

CONCRETE QUALITY IN THE PUBLIC REALM

EXECUTIVE SUMMARY

The City of Calgary owns and maintains over 12,200 km of sidewalks, curbs and gutters with a current replacement value of \$5.1 billion. The quality of new concrete and condition of existing concrete is monitored by staff in the Roads business unit. Currently, over 97% of concrete assets are in Good or Very Good condition based on inspection data, and citizen satisfaction with sidewalks downtown and in residential communities is relatively high. Building and maintaining quality concrete infrastructure ensures that Calgary has a safe, accessible, reliable road and sidewalk network for public use.

Administration conducted a trial using new design standards for City-built sidewalk projects in 2016 to add reinforcing fibers to the concrete mix. This cost-effective change should improve the strength of the concrete, and reduce cracking by slowing the rate of water evaporation as the concrete cures. Updates to the design standard for subdivisions continue to be investigated, and will be evaluated in consultation with the building and development industry, as well as trial practices to minimize the down time of concrete sidewalks during repairs, while maintaining good quality.

Investments in concrete assets are funded through multiple operating and capital programs. A total of \$16.8 million was allocated to concrete maintenance and renewal in 2016. The budgets for 2017 and 2018 are estimated to be approximately \$13 million per year. It is estimated that the available budgets will not be sufficient to address the future challenges of asset deterioration, increased asset inventory, and cost inflation for the concrete network. The estimated cost to repair all sidewalks, curbs and gutters that are currently in Poor or Critical condition is approximately \$35 million. Additional funding options should be explored in order to deliver and maintain a high-quality network of sidewalks, curbs and gutters for Calgarians.

Based on a review of current processes related to the management of concrete assets, a number of improvement opportunities have been identified. In addition, Administration will continue to focus on enhancing pedestrian access around construction sites. Administration will also work with industry stakeholders to explore ways to further improve the durability of concrete assets, and better protect City assets during construction work. The coordination of concrete projects will be reviewed using Roads' new electronic map system (eMAPS) to identify pending development or public works projects that could impact new concrete sidewalk, curb and gutter projects and optimize renewal programs.

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ADMINISTRATION RECOMMENDATION(S)

That the Standing Policy Committee (SPC) on Transportation and Transit recommends that Council:

1. Direct Administration to investigate future funding opportunities through the 2019-2022 business planning process in order to maintain the network of concrete assets through coordinated lifecycle maintenance programs; and
2. Direct Administration to continue to work with and engage industry stakeholders to improve construction processes, pedestrian travel accommodations and minimize the cost of concrete replacement.

RECOMMENDATION OF THE SPC ON TRANSPORTATION AND TRANSIT, DATED 2017 APRIL 19:

That the Administration Recommendations contained in Report TT2017-0345 be approved.

PREVIOUS COUNCIL DIRECTION / POLICY

On 2015 November 9, Council adopted NM2015-27 “Concrete Quality in the Public Realm” (Attachment 1) and directed Administration to “explore the following and other alternatives, along with a business case to improve concrete sidewalk infrastructure, and report back to the Standing Policy Committee on Transportation and Transit no later than September 2016”:

- Identify process gaps and inspection funding gaps, as well as lifecycle maintenance, resource allocation, and funding opportunities;
- Summarize current programs and budgets used for the repair and lifecycle maintenance of sidewalks. Outline how The City can better coordinate its various concrete infrastructure programs and budgets along with an update on quality monitoring;
- Staff training and cooperative support from city departments and partner agencies including Calgary Parking Authority, Parks, Calgary Community Standards, Calgary Transit, Alberta Road Builders and Heavy Construction Association, and other stakeholders, to identify deficiencies and ensure that best practices are being understood, implemented and applied.”

On 2016 September 21, at Administration’s request, Council deferred report TT2016-0538 to the 2016 November 9 session of the SPC on Transportation and Transit.

On 2016 November 9, the SPC on Transportation and Transit referred the Concrete Quality in the Public Realm report, TT2016-0844, to Administration for further information, to return to the SPC on Transportation and Transit Committee no later than 2017 Q2.

CONCRETE QUALITY IN THE PUBLIC REALM

BACKGROUND

The City installs and maintains many types of infrastructure in the public realm, such as sidewalks, street lights, utility poles, hydrants, transit shelters, waste containers, bike racks, benches and trees. The primary concrete assets in the public realm are sidewalks, curbs and gutters.

Concrete sidewalk, curb and gutter networks provide two distinct services, but are physically related assets that are often managed together. The concrete sidewalks adjacent to roadways make up the primary pedestrian network. The concrete curbs and gutters channel excess water from the pavement surface to the storm drain system. These assets provide:

- A pedestrian network that is safe, accessible and provides for efficient connectivity to destinations
- A road drainage network that prevents pooling of excess water on the pavement surface and provides a safe driving surface
- Support for the roadway structure

Asset Information

The City owns and maintains over 12,200 km of sidewalks, curbs and gutters (5,600 km of sidewalks and 6,600 km of curbs and gutters) with a current replacement value of \$5.1 billion (Attachment 2). The City of Calgary Roads Business Unit (Roads) delivers operations and maintenance activities for the sidewalk curb and gutter networks. Sidewalk renewals and upgrades may be delivered by Roads or Transportation Infrastructure. New sidewalks, curbs and gutters in subdivisions are constructed and funded by developers. On average, the inventory of sidewalk assets has increased by 70 kilometres (km) per year, and curb and gutter assets increased by 90 km per year over the past 10 years.

All concrete work completed by contractors are subject to inspection, prior to the issuance of a Construction Completion Certificate (CCC). The CCC provides for a two year warranty period, which is a common length for many municipalities. After the warranty period, the concrete sidewalks, curbs and gutters are subject to a Final Maintenance Certificate (FMC) inspection, prior to the assets being transferred to The City. All damaged concrete identified during FMC inspection is replaced by the contractor at no cost to the City. Following the transfer, the sidewalks, curbs and gutters are maintained and replaced by The City.

Based on historical data, the typical lifespan of concrete sidewalks, curbs and gutters in Calgary has been estimated to be 50 years. Roads conducts an annual defect survey that rates the severity of the damage and deterioration found on concrete assets. The survey uses a 5 point severity scale to rate concrete condition: (1-Very Good, 2-Good, 3-Fair, 4-Poor, 5-Critical).

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INVESTIGATION: ALTERNATIVES AND ANALYSIS

The City has conducted citizen satisfaction surveys of Calgarians to measure and assess satisfaction with its operations, maintenance and upgrading services. Surveys have been conducted since 1997 to better understand citizens' perceptions of services and to assist The City with ongoing planning. Over the past 5 years satisfaction scores have ranged between 80% to 86% for questions related to the quality of sidewalks. Highlights from the 2016 survey include:

- 86% of the respondents were either satisfied or very satisfied with the condition of sidewalks downtown and in other business areas.
- 85% of the respondents expressed satisfaction on the condition of sidewalks in their neighbourhood.

The number of service requests related to concrete sidewalks, curbs and gutters received from 2011 to 2015 are shown below. This service request is in place to report sidewalk, curb and gutter concerns related to cracks/crumbling, damage, heaving/sinking, ongoing construction concerns, rehabilitation due to previous repair, tree grate concerns, trip hazards, uneven surfaces, damaged bollards and bike rack repairs. From 2011 to 2015, over 88% of these service requests were responded to within 7 days. The volume of service requests has increased by 44% over this corresponding time period.

Number of Concrete 311 Service Requests 2011 - 2015				
2011	2012	2013	2014	2015
3,087	3,138	3,491	3,997	4,459

Concrete Compliance Program

Roads has as many as 33 inspectors to inspect concrete around Calgary during the construction season to monitor workmanship issues. In addition, The City has a compliance program for concrete and asphalt pavement to monitor the quality of materials and workmanship used on City projects (Attachment 2). The City randomly selects projects to be tested on a daily basis. If the concrete fails to meet the specifications, the contractor is responsible to either replace the concrete or pay a penalty for not meeting the specifications. In 2015, The City tested samples from 52,000 cubic meters of concrete placed in sidewalks, and found 6% of the concrete to be non-compliant.

Common Causes of Inspection Failure		
• Construction damage	• Shallow utility settlement	• Frost heave cracking
• Off-season installation	• Tree root damage	

Currently, 97.4% of concrete assets are in Good or Very Good condition. This is slightly above the 97% target in 2015-2018 Action Plan. 1.5% of assets were assessed to be in fair condition, and 1.1% in poor or critical condition. Assets that have been rated as poor or critical are prioritized for maintenance or renewal work that season, depending on available budget. Concrete rated as fair will be monitored for future maintenance.

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Design Standards for Sidewalks

The existing standard for sidewalk thickness is 100 mm of concrete, placed on a prepared subgrade. For all Roads projects, a base material of 100 mm to 150 mm of gravel or recycled concrete is used beneath the concrete slab. The design standards from other municipalities have been reviewed and The City of Calgary generally has lower concrete thickness specifications in comparison to other major municipalities (Attachment 2). While the defect survey results show the concrete quality has not been a problem to date, Roads has examined cost-efficient improvements that could be made to ensure concrete quality remains high. In 2016, a new design standard was piloted, which involved the addition of reinforcing fibers to the concrete mix for all Roads contracts. The City of Calgary will continue to work with industry stakeholders to review best practices to improve the durability of concrete assets and pedestrian accommodation. A working group will be formed to review methods to improve the lifecycle of concrete and joint pilot projects will be explored in 2017 and 2018.

Budget and Funding Analysis

The Roads 2016 budget for the concrete maintenance and renewal program was \$16.8 million (Attachment 2). The budget for 2017 and 2018 is approximately \$13 million. \$2.0 million from the 2017 budget allocation for sidewalk block replacement was advanced to 2016 during the Capital Recasting process. Currently, there are no funds allocated for sidewalk block replacement in 2018.

Historically, the Industrial Sidewalk Retrofit Program has been used to address the completion of missing pieces, or links, of the sidewalk network. High priority missing sidewalk links are currently funded by Program 126-103 City Wide Active Modes and 128-134 Various Concrete Construction to address these locations. A proposed funding program identified in the Pedestrian Strategy (Step Forward) would convert the Industrial Sidewalk Retrofit Program (126-176) into a Sidewalk Missing Links program with a prioritization process to address deficiencies in the sidewalk network.

Based on the most recent condition survey, the estimated cost to repair all the concrete assets currently rated with Severity 4 (Poor) and 5 (Critical) defects is \$34.7 million. The current budget can repair the Severity 5 defects identified but only 38% of the Severity 4 defects.

Severity 3 (Fair)	Severity 4 (Poor)	Severity 5 (Critical)
\$56.5 million	\$29.3 million	\$5.40 million

It is estimated that 2% of the concrete sidewalk will deteriorate annually from good condition to fair, and from fair condition to poor/critical. Periods of high growth in Calgary will influence the average replacement needs per year. The 2016 budget of \$16.5 million will have improved 0.65% of the overall condition of concrete sidewalks in Calgary. Future budgets will not be sufficient to overcome the expected rate of deterioration, the continual increase to the asset inventory, and cost inflation. Assuming the annual budget for concrete repairs and concrete renewal remains at the estimated 2017 budget levels for the next 4 years, concrete sidewalk condition would decrease to 90% by the end of year 2020. The estimated cost to return the condition to 97% would be approximately \$232 million.

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A significant funding gap is forecast between the expected available budget for concrete replacement in the future. For example, over \$1.1 billion of concrete assets that were constructed in the 1970's will reach the end of the expected service lifespan between 2020 and 2030. Administration will continue to look for suitable funding opportunities to conduct additional sidewalk, curb and gutter repairs when funding becomes available. Managing and maintaining a high-quality network of concrete sidewalks, curbs and gutters is important to providing a safe environment for all modes of transportation.

Improvement Opportunities

Based on the review of current processes related to sidewalks, curbs and gutters, a number of opportunities were identified. These are listed in Attachment 2, and include:

- Continued focus on appropriate pedestrian accommodation during sidewalk construction. Dedicated staff have been assigned to conduct inspections related to accessibility;
- Administration will look for innovative ways to protect City assets during construction, yet maintain adequate pedestrian accessibility. Industry users will be encouraged to trial new products or processes to minimize damage to concrete curbs and sidewalks;
- Continue to identify concrete sidewalks, curbs and gutters projects that are adjacent to pending large developments, infills or projects by other Business Units. Roads will reschedule these projects to prevent new concrete from damage during construction.

Stakeholder Engagement, Research and Communication

Administration met with the Building Industry Land Development organization (BILD) to discuss this report. Meetings are also scheduled annually to discuss changes to specifications. The Alberta Roadbuilders & Heavy Construction Association have been engaged to provide suggestions on ways to improve concrete quality.

Strategic Alignment

Proper maintenance and renewal of concrete sidewalks, curbs and gutters supports Council's Priorities to be "A City that Moves" by ensuring these assets are well maintained and providing a safe and accessible transportation environment. Administration's recommendations are aligned with the Calgary Transportation Plan, including the promotion of safety for transportation system users, and ensuring transportation infrastructure is well managed. The report supports the achievement of performance measure targets and Council outcomes identified in Action Plan 2015-2018:

- M.PM7 Per cent of concrete sidewalks that are in good or very good condition. (2016 Target: 97%, 2017 target 97%)
- N9.2 Provide missing links in sidewalks and bikeways and signing connectivity to encourage pedestrian and cycle commuting.
- M4.1 Design, construct and maintain sidewalks, bikeways and access roadways to promote use of active transportation modes.

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Social, Environmental, Economic (External)

Inspecting and maintaining concrete sidewalks, curbs and gutters will ensure City infrastructure functions properly and is managed to preserve the value of asset investments. Sidewalks that are kept in good or very good condition encourage active modes of travel, reducing dependence on automobiles and decreases associated carbon emissions.

The Government of Alberta's Carbon Levy, which started January 1, 2017, is estimated to increase the costs for concrete by 1.6% to 5%. Additional information is included Attachment 2.

Financial Capacity

Current and Future Operating Budget:

There is no impact on the current operating budget from this report. Increasing inventories of concrete assets will require additional resources in the future to inspect and evaluate concrete condition, and to maintain and renew assets that have deteriorated.

Current and Future Capital Budget:

There is no impact on the current capital budget from this report. Lifecycle maintenance of concrete assets will require future capital investments to ensure the pedestrian network and storm drain systems continues to function as intended, and provide a safe environment for all modes of transportation.

Risk Assessment

The approved budget for concrete maintenance and renewal are not sufficient to mitigate an expected annual deterioration, increases to the asset inventory, and cost inflation for ongoing concrete programs. The overall concrete sidewalk condition score is expected to decrease from 97.4% to 90% by the end of year 2020 without additional funding. The impact to Calgarians may include accessibility challenges due to sidewalk condition, increase in potential hazards and infrastructure damage from poor drainage.

REASONS FOR RECOMMENDATIONS:

1. The current investment into concrete maintenance and renewal will not be sufficient in the mid to long-term time frame to overcome annual rates of deterioration, increased inventory due to growth, and inflationary costs.
2. Proactively identifying future funding opportunities and more efficient replacement methods enables Administration to leverage concrete investments when funding becomes available.

ATTACHMENT(S)

1. Notice of Motion – Concrete Quality in the Public Realm
2. **Concrete Asset Information Report (Corrected)**