010 PEAK HOUR

Weekday Morning Peak Hour



Weekday Afternoon Peak Hour



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2011-01-06 09:35AM By: kcholodnuik

Jan, 2011
113154409

ORIGINAL SHEET - ANSI A

Stantec

Legend

XXX **Peak Hour Traffic Volume**

Client/Project

CITY OF SASKATOON
TRAFFIC BRIDGE NEEDS ASSESSMENT
AND FUNCTIONAL PLANNING STUDY

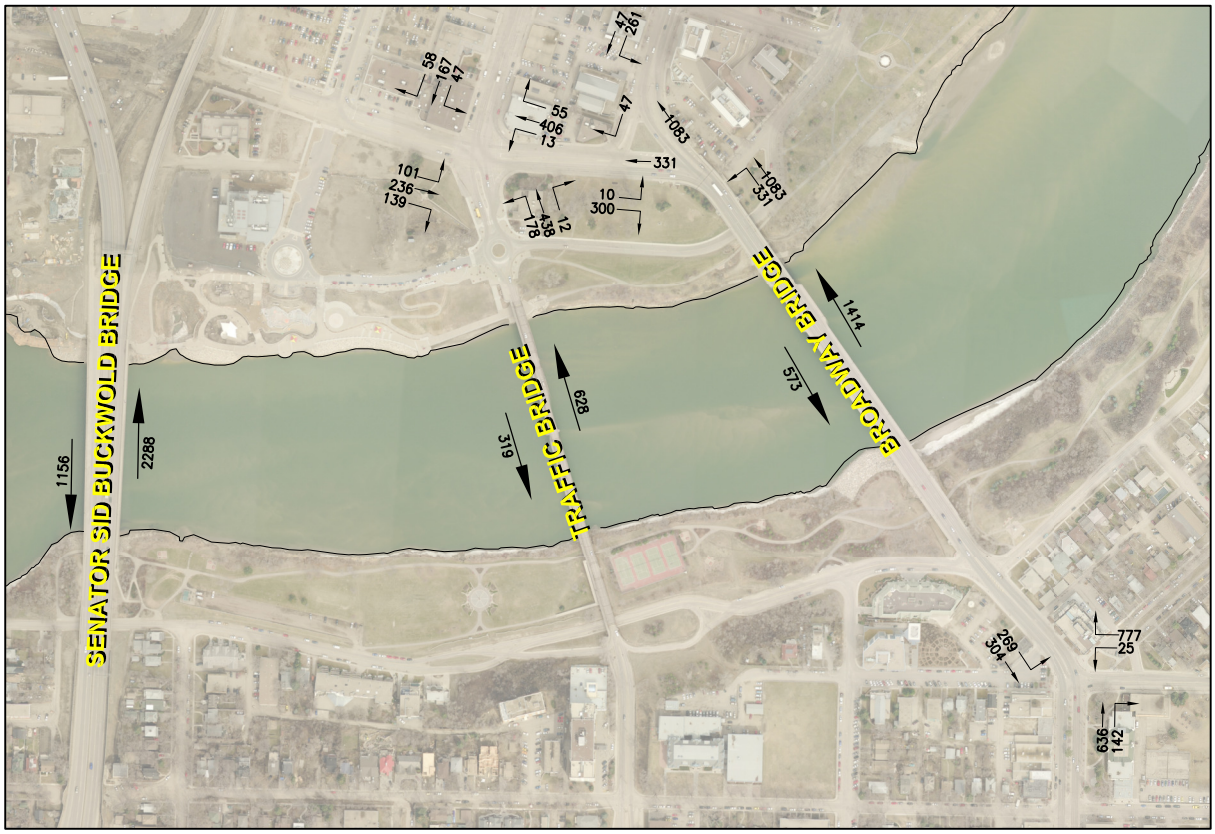
Figure No.

B.3

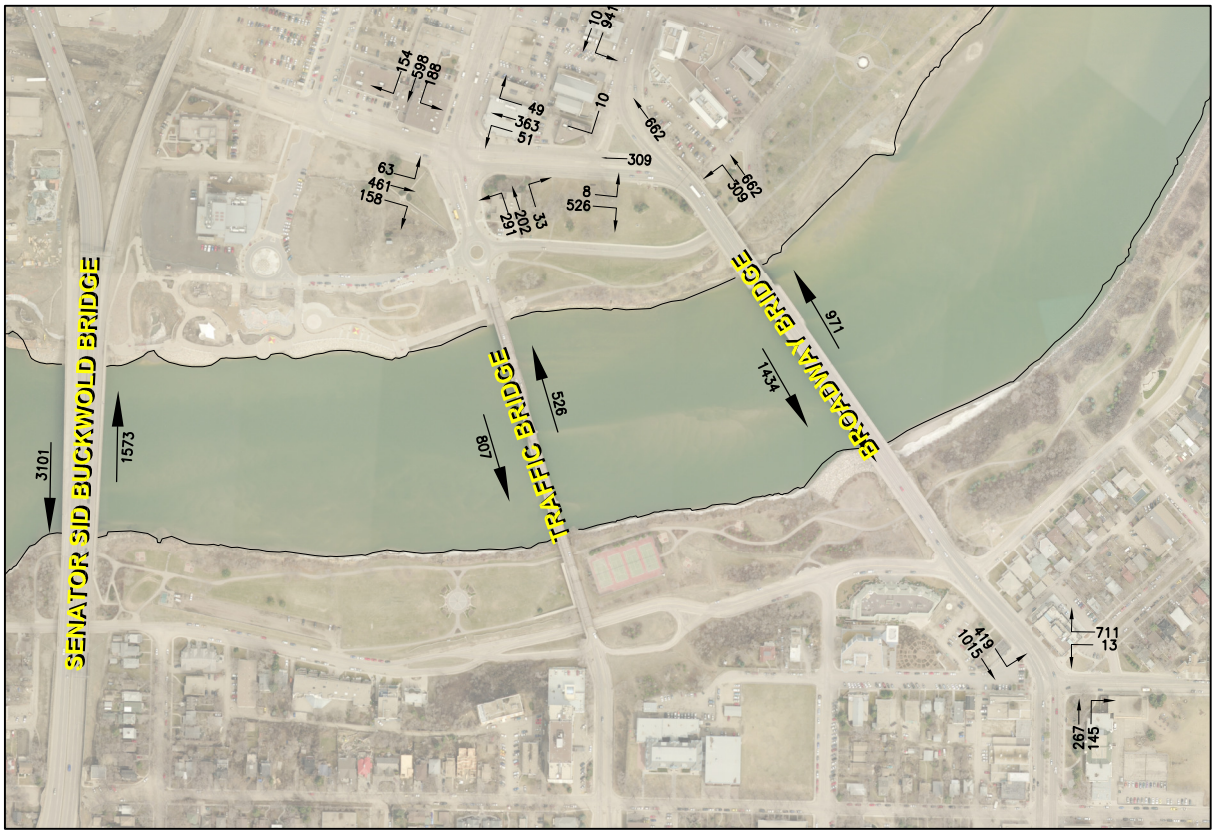
Title

2029 PEAK HOUR TRAFFIC VOLUMES
EXISTING TRAFFIC BRIDGE

Weekday Morning Peak Hour



Weekday Afternoon Peak Hour



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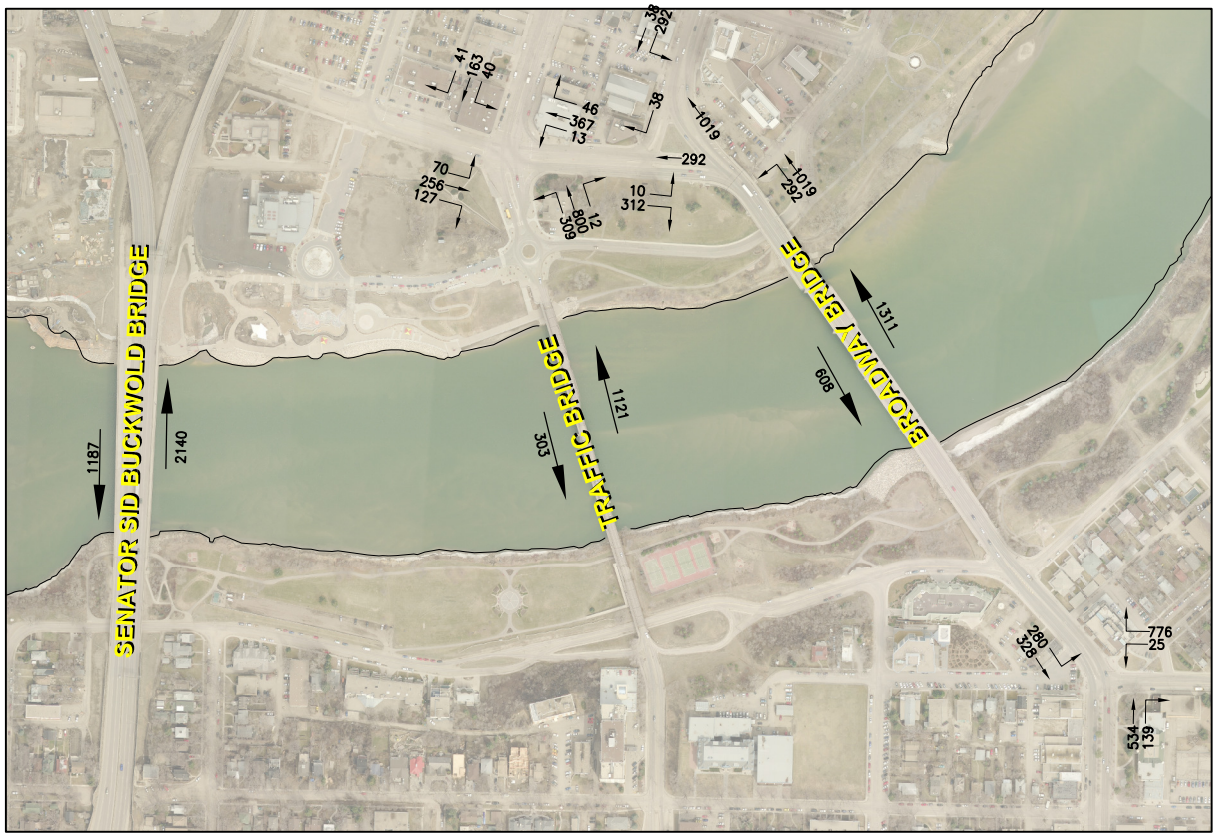
XXX Peak Hour Traffic Volume

Client/Project
CITY OF SASKATOON
TRAFFIC BRIDGE NEEDS ASSESSMENT
AND FUNCTIONAL PLANNING STUDY

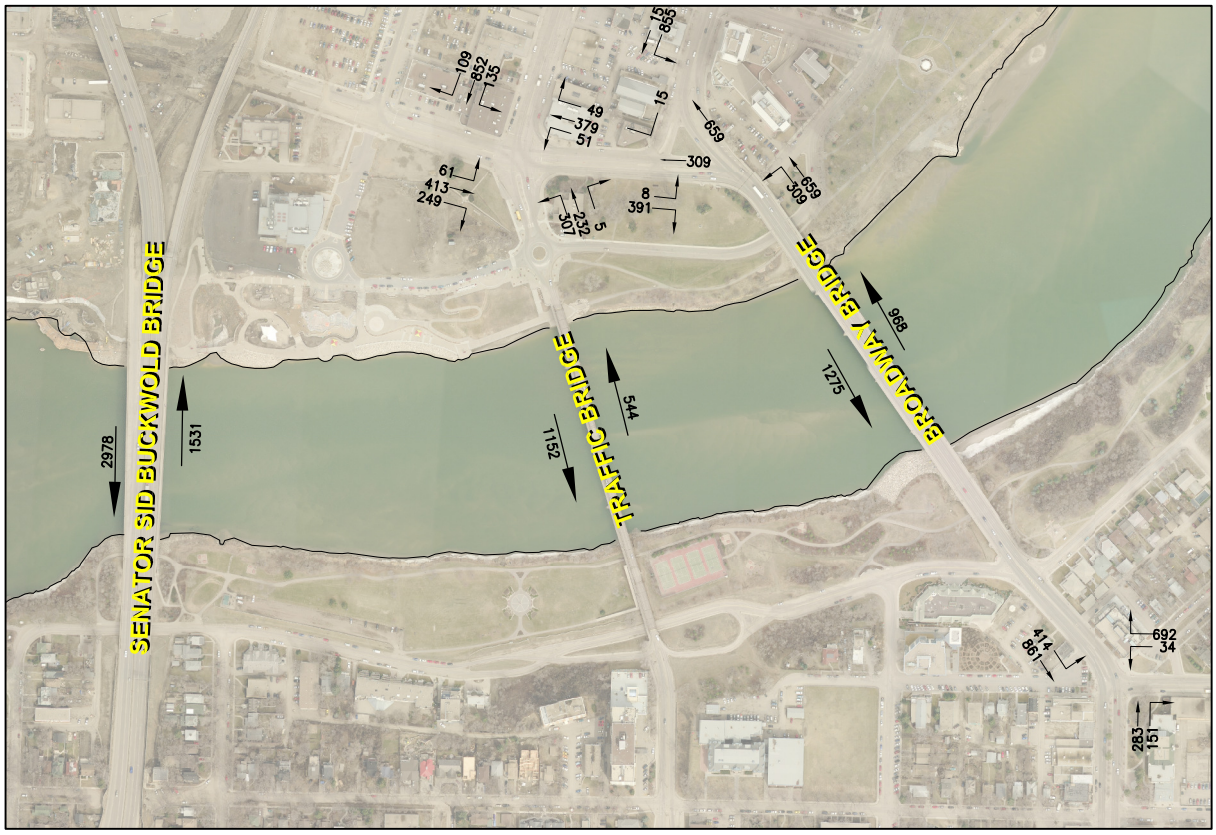
Figure No.
B.4

Title
2029 PEAK HOUR TRAFFIC VOLUMES
STANDARD TWO LANE BRIDGE

Weekday Morning Peak Hour



Weekday Afternoon Peak Hour



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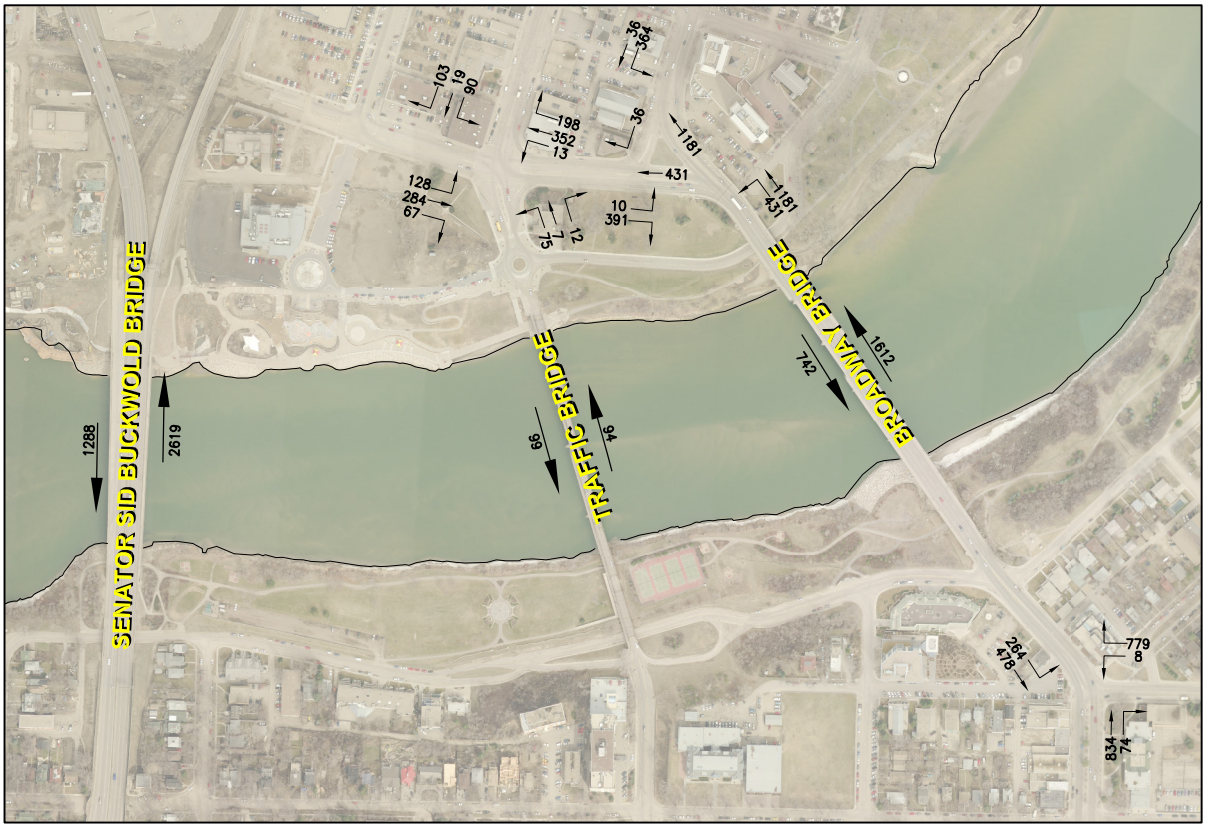
XXX Peak Hour Traffic Volume

Client/Project
CITY OF SASKATOON
TRAFFIC BRIDGE NEEDS ASSESSMENT
AND FUNCTIONAL PLANNING STUDY

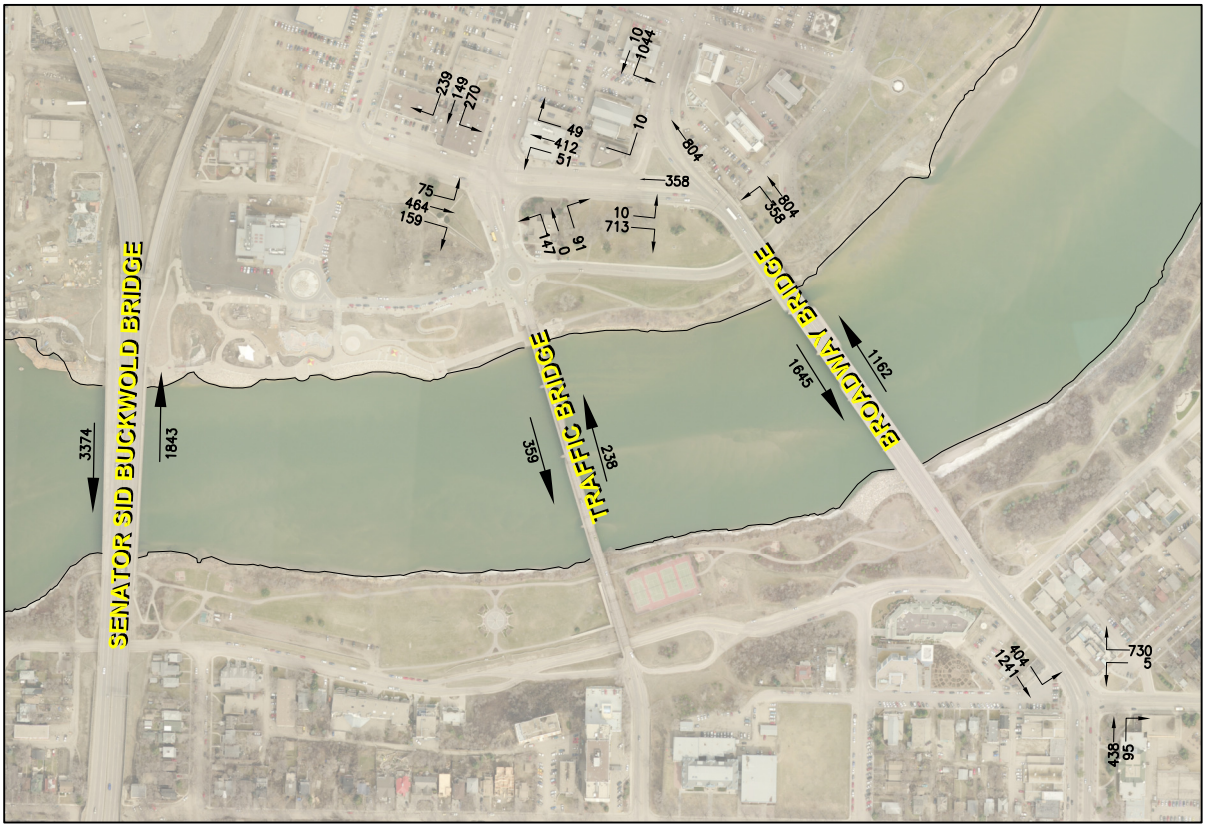
Figure No.
B.5

Title
2029 PEAK HOUR TRAFFIC VOLUMES
STANDARD FOUR LANE BRIDGE

Weekday Morning Peak Hour



Weekday Afternoon Peak Hour



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Stantec

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XXX Peak Hour Traffic Volume

Client/Project

CITY OF SASKATOON
TRAFFIC BRIDGE NEEDS ASSESSMENT
AND FUNCTIONAL PLANNING STUDY

Figure No.

B.6

Title

2029 PEAK HOUR TRAFFIC VOLUMES
TRAFFIC BRIDGE CLOSURE

1.4 TRAFFIC ANALYSIS

Traffic analysis was conducted for the weekday AM and PM peak hours for the following scenarios:

- 2010 Conditions with Traffic Bridge
- 2029 Conditions with Traffic Bridge
- 2029 Conditions with full width two lane Bridge
- 2029 Conditions with four lane Bridge
- 2029 Conditions without Traffic Bridge

The traffic operational measures of effectiveness most applicable to this analysis are 95th percentile queuing lengths and level of service (LOS). 95th percentile queue lengths represent the longest queue of vehicles that can be expected for a particular movement in a statistically significant number of occurrences of peak hour conditions. LOS is defined by ranges of average delay sustained by motorists traveling through an intersection. LOS A represents the lowest range of average delay and the best conditions while LOS F represents the highest range and represents a breakdown of traffic operations. Typically, LOS ratings worse than D are not considered acceptable in the peak hours of traffic flow. Table B.1 shows the ranges of delay associated with each level of service for signalized intersections.

Table B.1
Level of Service Criteria for Roadway Segments

Level of Service	Interpretation	Delay per Vehicle (seconds)
A	Low volumes; primarily free-flow operations. Density is low, and vehicles can freely maneuver within the traffic stream. Drivers can maintain their desired speeds with little or no delay.	≤ 10
B	Stable flow with potential for some restriction of operating speeds due to traffic conditions. Maneuvering is only slightly restricted. The stopped delays are not bothersome, and drives are not subject to appreciable tension.	> 10 and ≤ 20
C	Stable operations; however, the ability to maneuver is more restricted by the increase in traffic volumes. Relatively satisfactory operating speeds prevail, but adverse signal coordination or longer queues cause delays.	>20 and ≤ 35
D	Approaching unstable traffic flow, where small increases in volume could cause substantial delays. Most drivers are restricted in their ability to maneuver and in their selection of travel speeds. Comfort and convenience are low but tolerable.	> 35 and ≤ 55
E	Operations characterized by significant approach delays and average travel speeds of one-half to one-third the free-flow speed. Flow is unstable and potential for stoppages of brief duration. High signal density, extensive queuing, or progression/timing are the typical causes of the delays.	> 55 and ≤ 80
F	Forced-flow operations with high approach delays at critical signalized intersections. Speeds are reduced substantially, and stoppages may occur for short or long periods of time because of downstream congestion.	> 80

The study area intersections were analyzed using the computer program SYNCHRO ver. 7.0. SYNCHRO analyzes both signalized and un-signalized intersections in terms of delay and queues according to the methodology detailed in the 2000 Edition of the Highway Capacity Manual. It can be used to evaluate existing operations or to optimize traffic signal phase configurations, timing splits, and cycle lengths. The program also optimizes coordinated signal networks and their associated cycle offsets. For purposes of this study, SYNCHRO was used to analyze intersection operations and to optimize signal phasing, offsets and arterial coordination under existing and projected volume conditions.

In addition to the intersection/network analysis and optimizations, the traffic simulation program SIMTRAFFIC was used to validate roadway geometry and traffic control to ensure actual conditions were modeled as accurately as possible. It also provided a means for determining the suitability of various traffic control and geometric improvement alternatives. The primary benefit of traffic simulation is the identification of locations where significant queuing creates spillback that blocks adjacent lanes and/or affects upstream intersection operations.

In addition to SYNCHRO AND SIMTRAFFIC analysis, the Buckwold Bridge was analyzed using the methodology for multilane highways outlined in the HCM 2000 manual. LOS criteria is shown in Table B.2 The multilane highway analysis was used to establish levels of service for

the Buckwold Bridge for each of the above noted design scenarios. HCM 2000 correlates average run speed and density of vehicles per lane per kilometer to establish LOS.

Table B.2
Level of Service Criteria for Multilane Highways

Free-Flow Speed	Criteria	LOS				
		A	B	C	D	E
100 km/hr	Maximum density (pc/km/ln)	7	11	16	22	25
	Average Speed (km/hr)	100.0	100.0	98.4	91.5	88.0
	Maximum Volume to Capacity Ratio (v/c)	0.32	0.50	0.72	0.92	1.00
	Maximum Service Flow Rate (pc/h/ln)	700	1100	1575	2015	2200
90 km/hr	Maximum density (pc/km/ln)	7	11	16	22	26
	Average Speed (km/hr)	90.0	90.0	89.8	84.7	80.8
	Maximum Volume to Capacity Ratio (v/c)	0.30	0.47	0.68	0.89	1.00
	Maximum Service Flow Rate (pc/h/ln)	630	990	1435	1860	2100
80 km/hr	Maximum density (pc/km/ln)	7	11	16	22	27
	Average Speed (km/hr)	80.0	80.0	80.0	77.6	74.1
	Maximum Volume to Capacity Ratio (v/c)	0.28	0.44	0.64	0.85	1.00
	Maximum Service Flow Rate (pc/h/ln)	560	880	1280	1705	2000
70 km/hr	Maximum density (pc/km/ln)	7	11	16	22	28
	Average Speed (km/hr)	70.0	70.0	70.0	69.6	67.9
	Maximum Volume to Capacity Ratio (v/c)	0.26	0.41	0.59	0.81	1.0
	Maximum Service Flow Rate (pc/h/ln)	490	770	1120	1530	1900

1.4.1 2010 Traffic Conditions

In order to assess the effects of future bridge options on the adjacent transportation network, current traffic conditions were determined to establish a basis for comparison purposes. 2010 traffic conditions assume the existing traffic bridge in place. The future Circle Drive South river crossing is not included in this analysis.

1.4.1.1 AM Peak Hour

The traffic analysis results for study area intersections for the weekday AM peak hour for 2010 is shown in Tables B.3 and B.4 below.

Table B.3
Synchro 7 MOE – Alternative Analysis for AM Peak Hour

Analysis Option	MOE	3rd Avenue & 19th Street	Broadway Avenue & 4th Avenue & 19th Street	Broadway Avenue & 12th Street
		Over all Intersection	Over all Intersection	Over all Intersection
2010 – Existing Conditions	LOS	B	B	B
	Delay (sec)	12.4	10.1	18.9
	Max v/c Ratio	0.48	0.65	0.80

* Denotes turning movement of LOS D or worse.

The above base analysis represents operations of the Traffic Bridge and Broadway Bridge as the LOS of the bridges will be governed by the LOS of the upstream and downstream intersections.

Table B.4
HCM 2000 MOE – Alternative Analysis for AM Peak Hour

Analysis Option	MOE	Direction	
		Northbound	Southbound
2010 – Existing Conditions	LOS	B	C
	Density (pc/km/ln)	7.3	11.9

All study area intersections under 2010 conditions operate acceptably in the AM peak hour. Intersections adjacent to the Traffic Bridge and the Broadway Bridges operate at overall LOS B will all movements operating at LOS C or better. Traffic operations on the Buckwold Bridge operate with acceptable LOS in the AM peak hour.

1.4.1.2 PM Peak Hour

The traffic analysis results for study area intersections for the weekday PM peak hour for 2010 is shown in Tables B.5 and B.6 below.

Table B.5
Synchro 7 MOE – Alternative Analysis for PM Peak Hour

Analysis Option	MOE	3rd Avenue & 19th Street	Broadway Avenue & 4th Avenue & 19th Street	Broadway Avenue & 12th Street
		Over all Intersection	Over all Intersection	Over all Intersection
2010 – Existing Conditions	LOS	C[1]	B	B[2]
	Delay (sec)	20.3	16.8	16.7
	Max v/c Ratio	0.84	0.82	0.85

* Denotes turning movement of LOS D or worse.

1) NBL: LOS-D, Delay (sec)-43.7, 95th Queue Length (m)-58.9
SBT: LOS-D, Delay (sec)-38.0, 95th Queue Length (m)-107.3

2) WBL: LOS-D, Delay (sec)-35.6, 95th Queue Length (m)-40.1
NBT: LOS-D, Delay (sec)-37.8, 95th Queue Length (m)-111.2

Table B.6
HCM 2000 MOE – Alternative Analysis for PM Peak Hour

Analysis Option	MOE	Direction	
		Northbound	Southbound
2010 – Existing Conditions	LOS	B	C
	Density (pc/km/ln)	9.4	14.4

Overall levels of service at study area intersections remain acceptable, however, movements at the intersections of 3rd Avenue / 19th Street and Broadway Avenue / 12th Street are experiencing longer delays and queue lengths. At the intersection of 3rd Avenue / 19th Street the northbound left and southbound through movements operate at LOS D with 95th percentile queue lengths approximately 59 m and 107 m respectively. The intersection of Broadway Avenue / 12th Street experiences increased delays for the westbound left and northbound through movements. Both movements operate at LOS D and 95th percentile queue lengths are approximated at 40 m and 111 m respectively. Traffic operations on the Buckwold Bridge operate with acceptable LOS in the PM peak hour.

1.4.2 2029 Traffic Conditions

Traffic analysis completed for the design year of 2029 corresponds to a Saskatoon population level of 300,000. Traffic analysis for the design year of 2029 includes the addition of the Circle Drive South River crossing which will be completed in 2012. Traffic analysis within this section assumes typical operating conditions of all roadways and intersections. Reductions in bridge or intersection capacity are not included in this analysis.

1.4.2.1 AM Peak Hour

The traffic analysis results for study area intersections for the weekday AM peak hour for 2029 is shown in Tables B.7 and B.8 below.

Table B.7
Synchro 7 MOE – Alternative Analysis for AM Peak Hour

Analysis Option	MOE	3rd Avenue & 19th Street	Broadway Avenue & 4th Avenue & 19th Street	Broadway Avenue & 12th Street
		Overall Intersection	Overall Intersection	Overall Intersection
2029 – Existing Bridge (Alternative 1)	LOS	B	A	C [1]
	Delay (sec)	11.0	6.9	23.4
	Max v/c Ratio	0.40	0.63	0.90
2029 – 2 Lane Improved Bridge (Alternative 2)	LOS	B	A	C [2]
	Delay (sec)	11.9	6.9	22.0
	Max v/c Ratio	0.39	0.63	0.87
2029 – 4 Lane Bridge (Alternative 3)	LOS	B	A	C
	Delay (sec)	12.8	7.1	18.8
	Max v/c Ratio	0.55	0.57	0.83
2029 – Bridge Closure (Alternative 4)	LOS	A	A	C [3]
	Delay (sec)	7.6	9.0	24.6
	Max v/c Ratio	0.45	0.68	0.89

* Denotes turning movement of LOS D or worse.

1) WBR: LOS-C, Delay (sec)-21.3, 95th Queue Length (m)-158.5
NBT: LOS-D, Delay (sec)-37.5, 95th Queue Length (m)-88.1

2) WBR: LOS-C, Delay (sec)-21.0, 95th Queue Length (m)-157.7

3) WBR: LOS-C, Delay (sec)-28.2, 95th Queue Length (m)-184.5
NBT: LOS-D, Delay (sec)-37.3, 95th Queue Length (m)-108.5

Table B.8
HCM 2000 MOE – Alternative Analysis for AM Peak Hour

Analysis Option	MOE	Direction	
		Northbound	Southbound
2029 – Existing Bridge (Alternative 1)	LOS	C	A
	Density (pc/km/ln)	11.1	5.4
2029 – 2 Lane Improved Bridge (Alternative 2)	LOS	B	A
	Density (pc/km/ln)	10.8	5.5
2029 – 4 Lane Bridge (Alternative 3)	LOS	B	A
	Density (pc/km/ln)	10.1	5.6
2029 – Bridge Closure (Alternative 4)	LOS	C	A
	Density (pc/km/ln)	12.4	6.1

The above analysis of the four design scenarios predict future traffic operations of the Traffic Bridge and Broadway Bridge as the LOS of the bridges will be governed by the LOS of the upstream and downstream intersections.

- **Existing Bridge –** Traffic analysis for the existing bridge configuration shows that overall, each of the three key intersections will operate acceptably in the AM peak hour with all intersections at LOS C or better. Critical movements noted above include the westbound right turn and northbound through movements at the intersection of Broadway Avenue / 12th Street. Although the westbound right movement operates at an LOS C, 95th percentile queue lengths for this movement are long. The LOS for the northbound through movement is D. All other movements at each of the study area intersections operate acceptably.

  Traffic operations on the Buckwold Bridge operate within acceptable Levels of Service.

- **Standard Two Lane Bridge –** Operating conditions for study area intersections remain nearly consistent. Intersection delay for the intersection of 3rd Avenue / 19th Street slightly increases while delay at the intersection of Broadway Avenue / 12th Street slightly decreases. Queue lengths of the westbound right turn at the intersection of Broadway Avenue / 12th Street remain high.

  Traffic operations on the Buckwold Bridge improve slightly and operate acceptably.

- **Standard Four Lane Bridge –** LOS for study area intersections remain the same however, delay for the intersection of 3rd Avenue / 19th Street again increase while delay at the intersection of Broadway Avenue / 12th Street decreases to 18.8 sec/veh.

  Traffic operations on the Buckwold Bridge again improve in the peak direction but remain at an LOS B

- **Bridge Closure –** With the closure of the Traffic Bridge the intersection of 3rd Avenue / 19th Street improves to an overall LOS A while other study area intersections remain consistent. Delays and queue lengths at the intersection of Broadway Avenue / 12th Street increase. Delays and queue lengths for the westbound right turn and northbound through movements increase slightly past conditions shown above with the existing Traffic Bridge in place. All other movements at study area intersections operate acceptably during the AM peak hour.

  Traffic operations on the Buckwold Bridge are lowered to LOS C in the peak direction similar to conditions with the existing Traffic Bridge. Traffic conditions are acceptable.

As the above analysis shows, during the AM Peak hour, there is little deviation with study area operating conditions for the four design scenarios. Overall delays at study area intersections are acceptable at all design horizons.

1.4.2.2 PM Peak Hour

The traffic analysis results for study area intersections for the weekday PM peak hour for 2029 conditions is shown in Tables B.9 and B.10 below.

Table B.9
Synchro 7 MOE – Alternative Analysis for PM Peak Hour

Analysis Option	MOE	3rd Avenue & 19th Street	Broadway Avenue & 4th Avenue & 19th Street	Broadway Avenue & 12th Street
		Overall Intersection	Overall Intersection	Overall Intersection
2029 – Existing Bridge (Alternative 1)	LOS	B	B	A
	Delay (sec)	16.7	15.7	7.7
	Max v/c Ratio	0.76	0.82	0.67
2029 – 2 Lane Improved Bridge (Alternative 2)	LOS	C[1]	B	A
	Delay (sec)	20.2	15.5	7.5
	Max v/c Ratio	0.81	0.79	0.67
2029 – 4 Lane Bridge (Alternative 3)	LOS	D [3]	B[2]	A
	Delay (sec)	35.0	15.3	8.1
	Max v/c Ratio	1.06	0.72	0.67
2029 – Bridge Closure (Alternative 4)	LOS	B	B	B[4]
	Delay (sec)	12.9	15.5	11.2
	Max v/c Ratio	0.51	0.82	0.72

* Denotes turning movement of LOS D or worse.

1) EBL: LOS-D, Delay (sec)-35.8, 95th Queue Length (m)-20.5

2) NWL: LOS-D, Delay (sec)-35.0, 95th Queue Length (m)-77.3

3) EBL: LOS-D, Delay (sec)-41.5, 95th Queue Length (m)-23.3
NBL: LOS-F, Delay (sec)-88.9, 95th Queue Length (m)-84.7
SBT: LOS-D, Delay (sec)-43.1, 95th Queue Length (m)-200.7

4) NBT: LOS-D, Delay (sec)-35.0, 95th Queue Length (m)-61.4

Table B.10
HCM 2000 MOE – Alternative Analysis for PM Peak Hour

Analysis Option	MOE	Direction	
		Northbound	Southbound
2029 – Existing Bridge (Alternative 1)	LOS	B	C
	Density (pc/km/ln)	7.5	14.9
2029 – 2 Lane Improved Bridge (Alternative 2)	LOS	B	C
	Density (pc/km/ln)	7.4	14.7
2029 – 4 Lane Bridge (Alternative 3)	LOS	B	C
	Density (pc/km/ln)	7.3	14.1
2029 – Bridge Closure (Alternative 4)	LOS	B	C
	Density (pc/km/ln)	8.7	16.0

- **Existing Bridge –** Traffic analysis for the existing bridge configuration shows that overall, each of the three key intersections will operate acceptably in the PM peak hour with all intersections at LOS B or better.

  Traffic operations on the Buckwold Bridge operate within acceptable Levels of Service.

- **Standard Two Lane Bridge –** Operating conditions for study area intersections remain consistent with the exception of the intersection of 3rd Avenue / 19th Street which drops to a LOS C. The eastbound left movement operates at an LOS D. All other intersection movements within the study area operate acceptably.

  Traffic operations on the Buckwold Bridge improve slightly and operate acceptably.

- **Standard Four Lane Bridge –** With the addition of a four lane bridge in the location of the Traffic Bridge conditions at downstream intersection begin to deteriorate. The intersection of 3rd Avenue / 19th Street drops to LOS D with many movements operating at LOS D or worse. Maximum v/c ratios exceed 1.00. In addition to operational issues at this intersection, the traffic roundabout to the south would be overcapacity as it is currently served by one lane legs. All other intersections in the study are operate acceptably

  Traffic operations on the Buckwold Bridge again improve in the peak direction but remain at an LOS.

- **Bridge Closure –** With the closure of the Traffic Bridge all study area intersections operate at an acceptable LOS B. Delays and queue lengths at the intersection of Broadway Avenue / 12th Street increase. Delays and queue lengths for the northbound through movements increase slightly past conditions shown above with the existing Traffic Bridge in place. All other movements at study area intersections operate acceptably during the PM peak hour.

  Traffic operations on the Buckwold Bridge remain at LOS C in the peak direction similar to conditions with the existing Traffic Bridge. Traffic conditions are acceptable.

As the above analysis shows, during the PM Peak hour, the Standard Four Lane Bridge shows operational problems with downstream intersections. This scenario would also increase traffic on Victoria Avenue south of the bridge. This would have a negative impact as Victoria Avenue is a residential roadway. All other design scenarios operate acceptably under typical PM peak operating conditions at the 2029 design horizon.

1.5 CONCLUSIONS

The following conclusions are based on the above analysis:

- **Existing Bridge –** Traffic operations with the existing Traffic Bridge in place operate acceptably in both the AM and PM peak hours at the 2029 design horizon. Some

movements at the intersection of Broadway Avenue / 12th Street experience longer delays and queue lengths which may result in unstable traffic flow. In the future, pedestrian crossing locations and cross street intersections along Victoria Avenue may require reassessment.

- **Standard Two Lane Bridge –** Traffic operations with the addition or standard width (3.7 m) traffic lanes at the Traffic Bridge location show marginal improvements on traffic conditions at study area intersections and bridges. In the future, pedestrian crossing locations and cross street intersections along Victoria Avenue may require reassessment.

- **Standard Four Lane Bridge –** Traffic operations with the addition of a four lane bridge at the Traffic Bridge location have adverse affects on study area intersections and corridors. The intersection of 3rd Avenue / 19th Street experiences increased delays, queue lengths and will experience unstable traffic flow. It is also noted that the existing roundabout at the north end of the bridge would require conversion to a standard intersection. Signalization may be required. Victoria Avenue south of the bridge would also require modification to a four land roadway. This would consist of removing street parking on Victoria Avenue. Increased traffic would likely lead to reductions in level of service along Victoria Avenue. Cross streets and pedestrian movements would need to be re-evaluated and traffic signals may be required.

- **Bridge Closure –** Traffic operations reflecting closure of vehicular traffic on the Traffic Bridge show increased delays and queue lengths at the intersection of Broadway Avenue / 12th Street with some movements operating at LOS D. During typical operating conditions study area intersections and roadways operate acceptably.

  It is noted that during extreme peak periods when other bridges are being maintained unstable traffic flow may occur. The bridge acts as a release valve for other crossing in the area when they are at reduced capacity. As such, the bridge serves a unique role within the City transportation system.

APPENDIX C
2010 DETAILED VISUAL INSPECTION AND ASSESSMENT REPORT

Executive Summary

A detailed visual inspection and load rating was conducted on all components of the traffic bridge during the week of August 23rd, 2010. Initial observations identified significant section loss in the components of the bridge below the deck. The section loss recorded appeared to have exceeded the projections established in 2006 when the strengthening that was precipitated from the 2005 inspection had been implemented.

The detailed load rating identified many elements that can no longer support the desired dead and live loads. As well, Span 4 has reached the point that it can no longer support its own weight safely.

Therefore, based on our analysis, we recommend following actions be implemented for the Traffic Bridge:

- All vehicle and pedestrians loads must remain off the structure until repairs are completed;
- Temporary shoring must be installed on the trusses over the Meewasin Valley Trail and the Saskatchewan Crescent East or the traffic accommodated by these facilities must be directed to alternate accesses; and
- If repairs are implemented, the extent of repair must be increased to address all components of the bridge. At this time, we believe that the only viable future option for this structure is to either replace the traffic bridge with a new facility or to completely remove the lower portions of the truss and the entire deck structure system and replace with new.

Table of Contents

1.0 Introduction

1.1 STRUCTURE HISTORY

The Traffic Bridge was constructed in 1907 and spans the South Saskatchewan River. The structure has five main steel truss spans (2 @175 ft, 3 @ 200 ft) with short timber approach spans at each end of the bridge. The bridge originally carried streetcar traffic and currently carries two lanes of vehicle traffic with a sidewalk on the west side of the bridge for pedestrian use.

Past investigations of the Traffic Bridge were carried out in 1986, 1991, 1995, 2002, and 2005. Inspections were carried out previously to 1986, but no information was available from these reports. The 2005 detailed inspection revealed significant deterioration on the truss lower chords which precipitated a complete closure of the facility until repairs were implemented.

A summary of past repairs and maintenance is as follows:

- 1960 – Raised south spans, replaced original abutments and installed approach spans.
- 1978/79 – Recoated steel bottom chord and steel deck framing members.
- 1985 – Installed new exterior deck stringers to replace rotated elements and repaired select areas of the timber deck.
- 1992 – Installed new steel HSS traffic guardrails and pedestrian handrail on walkway.
- 1995 – Installed new concrete bearing pedestals, bearings, expansion joints, and repaired several damaged truss members. Installed new timber sidewalk.
- 1996 – Upgraded piles in timber approaches and new expansion joints.
- 2001 – Upgraded asphalt wearing surface.
- 2003 – Replaced and repaired impact damaged bottom chord members over Saskatchewan Crescent. Replaced damage rails on the north end of the pedestrian walkway. Replaced deteriorated timber stringers on the south approach.
- 2006 – Strengthening of the lower chords on Span 1, 2, and 3 plus isolated areas at discrete locations on the remaining elements.

After the conclusion of the 2006 repairs, the structure was re-opened to traffic with the same restriction a previous load rating completed in 1986 had identified of 5 tonnes.

1.2 CURRENT WORK

The City of Saskatoon (COS) commissioned Stantec Consulting Ltd. to perform a detailed inspection of the steel trusses, floor beams, stringers, and timber deck of the Traffic Bridge

located in Saskatoon. This investigation was initiated as a follow-up to an earlier detailed inspection that was completed in 2005 which found significant section loss had compromised the safety of the structure. Subsequent to the 2005 inspection, strengthening was implemented on the lower chords of Span 1 to 3 and at isolated areas on the remaining elements to allow the structure to be returned to service.

Stantec personnel completed the inspection during the week of August 23rd, 2010 with a lift truck on the land spans and with climbers on the river spans. All critical components of the truss were inspected using visual means with rust buildup removed at discrete locations to permit measurement of section. All section loss measurements were compared to the results of 2005 and new F-factors were determined on each component.

Existing conditions and findings from the visual inspections are outlined in Section 2.0 of this report. Results of the load rating are presented in Section 3.0 with recommendations summarized in Section 4.0.

2.0 Visual Inspection

A detailed visual inspection was conducted during the week of August 23rd, 2010. Two separate crews were engaged, one who was responsible for the land spans while the second crew was responsible for climbing the bridge to access portions of the bridge over the river. Each inspector was experienced in the inspection and rating of steel structures including the climbing inspectors.

The inspection methodology used is based on the Ontario Structures Inspection Manual (OSIM), 2008 which has been adopted by the Saskatchewan Ministry of Highways and Infrastructure for the provinces infrastructure. This method employs a defect, severity, and extent approach to evaluating a bridge rather than the traditional 1 to 9 point or other similar point rating systems. The strength of the OSIM method is that discrepancies between different inspectors related to interpretation are minimized which ensures results obtained from each inspector are consistent. This consistency of reporting is very important on a structure the size of the Traffic Bridge where different specialists are employed to access the various elements.

However, due to the extent of defects observed and the challenge of physically removing extensive layers of coatings and corrosion by-products on nearly every surface inspected, not all defects could be easily documented and measured. As well, many of the connections are configured in such a way as to preclude a complete visual inspection or cleaning. In these instances, the inspectors used judgment in comparing inaccessible areas with areas that were accessible in order to obtain condition and section loss estimates for use in the load rating presented in Section 3.0.

The terminology used in an OSIM inspection is unique and consistent. In order to assist with your interpretation of the results, a full OSIM manual can be obtained at: http://www.ogra.org/content_details.asp?itemcode=OGRA-NEWSINFO-MAIN&itemid=12648.

For reference purposes, abutments and piers are numbered from south (Nutana end) to north (Downtown end) and longitudinal members from west (upstream) to east (downstream).

In general terms, the visual inspection identified significant section loss in all elements below the deck surface. The corrosion observed had increased significantly in all areas over the observations recorded in 2005. New areas of corrosion were found which have jeopardized the structural capacity of the elements which had not been strengthened in 2006. As well, portions of the lower chord outside of the strengthening have experienced significant section loss which has also potentially caused the strengthening to be ineffective. When the extent of deterioration was found, the structure was immediately closed to all forms of transportation pending the load rating discussed in Section 3.0 was completed.

Listed below is a summary of the inspection for the major components of the bridge.

Lower Chord

- Coatings have completely failed;
- Very severe section loss typical on all elements with localized areas of complete section loss ranging from 10% to 60%;
- Locations at random panel points where rivets are missing or have corroded to the point where the rivet head is nearly missing.

Upper Chord

- Coatings are providing some protection; and
- Steel has not sustained any significant section loss due to corrosion, however, localized impact damage is evident on the end panels where the upper chords drop down to the bearing supports.

Verticals and Diagonals

- Above the deck, all verticals and diagonals are in similar condition to the upper chords with isolated areas of impact damage and corrosion;
- Below the deck, significant section loss has occurred on the verticals, diagonals, and gusset plates which connect each element; and
- At localized areas, rivets are missing and in some locations, corrosion has removed the rivet head.

Floor Beams

- Very severe section loss typically concentrated at the connection to each panel point.

Stringers

- Sidewalk stringers have very severe section loss at random locations on the top flange, bottom flange, and web; and
- Deck stringers have very severe section loss at connections and at random locations on the top flange.

Estimated section losses for those elements which impacted the load carrying capacity of the truss were established for each member based on physical measurements as shown below in Table 2.1 and 2.2. Included in Table 2.1 are section losses recorded during the 2005 inspection for the bottom chord. When establishing these section losses for 2010, the inspectors took the worst case identified for each element and applied that loss to the entire element. This is an acceptable approach given that elements presented are tension elements the capacity of which is based on the least section available within the entire element.

For other elements such as floor beams and stringers, section loss at critical locations such as the support or midspan was identified. Since the location of section loss can greatly influence the flexural capacity of a beam, additional information is provided in Table 2.2 which reflects

where the section loss occurred. Due to the number of floor beams and stringers contained within this structure only the worst section loss is presented in Table 2.2.

Table 2.1
City of Saskatoon
Traffic Bridge
Summary of Section Loss – Bottom Chords

Upstream Bottom Chord										
Span	**1**		**2**		**3**		**4**		**5**	
Member	**2005**	**2010**	**2005**	**2010**	**2005**	**2010**	**2005**	**2010**	**2005**	**2010**
L0-L1	0%*	5%	32%	50%	13%	30%	24%	30%	12%	40%
L1-L2	0%*	5%	32%	40%	5%	30%	26%	30%	14%	40%
L2-L3	53%	60%	32%	40%	39%	40%	50%	50%	22%	40%
L3-L4	32%	40%	24%	30%	15%	30%	9%	30%	11%	40%
L4-L5	54%	60%	26%	30%	39%	40%	9%	30%	14%	40%
L5-L6	44%	50%	12%	30%	39%	40%	23%	30%	6%	40%
L6-L7	53%	55%	19%	30%	20%	30%	19%	40%	13%	40%
L7-L8	N/A	N/A	38%	40%	13%	30%	11%	50%	N/A	N/A
Downstream Bottom Chord										
Span	**1**		**2**		**3**		**4**		**5**	
Member	**2005**	**2010**	**2005**	**2010**	**2005**	**2010**	**2005**	**2010**	**2005**	**2010**
L0-L1	0%*	5%	49%	50%	19%	30%	19%	50%	21%	40%
L1-L2	0%*	5%	37%	40%	14%	30%	14%	60%	17%	40%
L2-L3	50%	60%	36%	40%	14%	30%	14%	50%	17%	40%
L3-L4	50%	60%	32%	40%	14%	30%	14%	50%	14%	40%
L4-L5	31%	40%	32%	40%	14%	30%	14%	50%	21%	40%
L5-L6	35%	60%	32%	40%	14%	30%	14%	50%	22%	40%
L6-L7	39%	60%	32%	40%	14%	30%	14%	50%	26%	40%
L7-L8	N/A	N/A	32%	40%	19%	30%	19%	50%	N/A	0%*

Table 2.2
City of Saskatoon
Traffic Bridge
Summary of Section Loss – Floor Beams and Stringers

Element	Flexure	Shear	Comments
Floor Beam	10%-30%	50%	Section loss most extreme near the end of the beam, thus primarily affecting shear capacity
Sidewalk Stringer	30%-80%	30%-80%	Section loss varied among the stringers but high losses did occur at regions of high flexural and shear stress
S20 Stringer	20%	20%	Section loss occurs at regions of both high flexural and shear stress
S12 Stringer	20%	20%	Section loss occurs at regions of both high flexural and shear stress

3.0 Detailed Load Rating

3.1 STRUCTURAL ANALYSIS

The Traffic Bridge consists of five steel truss spans 53.2/61/61/61/53.2 plus timber spans at the north and south approach to the structure. Substructure components are concrete for the north abutment and all river piers, steel for the south span south pier, and timber for the south and north timber span abutment.

Several load ratings have been conducted on this structure which has resulted in the current 5 tonne load limit. Prior to 2005, load ratings had identified deck stringers as the critical elements due to the lack of mechanical connection between the top flange and timber deck. Without this connection, under load, the stringers could twist out and cause the deck to fail. This failure mechanism had occurred in 1985 when a City street sweeper broke through the deck when an exterior stringer rotated out from under the deck.

After the 2005 visual inspection, extensive deterioration was observed on the lower chords of Spans 1, 2, and 3 and at isolated areas where verticals, diagonals, and bottom chords connected. The load rating completed as part of this visual inspection revealed the main trusses could no longer support dead and live loads due to the extensive section loss observed. Therefore, after the 2005 inspection, the critical component of the bridge became the bottom truss chord. Strengthening was completed in 2006, which consisted of the addition of post tensioned threaded bars to the bottom chords in the affected spans. These threaded bars were post-tensioned to reduce the tension in the bottom chord and anchored near the midpoint of each end panel and were not connected at any other point along the truss.

The current load rating covers all of the same elements completed in 2005 which includes the bottom chords, deck supports stringers, deck support beams, and sidewalk stringers. Top chord, diagonals and verticals have been added to this report although section loss in these elements is generally localized and concentrated at the connection points below the deck. Estimated corrosion section losses from the 2010 inspection have been incorporated into the analysis, as well as the effects of the 2006 rehabilitation. Of note is that not every element could be accurately measured either due to access issues or the difficulty in measuring the remaining section. Due to these challenges in obtaining inspection results on each element, there is a significant degree of uncertainty in the final calculations. As well, while all connections were inspected, many of them are beginning to show signs of significant pack rust which appears to be causing the rivets to pop off. This type of failure mechanism cannot be accurately quantified as the change in connection properties is abrupt when a rivet fails. Therefore, the results presented in this section must be considered as an approximation of the condition of the bridge. However, it cannot be stressed enough that even though every effort was made to identify the critical section losses which were used in the load rating, other issues could occur resulting in localized failures as the deterioration process continues.

The load rating was performed using the requirements of /CSA-S6-06 (Clause 14, Evaluations) with the design truck used for the 2005 analysis, the MS50 (GVW=5000kg)

3.2 TARGET RELIABILITY INDEX

In new bridge design the load factors employed are fixed for each type of load being considered. When evaluating an existing structure load factors are varied to match the expected reliability or the target reliability indexβ, for each component. This index is established on the basis of system behavior, element behavior, and inspection level, and is used to determine the dead and live load factors used in the analysis.

As an example, for this structure the trusses are categorized as an S1 system since failure of one portion of the truss such as the bottom chord, diagonals or verticals, would lead to total collapse. When considering individual elements under load, the bottom chords under tension can be characterized as a Category E1, where failure could occur suddenly at the net cross section. The inspection level of the bridge is Level INSP3, since an on-site inspection of critical and/or substandard components has been carried out and the evaluation calculations account for the information obtained by the inspection.

Using this analysis, the target reliability index's were obtained for each element evaluated in the analysis which are shown in Table 3.1.

3.3 MATERIALS

Yield strength of all existing steel elements was based on the coupon testing performed in 1986 which indicated a strength of 260MPa. The modulus of elasticity was taken to be 200GPa.

Table 3.1
City of Saskatoon
Traffic Bridge – 2010 Detailed Visual Assessment and Load Rating
Summary of Load Factors

Element	Bottom Chord	Diagonals	Verticals	Top Chord	Floor Beams	Traffic Stringers	Sidewalk Stringers	
System Behavior	S1	S1	S1	S1	S1	S3	S3	
Element Behavior	E1	E1	E1	E1	E3	E3	E3	
Insp. Level	INSP3	INSP3	INSP3	INSP3	INSP3	INSP3	INSP3	
β =	3.75	3.75	3.75	3.75	3.00	2.75	2.75	
D.L Factors								
D1 ($\alpha_{D)}$	1.1	1.1	1.1	1.1	1.07	1.06	1.06	
D2 ($\alpha_{D)}$	1.2	1.2	1.2	1.2	1.14	1.12	1.12	
D3 ($\alpha_{D)}$	1.5	1.5	1.5	1.5	1.35	1.3	1.3	
L.L Factors								
MS50 ($\alpha_{L)}$	1.7	1.7	1.7	1.7	1.49	1.42	1.42	

3.4 DEAD LOADS

CAN/CSA-S6-06 recommends the use of three types of dead loads, as shown below in table 3.2. Type D1 includes all factory produced components and cast-in-place concrete excluding decks. The calculated self-weight of the steel components was increased by 5% to allow for connection material. Type D2 is for cast-in-place concrete decks, wood, and asphalt measured in the field. For the traffic bridge, the asphalt thickness was measured in 2001 and was found to vary between 140mm-230mm therefore an average thickness of 185mm was used for this analysis. Type D3 is used for asphalt if the asphalt thickness has not been measured and therefore was not used.

Table 3.2
City of Saskatoon
Traffic Bridge
Dead Loads

Type	Element	Dead Load
D1	Steel Self-weight	(Cross Sectional Area)x(Density)x(1.05) kN/m
D2	Wood Deck	1.50 kPa
D2	Sidewalk Deck	0.30 kPa
D2	Asphalt	4.48 kPa
D3	N/A	N/A

3.5 LIVE LOADS

The live loads considered are based on an MS style of vehicle which has been the standard vehicle used for assessment on this structure, refer to Figure 3.1 below.

The capacity of each element is assessed by calculating F-factors at critical locations of section change or regions of high stress using the following formula:

$$F = \frac{U\phi R - \sum \alpha_D D - \sum \alpha_A A}{\alpha_L L(1+I)}$$

Where U is the element resistance adjustment factor, Φ is a material reduction factor, R is the element resistance, α_D, α_A, and α_L are the dead load, additional loads, and live load factors respectively, D, A, and L are the element applied dead load, additional load, and live load respectively, and I is the impact value.

F-factors represent the percentage of load-carrying capacity remaining once dead loads have been accounted for. Therefore, an F-factor equal or greater than 1.0 implies that once dead loads are accounted for, the element still has the capacity required to resist live loads introduced by the worst case live loading condition. F-factors less than 0 indicate that the element cannot support the applied dead loads under the target reliability index selected for that element. F-factors that fall between 0 and 1 indicate that the element can support the dead loads but are unable to support all of the live loads.

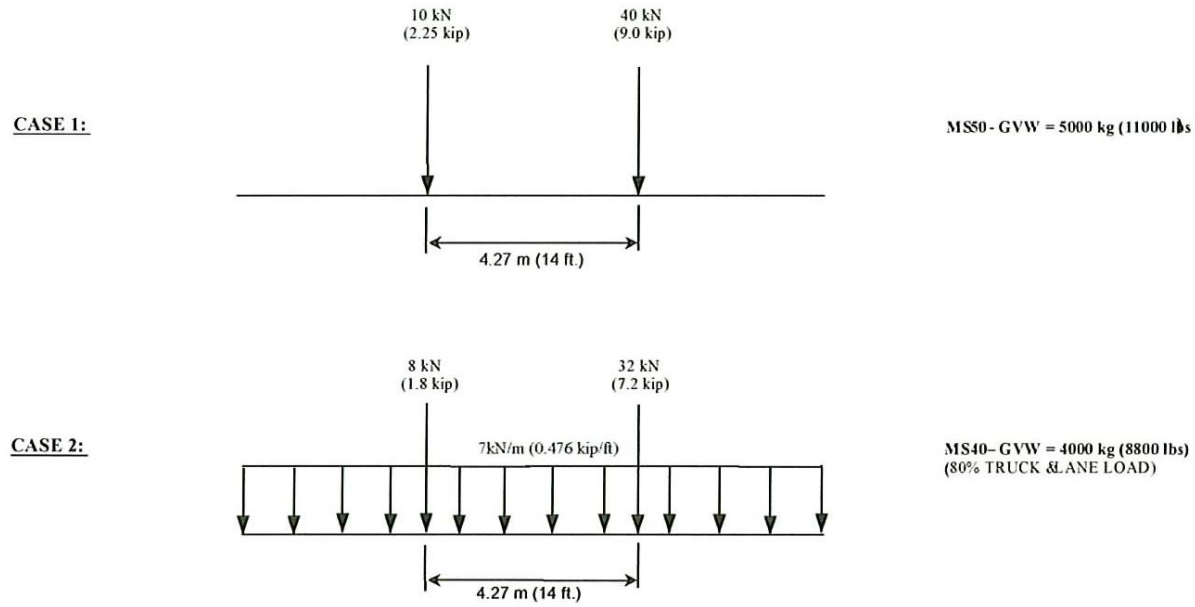

Figure 3.1. MS50 Truck

Two load cases of live loading were considered. The first load case was a full truck with a dynamic load factor of 1.30. The second load case consists of 80% of the design truck without a dynamic load allowance but with an additional lane load of 7 kN/m applied to each lane over the entire length of the bridge. A live load of 2.4 kPa on the pedestrian walkway was taken in combination with the vehicular traffic loading. This combination of loads causes heavier loading applied to the upstream truss which is reflected by the lower average F factors.

3.6 LOAD CARRYING CAPACITY

A summary of the load factor, F, for the MS50 rating is summarized in Tables 3.3 and 3.4. Table 3.3a includes load factors that had been calculated in 2005 for comparison purposes for the lower chord. Tables 3.3b through 3.3e include the worst F factors that have been calculated from the 2010 inspection for all other elements. Values for elements other than the lower chord were not calculated in 2005 as deterioration of these elements at that time had not progressed to the point that their strength was considered an issue.

The load rating indicates that strengthening completed in 2006 increased the capacity of those elements although in some cases, continued corrosion has lead to F factors less than 1.0 even for the strengthened elements. Areas that were not strengthened in 2006 have shown a drastic reduction in capacity which is directly related to the increased section loss observed. In particular, the downstream truss in Span 4 has F factors which are less than 0 which indicates that the truss cannot support its own weight using the target reliability values established previously. As well, end panels of the bottom chord have also changed significantly since the 2006 strengthening. At these locations, section loss has occurred outside of the area that was strengthened which has compromised the strengthening that had been installed.

Detailed Load Rating

For the stringers and floor beams, the section loss recorded in Section 2.0 was highly variable which presented challenges in determining the appropriate section properties required for determining the F-factor. Conservative section loss assumptions were made to account for this variability which is reflected in the values below.

Table 3.3a
City of Saskatoon
Traffic Bridge
Summary of Truss Bottom Chord F-Factors

Upstream Bottom Chord										
Span	**1**		**2**		**3**		**4**		**5**	
Member	**2005**	**2010**	**2005**	**2010**	**2005**	**2010**	**2005**	**2010**	**2005**	**2010**
L0-L1	3.14	2.38	1.29	0.06	2.13	0.92	1.66	0.92	2.55	0.74
L1-L2	3.14	3.49 *	1.30	1.60 *	2.46	2.03 *	1.55	0.92	2.43	0.74
L2-L3	0.43	0.71*	1.21	1.24 *	0.91	1.24 *	0.41	2.09 **	1.85	0.86
L3-L4	1.56	1.39 *	1.68	1.05 *	2.09	1.05 *	2.37	0.36	2.60	0.63
L4-L5	0.35	0.71*	1.61	1.05 *	1.01	0.70*	2.37	0.36	2.18	0.86
L5-L6	1.01	1.38 *	2.06	1.66 *	0.91	1.24 *	1.58	0.84	2.82	0.74
L6-L7	0.55	0.04	1.86	2.03 *	1.81	2.03 *	1.84	0.49	2.51	0.74
L7-L8	N/A	N/A	1.02	0.49	2.13	0.92	2.20	0.06	N/A	N/A
Downstream Bottom Chord										
Span	**1**		**2**		**3**		**4**		**5**	
Member	**2005**	**2010**	**2005**	**2010**	**2005**	**2010**	**2005**	**2010**	**2005**	**2010**
L0-L1	5.17	4.04	1.06	0.38	3.18	1.75	3.18	0.38	3.51	1.45
L1-L2	5.17	5.65 *	1.88	2.69 *	3.50	3.38 *	3.50	-0.30	3.85	1.45
L2-L3	1.08	1.31 *	1.82	2.16 *	3.36	2.82 *	3.36	0.28	3.52	1.65
L3-L4	1.28	0.96*	2.34	1.32 *	3.63	1.88 *	3.63	-0.27	4.08	1.28
L4-L5	2.50	2.88 *	2.34	1.32 *	3.63	1.88 *	3.63	-0.27	3.17	1.65
L5-L6	2.45	1.58 *	2.13	2.16 *	3.36	2.82 *	3.36	0.28	3.47	1.45
L6-L7	2.17	-0.03	2.24	2.69 *	3.50	3.38 *	3.50	0.38	3.15	4.41 **
L7-L8	N/A	N/A	2.24	1.06	3.18	1.75	3.18	0.38	N/A	N/A

* denotes members that were strengthened in 2006 with Post Tension system
** denotes members that were strengthened in 2006 with reinforcing plates

Table 3.3b City of Saskatoon Traffic Bridge Summary of Truss Top Chord F-Factors					
Summary of Truss F-Factors Upstream Top Chord (Compression Limit)					
Span / Member	**1**	**2**	**3**	**4**	**5**
L0-U1	1.48	1.33	1.33	1.33	1.48
U1-U2	1.87	1.23	1.23	1.23	1.87
U2-U3	1.65	1.34	1.34	1.34	1.65
U3-U4	1.56	1.22	1.22	1.22	1.56
U4-U5	1.65	1.22	1.22	1.22	1.65
U5-U6	1.87	1.34	1.34	1.34	1.87
U6-U(L)7	1.47	1.23	1.23	1.23	1.47
U7-L8	N/A	1.33	1.33	1.33	N/A
Summary of Truss F-Factors Downstream Top Chord (Compression Limit)					
Span / Member	**1**	**2**	**3**	**4**	**5**
L0-U1	1.65	2.40	2.40	2.40	1.65
U1-U2	2.05	2.25	2.25	2.25	2.05
U2-U3	1.83	2.42	2.42	2.42	1.83
U3-U4	1.74	2.25	2.25	2.25	1.74
U4-U5	1.83	2.25	2.25	2.25	1.83
U5-U6	2.05	2.42	2.42	2.42	2.05
U6-U(L)7	1.65	2.25	2.25	2.25	1.65
U7-L8	N/A	2.40	2.40	2.40	N/A

Table 3.3c City of Saskatoon Traffic Bridge Summary of Truss Vertical F-Factors					
Summary of Truss F-Factors Upstream Verticals (Tension or Compression Limit)					
Span / Member	**1**	**2**	**3**	**4**	**5**
L1-U1	4.37	4.38	4.38	4.38	4.37
L2-U2	18.23	11.18	11.18	11.18	18.23
L3-U3	14.33	20.93	20.93	20.93	14.33
L4-U4	14.34	17.42	17.42	17.42	14.34
L5-U5	18.23	20.93	20.93	20.93	18.23
L6-U6	4.37	12.12	12.12	12.12	4.37
L7-U7	N/A	5.93	5.93	5.93	N/A
Summary of Truss F-Factors Downstream Verticals (Tension or Compression Limit)					
Span / Member	**1**	**2**	**3**	**4**	**5**
L1-U1	4.51	6.44	6.44	6.44	4.51
L2-U2	18.28	13.96	13.96	13.96	18.28
L3-U3	14.47	24.60	24.60	24.60	14.47
L4-U4	14.47	23.87	23.87	23.87	14.47
L5-U5	18.28	24.60	24.60	24.60	18.28
L6-U6	4.51	13.96	13.96	13.96	4.51
L7-U7	N/A	8.44	8.44	8.44	N/A

Table 3.3d City of Saskatoon Traffic Bridge Summary of Truss Diagonal F-Factors					
Summary of Truss F-Factors Upstream Diagonals (Tension Limit)					
Span / Member	**1**	**2**	**3**	**4**	**5**
U1-L2	4.17	2.62	2.62	2.62	4.17
U2-L3	5.68	2.77	2.77	2.77	5.68
U3-L2	15.62	3.54	3.54	3.54	15.62
U3-L4	6.91	12.68	12.68	12.68	6.91
U4-L3	6.93	12.70	12.70	12.70	6.93
U4-L5	15.63	3.54	3.54	3.54	15.63
U5-L4	5.68	2.77	2.77	2.77	5.68
U6-L5	4.16	2.62	2.62	2.62	4.16
Summary of Truss F-Factors Downstream Diagonals (Tension Limit)					
Span / Member	**1**	**2**	**3**	**4**	**5**
U1-L2	4.32	4.15	4.15	4.15	4.32
U2-L3	5.81	4.08	4.08	4.08	5.81
U3-L2	15.52	5.26	5.26	5.26	15.52
U3-L4	6.95	10.39	10.39	10.39	6.95
U4-L3	6.95	10.39	10.39	10.39	6.95
U4-L5	15.57	5.27	5.27	5.27	15.57
U5-L4	5.81	4.08	4.08	4.08	5.81
U6-L5	4.32	4.15	4.15	4.15	4.32

Detailed Load Rating

Table 3.3e City of Saskatoon Traffic Bridge Summary of Truss F-Factors		
Deck Beams		
Member	**Limit**	**F Factor**
Transverse Beam	Moment	2.35
	Shear	3.41
Deck Stringer (S20x65)	Moment	5.08
	Shear	19.40
Deck Stringer (S12x31.5)	Moment	0.96
	Shear	7.69
Sidewalk Stringer	Moment	0.35
	Shear	8.84

4.0 Discussion and Recommendations

In the following sections, brief discussions are held regarding the visual observations and load calculations for each major component of the bridge excluding the substructure components and timber approach spans. Before final recommendations can be presented, an overview of how a truss performs and a presentation of system performance is required.

CSA S6 defines system performance of a structure in three broad categories as follows:

- Category S1, where element failure leads to total collapse. This includes failure of main members with no benefit from continuity or multiple-load paths;
- Category S2, where element failure probably will not lead to total collapse. This includes main load-carrying members in a multi-girder system or continuous main members in bending; and
- Category S3, where element failure leads to local failure only. This includes deck slabs, stringers, and bearings in compression.

For the truss components, almost every element in the truss, including bottom/top chords, verticals, diagonals, and connections fall into Category S1 as the truss by its very nature is non-redundant with failure of any one component resulting in failure of the entire truss. The floor deck and stringers are considered to meet Category S3 conditions, where only localized failures occur when one of these components fail.

As presented earlier, the configuration of the truss, extent of defects, and challenges in accessing all components create an environment where there is a high degree of uncertainty related to the current condition. As well, nearly all connections on the truss have some form of deterioration which is causing the rivets to fail which produces an environment where if one connection fails, the entire truss can collapse. The F-Factors that were produced in Section 3 have attempted to capture the uncertainty created by these features of the structure and the inspection methods employed (primarily visual). Therefore, the values identified can be considered realistic given the limitations imposed. However, there still remains the potential that a connection could abruptly fail as deterioration of heavily corroded connections generally do not follow a well defined path.

Based on the F-Factors calculated, it is apparent that the structure must remain closed to vehicles and pedestrians. Pedestrians cannot use the structure, either on the sidewalk or the roadway, as the individual sidewalk stringers have reached the point where they cannot support both live and dead loads as well, Span 4 cannot support its own dead load. As well, temporary shoring should be considered for those spans that cross over trails and streets as the potential exists that the truss above could abruptly fail. Therefore, shoring should be installed under spans 1, 2 and 5 as these spans cross over the Meewasin Valley trail system and the Saskatchewan Crescent East. Span 4 also presents a special challenge as the F-factors calculated are below 0 which indicates that the structure cannot support its own weight. Since

shoring cannot be installed at this location easily, we recommend that all river traffic be directed to avoid this span.

Strengthening could be considered for this structure in a similar manner to what was proposed in 2006. However, this would only deal with the bottom chord deterioration and would not address the section loss and connection issues present on the floor beams, stringers, and panel point connections. Therefore, we do not recommend that any strengthening be implemented on this structure unless it addresses the entire structure. If localized strengthening is implemented in a similar manner to what was completed in 2006 the City runs the definite risk that future inspections will identify a major deficiency that will cause the structure to be closed unexpectedly.

Therefore, based on our analysis, we recommend the following actions be implemented for the Traffic Bridge:

- All vehicle and pedestrians loads must remain off the structure until repairs are completed;
- Temporary shoring must be installed on the trusses over the Meewasin Valley Trail and the Saskatchewan Crescent East or the traffic accommodated by these facilities must be directed to alternate accesses; and
- If repairs are implemented, the extent of repair must be increased to address all components of the bridge. At this time, we believe that the only viable future option for this structure is to either replace the bridge with a new facility or to completely remove the lower portions of the truss and the entire deck structure system and replace with new.

APPENDIX D
PUBLIC CONSULTATION SUMMARY

Traffic Bridge
Public Consultation Summary

Prepared for

Stantec Consulting Ltd.

Submitted by

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November 2010

Contents

Executive Summary

Stantec Consulting teamed with Fast Consulting to conduct public consultations for the Needs Assessment, Functional Planning Study and Structural Assessment regarding rehabilitation or replacement of the existing Traffic Bridge. Originally built in 1907, the Traffic Bridge was Saskatoon's first to carry vehicular traffic and plays a key role in Saskatoon's history; it came into being when residents of Nutana agreed to merge with the town of Saskatoon and the village of Riversdale to form the City of Saskatoon.

More than 800 people attended 3 open houses held on June 22 at Nutana Collegiate Library (300 people), September 15 at Victoria School (400 people) and October 20 at the Legion Hall on Spadina (150 people). Approximately 1,000 people shared their views with comments they posted at the online community forum at saskatoontrafficbridgeforum.ca, or the survey they were invited to complete at that same site.

The level of public engagement on this issue is a reflection of how important it is to many residents of Saskatoon, and their desire to both learn more about the issues around options associated with the Traffic Bridge, and to share their opinions, concerns and thinking in terms of rehabilitating the existing bridge, or replacing it with another bridge.

The public consultation process for the Traffic Bridge was designed to provide an opportunity for people to come together to learn more about an issue and to express their opinions in the context of what they value about Saskatoon and what is important for them. Public engagement on this issue is not about which option wins – opinion among residents of the City is divided, with proponents for all three of the final options. The outcome provides Stantec, City Administration and Council with a deeper understanding of why people feel the way they do, not just about the Traffic Bridge, but about other issues around it such as safety, heritage, environment, urban transportation and growth.

Engaging the Public vs. Surveying Public Opinion

It is important to understand the distinction between a public engagement process using open house forums and a public opinion survey. Both have value and both provide insights into where people stand on issues. Random surveys seek to measure and quantify public opinion on an issue at a given point in time with limited involvement or interaction from respondents. Public consultations seek to engage people on an issue by encouraging them to increase their level of knowledge, share their opinions and get involved in discussion and

debate. A survey seeks to estimate and quantify opinion with statistical reliability; a public forum seeks to create dialogue around options.

Highlights

From the first of three public consultations around the Traffic Bridge - it was clear that the majority of people from the public open-house and respondents to the survey hosted as part of the online community forum discussion wanted to see the existing Traffic Bridge rehabilitated.

There are rational elements such as safety, convenience, linkage and tourism that people told us are important to them relative to keeping the existing bridge. Convenience references the access the bridge provides to the city's downtown core as well as River Landing, the Farmer's Market, Persephone Theatre, Meewasin Trails, etc. Regular users of the Traffic Bridge were proportionately overrepresented in the open house and online community forum survey results, so for many residents the Traffic Bridge is also a convenience for them relative to where they live.[1]

There are also emotional values that run through much of the feedback from the first open house; linkage of the City's present with its past and the pivotal role that Saskatoon's first bridge played in amalgamating the towns of Saskatoon, Nutana and Riversdale. There is, for many of the participants in the first open-house and online forum, a sense of 'character' that the bridge encapsulates for them. Comments around the character of the bridge differ from heritage comments in that they speak to the individuality of the Traffic Bridge, its rare truss construction and 'authenticity', its 'human scale' as a result of being so close to the water of the river it spans, and the quirkiness of its narrow road lanes and the memories that people associate with the experience of driving on it. The emotional values that people attach to the Bridge, subscribe to an inherent desire to see it remain part of the cityscape.

People attending the first open house and online forum were divided on the issue of how the bridge should be rehabilitated. For about a third of the participants at the first open house, the first choice would be for a pedestrian/cyclist bridge only. Another third of participants, however, said their first choice would be to rehabilitate the existing bridge in its current usage and that the City cannot ignore that vehicles are an important mode of transport even as we try to encourage more walking and cycling.

[1] The open house at Nutana Collegiate on June 22 had high representation from people that used the Traffic Bridge on a daily basis (44%), as did the first online survey option (36%) that accompanied the online discussion forum.

Stantec developed 10 options for the Traffic Bridge from input provided at the first open house, including five options for pedestrian-cyclist use only and one for demolition without replacement. The unexpected closure of the bridge on August 24 as a result of Stantec's structural assessment resulted in the removal of pedestrian-cyclist only options and the demolition without replacement option from the public consultation process. In the second round of public consultation on September 15 the public was asked to provide input on four multi-use options; rehabilitation of the existing bridge, replacement with a modern steel truss bridge, replacement with a conventional bridge and replacement with a signature bridge.

The third and final round of the Traffic Bridge public consultation narrowed the options to three with viewing of more detailed concepts from Stantec regarding; rehabilitation of the existing bridge, replacement with a (modern) steel truss bride and replacement with a conventional (concrete) bridge. These more detailed concepts provided participants with information around lane widths, construction build times, and maintenance costs.

The general feeling among participants at the second and third open houses and online forums was that a multi-use bridge is necessary. The primary drivers of this opinion may have been heavy traffic congestion resulting from the closure of the bridge, as well as the opinion of some that it would be difficult to justify to taxpayers the cost of fixing the bridge for pedestrians and cyclists only.

Just what type of multi-use bridge Saskatoon should have, however, became the subject of discussion at the open houses on September 15 and October 20. There are a significant number of people who support option #1, rehabilitation of the existing Traffic Bridge. Many of them are concerned that a short-sighted approach to solving traffic problems that does not involve rehabilitation will result in the irrevocable loss of a piece of history.

Perceptions regarding structural safety, functionality and longevity tend to be the main reasons given by those people that are not supportive of this option. Some people comment that while rehabilitation might have been their preferred option at one time, the level of corrosion and deterioration of some parts of the bridge make them feel the existing structure is beyond saving, or that they have a perception that a rehabilitated bridge would not last as long as a replacement bridge, or they think that a rehabilitated bridge has limited practicality for the next 80 years because of its narrow lanes.

There is also a small portion of people attending the open houses who do not place a high importance on the heritage value of the existing structure. Some people also support replacement with a conventional design because it is more aesthetically pleasing to them.

The key issue for open house and online participants who prefer option #4, the conventional bridge, is function: they want a new bridge with wider lanes to handle Saskatoon's growing traffic volumes, they want it built inexpensively and quickly, and they see this option as

fulfilling those needs. It appears to be a common perception among some people that the conventional bridge option will be the fastest to build, despite information at the open house forum indicating that build times for all the bridge options could potentially be similar; the rehabilitation option would require 24 – 36 months, while the other two replacement options would require 18 – 24 months. Some participants describe their choice to choose the conventional option as 'putting their emotions aside' and making what they see as the most practical choice.

The human scale that many open house participants value about the Traffic Bridge, as a result of its smaller dimensions, 'closeness to the river' and more intimate connection to the environment, would be lost with a conventional bridge according to detractors of this option. Others that are opposed to a conventional replacement bridge feel that 'a plain girder and deck bridge has as much aesthetic value as an overpass', and that it would detract from the gateway to the downtown and River Landing.

Finally, there is a general sense that a conventional bridge with standard width traffic lanes will be more attractive to drivers, and therefore lead to more traffic. This is a positive aspect of a new bridge for some residents, and a negative aspect for others. Those that do not like the idea of wider lanes are concerned that wider lanes will lead to more residential traffic in the neighbourhoods surrounding Victoria Avenue and an increase in truck traffic better able to access a bridge with wider lanes.

Supporters of option 5, modern steel truss replacement bridge, feel that it provides the best compromise between preserving the heritage feel and memory of the existing bridge, with better functionality from wider lanes and 'longer life expectancy.' They also see this option as being more accommodating for pedestrians and cyclists as a result of wider lanes on both the bridge and sidewalks. (Life expectancy is actually the same for both options, and both feature wide sidewalks for improved pedestrian and cyclist access.) There are also some people, that would prefer a totally new structure, but also one that replicates the design of the current bridge including its narrow lanes, as this would be more authentic to them and deter increased traffic and large vehicles.

People who are not supportive of the modern steel truss replacement option are concerned that it will have the same challenges with rust and maintenance as the original bridge. They are also concerned that people may not appreciate how different a modern steel truss bridge might actually look after it is built compared to the existing structure because some of the original historical construction and design techniques would not be employed in modern truss construction.

The comments and discussion at the final open houses and online forums appear to suggest that most people favour a multi-use bridge for vehicles, pedestrians and cyclists. The decision to remove the pedestrian-cyclist only option for consideration in the second round of public consultation was a sore point for some who continue to be most supportive of this

option. There were also participants at the second and third rounds of the public consultations that supported the decision to not request further public input feedback on pedestrian-cyclist only options.

At the end of the third round of public consultation, the results from participants that attended the open house and/or the online community forum and that indicated their option preference in the comment forms available at both, suggest that they are divided between preference for rehabilitating the existing bridge, replacing the bridge with a conventional (concrete) design and replacement with a modern steel truss. Although a plurality of the participants attending the open houses or visiting the online community forums value the heritage of the existing bridge and prefer rehabilitation of the bridge over replacement, a significant portion of those attending prefer the replacement options for reasons they give around their perceptions related to safety and functionality.

Supporters of rehabilitating the existing bridge emphasize the importance of a safe bridge that accommodates vehicles, pedestrians and cyclists as well, but also one that stands as a reflection of the link to the core of Saskatoon's heritage, the downtown centre and River Landing. Supporters of the replacement bridge options also indicate their priorities are for a bridge that provides safe, easy access to cross the river for vehicles, pedestrians and cyclists, as well as a somewhat quicker build time and lower maintenance costs.

Summary of Results

Public Feedback on Saskatoon's Traffic Bridge

Fast Consulting teamed with Stantec Consulting Ltd. to conduct public consultations for the Needs Assessment, Functional Planning Study and Structural Assessment regarding rehabilitation or replacement of the existing Traffic Bridge. In order to engage a broad spectrum of residents in the public consultation process, we developed and managed three rounds of online forums and public open houses. This report is a summary of the input received from that process.

More than 800 people attended 3 open houses: June 22 at Nutana Collegiate Library (300 people), September 15 at Victoria School (400 people) and October 20 at the Legion Hall on Spadina (150 people). Approximately 1,000 people shared their views with comments posted on the online community forum at saskatoontrafficbridgeforum.ca, or a survey completed at that same site. Results of the first round of public consultation (open house June 22; online forum June 23-July15) were presented in the Traffic Bridge Public Consultation Results, July 2010 report, available on the City of Saskatoon website.

From the beginning, it was clear that the majority of people at the public open houses and respondents to the survey hosted as part of the online community forum discussion wanted to see the existing Traffic Bridge rehabilitated.

There are rational elements such as safety, convenience, linkage and tourism that people told us are important to them relative to keeping the existing bridge. Convenience references the access the bridge provides to the city's downtown core as well as River Landing, the Farmer's Market, Persephone Theatre, Meewasin Trails, etc. Regular users of the Traffic Bridge were proportionately overrepresented in the open house and online community forum survey results, so for many residents the Traffic Bridge is also a convenience for them relative to where they live.[2]

There are also emotional values that run through much of the feedback from the first open house; linkage of the City's present with its past and the pivotal role that Saskatoon's first bridge played in amalgamating the towns of Saskatoon, Nutana and Riversdale. There is, for many of the participants in the first open-house and online forum, a sense of 'character'

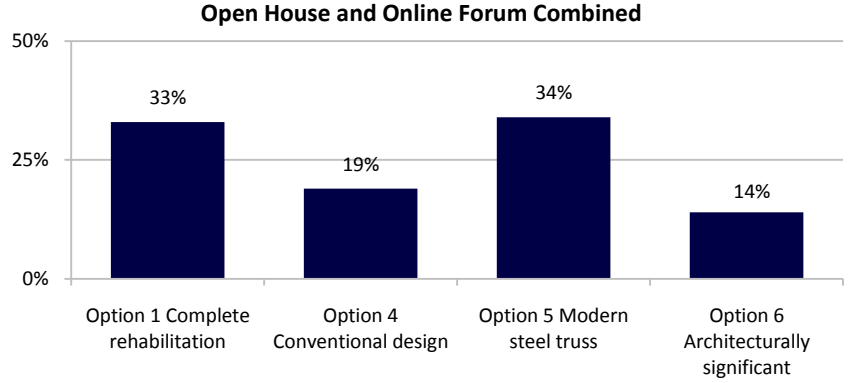
[2] The open house at Nutana Collegiate on June 22 had high representation from people that used the Traffic Bridge on a daily basis (44%), as did the first online survey option (36%) that accompanied the online discussion forum.

that the bridge encapsulates for them. Comments around the character of the bridge differ from heritage comments in that they speak to the individuality of the Traffic Bridge, its rare truss construction and 'authenticity', its 'human scale' as a result of being so close to the water of the river it spans, and the quirkiness of its narrow road lanes and the memories that people associate with the experience of driving on it. The emotional values that people attach to the Bridge, subscribe to an inherent desire to see it remain part of the cityscape.

People attending the first open house and online forum were divided on the issue of how the bridge should be rehabilitated. For about a third of the participants at the first open house, the first choice would be for a pedestrian/cyclist bridge only. Another third of participants, however, said their first choice would be to rehabilitate the existing bridge in its current usage and that the City cannot ignore that vehicles are an important mode of transport even as we try to encourage more walking and cycling.

Stantec had originally developed 10 options for the Traffic Bridge, including five options for pedestrian-cyclist use only and one for complete demolition. The unexpected closure of the bridge on August 24 as a result of Stantec's structural assessment resulted in the removal of pedestrian-cyclist only options and the demolition without replacement option from the public consultation process. In the second round of public consultation on September 15 the public was asked to provide input on four multi-use options; rehabilitation of the existing bridge, replacement with a modern steel truss bridge, replacement with a conventional bridge and replacement with a signature bridge.

Figure 1
Public Consultation #2 - Comment forms from Sept 15 and online forum until Oct 1



The third and final round of the Traffic Bridge public consultation narrowed the options to three with viewing of more detailed concepts from Stantec regarding; rehabilitation of the existing bridge, replacement with a (modern) steel truss bride and replacement with a conventional (concrete) bridge. These more detailed concepts provided participants with information around lane widths, construction build times, and maintenance costs.

Three Options

1. Complete rehabilitation for vehicle, pedestrian and cyclist use: Maintain bridge in its existing form and function, providing narrow traffic lanes (2.9 m) but replace existing separate pedestrian walkway on west side of bridge with two standard width walkways (3 m) on both sides.
   - Probable cost: $24-$34 million
   - Construction time: 24-36 months
   - Annualized operating cost: $150,000 ($12M)

4. Replace with conventionally designed structure (girder and deck) for vehicle, pedestrian and cyclist use: New structure providing two standard width traffic lanes (3.7m plus 1.5m shoulder) and separate 3.0m shared walkways on both sides. Likely a concrete bridge.
   - Probable cost: $26-$35 million
   - Construction time: 18-24 months
   - Annualized operating cost: $16,000 ($1.28M)

5. Replace with modern steel truss or similar form to the existing bridge for vehicle, pedestrian and cyclist use: New structure providing two wider traffic lanes (3.3m/3.7m), shoulders/no shoulders and separate 3m shared walkways on both sides.

   <u>3.3m lanes</u>:
   - Probable cost: $25-$33million
   - Construction time: 18-24 months
   - Annualized operating cost: $15,000 ($1.2M)

   <u>3.7m lanes</u>:
   - Probable cost: $27-$34million
   - Construction time: 18-24 months
   - Annualized operating cost: $18,000 ($1.44M)

   <u>3.7m lanes with 1.5 m shoulders</u>:
   - Probable cost: $29-$37million
   - Construction time: 18-24 months
   - Annualized operating cost: $20,000 ($1.6M)

- All options have the capacity to carry vehicular, pedestrian and cycling traffic for the foreseeable future (e.g. 80 years).
- All options have 3.0 metre pedestrian/cyclist lanes on both sides of the bridge.
- The conventionally designed structure option and modern steel truss option both have 1.5 metre shoulders on vehicular lanes, which could be dedicated cycling lanes.
- All options use the existing piers (upgraded).

Saskatoon Needs a Traffic Bridge

The one thing almost all online forum participants agree on is that a bridge, in one form or another, should continue to be part of Saskatoon's future at the current location of the Traffic Bridge. "I believe that any of the 4 options chosen would make a great bridge for the city of Saskatoon," JC writes. It is a common refrain reflected in other posts: "I will be happy if we get a new (option#1, then #4 and #5) bridge." -Matthew

One of biggest motivators for this opinion appears to be traffic congestion: Saskatoon's recent growth, both economic and demographic, has led to a significant increase in traffic. Traffic in and out of the downtown core has become increasingly congested, due in part to summer construction restrictions on the Idylwyld Freeway/Senator Sid Buckwold Bridge. The unexpected closure of the Traffic Bridge in August exacerbated the situation.

"We need this bridge to keep our traffic flowing (bikes, pedestrian or vehicles)"-Curtis M.
"Any option that allows vehicles to use the bridge is fine with me. … I find it very difficult and frustrating using the Broadway Bridge. The traffic delays getting to and from work using the Broadway Bridge have made it very frustrating." -Carole-Anne "Since the closure of the Traffic Bridge, getting in and out of downtown Saskatoon has been an absolute nightmare. It's obvious that a bridge for vehicle traffic is needed." -Tera

"We cannot justify to taxpayers fixing the bridge for pedestrians and bikes. The cyclists and pedestrians are only a few of the ones paying taxes here. Use it for all kinds of transportation." -Diane S.

"Build a bridge that serves the citizens of Saskatoon and all visitors to the city. It need not be an architectural icon – just wide enough, pleasing to the eye, in sync with its natural surroundings and built sooner as opposed to later."

-Anon.

Just what type of multi-use bridge Saskatoon should have, however, is the subject of debate and discussion at the open houses. Opinion is divided on which of the four options is most preferred with proponents for each: option #1 rehabilitation of existing bridge, option #4 conventional bridge (likely concrete), option #5 replica steel truss bridge and option #6 signature bridge.

Open house and online forum participants may differ in terms of the strength of their agreement regarding which of the options they support – many are strongly attached to their viewpoint, others are open to alternatives and some rank the four options in order of preference. Whichever option they favour, the underlying current through much of the discussion is that Saskatoon needs a traffic bridge at this site, and soon.

Option #1 – Rehabilitate

Option #1: Complete rehabilitation for vehicle, pedestrian and cyclist use; maintain the bridge in its existing form and function, providing narrow traffic lanes (2.9 metres) but replace the existing separate pedestrian walkway on the west side of the bridge with two standard width walkways (3 metre) on both sides (Probable cost: $27 million)

Many people are strongly attracted to the history of the Traffic Bridge. The fact that this was the first vehicle bridge in Saskatoon and central to the city's formation and early growth is of great value and importance to them. "I prefer option #1. The bridge is a significant heritage resource representing the creation of the city of Saskatoon. I think we should start taking care of our heritage resources as they do in other cities and countries." -Jason

"But this is an historic landmark, aesthetically pleasing, and a sheer pleasure to use. It's short-sighted to imagine that bulldozing history for modern convenience is the only way to go. Do we want nothing but freeways?" -Vic

Many supporters of option#1: rehabilitation, fear that a short-sighted approach to solving traffic problems by building a replacement bridge will result in the irrevocable loss of an important piece of history. "Our eagerness to discard our past due to a two-month traffic snarl downtown while the Buckwold Bridge is closed off is interesting. Historical significance notwithstanding, by preserving and rehabilitating the existing Traffic Bridge, a stronger argument is thus formed for provincial and federal dollars now and especially down the road to be put toward the bridge." -Jonas K.

Others believe that heritage structures such as the Traffic Bridge have an inherent value and warrant, even demand, preservation. "The Traffic Bridge is not just any heritage bridge. It is one of the most significant heritage bridges in the entire province." –Nathan H.

Some participants suggested that the more they have learned about the bridge's history, at the open houses, in the media and through the online forum itself, the more attached some of them became to the bridge. "Please keep this bridge looking the way it always has, but just fortify it. In another 100 years it will be even cooler that we did. Sometimes our ancestors get things right the first time…" -Max B.

Perceptions regarding structural safety, functionality and longevity are the main reasons given for option #1 by those that like it 'least' of all the options.

Regarding safety, comments in the round two online forum reflect a subtle change in tone following the closure of the Traffic Bridge in August. A number of respondents indicate that

while rehabilitation would be their preferred option, the level of corrosion and deterioration of some parts of the bridge make them feel the existing structure is beyond saving.

"We would usually go for preserving historical structures as they do in Europe, but in this case safety should be the first consideration." -Don & Maxine. "If I thought it was feasible to keep the Traffic Bridge restored for its historical significance, I would back that, but in no way do I feel like any upgrade will last sufficiently long after all the neglect to hold up and I'm concerned we will be throwing good money after bad." -Dean

There are also some participants at the open house and online forums who do not place a high level of importance on the heritage value of the structure. "Just because something is old does not automatically make it historically significant." -Tony S.

These participants appear to generally take a more practical view of the four options. "…We do not need to cripple ourselves with a 1907 design to fill the needs of a city in 2010. We can find an appropriate way to commemorate and remember our first bridge that doesn't strangle traffic flow into the future." -Don

Despite assurances from the consulting team that option #1 would ensure the bridge is capable of carrying vehicle, pedestrian and cyclist traffic for the next 80 years, longevity is an issue for some: "Rehabilitating the existing bridge is a romantic option but it has limited practicality. Its lifetime will most certainly be less than new bridge construction, and we are left with a very narrow roadway at the end of the process." -Stephen

"The Traffic Bridge has given us 100 years of good service. Now let's say our goodbyes, put it to rest and build something we know can support another 100 years of vehicle and pedestrian traffic." -B. Neufield

Option #4 - Conventional

Option #4: Replace with a conventionally designed structure (girder and deck) for vehicle, pedestrian and cyclist use; a new structure providing two standard width traffic lanes (3.7 metre plus 1.4 metre shoulder) and separate 3 metre shared walkways on both sides. Likely a concrete bridge. (Probable cost: $26 million)

The key issue for open house and online participants who identified option #4: conventional bridge as their preferred option is function: they want a new bridge to handle Saskatoon's growing traffic volumes and they want it soon. "Let's just build the cheapest, fastest and most long-term solution to getting people from one side of the river to the other." -Darwin

A common perception is that this option will be the fastest to build, despite information indicating options #4 and #5 would require the same construction time.

Functionality is also strong motivator. "My preference would be option #4 – a bridge with standard width traffic lanes. We are by necessity a city of bridges. Let's make sure we have the infrastructure to serve our needs." -Len

Other comments echo this practical approach. "The bridge should be replaced with the most cost-effective design that will meet the city's present and future requirements. The cost of maintaining the bridge should also be considered when making the decision. A basic concrete bridge would be the most viable option." -David C. "I agree we have to put emotions to the side and focus on the fact that the city is growing in leaps and bounds, and we need the bridge to accommodate said growth, as well as considering the cost factor." -Virginia J.

Beauty is in the eye of the beholder, and many supporters of option #4 say it is because it is aesthetically pleasing to them. G. Stephenson comments, "Part of the beauty of walking across the Broadway and 25th Street bridges is the openness one feels when the view all around is unobstructed. The old bridge was not attractive, simply functional for the times." Another viewpoint: "the use of the trusses to remind us of the way it was may be nice, but I don't think they serve much purpose except for pigeons and pranksters." -John

In round one of the public consultation process, a concern about the existing bridge was the narrowness of the vehicle lanes. The fact that option #4 calls for standard width traffic lanes (3.7 metres plus a 1.4 metre shoulder, plus separate 3 metre shared walkways on both sides is a plus for some. "I am in favour of option #4 as long as the shoulder is wide enough to serve as an adequate bike lane." -Kirsten

"Our city needs a nice functional bridge, nothing fancy. The beauty of the river does the rest."
-Crystal W.

While function is the main attraction of a new conventional bridge, aesthetic appeal – or a perceived lack thereof – is the biggest detraction. "Ugly" is a common epithet among those who say option #4 is their least liked option. "Option #4 is least liked by some (flat, plain, concrete at $26 million) because it is cold, barren, no wind protection, ugly modern architecture, no beauty, no place for birds, wildlife, too many streetlights." -B. Dolman

This comment highlights one of the interesting insights revealed in round one of the public consultations, before the presentation of options. When asked what they value most about the Traffic Bridge, many online forum participants pointed out its "human scale", saying its smaller dimensions and "closeness to the river" provide a more intimate connection to the environment. They feel such a connection will be lost with a conventional bridge.

This aesthetic is closely connected to open house and online participants' sense of heritage: those in favour of option #1 are often among the most vehemently opposed to option #4.

Finally, aesthetics is also seen as an important factor in the continuing evolution of River Landing and Saskatoon's downtown. "A bridge that plain should not be built right next to River Landing." -Ron In a similar vein, Daryl writes that "a plain girder and deck bridge has as much aesthetic value as an overpass. It would detract from one of the most important gateways to the downtown and River Landing. It would also be an insult to the historic significance of the Traffic Bridge and the role it played in the formation of our city."

There are also concerns regarding the impact of a conventional concrete bridge on quality of life in the east side residential neighbourhoods through which the main arteries onto the Traffic Bridge run. The general sense is that a conventional bridge with standard width traffic lanes will be more attractive to drivers, and therefore lead to more traffic – including more heavy traffic like trucks. "My impression from the meeting is that the old bridge is more of a neighbourhood bridge than a city bridge. Most of the people like the old bridge, being able to bike or walk over it and not having too heavy of traffic in the area … Keep it as a neighbourhood-friendly bridge that the rest of the city can use too." -Brent N.

Overall, the general feeling among detractors of option #4 is that it sacrifices visual beauty or appeal to expediency. "Throw out #4. It's a copout: either we do it right or we may as well do nothing." -Deanna G.

Option #5 - Replica

Option #5: Replace with a modern steel truss or similar form to the existing bridge for vehicle, pedestrian and cyclist use; a new structure providing two non-standard width traffic lanes (3.3 metre), no shoulders and separate 3 metre shared walkways on both sides. (Probable cost: $25 million)

A modern steel truss bridge provides the best compromise as far as supporters of option #5 are concerned. Some like the fact this it preserves the heritage feel of the existing bridge. "… If we can't preserve the original bridge, then we should try our hardest to preserve its memory in a new form. Its replacement should echo its design, to keep the historic symbolism." -Daryl

Others feel it will preserve the overall look of the riverscape. "We like option #5. A new steel truss bridge is cheaper to build than to refurbish the present bridge and would still look like the present one and so keep the appearance and ambiance that the present bridge has." -Peter & Arlene B.

> *"It maintains the historical 'feel' of the bridge while being practical and cost-effective."*
> *-Josi*

Still others are swayed by functionality and cost. "I think option #5 is the best because you get the best of both worlds – the look of the original bridge with better functionality and longer life expectancy." -Cam

One issue that option #5 proponents differ on is lane width. "Maintaining the visual appeal of a steel truss Traffic Bridge gets my vote … While I love the look of the Traffic Bridge as it stands, this seems like a wonderful opportunity (for roughly the same money) to widen the lanes, making the bridge safer and more modern without sacrificing the distinctive (and much loved!) look the Traffic Bridge gives the surrounding landscape." -Shawna

Jerry M. agrees: "I like option #5 – replace the bridge with a look-alike structure to the existing bridge, but with wider traffic lanes and pedestrian/bicycle pathway(s)." But Elaine B. disagrees: "I would like to see a totally new structure, maintaining the design of the current bridge. Narrow lanes would be an asset, as this would deter large vehicles from crossing."

Many supporters agree that pedestrian/cyclist lanes are a must. "I believe that the pedestrian and cyclist features are very important for that area of the city, but cars won't be going away any time soon…" -Liz M. "Option #5 is my choice. Keep bikes on one side and pedestrians on the other." -Carolyn

Those who say option #5 is their least liked option tend to see it as 'fake'. "For a city that prides itself as the 'City of Bridges' this would be a cheap imitation of our heritage, akin to slapping together a new Eiffel Tower if the original was needing maintenance." -Jonas K.

Others question the practicality of a replica bridge: "If we go with steel trusses or make it look like the old bridge we will have the same problems with rust and maintenance." -Bruce

"Option #6 is the best option; a modern looking bridge which puts an exclamation point on the 'Bridge City.'" -Carter

And finally, there is some concern that people may not fully understand how different a modern steel truss bridge will look compared to the existing structure. "Modern truss bridges do not look like the existing Traffic Bridge … the aesthetic value will be dramatically reduced because the historical construction and design techniques are not employed in modern truss construction." -Nathan H.

Option #6 - Signature

Option #6: Replace with an architecturally significant structure for vehicle, pedestrian and cyclist use, a modern "signature bridge"; a new design providing two standard width traffic lanes (3.7 metre plus 1.4 metre shoulder) and 3 metre shared walkways on both sides. (Probable cost: $60 million)

Option 6 was removed from consideration in the third open house. It garnered the least support in the second open house and online forum, but there is nonetheless a contingent in favour of the architecturally significant option. "I watch a lot of TV from England and

Europe and what surprises me is the beauty of modern architecture of even the remotest places in former Eastern Bloc countries. We have a better economy and yet most of our municipal buildings and structures tend to be utilitarian and plain. Time to take pride in where we live." -Rod

Taking pride in where we live inspires a number of option #6 supporters. Cayley says, "I like option #6 because it looks the best. Saskatoon is boring right now so we need something to spoof it up!" Adds Shelby, "Every time I visit Winnipeg, I am jealous of their suspension-style bridge. Since the new Circle Drive bridge will be extremely plain, I believe Saskatoon is well overdue for a beautiful, modern signature bridge."

A number of supporters believe a signature bridge will add to Saskatoon's tourist appeal. "Every tourist photo of beautiful Saskatoon will feature this future icon." -Frances. Others feel it is an appropriate link to River Landing."Although it is the most expensive, I think it is important to have something 'exceptional' to complement the River Landing area." -Orva C.

Option #6 supporters tend to take a long-term view of the investment. "Spend the money now, in 20 years it will look like a bargain," writes Scott. "We are not building a one-time structure; this new bridge will be an integral part of the character of Saskatoon for at least four generations and probably to the bicentennial … if you are going to do something of importance once, by all means *do it right*." -Dean

For most, the price tag for a "signature bridge" is simply too high. "While a 'signature bridge' would be nicer to look at, the reality is that we have the new Circle Drive South bridge in the works and the need for a new Circle Drive North bridge. Our dollars are going to be stretched too far with a signature bridge replacing the Traffic Bridge." -Bronwen M.

What's Most Important

Having Their Voice Heard

Most online forum participants favour a multi-use bridge. This trend was somewhat evident during round one of the public consultation, and was a factor in the decision to remove pedestrian-cyclist only options from consideration in subsequent open houses. This decision is a sore point for those who continue to believe in a pedestrian-cyclist only option and they wonder if their voices were heard.

"The most important thing to me: my voice is heard as part of this process. City Council has the last say…why do they also get the first say? " asks Tom. "I also don't like how mention of the pedestrian/bike only bridge has been removed entirely from the discussion before it has started, why can't the people have their say in this city?"adds James. This sentiment is reflected in supporters of the multi-use options as well. "I applaud Council for not requesting comments on obviously unreasonable options." -Wayne

History

Those who value history are the most emotionally attached to the existing bridge. "I am so upset over this and that day we took our walk [under the bridge] and looked up, it brought me to tears. The rust was awful and it made me very angry, as there is no reason to let this happen… shame." -Dolores M.

"I think it's really depressing how little people care about the history of this city. The Victoria Bridge is a historical landmark and should be saved! … In the past few years there have been many beautiful old buildings around the city torn down to make way for parking lots. Please, let's try to make an effort to save this piece of Saskatoon's history!" -Danielle

"History. It is a big part of Saskatoon's history, in it becoming a city."
-Justin I.

"Many others have stated that emotion should not be a factor in this decision. I disagree utterly – emotion should play a very important role in this decision. The bridges in our city are not just roads over water. They are an integral part of our city's history, identity, character and pride." -Daryl

Safety & Functionality

Although many open house and online forum participants value the heritage of the existing bridge, for them, safety and functionality are also important. "First priority – a bridge that provides safe, easy access to cross the river for cyclists. Second priority – get traffic out of downtown at peak hours. Third priority – upfront capital cost and annual maintenance as well as maintaining historical features."
-Annette W.

Traffic congestion prompts a number of comments like Jennifer's: "Something needs to be done to alleviate the rush hour pressure on 4th Avenue until a replacement bridge is in place (hopefully an option with a rapid build)."

And one participant expresses concern about the strain of increased traffic on of Saskatoon's other bridges. "With all of the extra traffic now using these routes, the bridges have extra stress put on them. I'm not a structural engineer, but wouldn't this added stress increase the rate of which the bridge would need repairing? Not safe." -Riane

"We need a new bridge that is wide enough so the population aren't terrified to drive over it…"
-John C.

Human Scale

A number of open house and online forum participants post comments that reflect their appreciation of the human scale offered by the Traffic Bridge. This reflects comments first heard in round one of the public consultations, in which participants said they valued the "intimacy" of the bridge, as well as its smaller dimensions and its closeness to the river. "The pedestrian walkway is unlike any other bridge; you actually feel like you are over the water, not on just another sidewalk with an interesting side view." -A.

Comments reflect a desire to preserve as much of this ambiance as possible – and some suggest the way to do this is by retaining the current narrow traffic lanes. "I think that narrow lanes are an asset as they deter large vehicles. Increased traffic flow is not necessary," says Margi.

Others are fine with standard width lanes, but only two: "A conventional two lane bridge will not overwhelm Victoria Avenue with traffic, yet will allow for local and various thru traffic to flow, while walkers and bikers will have a convenient line into the downtown." - Gordon W.

There are some who would like to see a four or three lane bridge (see Suggestions for Improvement), but an equally vocal group want to preserve the current two-lane structure. "I would not like to see Victoria Avenue become a freeway. Nutana is a residential area, and we certainly have enough traffic cutting through this neighbourhood without adding more." -Linda M. Adds Dustin L., "I agree that the bridge should not be akin to a double lane freeway bridge as the intersecting area on the east side is a residential area. This is also one of the reasons why the focus should be on providing pedestrian traffic."

Pedestrians-Cyclists

Meeting the needs of pedestrians and cyclists is the most important concern for a number of people. Some remain advocates of a pedestrian-cyclist only option, but many simply want to see their needs addressed, whether in a new or rehabilitated bridge.

Tom's post reflects a pedestrian-cyclist-only point of view: "My main concern is whether we should funnel more car traffic through downtown. Cars make it more difficult for people to walk and cycle to work, or enjoy a lunch or coffee on a street side patio. That's a big part of what downtown should be about. People. Not cars."

The importance of having pedestrian and cyclist lanes is a prevalent theme, although opinion differs on how best to handle this. Some suggest having separate dedicated lanes pedestrians and cyclists, others suggest adding dedicated cycling lanes to a new bridge.

Suggestions for Improvements

If It Must Come Down …

Many people are saddened by the thought of losing the Traffic Bridge. One Saskatoon Public Schools teacher posted a comment on behalf of her students: "The grade four/five students in my class would appreciate if their concerns were heard. They do not want the bridge to be torn down. They are afraid that it will ruin Saskatoon's history, since the bridge has been around for over a hundred years. However, if they cannot fix the bridge, and it has to be taken down, the students suggest that a few pieces of the original bridge be put into the Western Development Museum for memory."

The suggestion that some way be found to honour the existing Traffic Bridge if, in fact, it is replaced, is echoed in a number of comments. "I also feel that the trusses should be salvaged and used in our parks with a plaque of our beautiful bridge and its history." –Dolores M.

"What about using a section of it in River Landing as a focal point?"
-Shiela

Integrating Old & New

Several open house and online forum participants, including rehabilitation (option # 1) and new bridge supporters (options #4, 5, 6) suggest ways to integrate the old and new designs. An option #1 supporter says, "I suggest that option #4 could be modified to provide a good compromise. It would be possible to salvage and modify the trusses of the existing Traffic Bridge to fit and mount them on top of a replacement girder bridge for decorative, non-structural purposes."

Another says, "I like option #4: the conventional bridge with an addition of decorative only steel arches mounted on each side rail to recognize the significance of the traffic bridge it is replacing."

Add More Traffic Lanes

In contrast to those who want to deem the current human scale of the Traffic Bridge important, a small contingent would like to see the new or rehabilitated bridge add more traffic lanes. They see this as being a proactive means of solving future traffic congestion issues. "The city is growing and traffic will only become an increasing problem so instead of being reactive with this problem we, for once, should be proactive and build a bridge that can accommodate more than two lanes." -Alaina GM. Mike M. agrees: "Option #6 or #4, except make it a four lane bridge. We need the extra traffic capacity for when the city surpasses 250,000."

Some suggest three lanes, with the third alternating traffic flow during morning and evening rush hour. "In consideration of our growing city, would it be wise to consider a third lane

that could be switched morning and evening to accommodate traffic flow similar to the Lion's Gate Bridge? Perhaps the third lane could be used for buses, LRT or multi-passenger vehicles." -Carolyn

Others suggest that adding the capacity for a four lane bridge will provide future infrastructure for a light rail transit system: "Light rail transit will be part of Saskatoon's future. A properly constructed bridge provide four lanes of traffic now and then becomes the north-south link for the LRT. This is a golden opportunity to prepare for the future traffic needs in our city. Let's get it right." -Alan R.

Separating Pedestrians and Cyclists

A number of open house and online forum participants suggest that, since all four options call for walkways on both sides of the bridge, one side be designated for pedestrians and one side for cyclists. "New crossing must feel safe and inviting to cross, meaning separation from the sound and proximity of vehicle traffic, as well as separation between cyclists and pedestrians." -Lon N.

Understanding the Pedestrian-Cyclist Only Perspective

As previously noted, a number of online forum participants continue to support a pedestrian-cyclist only option. Because this option was not 'on the table', their comments did not form part of the overall discussion of options. The value of open houses and online pubic forums, however, is that it lets all voices be heard. Reviewing the comments of pedestrian-cyclist only proponents provides valuable insights into what pedestrians and cyclists want and need – insights the City of Saskatoon may find useful in future planning efforts.

A comment by Michael S. sums up the general pedestrian-cycle only perspective. "There are a lot of people within walking or cycling distance that make daily trips between downtown and Nutana, many who currently drive but could very comfortably use a bike or walk instead. Not having vehicle traffic on this bridge would make it a very attractive option for many more people and would surely reduce the number of drivers and improve both the overall traffic situation downtown as well as parking." Michael S.

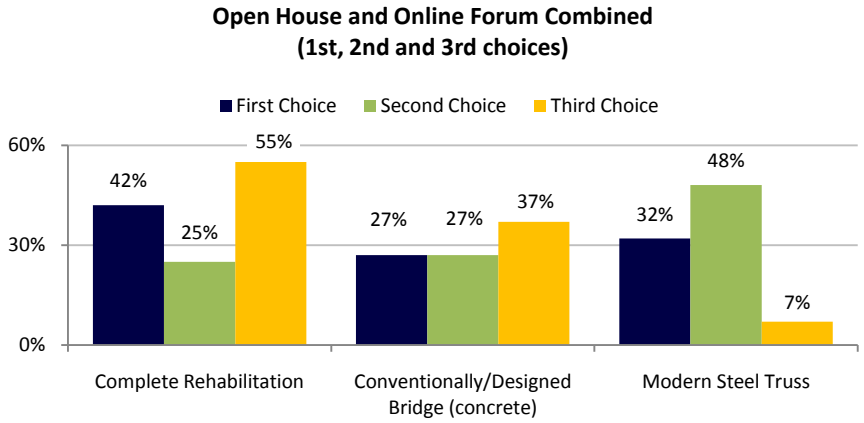
Two consistent themes emerge from the discussion.

- **Safety**: more people are choosing to walk and bike to various destinations around Saskatoon, including the Downtown core. And they are being encouraged to do so – by media, by advertising, by healthy lifestyle campaigns, environmental lobbyists and so on. But safety is raised again and again, especially among cyclists who are finding Saskatoon roads (and drivers) unwilling to accommodate them. This issue has arisen in all three rounds of the public consultation.

- **Choice**: pedestrians and cyclists are making a choice to use alternative transportation. Many are spurred by concerns for the environment and are trying to do what they can to reduce their own carbon footprint. Others are motivated by a desire to live a healthier lifestyle – they want to be more active, and walking/cycling to and from various destinations in the city is seen as a great way to do this. They want to be able to choose walking and biking rather than driving, and they want the new or rehabilitated Traffic Bridge to accommodate this choice.

At the end of the third round of public consultation, the results from participants that attended the open house or the online community forum and that indicated their option preference in the comment forms available at both, suggest that they are divided between preference for rehabilitating the existing bridge (42%), replacing the bridge with a conventional (concrete) design (27%) and replacement with a modern steel truss (32%). These quantified results are an aggregate summary of the opinions of the people attending the pubic and online forums.

Figure 2
Public Consultation #3 – Comment forms from Oct 20 and forum until Nov 1



Although a plurality of participants attending the open houses or visiting the online community forums value the heritage of the existing bridge and prefer rehabilitation over

replacement, others attending prefer the replacement options for reasons they give around their perceptions related to safety and functionality.

Supporters of rehabilitating the existing bridge emphasize the importance of a safe bridge that accommodates vehicles, pedestrians and cyclists, but also one that stands as a reflection of the link to the core of Saskatoon's heritage, the downtown and River Landing. Supporters of a replacement bridge options also indicate their priorities are for a bridge that provides safe, easy access to cross the river for vehicles, pedestrians and cyclists, as well as a somewhat quicker build time and lower maintenance costs.