Prioritization of Arterial Roads and Primary Highways Projects

Level of Service and Capital Budget Information

Recommendation

That the April 3, 2018, Urban Form and Corporate Strategic Development report CR_4227, be received for information.

Previous Council/Committee Action

At the November 1, 2016, Executive Committee meeting, the following motion was passed:

That Administration provide:

a. a report outlining the breakdown by quadrant of infrastructure demand/capacity for arterial roads and primary highways in poor and very poor condition.
b. a rating (A, B, C, D, F) for intersections on major arterials and primary highways categorized by quadrant
c. some analysis on how this information would inform the prioritization of arterial road addition and widening projects for the next couple of budget cycles

and return to Committee in the first quarter of 2018.

Executive Summary

This report outlines the status and performance of aspects of the road network and how improvements to the network are coordinated between the land development industry and the City.

Monitoring indicates that the majority of Edmonton's arterial road network and primary highways are operating within design capacity, and 94 percent of arterial road intersections in the city are rated A through E. This means they are operating within an acceptable level of service. Twenty intersections (six percent) are rated F. This means they are congested during peak hours. Some of the F rated intersections are in new growth areas where the road network is not fully developed. Other F rated

intersections in the city would require additional investigation to determine the cause of congestion and the benefits of additional investment in improvements.

The City of Edmonton's acceptable targets for the operation of the arterial road network and primary highways reflect infrastructure and expenditure requirements, and the need to balance traffic considerations with other policy outcomes. Edmonton aims for a C to E rating for most intersections, which is within the acceptable level of service. The target level of service is based on capital investment required to improve the rating, consideration of the land use context of the surrounding area, and provision of safe travel options for all users including pedestrians, cyclists and drivers.

Improvements to the road network are informed by a variety of data and modelling, and are advanced by the land development industry, the Province of Alberta and the City of Edmonton. Improvements to arterial roads in growth areas are coordinated with the land development industry and timed based on growth in housing, population, jobs, traffic volumes, and business choices made by developers. The Province of Alberta is responsible for Anthony Henday Drive, and sections of Yellowhead Trail, Queen Elizabeth II/Highway 2, Highway 15/Manning Drive, Highway 28, and Highway 28A. Improvements to the city-wide arterial and goods movement network by the City are based on monitoring, the identification of improvements and their relative prioritization in the capital budget process.

Report

The City, through its planning and design processes, strives to improve the quality of all modes of transportation and to optimize the use of the transportation network. The City recognizes that many physical, financial and community constraints make it infeasible to build or expand roads to alleviate all congestion.

The City collects a variety of data to understand the functionality and service level of the transportation network. Administration uses roadway design capacity, traffic flow data (counts) and signalized intersection performance in combination with traffic modelling, safety and transit requirements to inform improvements to a particular road, identify other roads that could provide alternate travel routes, or inform other transportation system infrastructure improvements.

Edmonton’s road network is based on a hierarchy in which roads have different functions and capacities. The road categories include freeways (primary highways), arterials, collectors, and local roads. The primary function of a freeway is to move large volumes of traffic at higher speeds with no direct access except to arterial roadways. Freeways support regional mobility. Arterial roadways also support high volumes and through traffic, but include at grade intersections to provide access to adjacent neighbourhoods and developments. Arterial roads in Edmonton are generally spaced on a 1.6 kilometre (1 mile) grid. This means the majority of Edmontonians will

have access to an arterial road within 800 metres of their residence or place of work. The primary function of collector and local roads is to provide circulation within a neighbourhood and support access to individual properties (a residence, or business), but with less volume and at lower speeds. Collector roads may also include transit service and have somewhat higher traffic volumes than local roads.

Design Capacity and Volume

The primary contributing aspect of a road's design capacity is its cross section (width) and available number of travel lanes. Generally, roads with more lanes are designed to accommodate more vehicles per day. City of Edmonton arterial roadway widening typically apply the following volume thresholds. These are general guidelines; expanded or upgraded roadway cross sections may be required in locations where volumes exceed these thresholds, or where intersection operations require additional lanes.

Arterial Roadway Volume Threshold Guidelines

Roadway Cross Section	**Applicable Volume Ranges (vehicles per day)**
Two Lane Undivided Arterial	up to 12,000
Four Lane Undivided Arterial	up to 25,000*
Four Lane Divided Arterial	up to 40,000
Six Lane Divided Arterial	up to 60,000

* to accommodate staging the first two lanes of a four lane undivided arterial has a threshold of 16,000 vehicles per day

Design standards for freeways in the City have volume thresholds in the range of 100,000 vehicles per day and higher, and speed limits up to 100 km per hour.

The City monitors traffic activity through an ongoing traffic count program. Traffic counts are based on a minimum one day duration (usually completed between April and October), measure two way flows, and are adjusted to reflect an average weekday during the year. Adjustments are based on variations by time of year measured at permanent sites and via automated means.

Attachment 1 illustrates 2015 city wide traffic volumes on the City's arterial roads including the regional facilities of Anthony Henday Drive, Yellowhead Trail, Whitemud Drive and Highway 2 (Gateway Boulevard, Calgary Trail, St. Albert Trail). Anthony Henday Drive, Whitemud Drive and Yellowhead Trail carry the highest traffic volumes

in the city with the west leg of Anthony Henday Drive carrying the highest traffic volumes (121,300 vehicles per day) for all roads.

One guideline to gauge the performance of road segments is to apply actual traffic volumes against its design capacity. Where volumes exceed the design capacity, traffic congestion may be occurring; however, this does not take into account impacts of intersections operations and access locations on roadway capacity and overall travel time and congestion experienced by commuting traffic.

Intersection Performance

While design capacities provide a general overview of the capacity of the roadway, the overall operations of the roadway are limited by intersections, which are typically classified based on Level of Service Assessments.

Level of Service is calculated as a flow volume to capacity ratio, or the volume of traffic divided by the design capacity (in volume) of an intersection based on a number of factors. Level of Service at intersections is translated into a standardized rating of A through F, with A representing nearly free flow traffic at or above the speed limit, and F representing delays of more than 80 seconds to traffic flow.

The software program used to summarize the level of service uses the Highway Capacity Manual definitions for level of service. For at-grade signalized intersections, level of service is defined as the delay vehicles experience as a function of the presence of traffic signal controls.

Level Of Service	Associated Intersection Delay	Description
A	≤ 10 seconds	Congestion-free traffic operations
B	> 10 ≤ 20 Seconds	Reasonably unimpeded traffic operations
C	> 20 ≤ 35 Seconds	Stable traffic operations
D	> 35 ≤ 55 Seconds	Approaching unstable traffic operations
E	> 55 ≤ 80 Seconds	Unstable traffic operations or operating at capacity
F	> 80 seconds	Breakdown of traffic operations and congested conditions

Administration uses Level of Service to understand wait times at intersections and congestion, and to inform improvements in signal timing and/or improvements to the capacity of the intersection or roadway. Many cities aim for a C to E rating for the majority of intersections and accept an F rating for the minority of intersections, based on constraints such as the amount of capital investment required to improve the rating, and other considerations including surrounding land use context and other policy objectives. For example, congestion and slower traffic movement may be appropriate to support pedestrian-oriented commercial streets and safely accommodate active modes such as cycling.

Attachments 2 through 6 illustrate the location of 339 arterial road intersections under the control of the City of Edmonton*. The majority (94 percent) of intersections, are rated between A and E and operate at an acceptable level of service, with traffic movement between free flow to a delay of no more than 80 seconds. Twenty intersections (6 percent) are rated F, where intersections delays may exceed 80 seconds.**

City Wide Level of Service Summary

Level of Service		Number of Intersections	Percent of Acceptable or Congested Intersection
Acceptable Level of Service	A	13	94%
	B	118	
	C	137	
	D	36	
	E	15	
Congested Level of Service	F	20	6%
Total		339	100 %

*Some intersections in the city are controlled by the Province of Alberta.

**Intersection signal operations to support the Level of Service Assessment summary are analyzed on a rotating four year cycle for different sectors of the city.

Of the 20 F rated intersections, nine are located in mature and core areas of the city and provide access to key destinations such as the University of Alberta and Downtown. Three F rated intersections are located in growth areas where improvements to the road network are planned and managed through the arterial road assessment program. Eight other intersections require further evaluation to understand their operations and identify potential improvements.

Improvements to some F rated intersections, particularly those in existing developed areas, would require significant capital investments in land and infrastructure to improve this level of service. Further investigation would be required to understand the benefits to traffic flows, transit and goods movement and the impact on land use and development associated with improving level of service at these locations.

Cross-referenced report CR_4524rev outlines the factors that Administration considers, in addition to design capacity and intersection level of service, to assess roadway performance: vehicle-hours traveled; kilometres traveled; emissions; and additional transit ridership.

Prioritization of Improvements

Improvements to the road network may be initiated by the development industry, the City and the Province of Alberta. While the land development industry is predominantly active in growth areas and the Province is responsible for the Anthony Henday, the City plans and invests in the road network across the city.

Growing cities will experience a ‘lag’ between when growth is initiated for a certain area and when the nearby road network is fully developed as designed. During this period Levels of Service will fluctuate based on rising traffic flows and ongoing improvements to the network. Administration coordinates management of this “lag” in collaboration with the land development industry and the Province.

Improvements to the network by the development industry are triggered by a number of factors including the subdivision of land, growth in housing, population, jobs and traffic volumes, and are timed based on the availability of land and private funding, and business choices made by developers. Some developers have multiple holdings and will make choices on when and how to invest in the road network to support their particular development portfolios. Groups of developers collaborate in an area to construct roads to the benefit of one or all developers for one or several construction seasons.

While land developers have a significant role in providing road infrastructure in growth areas, the City has a strong role in coordinating the timely construction of road infrastructure among land developers through monitoring and addressing local infrastructure needs, by requiring the construction of roads through the subdivision process.

An element of this coordination occurs in the funding and construction of arterial roads. The City manages the Arterial Roadway Assessment (ARA) program, which is a mechanism to assign obligations for road construction and share the funding for the construction of arterial roadways between developers in a catchment basin. The bylaw requires developers to construct or pay for the construction of the first four lanes of

new arterial roads that are deemed to have four or six lanes in their ultimate design; and the first five lanes of new arterial roads that are deemed to have five or seven lanes in their ultimate design.

The City also undertakes improvements to the network through a process of monitoring the system, identifying potential improvements, planning and prioritizing improvements, and managing the funding of improvements. Factors informing Administration's prioritization using this data include project readiness, the cost of the project, the benefit of the improvement to optimize operations for commuters, transit, safety, goods movements, and public policy choices to invest in mode shift and goods movement (see Attachment 7).

A more detailed outline of how Administration uses transportation related data to identify improvements to the network is presented in cross referenced report CR_4524rev. In addition, the Capital Investment Outlook will provide an overview of the transportation growth priorities which have been identified as being required in the next 10 years.

Corporate Outcomes and Performance Management

Corporate Outcome(s): The City of Edmonton has sustainable and accessible infrastructure			
Outcome	**Measures**	**Results**	**Target**
Infrastructure investment accommodates growth in an orderly and economical fashion	Provision of suitable road infrastructure in and to new and developing areas.	n/a	Suitable road right-of-way and road infrastructure are provided in and to new and developing areas.

Corporate Outcome(s): Edmontonians use public transit and active modes of transportation			
Outcome(s)	**Measure(s)**	**Result(s)**	**Target(s)**
Edmontonians use public transit and active modes of transportation	Transit ridership (rides/capita)	96.9 a (2016)	105 (2018)
	Journey to work mode (Auto Passenger, Transit, Walk, Cycle or Other)	24.7% (2016)	25.9% (2018)

Corporate Outcome(s): Goods and Services move efficiently			
Outcome(s)	**Measure(s)**	**Result(s)**	**Target(s)**
Goods movement is efficient on city highways and streets	Travel Time and Reliability for Goods and Services Movement	10.41 minutes 50% of time (December 2016)	Maintain Travel Time and Reliability below 12.5 minutes 50% of time to travel 10 km route (December 2018)
	Business Satisfaction: Goods and Services Transportation (% Satisfied/Very Satisfied)	49.7 (December 2016)	Increase to 53% by 2018.

Attachments

1. 2015 Traffic Flow Map
2. Northwest Peak Hour Level of Service for Arterial Intersections
3. Northeast Peak Hour Level of Service for Arterial Intersections
4. Core Area Peak Hour Level of Service for Arterial Intersections
5. Southeast Peak Hour Level of Service for Arterial Intersections
6. Southwest Peak Hour Level of Service for Arterial Intersections
7. Transportation Master Plan Direction, Policy C569 and Policy C577

Others Reviewing this Report

- T. Burge, Chief Financial Officer and Deputy City Manager, Financial and Corporate Services
- D. Jones, Deputy City Manager, City Operations
- A. Laughlin, Deputy City Manager, Integrated Infrastructure Services
- C. Campbell, Deputy City Manager, Communications and Engagement
- R. G. Klassen, Deputy City Manager, Regional and Economic Development