ROAD RENEWAL PROGRAM VALUE FOR MONEY AUDIT

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Office of the Auditor General
City of Ottawa

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Acknowledgement

The team responsible for this audit was comprised of Cory Richardson and Mary Anne Patrice Malenab from the Office of the Auditor General and independent pavement engineering subject matter expert from Egis Group (external consultant), under the supervision of Joanne Gorenstein, Deputy Auditor General and my direction. My colleagues and I would like to thank those individuals who contributed to this project.

Respectfully,

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Auditor General

Introduction

The Road Renewal Program Value for Money Audit was included in the 2022-2023 Audit Work Plan of the Office of the Auditor General (OAG), approved by City Council on December 8, 2021.

Background and Context

Road Asset Management

The City of Ottawa (City) has the largest geographical area of Canada's major cities and has over 6,000 km (12,400 lane-km) of roadways. The planning, design, monitoring, and management of this road network takes significant financial and human resources. The 2023-2026 City Strategic Plan identifies: "a city that is more connected with reliable, safe, and accessible mobility options" as one of its top priorities.

The City uses its Comprehensive Asset Management framework to manage existing and new infrastructure. The goal of this framework is to keep the City's infrastructure safe, in good working order and at an approved level of service and to ensure continued service delivery that meets the needs of the community, now and into the future.

Within this framework is the Transportation Asset Management Plan (TAMP), which was created in March 2022 as required by the Province[1]. The TAMP is a strategic document that provides a snapshot of current conditions and establishes a basis for future asset management planning and decision making and will be updated in July 2025. Roads is a category of assets included in the TAMP, represented by the following types:

- **Freeways** - high volumes of traffic with controlled entrances and exits[2];
- **Arterials** - moderate to high traffic volumes over moderate distances between principal areas of traffic generation;
- **Collectors** - low to moderate traffic volumes within specific areas of a municipality, and collect local traffic for distribution to arterials or to highways or freeways;
- **Local Roads and Lanes** - low volumes of traffic and access to private properties; and
- **Gravel Roads** – made of gravel rather than paved.

[1] Ontario Regulation 588/17: Asset Management Planning for Municipal Infrastructure

[2] Note that the Province has announced that it plans to take full responsibility for Highway 174, the City's only freeway. At that point, the City will no longer have responsibility for road rehabilitation of any freeways.

As of March 2022, Ottawa's road network had an estimated replacement cost of $16.02 billion. The existing average age of City roads is 35 years. Based on the 2017 Long Range Financial Plan (LRFP), the 10-year planned investment to maintain collector and arterial roads in a state of good repair is $607.5 million. However, the 2022 TAMP estimated preliminary costs to maintain all roads infrastructure at the current level of service is $1.535 billion, resulting in a funding gap of $927.5 million. Local roads and lanes represent $672.2 million (72%) of this gap. As per the TAMP and the approved strategy, investments in road renewal are prioritized for higher volume and more critical roads such as freeway, arterial, and collector roads, whereas local roads receive lower investment.

The condition (measured by the Pavement Quality Index[3]) of paved roads is assessed by independent contractors using a vehicle equipped with cameras and other sensors every 2 to 5 years, depending on the type of road. Below is a breakdown of the quality conditions of the City's roadway network, as approved by Council, as of 2022. Overall, about 46% of the City's paved roads were rated "Very Good" or "Good", with the remaining rated "Fair" or below.

Table 1: State of the City's Road Infrastructure

	Length and Share		Quality Ratings				
Road Class	**Km**	**% of Roads**	**Very Good**	**Good**	**Fair**	**Poor**	**Very Poor**
Local and Lane	2,519	40%	11%	47%	30%	11%	1%
Arterial	1,493	25%	4%	37%	56%	3%	0%
Collector	1,455	24%	3%	25%	64%	8%	0%
Freeway	41	0.9%	0%	91%	9%	0%	0%

Note: This table does not include 535km of gravel roads (10.1% of the network). Figures are sourced from the 2022 TAMP Technical Report.

Road Renewal Program

Road renewal is the strategic rehabilitation of road assets. More recently at the City, this also includes some upgrades known as enhancements such as cycle tracks or traffic calming measures. For the road renewal program, rehabilitation strategies can vary. Broadly they include:

- **Preservation** – This involves minor rehabilitation of roads such as light surface treatments that can be applied at low cost.

[3] The Pavement Quality Index is a numerical representation of the quality of road conditions which allows the City to make data driven decisions on keeping the pavement in good condition.

- **Resurfacing/rehabilitation** - Restores the functionality and improves the performance of an existing road without entirely replacing its structure.
- **Reconstruction** - A comprehensive overhaul of an existing road that typically involves completely removing and replacing the road surface and a significant portion, if not all of its underlying layers at significant cost.

Of the $609 million in projected total infrastructure investment for 2024, $98.7 million is budgeted for road renewal. Other road investments include $50.4 million for new roads and intersections and $163.6 million for integrated projects (road, water, and sewer).

The road network is managed by Asset Management Services (AMS), within the Infrastructure & Water Services Department (ISWD). They are responsible for maintaining the roads inventory, monitoring condition and performance, identifying road renewal needs, and developing scopes of work.

Infrastructure Services, also within ISWD, is a key stakeholder in road renewal management and delivery. Specifically, it manages the construction of new, and renewal of existing municipal infrastructure by contractors and provides overall quality management in terms of design guidelines and construction standards as well as material quality and project assurance management.

Road renewal requires coordination with multiple teams, departments, and external stakeholders. Transportation Planning, within the Planning, Development and Building Services Department provides strategic planning to address the City's transportation growth needs in a sustainable and affordable manner. Their inputs (such as environmental assessments and functional planning for road enhancements) are crucial to renewal projects.

Right of Way, Heritage and Urban Design Services, housed within the Planning, Development and Building Services Department, is responsible for administering right of way permitting (such as for road cuts[4]) and providing direct inspection and coordination of construction of municipal infrastructure related to private development as well as to road cut reinstatements.

[4] Road cuts take place when utilities or other stakeholders must remove a portion of the road to access or develop other infrastructure.

Audit Objective and Scope

The objective of this audit was to assess the efficiency, effectiveness, and economy of road asset management at the City, specifically how road renewal is planned, designed, constructed, and monitored.

The audit focused on key aspects of City road asset management renewal and how they provide the most value for money to the City. This included condition and needs assessment, prioritization of activities, design and construction of appropriate road work, as well as quality assurance for the fiscal years 2022 and 2023, as well as some in progress projects from 2024.

The scope of this audit **did not** include the maintenance activities (such as pothole filling) of Roads Services in the Public Works Department, the development of the Transportation Master Plan, growth projects, or the road cut permitting process of Right-Of-Way activities within the Planning, Development and Building Services Department. However, coordination activities with these and other teams (e.g. Traffic Services) were examined as well as the inspection and oversight work performed by Right of Way, Heritage and Urban Design Services. Additionally, the management of gravel roads was not reviewed as part of this project. As well, procurement activities related to construction contractors were not included in the scope of the audit.

Refer to Appendix 1 for additional details on the objective, criteria, and approach to the audit. This audit was conducted in conformance with the Institute of Internal Auditors International Standards for the Professional Practice of Internal Auditing[5].

Conclusion

Although the City's overall transportation strategy is evolving, roads renewal is a mature program that has embedded many best practices into their processes. The City has an advanced pavement management system in place to track and assess road conditions and leverages innovative data collection tools. Further, aligned with the approved renewal strategy, the City continues to successfully deliver an increasing renewal program ($88.5 million in 2023) that includes projects with road enhancements (e.g. traffic calming features, pedestrian crossings, and cycling tracks).

While the City has structures in place to prioritize as well as design and deliver on road renewal projects, the audit identified opportunities to improve the integrity of data used in decision-making, effectiveness of oversight controls and potential opportunities for

[5] https://www.theiia.org/globalassets/site/standards/mandatory-guidance/ippf/2017/ippf-standards-2017-english.pdf

increased value for money. There are deficiencies in some road network data attributes used to establish the initial road renewal program; potentially impacting the prioritization of projects. In specific road renewal projects, we noted that project design could consider less expensive materials, which would still be aligned to required specifications. Oversight of quality assurance and activities related to asphalt samples should be improved to reduce the risk that contractors are providing sub-standard materials, or that overall construction is of lower quality as compared to required standards. Additionally, due to the expanding scope and complexity of renewal projects, cross-departmental expectations for design inputs should be clearly defined. Finally, there is limited program-level reporting or key performance indicators, which could impact the overall decision-making and transparency of the program.

Value of Audit: The audit made recommendations to ensure the City receives optimal value for money from investments in road renewals. This includes improvements to the collection of data used in project prioritization and design, selection of appropriate materials, as well as oversight of quality assurance measures.

Audit Findings and Recommendations

1. Road Network Data and Prioritization

1.1 There are deficiencies in the road network data used to establish the initial road renewal program; potentially impacting planning and prioritization.

The City performs a regular assessment of pavement conditions and other road data using the pavement management system called RoadMatrix. Pavement management systems are essential tools to provide a systematic, data-driven method of road network data collection, storage, analysis, and modelling to support the City's road renewal program in planning and decision-making when managing limited resources across the pavement network. RoadMatrix, designed and owned by a third-party supplier, is a database of the City's road network by section, with key attributes such as location, materials, traffic volumes, as well as measures of the

road's quality. Pavement Quality Index is the primary measure of overall quality, which is a function of surface distresses as well as ride (roughness of the road). It is data housed within RoadMatrix that contributes to the first, data-driven prioritization of the road network for renewal purposes.

As part of our audit, we evaluated the data components and key attributes within RoadMatrix as these enable each road asset to be clearly identified, quantified, described, and evaluated, based on budget and needs assessments. Accuracy and completeness issues were identified for several attributes in the pavement management system. However, we understand that because of the City's strategy of prioritizing higher-class roads (i.e. collectors and arterials), data issues for local roads are of lower risk.

- **Traffic volumes, i.e. Annual Average Daily Traffic (AADT)** – Traffic volume is a critical attribute considered in the system's needs analysis for prioritization. For 43% of collector and arterial roads (and 83% of local roads) traffic data is over 6 years old. AMS applies a growth rate of 1-2% in lieu of current data.
- **Pavement Quality Index (PQI**) – As noted above, PQI is the primary measure of overall road quality. This is collected using a vehicle that detects surface distresses as well as other characteristics using cameras and sensors. A deterioration calculation is applied in years where data is not collected to factor in regular wear and tear on the roads. Our audit confirmed that PQI data has not been reflected in RoadMatrix since 2021. The City's standard is to collect PQI data on a 3 year-cycle for collectors and arterials and a 5 year-cycle for local roads.
- **Rehabilitation costs and dates** – These costs are key inputs in the asset management plan for regulatory reporting purposes. The rehabilitation costs are also used in the cost-benefit analysis to identify initial renewal needs in the system. The rehabilitation cost in the database for a common treatment type showed a significant variance from actual costs. We understand that the costing information maintained within the database was being updated every two years, though this process is evolving to reflect construction cost fluctuations. The rehabilitation date is the last date a rehabilitation treatment took place. For 53% of the network, the data is from 2012 or earlier and there was no data for 47% of the road network as of 2023. This attribute is used to calculate pavement age and is used in program-related reporting. It should be noted that some roads may not have had rehabilitation work since amalgamation in 2001 and therefore would have no data for this attribute.

The information maintained within RoadMatrix is the foundation of the City's asset management and prioritization processes and its output provides a data-driven candidate list of priorities for rehabilitation. While we understand that the sensitivities of these attributes have not been analyzed by management, the absence of a standard for data collection increases the risk of deficient data, impacting the effectiveness of planning and prioritization.

RECOMMENDATION 1 – STANDARDS FOR ROAD NETWORK DATA

The Director, Asset Management Services should establish a cost-effective and risk-based (e.g. by road class) standard for the collection of road data (such as traffic volumes, PQI, and rehabilitation costs) information that can be relied upon for decisions related to pavement management.

MANAGEMENT RESPONSE 1

Management agrees with the recommendation.

Staff will develop a standard for the collection, evaluation, and use of road data to promote consistent data quality that supports decisions related to pavement management. Development of this standard will occur during 2024 and completed by Q2 2025 to support the next cycle of road prioritization.

1.2 There is limited documentation available to justify specific rehabilitation projects included on the candidate list.

The output of the prioritization process within RoadMatrix forms the initial candidate list of approximately 1,000 potential road sections (out of a population of over 10,000) to be considered for the City's 5-year program. This list is then refined through road inspections, Councillor requests, and other factors, leading to the draft program list. The following was noted from the 2022 draft program list:

- 89 out of the top 200 prioritized road sections from RoadMatrix were not included.
- 153 of road sections ranked from 2,000 to 5,000 and 150 of road sections ranked from 1,000 to 1,999 were included.

We understand that management maintains a portion of the annual budget to address localized/small projects, public inquiries, and Councillor requests. Based on the 5-year program, selective resurfacing represents on average, 3% of total estimated rehabilitation cost.

Though there is legitimate engineering rationale for candidate projects selected beyond the initial candidate list, management was unable to provide documentation, in many instances, of the justification for the change in prioritization. Without documented rationale and oversight for selected road projects, the City cannot demonstrate that it is optimizing the use of limited funds.

RECOMMENDATION 2 – INCREASED TRANSPARENCY OF PROJECT SELECTION

The Director, Asset Management Services should consistently document the engineering rationale of projects selected for rehabilitation beyond the initial candidate list.

MANAGEMENT RESPONSE 2

Management agrees with this recommendation and will begin to implement immediately to ensure engineering rationale of projects leading to the recommended road rehabilitation program are consistently documented.

2. Project-Level Data and Road Design

2.1 Traffic data used for asphalt mix design is not current; potentially impacting the material used for road rehabilitation.

Once projects are selected, a project charter is developed that includes the scope and design of the road being rehabilitated, including the asphalt mix. A key data point in the design of roads is the traffic and truck volume on the road sections to be treated. Average Annual Daily Traffic (AADT) is the standard measurement for traffic volume used at the City[6] and in the wider industry. The traffic as well as truck loads and volume impact the asphalt mix, with different mixes suggested at different AADT thresholds. The required traffic data is gathered in partnership with Traffic Services. There is no standard for how current traffic volumes should be for use in the design of renewal projects. However, AMS management indicated that traffic data within two (2) years is ideal and that data over five (5) years old is considered unreliable.

As part of our audit, we sampled 20 project charters from 2022, 2023, and 2024 which represented a total of 130 individual projects requiring AADT counts. The average age of the AADT used was over 4 years old and there were 43 projects (33%) with AADT collection over 5 years old (including 2 cases of data over 10 years old). Management

[6] City specifications for Superpave Hot Mix Asphalt Mixes (the standard material used in most City roads) provide guidelines for selecting appropriate asphalt mixes.

has indicated that traffic patterns were impacted by COVID-19 and that, in some cases, it would have been more appropriate to use pre-pandemic data.

While we understand management has not evaluated the impact of newer data on the selection process, the absence of a standard for data collection increases the risk of deficient data, impacting the selection of the quality and design of road materials that have varying costs; potentially impacting the value for money received by the City.

RECOMMENDATION 3 – STANDARD FOR TRAFFIC DATA IN ROAD DESIGN

The Director, Asset Management Services should establish a standard for the acceptable maximum age of the data to be used in the design of projects (specifically the asphalt mix selection). Rationale should be formalized when data outside of this standard is being used.

MANAGEMENT RESPONSE 3

Management agrees with the recommendation to establish a standard for the quality of data being used and how it is selected, including guidance on the age and appropriateness of traffic data.

Asset management and Infrastructure Services Standards and Quality Management branch will coordinate investigation and development of this standard for future road renewal planning. Completion date Q1 2026.

2.2 Less expensive asphalt mixes could be appropriately used in specific road projects.

As mentioned above, traffic volume (i.e. AADT) is a key component of selecting the appropriate asphalt mixes for road design. Additionally, Equivalent Single Axle Loads (ESAL) is a standard measure of truck loadings used for road designs. The City's specifications lay out the requirements for asphalt mix selection based on the AADT, ESAL, and road class. In the road construction industry there are levels of asphalt mixes from A through E that scale with traffic and truck volume and loading as well as road class (Level E being the most robust and expensive - for example, used by the City on the Transitways). Additionally, there are different sub-types within Level D (i.e. FC1 and FC2)[7] that the City can use on higher volume roads. On most projects, the City uses Level D for collectors and arterials and Level B for local roads. The City does not currently use Levels

[7] FC represents "friction courses" which are designed to provide high skid resistance on roads with high traffic and truck volume and loading.

A and C in their road projects in order to streamline design and testing requirements. However, asphalt mix Level C is commonly used in Ontario for collectors and minor arterials.

Our audit identified many projects which selected a higher quality asphalt from what would have been expected per the City's specifications. In these cases, a less expensive asphalt mix could have been appropriately used based on the roads' traffic and truck volumes; either gradients within Level D, or Level C mixes. While engineering judgement may have been used in these cases to override the asphalt specification, the rationale documented, in many cases, was that the road was a truck or bus route. However, the City already uses a conservative truck factor when calculating ESALs as part of the pavement design, which should consider additional trucking loads. As such, in these cases, the rationale provided does not seem to warrant the higher-grade asphalt mix.

Price Difference in Asphalt Mix

The price per tonne is $185.84 for Level D (FC1) and $232.85 for Level D (FC2)[1]. Both mixes can be used as surface course mixes for collectors and arterials and guidelines for selection are based on AADT and ESAL figures. The difference in materials cost, between these two options, for a 5,000-tonne project would be approximately $235,050.

[1]City's Master Price List for 2024

We understand that the City has generally taken a conservative approach to asphalt mix selection. For example, an upgraded mix of asphalt may be selected for roads that have a higher collision rate, are a known truck route, or for geotechnical reasons, such as a composition of the underlying road materials. Additionally, climate impacts have been impacting service life of roads which could lead to favouring a higher quality asphalt. Finally, when projects are bundled, it may be more financially prudent to purchase more of one type of mix, to take advantage of possible volume discounts.

Despite these factors, using higher level asphalt mixes than required can add material costs to projects, without necessarily extending the road's useful life, impacting the overall value for money of the program that is facing significant funding gaps.

RECOMMENDATION 4 – ROAD DESIGN SPECIFICATION ALIGNMENT

The Director, Asset Management Services should consider less expensive asphalt mixes that align with the City's specifications when other design conditions allow. If a mix is selected different from that prescribed in the specification, the engineering basis for these should be documented in the project charter to ensure clarity and appropriateness of decisions made.

MANAGEMENT RESPONSE 4

Management agrees with the recommendation to consider less expensive asphalt mixes when design conditions allow and will document rationale for engineering decisions about asphalt mix in the project charter starting immediately.

3. Oversight of Quality Assurance for Asphalt Samples

3.1 There is currently no direct oversight of asphalt samples taken by contractors at project sites.

As part of road renewal projects, Project Managers and Coordinators (City employees) are assigned as Contract Administrators to provide onsite oversight of project delivery. The City also employs a third-party inspector to monitor onsite daily activities. Contractors[8] perform their own quality assurance activities including collecting bulk (i.e. hot asphalt) and core (i.e. three cores of completed pavement) samples. These samples are sent to independent laboratories for testing and then used for comparison against project specifications by the City.

City specifications detail that the Contractor shall conduct sampling as per the principles set out in the latest version of the Ministry of Transportation of Ontario (MTO) *Field Guide for the Acceptance of Hot Mix and Bridge Deck Waterproofing*. This states that the City's Contract Administrator, or their representative, must observe sampling and sealing of the sample. Additionally, other controls are expected, including retaining custody of samples until transferred to the third-party laboratory. These guidelines were adopted by the MTO in response to a 2016 Road Infrastructure Construction Contract Awarding and Oversight from the Auditor General of Ontario that noted that whistleblowers came forward suggesting sample switching is a systemic issue in the industry. Contractors would have an incentive to swap in higher quality materials for testing in order to obtain bonuses for high quality product, while laying cheaper and poorer quality materials.

[8] Private construction companies that perform the rehabilitation treatment on the road.

As part of the audit, we visited a City road renewal project to observe the inspection and oversight of quality assurance activities. In general, the City's inspector was observed in completing key inspection controls. However, there was no direct oversight of the quality assurance activities by a City representative (i.e. Contract Administrator or inspector) to ensure the samples taken by the Contractor were not tampered with. Management confirmed that it is not regular practice for City representatives to directly oversee quality assurance activities as there are limited resources available to oversee quality assurance activities and take custody of samples for independent testing.

Though it is the responsibility of the Contractor to ensure all quality assurance requirements are met, established guidelines and best practices set by the MTO assign oversight of these activities to the City. Without this oversight embedded within the process, there is a risk to the integrity of the samples taken, which could lead to the City paying for sub-standard materials.

RECOMMENDATION 5 – IMPROVE OVERSIGHT OF CONTRACTOR QUALITY ASSURANCE FOR ASPHALT SAMPLES

The Director, Infrastructure Services should ensure that specifications related to oversight and chain of custody of Contractor asphalt samples are consistently followed or as necessary, establish and embed compensating measures.

MANAGEMENT RESPONSE 5

Management agrees with the recommendation.

The City will review the specifications to assure they align with the recommendation and will make modifications should it be necessary. The City will reinforce the processes to ensure that a designated City representative observes sampling and sealing of the asphalt samples. Additionally, the City will explore and implement the required changes in the process to ensure a chain of custody for the asphalt samples for the road rehabilitation program until transferred to the third-party laboratory.

The recommendation will be implemented by Q2 2025.

3.2 There is no testing program for Reclaimed Asphalt Pavement or for other undesirable materials that may have been added during production.

The City develops and oversees design specifications and standards as well as quality assurance testing. To test the quality of the asphalt mixes, contractors annually send their samples taken from the asphalt plant to independent laboratories and the City will review the results for appropriateness to specifications.

Reclaimed Asphalt Pavement (RAP) is processed from existing pavement and can be recycled for new asphalt mixes. This is cheaper for the asphalt producer as well as more environmentally sustainable. City specifications prescribe the amount of allowable RAP as it is not appropriate for certain asphalt mixes, and in other cases is allowed up to certain thresholds. Too much RAP can lead to significantly lower road quality and faster deterioration of the road. Management confirmed that the substitution of RAP is a known issue in the pavement industry as is the addition of undesirable materials (such as motor oils). There is an incentive to substitute RAP and other materials as it is cheaper to produce these mixes.

Testing programs to detect RAP and other undesirable materials on completed projects have been implemented within other Ontario jurisdictions. While we understand that discussions on testing for RAP and undesirable materials have taken place within the City in the past, no testing program has been adopted for completed City projects where added RAP or other undesirable materials could have been substituted. As a result, the City could unknowingly be receiving and paying for sub-standard materials which could lead to faster deterioration of the roads.

RECOMMENDATION 6 – TESTING FOR SUBSTITUTED MATERIALS ON COMPLETED PROJECTS

The Director, Infrastructure Services should establish a risk-based program to test for RAP and other undesirable materials (such as motor oils) on completed projects to ensure the City is obtaining value-for-money and a quality product.

MANAGEMENT RESPONSE 6

Management agrees with the recommendation.

Staff will develop a risk-based program by reviewing testing programs to quantify RAP usage and presence of undesirable materials on completed projects implemented within other jurisdictions, conducting research, and discussing with industry and

technical experts. The outcome of the risk-based program to test RAP and undesirable materials will be implemented by Q1 2026.

3.3 The quality of road cut reinstatements is not being tested or integrated into the road renewals program.

Right of Way, Heritage & Urban Design Services is responsible for administering right of way permitting (such as for road cuts used by utility companies and other stakeholders to get access to infrastructure under or around the road). They are also responsible for providing inspection and coordination of construction of municipal infrastructure related to private development and road cut reinstatements.

A comprehensive Pavement Degradation Framework Assessment was completed in 2022. It showed the degradation of a road increases by an average of 20% across road classes after a road cut (this increases to 31% for collectors). As a result of this assessment, the City updated its Pavement Degradation Fee (PDF) and Road Cut By-Laws to be more aligned to comparable municipalities. These fees help compensate the City for the increased deterioration caused by road cuts. Once the permit holder completes final road cut reinstatement, they are required to complete and submit a Road Cut Completion Report. This triggers a visual inspection by the City, which marks the start of the warranty period if the work is deemed satisfactory. A final inspection is conducted after the warranty period which completes the process. The City issued 4,036 permits for road cuts in 2022 and 3,383 in 2023.

The City puts the responsibility on the permit holder to reinstate the road to a specific standard and the City can request evidence to confirm this. Specifically, Road Activity By-law No. 2003-445 indicates that the City may at any time request testing certifying that backfilling procedures have been performed in accordance with the by-law.

We understand from management that there have been concerns with road cut reinstatement quality within the City and are common in many municipalities. However, since the implementation of the updated By-Law in 2022, there have not been any instances of the City requiring permit holders to produce testing results to confirm the quality of the reinstatement.

A visual inspection may not be a strong indictor of reinstatement quality. Without obtaining additional evidence of the quality of reinstatements, the City cannot be assured of the quality of the road that has been reinstated by a permit holder.

We learned, additionally, that road cut reinstatement information is not currently reflected in the pavement management system (RoadMatrix). Given the impact of a road cut on the rate of degradation, this could be a valuable data point in the overall prioritization and needs assessment of the road system. Ultimately, without tracking and monitoring of reinstatements, the City may not be able to identify and quantify impacts.

RECOMMENDATION 7 – RISK-BASED REINSTATEMENT TESTING

The Manager of Right of Way, Heritage & Urban Design Service should develop a risk-based program for requesting road reinstatement test results from permit holders.

MANAGEMENT RESPONSE 7

Management agrees with this recommendation.

Right of Way, Heritage & Urban Design Service staff will develop a risk-based program for requesting road reinstatement test results from permit holders. This recommendation is anticipated to require incremental staff resourcing to administer the enhanced quality management program. This will be completed in Q2 2025.

RECOMMENDATION 8 – INTEGRATION OF ROAD CUT DATA

The Director of Asset Management Services, in coordination with the Manager of Right of Way, Heritage & Urban Design Service, should ensure that key road cut reinstatement data (e.g. size, location, dates, visual inspection dates and condition) is integrated into the pavement management system to track road degradation from road cuts.

MANAGEMENT RESPONSE 8

Management agrees with this recommendation.

The Manager of Right of Way, Heritage and Urban Design Service will ensure that key road cut reinstatement data is available, and the Director of Asset Management Service will explore the possibility of integrating this data into the pavement management system. Since the pavement management system service is provided by a third party, staff cannot commit to integration before exploring feasibility, value and cost

implications and a business case is warranted. Completion date Q1 2026 for the business case.

4. Governance, Coordination, and Reporting

4.1 Insufficient formal expectations for cross-departmental inputs for road renewal projects impacts project delivery.

The City's strategies for transportation are evolving towards a multi-modal, holistic approach as evidenced by the 2013 Transportation Master Plan and other initiatives like Complete Streets[9]. These initiatives call for upgrades, or enhancements for renewed roads and are funded from the road renewal budget. Enhancements can include cycle tracks, pedestrian crossing, rumble strips, and other additions. Enhancements are included on a case-by-case basis and costs vary from project to project.

Because road renewals must consider these enhancements, additional coordination is required for each renewal project. While AMS manages the coordination of road renewal projects across the City, key inputs and deliverables from various groups are required, including from Transportation Planning Service within the Planning, Development and Building Services Department and Traffic Services within Public Works to ensure projects can proceed and will not impact other City work. Complete and timely details on the inclusion and design of enhancements are crucial to the delivery schedule on each project. If not received on time, project scope changes are difficult to accommodate, impacting overall cost, according to AMS management.

Based on the results of a process efficiency exercise recently conducted by AMS, delays in receiving key inputs from other teams impact the quality of the project planning. We understand that, as a result, project scope changes are necessary for many projects which can add cost and delays to the project.

We learned that clear roles, accountabilities, and timelines for input/deliverables on projects from key stakeholders, outside of AMS, are not formally defined and there are no formal expectations established or forum to discuss/escalate these issues. As noted above, delayed inputs result in less defined projects which can lead to later tendering as well as increased change orders. These factors can delay the timing and increase the price of the project.

[9] Complete Streets incorporate the physical elements that allow a street to offer safety, comfort and mobility for all users.

RECOMMENDATION 9 – DEFINE CROSS-DEPARTMENTAL ROLES AND EXPECTATIONS FOR PROJECT INPUTS

The Director, Asset Management Services, in consultation with Transportation Planning and other stakeholders, should formally define key roles, responsibilities and accountabilities, and set expectations, and timelines for the road renewal project cycle to minimize delays and impact on project costs. This should include tracking of inputs and the establishment of escalation protocols.

MANAGEMENT RESPONSE 9

Management agrees with the recommendation.

Work led by Asset Management is underway (commenced Q2 2024) and is anticipated to be completed in Q4 2024. Testing of targeted possible improvements is underway. Implementation of this recommendation by Q2 2025 for the next cycle of budget preparation.

4.2 There is limited program-level reporting and monitoring for the road renewals program.

As noted earlier in this report, the Transportation Asset Management Plan includes road network data such as current state of the road assets, levels of service, strategies and activities applied by the City, as well as historical and forecasted financial information. This is a strategic "point-in-time" document, though, after the next update in July 2025, regulations[10] will require annual status updates.

A bi-weekly status report of ongoing renewal projects is distributed which allows for project-level oversight. This includes status and other information on renewal projects and is widely circulated to management and Councillors. Additionally, there is a public-facing interactive map that includes road construction information. However, there are limited reporting mechanisms or key performance indictors to monitor the road renewal program overall.

Program reporting on the renewal program, including lane-km or pavement area and budget spend by treatment category (i.e. Preservation, Rehabilitation, Reconstruction) is not currently reported to stakeholders. This information is collected; and along with other data (such as geographical location, road class); is archived in the Construction History Database. Additionally, concepts such as remaining service life, average PQI by road

[10] Ontario Regulation 588/17: Asset Management Planning for Municipal Infrastructure

class, life extension for treatment categories, and presenting varied models for treatment strategies were identified as best practices in industry for reporting on road renewal programs.

Reporting on key program metrics would increase transparency and be a valuable communication and decision-making tool to measure the effectiveness and deliver on strategies.

RECOMMENDATION 10 – INCREASED REPORTING ON KEY ROAD RENEWAL PROGRAM INDICATORS

The Director, Asset Management Services should identify key program indicators for the road renewal program (e.g. remaining service life and expected life extension for treatment categories). Identified measures should be annually reported, at a minimum, to the Transportation Committee of City Council to provide a view to the status of the overall road renewal program.

MANAGEMENT RESPONSE 10

Management agrees it would be beneficial to report annually on the status of the overall road renewal program.

In accordance with Asset Management Planning for Municipal Infrastructure Reg 588/17, the 2025 Asset Management plan for Transportation services, including roads, must be approved by Council before July 1, 2025. Progress must be reported to Council annually before July 1 each subsequent year.

The annual review must address:

a) the municipality's progress in implementing its asset management plan;

b) any factors impeding the ability to implement the AMP; and

c) a strategy to address these factors.

The AMPS must be updated every 5 years or less per O.Reg 588/17.

Management believes reporting required to comply with Ontario regulation will also satisfy this recommendation starting Q3 2025.

5. Potential Opportunities for Future Improvements

5.1 Alternative road rehabilitation techniques could offer more environmentally sustainable options and possible cost savings.

Cold In-Place (CIP) Recycling as well as Cold In-place Recycling with Expanded Asphalt Mix (CIREAM) are rehabilitation techniques that involve removing and reusing the existing surface of the road. These methods use fewer raw materials and reduce hauling distances resulting in energy and cost savings.

We understand from management that CIP treatments have been used at the City in the past, though were stopped in 2012 due to concerns of the overall quality and longevity of the treatments, especially in urban environments with a high frequency of road cuts.

Other jurisdictions across Ontario are currently leveraging these treatments and there have been advancements in the industry since the City last leveraged these techniques. There may be opportunities to revisit the feasibility of these treatments and technologies in future road planning with the potential for cost savings and more environmentally sustainable treatments.

RECOMMENDATION 11 – INVESTIGATE FEASIBILITY OF COLD-IN PLACE ALTERNATIVES

The Director, Asset Management Services should investigate the feasibility of alternative treatments and technologies, such as CIP and CIREAM recycling, in future road renewal planning.

MANAGEMENT RESPONSE 11

Management agrees with the recommendation.

Asset management and Infrastructure Services Standards and Quality Management branch will coordinate investigation of the feasibility of alternative treatments and techniques for future road renewal planning. Completion date Q4 2025.

5.2 Use of unshrinkable backfill could improve the quality of road cut reinstatements.

As mentioned above, the City holds permit holders for road cuts to a specific standard for road reinstatements. As part of reinstatement work, if there is insufficient compaction of the asphalt, the pavement will settle improperly and lead to performance issues. This is a common issue with reinstatements, in part, because it is difficult to use effective compaction equipment in many cases.

In order to improve the performance of road cut reinstatements and the lifespan of the road, some municipalities (e.g. City of Toronto) are requiring unshrinkable backfill. Unshrinkable backfill uses small amounts of cement to reduce the need for compaction which improves the lifespan of a road after a road cut. The City does not currently require this approach.

RECOMMENDATION 12 – REVIEW OF REINSTATEMENT STANDARD

The Director, Infrastructure Services should consider the applicability of unshrinkable backfill in road cut reinstatements. If applicable, the applicable City standard should be updated accordingly.

MANAGEMENT RESPONSE 12

Management agrees with the recommendation.

The applicability of unshrinkable fill is already under consideration for certain applications. Applicability for use in road cut reinstatement will be investigated and considered by Q2 2025.

5.3 The current prioritization methodology should integrate elements of the City's risk assessment framework for roadways.

The City established its current Risk Assessment of Roadways framework in 2020, to analyze risk by calculating the likelihood of failure criteria (condition data) and consequence of failure criteria (environmental, economic, and social concern). This framework was developed in response to policy changes. While the framework was updated in 2022, it is not currently a factor that drives the establishment of the priorities for the road renewal program. Instead, an independent prioritization process is applied, which is based on road conditions, traffic volume and benefit-cost criteria.

This prioritization combines road sections and ranks them, incorporating specific criteria. Arterial and collector roads, particularly those that carry substantial bus and truck traffic, are ranked higher, and rehabilitated more frequently than local roads. While both methods are generally correlated, the current prioritization analysis does not consider all criteria and factors considered under the risk-based assessment framework, such as climate change, cycling routes, and number of service requests. These factors will be increasingly relevant under evolving transportation strategies (i.e., the Transportation Master Plan and Transportation Assessment Management Plan) that are moving towards a multi-modal approach that considers other road users as well as economic, social and environmental impacts.

RECOMMENDATION 13 – INTEGRATED RISK-BASED PRIORITIZATION METHODOLOGY

For future iterations of the of the prioritization methodology, the Director, Asset Management Services should identify and define key risk factors aligned to City strategies, including the Transportation Asset Management Plan and Transportation Master Plan, and incorporate these into the formal prioritization methodology that is utilized in their decision-making and selection of roads for rehabilitation.

MANAGEMENT RESPONSE 13

Management agrees with the recommendation.

We are committed to continuously updating the risks considered within the prioritization methodology, so it reflects Council's approval and strategies. The Transportation Master Plan update is planned for 2025 and will provide an opportunity to consider risk factors by Q2 2026.

Appendix 1 – About the Audit

Audit Objective and Criteria

The objective of this audit was to assess the efficiency, effectiveness, and economy of road asset management at the City, specifically how road renewal is planned, designed, constructed, and monitored.

Criteria listed below have been developed from our assessment of key risks and in consultation with subject matter experts.

Strategy, Governance, and Coordination	
1.1	The City has developed frameworks/strategies/policies for road asset management that are aligned to asset optimization.
1.2	There is an established governance framework to provide oversight of road asset management activities, including clear roles and responsibilities.
1.3	Road asset management activities are coordinated across the City throughout all stages the road asset life-cycle.
1.4	There is an appropriate allocation of in-house and contracted resources across road asset management activities to ensure value for money.
Road Asset Management and Monitoring Activities	
2.1	The City has implemented efficient, effective, and appropriate processes to assess road conditions and identify road asset needs to optimize the assets.
2.2	The City has implemented efficient, effective, and appropriate processes to prioritize and coordinate road renewal activities to achieve value for money.
2.3	The City has processes to design road assets, including determining appropriate materials, for asset optimization.
2.4	The City has implemented efficient, effective, and appropriate processes to deliver on road construction, including renewal projects.
2.5	The City has implemented efficient, effective, and appropriate processes to assess and evaluate the quality of road construction projects.
2.6	The City has timely, complete, and accurate systems and reporting to support decision making related to road assets.

Audit Approach and Methodology

- Audit staff performed the following procedures to complete this audit:
- Reviewed relevant documents;
- Performed interviews and/or walkthroughs with City staff;
- Tested samples of road projects;
- Performed site visits to observe and confirm the existence of controls;
- Comparisons with other Ontario municipalities, where relevant;
- Utilized subject matter expertise in the area of road design, construction and quality management, where deemed applicable; and
- Performed other analyses, as deemed necessary.

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