

2023

CORPORATE ASSET MANAGEMENT PLAN

Saskatoon Bridges and Structures

*We invest in what matters...financial
and physical resources under our
care are used to address the needs
of citizens today – and tomorrow.*

INTRODUCTION

The City of Saskatoon's (City) bridges and structures inventory is composed of bridges, overpasses, pedestrian crossings, sound walls, retaining walls, and chain-link fences.

Preservation of the City's bridges and structures is funded from the Bridge Major Repair Reserve (BMRR) and Bridge Operating budgets.

Significant progress has been made to address the funding gap by increasing the annual base contribution to the BMRR from \$720,000 in 2012 to \$4.34 million currently. However, this funding has not increased since the last report in 2021. The target contribution per the resolution of City Council in 2012 was to increase the budget to \$5.80 million (2023 dollars) with no requirements for one time contributions.

At this time of this report, the annual budget remains at \$4.34 million. With major rehabilitations required in the next 10 years, and significant inflationary increases, it is anticipated there will be a budget shortfall in 2025 for the Broadway Bridge rehabilitation, and in 2027 for the University Bridge Arch Rehabilitation. One time funding contributions will be required to allow the projects to proceed. Once the BMRR is fully funded for a period of time, there should be sufficient balance within the reserve to preclude the need for one-time funding.

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CURRENT INVENTORY

Table 1: Bridges and Structures Inventory and Replacement Values

Asset	Inventory	Replacement Value**
Bridges	6 ea.*	\$465,000,000
Overpasses	51 ea.	\$422,000,000
Pedestrian Crossings	24 ea.	\$50,000,000
Sound Attenuation Walls	20 km	\$44,000,000
Chain-Link Fencing	48 km	\$3,000,000
Retaining Walls (Structures)	5 km	\$26,000,000
Public Private Partnership (P3)	2 ea.	\$135,000,000
Total		\$1,145,000,000

*The six bridges include: Circle Drive North/42nd Street (considered two structures), University, Broadway, Senator Sid Buckwold, and Gordie Howe. Chief Mistawasis Bridge and Traffic Bridge are currently managed by a P3 and are not included in the total replacement costs.

** Note that replacement values are in 2022 dollars, and will be further refined on the next report as inflation values are recognized.



*108th Street Overpass
Emergency Repairs*

DEFINITIONS

For the purpose of this report, the structures have been defined as follows:

Bridges

A bridge is a traffic crossing structure over a body of water.

Overpasses

An overpass is a traffic crossing structure over or under roadways and railways.

Pedestrian Crossings

A pedestrian crossing is a structure that allows pedestrians, cyclists, and other walkway or trail users to cross over or under a major roadway, railway, body of water or other obstacle. Pedestrian crossings that are attached to a bridge or overpass at elevations lower than the road surfaces are considered separately from the larger structure. (i.e. the pedestrian crossings under the Gordie Howe Bridge, the CP Rail Bridge, and Circle Drive North Bridge)

Sound Attenuation Walls

A sound attenuation wall is a barrier built alongside a railway, freeway, or other high capacity roadway that reduces the impact of noise pollution to neighbouring properties.

Chain-Link Fencing

Chain-link fencing is along expressways and major arterial road right-of-ways and prevents pedestrians from crossing onto the roadway. Chain-link fencing in parks and other local areas is not considered in this report.

Retaining Walls

A retaining wall is a structural wall designed to stabilize an earthen slope which would otherwise slide downwards, allowing the creation of usable area at various elevations. The retaining walls considered in this report are related to a bridge grade separation or major roadway grade separation.

Condition of Asset

Condition ratings for bridges are on a five-point scale from “A” to “F”, where a rating of “A” indicates that the structure is in “Very Good” condition or in a like new state, and a rating of “F” indicating a “Failed” condition or “Severe Deterioration”.

Table 2: Structural Condition Rating

Rating	Physical Condition	Action
A	Very Good	No structural problems evident. Only monitoring and maintenance required.
B	Good	Minor deficiencies noted, monitoring and maintenance required.
C	Fair	Structures showing signs of deterioration. Corrosion is actively occurring in components of the structure.
D	Poor	Structure showing advanced deterioration.
F	Failed	Structure no longer capable of safely supporting design traffic loadings.

It is difficult to illustrate the differences between “Very Good”, “Good” and “Fair” since not all structural defects are visible, as the overall condition rating is based on the deck testing reports and the following testing: copper sulfate electrode (CSE) equipotential survey, delamination survey, chloride testing, steel reinforcement bar cover/depth testing, and visual inspections in accordance with the Ontario Structures Inspection Manual (OSIM).

All structures in the City’s inventory are safe for public use based on the physical condition ratings. The City works diligently to ensure all structures remain serviceable with the preservation program. Each structure in the City’s inventory is inspected annually by civic staff to identify any critical defects that may require investigation and to determine if there are any immediate or long-term safety concerns.

The Preservation Program rates the condition of each structure. A “Poor” condition rating can still have the structure rated as safe for users, however it describes a structure that all inspection, testing, and maintenance activities indicate that advanced deterioration is present, and a major rehabilitation is required, typically in two to five years.

- Note that allowing a structure to reach a “Poor” condition is not ideal as it can lead to costly rehabilitations and lengthy construction duration. Extending the service life of the structure and minimizing total life-cycle costs involves proactive rehabilitation to mitigate against structures falling into a “Poor” rating.

An example of a “Failed” condition structure was the original Traffic Bridge, which was closed to traffic in August 2010 after critical defects/deterioration were discovered through a detailed inspection (severe corrosion). Due to concerns with the structural integrity of the bridge, it was deemed unsafe to remain open.

The following table aligns the desired condition and expenditure level by actual inventory condition.



*108th Street Overpass
Emergency Repairs*



*Attridge Drive Overpass
Rehabilitation*

Table 3: Current Structural Condition by Actual Inventory

Asset	Physical Condition Actual	Physical Condition Desired	Desired Expenditure Level
Bridges	34%	Very Good	Good Level B
	33%	Good	
	33%	Fair	
	0%	Poor	
Overpasses	47%	Very Good	Good Level B
	33%	Good	
	8%	Fair	
	12%	Poor	
Pedestrian Crossings	21%	Very Good	Good Level B
	50%	Good	
	21%	Fair	
	8%	Poor	
Chain-Link Fencing	70%	Good	Good Level B
	25%	Fair	
	5%	Poor	
Sound Attenuation Walls	90%	Good	Good Level B
	10%	Fair	Good Level B
Retaining Walls	100%	Good	Good Level B

Service Expenditure Levels

The Administration evaluates the condition of the City's assets in order to develop annual programs to maintain the assets at the defined service level at a minimum cost. Condition assessments or evaluations are conducted and used to establish condition levels as well as develop annual capital improvement plans.

The level of service for each type of asset is defined; however, as the level of service increases for the asset, so does the cost of maintenance. In order to be able to compare the level of investment for all assets corporate-wide, five levels of expenditures are identified below.

It should be noted that expenditure levels are not condition assessments but lead to a change in the asset condition over time.

Table 4: Expenditure Levels

Rating	Asset Condition	Action
A	Getting Better Quickly	Sufficient expenditures to keep asset in the condition specified by City Council and to increase asset condition/value quickly over time.
B	Getting Better	Sufficient expenditures to keep asset in the condition specified by City Council and to increase asset condition/value slowly over time.
C	Maintain Assets in Current Condition	Sufficient expenditures to keep asset in constant condition over time.
D	Getting Worse	Insufficient expenditures to maintain asset condition. Over time asset condition will deteriorate.
F	Getting Worse Quickly	No expenditures. Asset condition/value decreased rapidly.

LIFE-CYCLE PROGRAMS

The City has multiple life-cycle programs in place to ensure that all the bridges and structures remain safe to the travelling public and to assist with long term planning for upcoming rehabilitations. Currently, the preservation program includes:

- Washing and Sealing
- Minor Maintenance and Repairs
- Bridge Inspections and Deck Testing
- Safety Inspections
- Load Rating Program
- Major Rehabilitations

The programs are funded through the Bridges Operating budget and the BMRR Capital budget. Each program plays a vital role in maintaining the bridges and structures inventory. Currently, the operating budget for the annual maintenance programs is sufficiently funded. A brief description of each program is provided below:

Washing and Sealing

During the winter, bridges are exposed to gravel, sand, and anti-icing chemicals that are spread on the roads. The debris can cause wear on the surface of the bridge, and the de-icing chemicals can initiate chloride induced corrosion of the reinforcing steel in the concrete, which is one of the primary causes of advanced deterioration in bridge elements. The structures are washed on a yearly basis, and concrete elements exposed to “splash” are sealed with a silane sealer on a five year cycle.

Safety Inspections

The key goal of safety inspections is to determine if there are any immediate safety concerns with each structure, develop the minor maintenance repair program, and identify critical/severe defects that may require either additional investigation or closure of a structure.



Emergency Repairs to Campus Pedestrian Bridge



*Spadina Crescent Bridge
- Deck Demolition*

Bridge Inspections and Deck Testing Program

The Bridge Inspection and Deck Testing Program consists of completing industry standard inspections on a three year cycle utilizing the Ontario Structures Inspection Manual (OSIM), and deck testing on a six-year cycle in accordance with Alberta Transportation’s BIM Level 2 Inspection Manual on all structures over 10 years old in the City’s inventory. Testing is performed on the bridge decks, barriers, piers (if exposed to splash), abutments (if exposed to splash/leaking joints), and expansion joints. Test methods include:

- CSE half-cell readings;
- Chloride concentration testing at varying depths;
- Delamination surveying; and
- Expansion joint probing.

The results from the above tests are combined and can determine the approximate point at which each element is within its service life and produce corresponding remaining service life estimates. Once the remaining service life has been identified, rehabilitation strategies are developed and compared to help determine the optimal timing for intervention.

Minor Maintenance and Repairs

The Minor Maintenance and Repair program is completed on an annual basis under the Bridges Operating and Capital Budgets. The program deals with repairs and maintenance for each asset in the inventory either based on reported issues or as determined by the internal and external inspection programs. The scope of minor repairs includes paving, routing and sealing cracks, concrete patching, repairing settlement issues, erosion control at bridges, drainage, impact damages, hand railing maintenance, fence repairs, retaining wall repairs, and minor expansion joint repairs.

Major Rehabilitations

The City uses deck testing data to select the optimal rehabilitation method and timing for each structure based on preservation strategies focused on reducing the life-cycle cost of owning and maintaining the structures.

The rehabilitation strategies for each structure have a critical period of time for each strategy based on the level of chlorides (salts) to induce corrosion in each structure. Once the critical period for a given rehabilitation strategy is missed, the strategy changes, and the rehabilitation costs increase over the long term. Typically, the rehabilitation strategies are defined as follows:

- **Do Nothing:** Outlines the option of leaving the structure in its existing condition until the end of its service life and no longer capable of supporting the applied loading.
- **Reactive:** Similar to the “Do Nothing”, however, intervention occurs before structural capacity becomes deficient.
- **Proactive:** Strategy aims to intervene before substantial damage has occurred to the concrete.

- **Proactive Plus:** Intervention occurs prior to damage in the concrete in the form of wearing surface and waterproofing membrane replacements prior to the end of their service lives.
- **Like New:** Similar to Proactive Plus with a higher degree of maintenance to maximize probability of protective mechanisms remaining effective.

Structures are typically selected for rehabilitation at the optimum date and confirmed through testing prior to rehabilitation. There is variability in the critical timeframe for rehabilitation, as it is unknown exactly when corrosion will be induced in the structure. However, typically once the protective membranes have failed and corrosion is occurring, the deterioration rate substantially increases.

The sound attenuation and retaining wall inventory is generally new and in the “Good” condition. Currently, all repairs are completed with the Minor Maintenance program and none require major rehabilitation. This trend is expected to last for the next 10 years and will be updated as the asset’s conditions change.

Load Rating Program

The City develops and maintains load rating analysis for several bridge/overpass structures located throughout Saskatoon. The City has had consultants prepare load capacity charts to confirm bridge capacity for truck traffic. The information is then used to develop the long-haul vehicle routes, pickup and delivery maps and to assist with the permitting process. This ensures vehicle loads are within safe loading parameters for the bridges and structures.

10-Year Rehabilitation Plan

The projects that are part of the major rehabilitation program are selected based on preservation strategies focused on reducing the life-cycle cost of owning and maintaining the structures, as determined by the City’s testing and assessment program.

The projects that have been selected within the 10-Year Plan have a critical time period for each strategy, based on the level of chlorides (salts) to induce corrosion in each structure. Once a critical time period is missed, the optimal strategy changes and the rehabilitation costs increase. There is variability in the critical timeframe for rehabilitation, as it is unknown exactly when corrosion will be induced in the structure, which is why a range is provided. Projects are typically selected for rehabilitation at the mid-date and confirmed through testing prior to the work being performed.



*Spadina Crescent Bridge
- Deck Pour*

Table 5: Asset Performance and Expenditure

Asset Program	Current Performance	Desired Performance	Desired Expenditure Level	Required Annual Funding to meet Expenditure Level (2023)	Current Dollars (2023)	Gap ³
Operating Programs ¹	Good	Good	Level C	\$1.179M	\$822,000 ²	0
Major Rehabilitations and Capital Minor Maintenance	Satisfactory	Good	Level B	\$5.8M	\$4.34M	\$1.46M

¹Operating Programs include Washing and Sealing, Minor Maintenance and Repairs, Safety Inspections, Bridge Inspections and Deck Testing, Load Rating Program.

²Difference accounts for the Operations budget funding the Capital Minor Maintenance program.

³Growth and inflation increase requests are estimated at \$48,100.00 for 2024 and \$47,600.00 for 2025. The majority of the operation costs are in-house (vehicle maintenance, fuel costs) and have seen significant increases with inflation.

FUNDING SUMMARY

Bridges, Overpasses, and Pedestrian Crossings

As identified in the 2021 Asset Management Report, the BMRR has been underfunded in the past. In 2023 the funding is \$4.34 million. The target contribution per the 2012 resolution of City Council is to fund \$5.80 million (2023 dollars) per year with no requirement for one time contributions.

Sufficient funding is not in place for the current 10-year rehabilitation plan, and one-time funding may be required in 2025 for the Broadway Bridge Rehabilitation Project, and in 2027 for the University Bridge Arch Rehabilitation project. The 10-year plan will be reviewed to determine if any of the planned work can be delayed without significantly increasing life-cycle costs. A report providing an update on the Broadway Bridge project and budget estimate will be provided to City Council in 2024 following completion of the detailed design.

In the past, the bridge program has received favourable tender pricing that assisted in delivering the annual programs while staying within the BMRR budget. However, since the pandemic, the construction costs have increased significantly due to market conditions (increased material costs, labour shortage, etc.). It should be noted that the most recent tender that closed was approximately 30% higher than the anticipated budget.

Projects have been delayed due to the underfunding of the BMRR. If further reduction to the funding should occur, additional projects will need to be postponed. This will result in higher rehabilitation costs and increase the duration of work. One time funding requests would also increase as repairs/treatments would be more expensive than conventional maintenance requirements.

However, if the target funding is achieved, and one time funding is realized, it would allow for the implementation of the revised 10-year plan with the least life-cycle cost. This would ensure that structures which require timely rehabilitations are addressed to mitigate further damage and potential increased repair costs.

After the impacts from reprioritizing the program to complete Broadway Bridge, budget shortfall, and one-time funding has been determined, the Bridge program funding targets will be updated in the 2025 AMP using the construction inflation the program has experienced based on a two-year cycle.

Sound Attenuation Walls

The majority of sound attenuation walls were constructed after 2003. The design life for a sound attenuation wall is 50 years, therefore, no major rehabilitation activities are expected to be required within the next 20 years. Funding is available for minor maintenance activities that occasionally arise.

Retaining Walls

Retaining walls have been designed with a long service life and are inspected on a regular basis (retaining walls next to bridges are inspected as part of the three-year inspection cycle). There are no major rehabilitation activities anticipated within the next 10 years. Funding has been allocated to cover on-going minor maintenance requirements for retaining walls.

Chain-Link Fencing

Chain-link fencing has been inspected and is undergoing a condition assessment. Funding has been allocated to cover immediate maintenance requirements. More detailed information will be added in future reports.

INFRASTRUCTURE RESILIENCE AND CLIMATE CHANGE ADAPTATION STRATEGY

All of the City's bridges and structures are designed to resist the effects of weathering due to rain, ice, wind, and snow. Due to the nature of the construction materials used for these assets (i.e. concrete and steel), they are by nature resistant to many of the effects of climate change. Studies have shown that deterioration may begin to accelerate due to higher projected temperatures, increased precipitation, and even higher carbon concentration in the atmosphere. However our preservation program (i.e. washing/sealing program) will assist with extending the service life of structures.

During periods of extreme weather such as a major rain event or high river levels due to flood, there is an established protocol to complete underwater inspections of critical bridge elements. Inspections include bridge piers to detect undermining or scouring, and ensuring that the structural components have not been compromised.



*Spadina Crescent Bridge
- Resurfacing*

The Way Forward

The Technical Services Department has put an emphasis on reducing the costs associated with maintaining and operating the City's bridges and structures.

The group has focused on continuous improvements by strategically using innovative and creative means beyond conventional approaches to manage infrastructure in a sustainable manner.

The previous two construction seasons have had bridge rehabilitations on multiple structures (Circle Drive over 8th Street Overpasses and Attridge Drive over Circle Drive) which were designed and inspected with City staff only, reducing the overall cost of the project. The City's Minor Bridge Maintenance program has been successful in repairing smaller defects and is now incorporating longer-term maintenance treatments such as asphalt resurfacing on structures.

Our teams are committed to continuous improvement in our processes and programs within the Bridges and Structures program:

- Achieving appropriate base funding to maintain a Level "B" expenditure level and thus minimize long-term maintenance costs;
- Inspection process improvements;
- Focusing on alternative repair and maintenance technologies;
- Continuing preventative maintenance;
- Alternate rehabilitation design with designs focused on reducing life cycle costs;
- Creating additional modeling of corrosion and life-cycle costs;
- Targeting proactive rehabilitations;
- Optimizing project timelines while reducing the impact to the public;
- Continuing to target minor rehabilitations with City staff; and
- Developing strategic tendering with local considerations for specifications and timelines.



We strive to maintain and fund our key infrastructure assets to minimize total life-cycle costs.

