

Arterial Roadway System

Historical and Projected Trends

Recommendation:

That the May 1, 2013, Transportation Services report 2013TS4472, be received for information.

Report Summary

This report provides key background information for the arterial roadway system, shows its overall historical performance, and projects it into the future using various funding levels.

Previous Council/Committee Action

At the March 13, 2013, Transportation Committee meeting, the following motion was passed:

That Administration provide a report to Transportation Committee outlining historical and projected trends in arterial roadway condition and providing an estimate of expenditures that would be required to adequately rehabilitate and maintain conditions of the arterial roadway system over the next five to ten years.

Report

The City's arterial roadway system represents an investment of \$3.85 billion, or 10% of the Corporation's total assets. It is 832 kilometres in length and constitutes nearly 14 million square metres of pavement. This is roughly equivalent to a 12-lane highway between Edmonton and Calgary. These

streets are typically used as major commuter routes by both private vehicles and Transit. They also accommodate a significant amount of goods and service movement throughout the city.

The arterial roadway system includes "major arterials" which are in a separate category representing high-speed roadways such as Whitemud Drive and Yellowhead Trail. Major arterials have a length of 54.4 kilometres and a replacement value of \$ 0.58 billion.

To manage this pavement inventory, Roadway Maintenance measures the performance of all pavements on a regular basis. On arterials and major arterials, the ride comfort, and the degree of surface distress are measured biennially in even years (e.g. 2008, 2010). Structural capacity is measured approximately every six years. All of these measures are combined into an overall 0 to 10 score called the Pavement Quality Index. A high score represents high quality.

The typical service life of an arterial pavement surface will vary between 8 and 15 years, depending on its age and construction. Overall road structure built to current standard including base and sub-grade should last more than 50 years. The roads with the shortest service life were generally constructed 50 or more years ago with a concrete base. The joints in these concrete slabs have deteriorated to the point that asphalt overlays are not able to bridge over them for more than a few years. These types of locations need to be reconstructed at a relatively significant cost.

Attachment 1 shows the historical condition for arterial roads as well as the future performance under various funding scenarios over the next 10 years. The calculations were done by the City's Pavement Management System. This system predicts the performance of each individual street section based on data from prior years, determines the year in which the section will become a rehabilitation candidate, and then performs an optimization to select the most cost-effective projects for the funding that is available.

As can be seen in Attachment 1, the arterial network Pavement Quality Index rose from 5.2 in 1994 to 6.4 in 2012. Attachment 2 shows the square metres of arterial inventory rehabilitated since 1990. A few points should be noted. First, the funding cycle has been very cyclical creating a substantial challenge to develop and maintain a sustainable management strategy. Secondly, there is a direct correlation between network performance and the amount of work performed. For example, in the early 1990s, very little arterial rehabilitation occurred resulting in a steep decline in condition. If current funding levels are continued, this history will repeat itself. The main differences from twenty years ago are that there are now more arterial roads and they are older.

Going forward, there are a series of potential trajectories that the network could take dependent on the annual amount of square metres renewed. At the current renewal rate of 112,500 square metres per year (\$9 million), the network Pavement Quality Index will fall steadily to 4.5 by 2022. At an annual renewal rate of 500,000 square metres

(\$40 million), the deterioration in network performance is not as dramatic, but still results in a decrease to 5.4. To maintain current service levels, an annual renewal rate of 812,500 square metres (\$65 million) is required. This includes mill and overlay, rehabilitation, reconstruction, and any other form of roadway renewal carried out in conjunction with other Capital projects. The ratings reflect anticipated growth in arterial inventory over time.

Attachment 3 shows the percentage of arterial inventory that would remain in the rehabilitation backlog in each year under the various funding levels. These are the roads which are most susceptible to pothole development. Once again, it is clear that the lowest two funding levels will result in an increase in the number of poor arterial roads.

These predictions are based on the average cost of rehabilitation which includes not only resurfacing of the pavement, but also needed repairs to base layers, adjacent curbs and sidewalks. Projects which require full reconstruction are not included in these calculations. Furthermore, the predictions are based on an optimized schedule which does not take into account coordination with other projects, or the need to provide adequate detouring. Given those realities, the funding levels presented here are likely to be conservative.

Attachments 1 and 3 reflect the current approved budgets to the end of 2014, including recently approved increases for 2013.

Attachment 4 shows the deterioration pattern of a typical road over time. The key point is that the most effective life-extension dollars are those that are spent in the first 75% of the road's life. This is where treatments such as crack-sealing, mill and overlay, as well as spot repair of curb and gutter are most effective. If a road is allowed to deteriorate past the 75% point, the cost of restoration work increases exponentially along with the incidence of potholes. Although mill and overlay can still be performed on some of these streets, the expected life of such a treatment will be greatly reduced. Therefore, the least-cost approach to maintaining road assets is one that ensures that timely funding is available when required.

Corporate Outcomes

- Transform Edmonton's Urban Form - Edmonton has sustainable infrastructure that fosters and supports civic and community needs.
- Ensure Edmonton's Financial Sustainability - The City has well managed and sustainable assets and services.

Attachments

1. Arterial Roadway Performance 1990 – 2022
2. Amount of Arterial Rehabilitation by Year
3. Percent of Arterial Inventory Requiring Rehabilitation
4. Typical Road Service Life Behaviour

Others Reviewing this Report

- L. Rosen, Chief Financial Officer and Treasurer