

# 2021

## **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.*



*City of*  
**Saskatoon**

## INTRODUCTION

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

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

Significant progress has been made to address the funding gap since the previous Asset Management Plan Report in 2019. The targeted contribution per the resolution of City Council in 2012 was to increase the budget to \$5.80 million per year with no requirements for one-time contribution. At the time of this report, the yearly budget has been increased to \$4.34 million. Although the targeted budget has still not been met, the increased funding has allowed for the planning of major rehabilitations in the next ten years.

*Significant progress has been made to address the funding gap since the previous Asset Management Plan Report in 2019.*

## CURRENT INVENTORY

**Table 1: Bridges and Structures Inventory and Replacement Values**

Asset	Inventory	Replacement Value
Bridges	6 ea.*	\$451,000,000
Overpasses	51 ea.	\$409,000,000
Pedestrian Crossing	24 ea.	\$48,000,000
Sound Attenuation Walls	20 km	\$43,000,000
Chain-Link Fencing	48 km	\$3,000,000
Retaining Walls (Structures)**	5 km	\$25,000,000
Public Private Partnership (P3) <sup>†</sup>	2 ea.	\$131,000,000
<b>Total</b>		<b>\$979,000,000</b>

\*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.

\*\*Retaining walls inventory was added to the report in 2018.

<sup>†</sup>Estimated replacement cost for the P3 structures added for information only.



*Concrete Barrier Demolition*

## 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 Crossing

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 adjacent to the road surfaces are considered separately from the larger structure.

### 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 included in this report are along expressways and major arterial road right-of-ways and prevent pedestrians from crossing onto the roadway. Chain-link fencing in parks and other local areas are 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**

Expenditure Level	Asset Performance	Description
<b>A</b>	Very Good	No structural problems evident. Only monitoring and maintenance required.
<b>B</b>	Good	Minor Deficiencies noted, monitoring and maintenance required.
<b>C</b>	Fair	Structures showing signs of deterioration. Corrosion is actively occurring in components of the structure.
<b>D</b>	Poor	Structure showing advanced deterioration.
<b>F</b>	Failed	Structure no longer capable of safely supporting design traffic loadings.

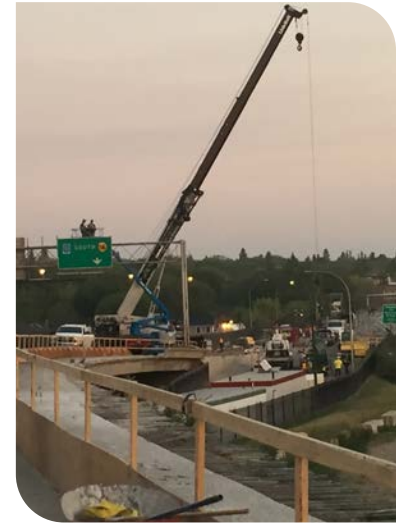
It is difficult to illustrate the differences between “Very Good”, “Good” and “Fair” since not all structural defects are visible, as the overall conditions rating is based on the deck testing reports and the following testing: copper sulfate electrode (CSE) equipotential survey, delamination survey, 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 2-5 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. More proactive rehabilitations are taking place to not only ensure that structures do not fall to a “Poor” rating, but to extend the service life of the structure.

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



*Overhead sign structure removal on Sid Buckwold Bridge Rehabilitation*

**Table 3: Current Structural Condition by Actual Inventory**

Asset	Current Performance		Desired Performance
Bridges	34%	Very Good	Good
	33%	Good	
	33%	Fair	
	0%	Poor	
Overpasses	45%	Very Good	Good
	33%	Good	
	8%	Fair	
	14%	Poor	
Pedestrian Crossings	21%	Very Good	Good
	50%	Good	
	21%	Fair	
	8%	Poor	
Chain-Link Fencing	70%	Good	Good
	30%	Fair	
Sound Attenuation Walls	100%	Good	Good
Retaining Walls	100%	Good	Good

*Barrier Demolition on Idylwyld Drive over 19th Street Overpass*

## LIFECYCLE PROGRAMS

The City has multiple lifecycle 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 structure inventory. Currently, the operating budget for the annual maintenance programs is sufficiently funded. A brief description of each program can be seen 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 induce 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.

### 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 ten 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.



*Epoxy crack sealer application on Clarence over Circle Dr Overpass*

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.



*Full depth concrete repairs*

### 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 rehabilitation strategies to select rehabilitations and optimal timing for each structure 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 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 is missed, the repair 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:** Interventions 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.

The projects 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 ten-year rehabilitation plan has been developed based on the current funding plan. Due to the budget shortfall, the program currently includes

locations with preferred treatment timing has not occurred, which has delayed the work outside the ten year period reducing the short-term cost, but increasing the long-term cost (10-30 year period).

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.

Service Expenditure Levels

The Administration evaluates the condition of the City’s assets in order to develop annual programs to maintain the assets 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.



Concrete spall with corrosion on the reinforcing steel



**Table 5: Asset Performance and Expenditure**

Asset Program	Current Performance	Desired Performance	Desired Expenditure Level	Required Annual Funding to meet Expenditure Level (2022)	Current Dollars	Gap
Operating Programs*	Good	Good	Level C	\$1.179M	\$809,200	0
Major Rehabilitations and Capital Minor Maintenance	Satisfactory	Good	Level B	\$5.8M	\$4.24M	\$1.56M

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



Completed barriers on walkway on Sid Buckwold Bridge rehabilitation project

## FUNDING SUMMARY

### Bridges, Overpasses, and Pedestrian Crossing

As identified in the 2018 Asset Management Report, the BMRR has been underfunded in the past. At the time of that report, the annual funding was \$3.18 million per year. As of 2021, the funding has increased to \$4.24 million. The target contribution per the resolution of City Council is to fund \$5.80 million per year with no requirement for one time contributions.

The increased funding allowed for the planning of major rehabilitations of multiple overpasses that are in need of reactive rehabilitations, to ensure that the condition rating of these structures is elevated to a rating of "B". However the program currently has a shortfall which will require one time funding for projects, delaying projects and/or increasing the long term funding requirements

The current base funding is forecasted to be sufficient for the 2022 and 2023 program plan, however work planned on Broadway Bridge and University Bridge (Substructure) within the next ten years have uncertainty until detailed design work can be completed which may require one time funding or further delays of other projects to allow for the work to be completed.

The administration will continue program improvements, explore alternative funding sources, and provide financial updates as future maintenance schedules and condition data change.

### Sound Attenuation Walls

The majority of sound attenuation walls have been 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. The bridge program accounts for future rehabilitation

for sound attenuation walls, assuming the program is fully funded with the backlog of reactive bridge projects completed.

### **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 3-year inspection cycle). There are no major rehabilitation activities anticipated within the next ten years. Funding has been allocated to cover on-going minor maintenance requirements for this item.

### **Chain-Link Fencing**

Chain-link fencing has been inspected and condition assessed. Funding has been allocated to cover immediate maintenance requirements. The fencing is planned to be reinspected by 2023 with further details on the program to be included 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 events such as a major rain event or high river levels due to flooding, there is an established protocol to complete underwater inspections of critical bridge elements, such as piers and abutments, to detect undermining or scouring and ensuring that the structural components have not been compromised.



*Installation of concrete on Sid Buckwold Bridge*



*Barrier construction on  
Sid Buckwold Bridge*

## THE WAY FORWARD

The Asset Preservation section within the Technical Services department have 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 innovation and creative means beyond conventional approaches to manage our infrastructure in a sustainable manner.

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.
- Exploring alternate rehabilitation designs focused on reducing the 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.
- 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.*