

92 Avenue (Edmonton) Arterial Roundabouts: Collaborative Concept Development

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ABSTRACT

This paper describes the process, challenges, lessons learned, and cooperation required between the Developer, City and Consultant to develop an innovative and context sensitive concept plan for a developer-initiated 1.6km arterial road in a new growth area in west Edmonton (Secord and Rosenthal Neighbourhoods). The approved plan includes five roundabout intersections, reduced lanes and right-of-way width, and is anticipated to provide superior operations to a conventional four-lane divided arterial roadway with signalized intersections.

It has been common practice in Edmonton for Developers to be involved in the design and construction of arterial roads. However, typically concept (functional) planning has been completed by or under the direction of City staff. Strong growth in Edmonton has accelerated demand for new arterial roadways, stretching City planning resources. To meet the demand for planning of arterial roadways in new growth areas, the City recently implemented a process where planning of arterial roads in new areas can be completed by the Developer's Consultant(s), supported by a City approval process.

The desire for Consultants to be innovative and develop new approaches to planning arterials is often stifled by the desire to obtain quick approvals, which are most easily achieved by maintaining the status quo, applying existing standards, and generally not looking outside-the-box for more context-sensitive design solutions. While undertaking the 92 Avenue planning study between 215 Street and 231 Street in Edmonton, Al-Terra Engineering Ltd. identified early on that the arterial was an ideal candidate for an alternate approach. Since the bordering lands were primarily residential, including a large district park, a context-sensitive design was desirable to promote lower traffic speeds and create a pedestrian/bicycle friendly environment. Al-Terra Engineering Ltd. was afforded the rare opportunity by their client, MLC Group Inc., to challenge the status quo and develop an arterial roadway incorporating several roundabout intersections.

Although cautious of the alternative design solution, the City provided support and assurances that if the design could be technically supported they would provide due consideration and work with the Consultant to advance the alternate design through to approval. Although the concept planning process took longer than usual due to the detailed reviews required and the educational aspects of the planning study, the plan was recently approved by the City of Edmonton. The Developer, Consultant, and City successfully collaborated to develop a context-sensitive, alternative design solution for this new arterial roadway.

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1.0 INTRODUCTION

In recent years, Edmonton has been one of the fastest growing cities in Canada. Edmonton's growth has spurred the demand for new infrastructure, and the need to ensure that planning studies for this new infrastructure are in place in a timely fashion to serve rapidly occurring development.

Traditionally in Edmonton, concept (functional) planning for roadway infrastructure has been completed by, or under the direction of, City staff. The plans completed by the City would be used by Developers to set the stage for new developments as they were established.

Strong growth in Edmonton has accelerated the demand for new arterial roadways. As development activity picked up, the City's planning resources were stretched, creating difficulty for the City to complete the concept plans required to support development. To meet the demand for planning of arterial roadways in new growth areas, the City formalized a process whereby planning of arterial roads in new areas can be completed by the Developer's Consultant(s), supported by a City approval process. The process allows Developers and their Consultants to generate cost-effective conceptual roadway plans following timelines associated with upcoming stages of development. Through the formalization of this process, in recent years, it has become common practice in the Edmonton for Developers, and the Consultants representing them, to be involved in the design and construction of arterial roads.

This paper describes the process, challenges, lessons learned, and cooperation required between the Developer, the Municipality, and the Consultant to develop innovative and context sensitive roadway conceptual plans. To highlight the learnings, a case study is presented for a Developer-initiated 1.6 km arterial road in a new growth area in west Edmonton (Secord and Rosenthal Neighbourhoods). The approved plan includes five roundabout intersections, reduced lanes, and reduced right-of-way width. The recommended design is anticipated to provide superior operations to a conventional arterial roadway design with a wide variety of benefits to the surrounding developments and future residents.

2.0 INNOVATION AND CONTEXT-SENSITIVE DESIGN IN NEW DEVELOPMENTS

The desire for Consultants to be innovative and to develop new approaches for roadway planning is often stifled by the desire to obtain quick approvals. Fast plan approval processes are desired by most Developers and are commonly achieved by maintaining the status quo, applying existing design standards, and generally without looking outside-the-box for more context-sensitive design solutions. This approach, however, does not necessarily provide the most desirable, cost-effective, aesthetic, or safe end-product. It is essential that practitioners approach planning studies with an open mind to ideas that may not be considered typical and to ensure that final products are representative of their context.

Over the last several years, the City of Edmonton's approach to roadway planning has evolved, and the City has developed and adopted a number of policies and practices to guide the preparation of plans for roadway infrastructure in the City. Most notably, in May 2013, Edmonton's City Council approved the Complete Streets Policy. The policy is paired with the Complete Streets Guidelines to encourage a holistic approach to roadway planning and design. The intent of the Complete Streets Policy and Guidelines is to provide a framework for context-sensitive design for roadway infrastructure to ensure that roadways reflect the surrounding area context, land use, and provide for all users.

The development and adoption of Edmonton's Complete Streets Policy and Guidelines demonstrates the City's commitment to ensuring that roadways fit their context and users, and give permission to Developers and their Consultants to tailor their approach and design roadways differently on a case-by-case basis.

3.0 CASE STUDY - 92 AVENUE (215 STREET - 231 STREET)

While undertaking the 92 Avenue planning study between 215 Street and 231 Street in Edmonton (See *Figure 1 – Location Plan*), Al-Terra Engineering Ltd. identified early on that the 92 Avenue arterial was an ideal candidate for an alternate approach. Since the bordering lands were primarily residential, including a large district park, a context-sensitive design was desirable to promote lower traffic speeds and to create a pedestrian and bicycle friendly environment.

Al-Terra Engineering Ltd. was afforded the rare opportunity by their client, MLC Group Inc., to challenge the status quo and develop an arterial roadway incorporating several roundabout intersections.

Although cautious of the alternative solution to the design of this particular arterial roadway, the City provided support and assurances that if the design could be technically supported they would provide due consideration and work with the Consultant to advance the alternate design through to approval.

The planning team recognized early that it would require significant extra effort to achieve acceptance and approval from the various City departments for the arterial roundabout intersection concept. An approach with frequent, honest, and open communication between all involved (City, Developer and Consultant) was employed throughout the planning process to expeditiously and effectively deal with issues, constraints and “hidden agendas.” It was also considered imperative to gain broad support for the concept from City senior management in the early stages of the project to avoid rejection of the plan late in the game.

Extensive intersection traffic analysis was completed during the initial stages of planning to compare roundabout operations to conventional intersection operations. This work was considered necessary to demonstrate not only that the roundabouts could meet the traffic demand, but operate better than conventional intersections. To assure that roundabouts provide a sound long term solution, analysis was completed based on projected traffic volumes (See *Figure 2 – Projected Traffic Volumes*) from the City of Edmonton’s Regional Travel Model for an interim 30-year horizon, as well as for a long term development horizon for which the City’s regional population is projected to approximately 2.5 million (expected to be reached in approximately 70-90 years).

Traffic analyses were summarized in a working paper, which was submitted to the City for approval before extensive conceptual design of the arterial roadway was completed. This was a critical step for the project as acceptance of the analysis process, results and recommendations would confirm that alternative intersection controls (roundabouts) would be technically feasible for the roadway. Review by the City was very thorough and required numerous meetings to address all questions and concerns. A significant challenge encountered was that many City staff were unfamiliar with roundabout analysis and design, and were skeptical about the reliability of work presented by the Consultant. Extra effort and diligence was required by all

involved to work through these issues and not be discouraged by the intensive scrutiny. Approval of the traffic analysis working paper was considered a significant milestone in the study process and set the stage for further plan development.

Traffic analysis completed in conjunction with this concept planning study indicated that roundabout intersection control on 92 Avenue provides similar but superior operation when compared to signalized intersections during peak hours.

Intersection analysis was conducted based on the long term traffic projections using Synchro for the signalized intersections and Sidra for the roundabouts. Both models use the 2010 Highway Capacity Model methodology. Table 1 compares the average delays for each intersection, average delays for the worst movement, volume to capacity ratios, and queues. The analysis did not present level of service (LOS) due to the inconsistent thresholds for the signals and roundabouts.

**Table 1 - Intersection Operations on 92 Avenue at 220 Street and 225 Street:
Signalized Intersection vs. Roundabout Intersection**

92 Avenue and 220 Street (Multi-Lane Road Cross-Section)				
AM Peak	Signals		Roundabout	
Intersection Average Delay	21.0 sec/veh		11.8 sec/veh	
Worst Movement Delay	40.2 sec/veh	NBT	19.9 sec/veh	NB
Worst Movement v/c	0.830	SBL	0.523	EB
Longest QUEUE	88.7m	SBL	21.7m	NB
PM Peak	Signals		Roundabout	
Intersection Average Delay	12.3 sec/veh		16.6 sec/veh	
Worst Movement Delay	43.4 sec/veh	SBL	22.1 sec/veh	WB
Worst Movement v/c	0.690	SBL	0.800	WB
Longest QUEUE	64.5m	SBL	75.5m	WB
92 Avenue and 225 Street (Multi-Lane Road Cross-Section)				
AM Peak	Signals		Roundabout	
Intersection Average Delay	11.2 sec/veh		7.6 sec/veh	
Worst Movement Delay	17.9 sec/veh	SBL	9.9 sec/veh	NB
Worst Movement v/c	0.620	SBL	0.402	NB
Longest QUEUE	45.6m	SBL	10.7m	NB
PM Peak	Signals		Roundabout	
Intersection Average Delay	7.6 sec/veh		10.0 sec/veh	
Worst Movement Delay	26.1 sec/veh	SBL	10.6 sec/veh	SB
Worst Movement v/c	0.590	SBL	0.518	WB
Longest QUEUE	69.2m	WBL	23.8m	WB

The analyses indicate that for both intersection types, the results are satisfactory and in only one instance the queues for the roundabout are slightly longer than the queues for the signals.

There are also a variety of major benefits of roundabout intersections during off peak times. Roundabouts have a number of advantages as compared to signalized intersections, making them a preferred option for this section of 92 Avenue.

Benefits of roundabouts as compared to signalized intersections include:

- Proven safety benefits:
 - Traffic moves through the roundabout at lower speeds in urban (~30km/hr) conditions with vehicles traveling in the same direction, thus collisions are commonly not as severe (in rural area 50km/hr).
 - Fewer conflict points for pedestrians and motorists.
 - Elimination of right angle, left turn, and head-on high speed collisions.
 - May reduce likelihood of rear end collisions by removing the incentive for drivers to speed up as they approach green lights and by reducing abrupt stops at red lights.
- Through geometry, roundabouts act as a traffic calming measure, preventing speeding, while increasing safety and comfort of the non-motorized users.
- Slower and safer vehicle speeds promote active alternatives of travel, such as cycling and walking.
- Splitter island medians provide pedestrian refuge, allowing road crossing in stages.
- Improve traffic flow during off-peak hours.
- Vehicles using a roundabout are not forced to stop, reducing delays, congestion, noise, fuel consumption, and emissions, especially during off-peak hours.
- Lower operation and maintenance costs than traffic signals.
- Power independent, so they can continue to function normally, where signals may not, if there is a power failure or damage to signals.
- Improve the character of the roadway through landscaping.

Roundabouts certainly provide a number of benefits in the appropriate context. There are, however, some drawbacks that must be considered to make a well-informed decision. Such considerations include:

- Staging of roadways with roundabouts can prove difficult and in some cases not possible. Difficulty in staging may require a roadway to be built to its ultimate configuration at the outset, whereas a roadway with conventional intersection designs may allow the roadway to be built in stages.
- Complexity in the case of multi-lane roundabouts may present a challenge for motorists. If this is a case, the signs and pavement markings should remind drivers of correct yielding patterns, and help them to choose the appropriate lane.
- Directing visually impaired pedestrians through the roundabout can be challenging and requires special consideration at the design stage.

For 92 Avenue, the benefits of roundabout design were found to outweigh the drawbacks. As noted above, roundabouts naturally slow traffic, which is preferred along 92 Avenue,

considering the primarily residential and park/school environment. The slower speeds promoted by the roundabouts create a friendlier environment for pedestrians and cyclists.

Throughout the concept planning study for the 92 Avenue arterial road and roundabout intersections, the planning team continued to meet with City of Edmonton Transportation representatives to address issues and concerns as they arose. The process was effective. However, discussions and resolution of issues may have been streamlined with greater involvement by other City departments at these meetings, which may have resulted in shorter review times and reduction in revisions / changes during later reviews of the conceptual plan.

An additional challenge to the conceptual plan approval process was that many City staff in a review capacity were unfamiliar with roundabout geometric design requirements, principles and objectives, and were therefore uneasy with the design checks required for sound roundabout design. This challenge required the consulting team to work closely with City staff to provide further roundabout design education and to guide the City to understand that the review should focus on different elements than a conventional design.

Throughout the 92 Avenue concept planning study, City staff requested thorough documentation of the operational comparison between traditional signalized intersections and roundabout intersections. In addition, City staff requested multiple design reviews, safety checks, and reassurances that the design would provide superior operation, safety, and other benefits as compared to other more traditional designs. These requests and reassurances were based, in part on the unfamiliar nature of modern roundabouts and their application in the Edmonton context, but more so due to past experience in Edmonton as it relates to other types of intersection treatments. The City of Edmonton has a number of traffic circles throughout the city. These traffic circles are commonly perceived and observed to pose operational challenges and face significant critique from the public. In recent years, studies have been undertaken that suggest these traffic circles be replaced with modern roundabouts and in some cases with traditional, signalized intersections. As a result, the City desired a high level of comfort with the design and supporting material.

The laning requirements for 92 Avenue vary along the route from 4-lanes to 2-lanes as based on forecast traffic demand. It would be possible to reduce the right-of-way width of 92 Avenue due to the narrower recommended road cross-section; however, to maintain flexibility and to provide a greater level of comfort to the City, it was agreed that the 37m standard arterial road right-of-way would be retained to accommodate a full 4-lane divided cross-section for the future if it is ever required.

The recommended concept plan developed for 92 Avenue between 215 Street and 231 Street (*See Figure 3 – 92 Avenue Approved Concept Plan*), with five roundabout intersections, provides a context sensitive solution, which will provide a safe, efficient and cost effective arterial road to meet the long term traffic demand in this area. Although stop controls at a couple locations along 92 Avenue may have been adequate intersection control, roundabouts at these locations provide design consistency along the corridor.

Although the concept planning process took longer than usual due to the detailed reviews required and the educational aspects of the planning study, the plan was recently approved by the City of Edmonton. The Developer, Consultant, and City successfully collaborated to develop a context-sensitive, alternative design solution for this new arterial roadway.

4.0 CONCLUSION

Through this new approach to arterial roadway planning in the Edmonton area, a number of lessons were learned which may help to advance the progress of future roadway conceptual plans more smoothly through the development and approval process. These lessons include:

- The fastest and easiest way to get a plan approved is to follow a traditional process and not push the envelope. However, greater value can be achieved by trying new things, allowing the potential for a unique design that better fits the context of the area and achieves a greater vision.
- When trying a new roadway design approach under the oversight of a Municipality, the process will likely take more time than if a conventional design was utilized; but the time and effort can be worth the result.
- Innovation is key at the planning stage of a project. A conventional approach works on a lot of jobs, but does not always provide the best solution. A context sensitive design approach needs to be considered regardless of how the project is delivered. The best value is to do this at the concept stage.
- Planners can expect to be required to go the extra mile to validate technically that a new concept is appropriate for the specific application. Furthermore, they can expect that an educational component may be required to demonstrate the validity of the concept.
- Conceptual plans cannot be done in isolation; they require the collaborative effort of Consultants, Developers, and the Municipality.
- Innovative projects can be dependent on political will. City Administration may be cautious with new and innovative designs, as the Administration must answer to the citizens and the politicians.
 - The project team should advance with support from elected officials to help prevent fallout. Discussions should start early in the planning stages.
 - Find the policies and guidelines that support your innovative approach.

Although plan approvals can be reached quickly using conventional design solutions, conventional designs are not always the most appropriate solutions to suit the needs of an area. Through collaboration between Developers, Consultants, and Municipalities, innovative and context-sensitive design solutions can be developed for arterial roadway planning projects. This collaboration has the potential to generate designs that better suit the context of the surrounding development, improve safety, and contribute to the well-being of surrounding residents and roadway users.

5.0 LIST OF FIGURES

Figure 1 – Location Plan

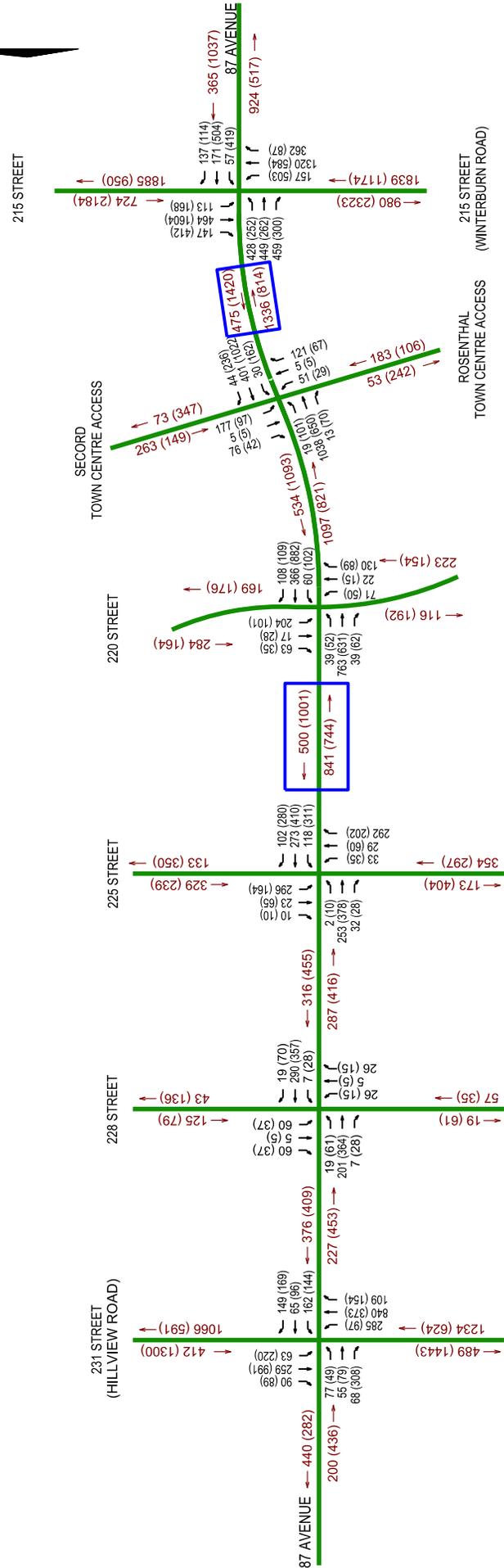
Figure 2 – Projected Traffic Volumes

Figure 3 – 92 Avenue Approved Concept Plan

6.0 REFERENCES

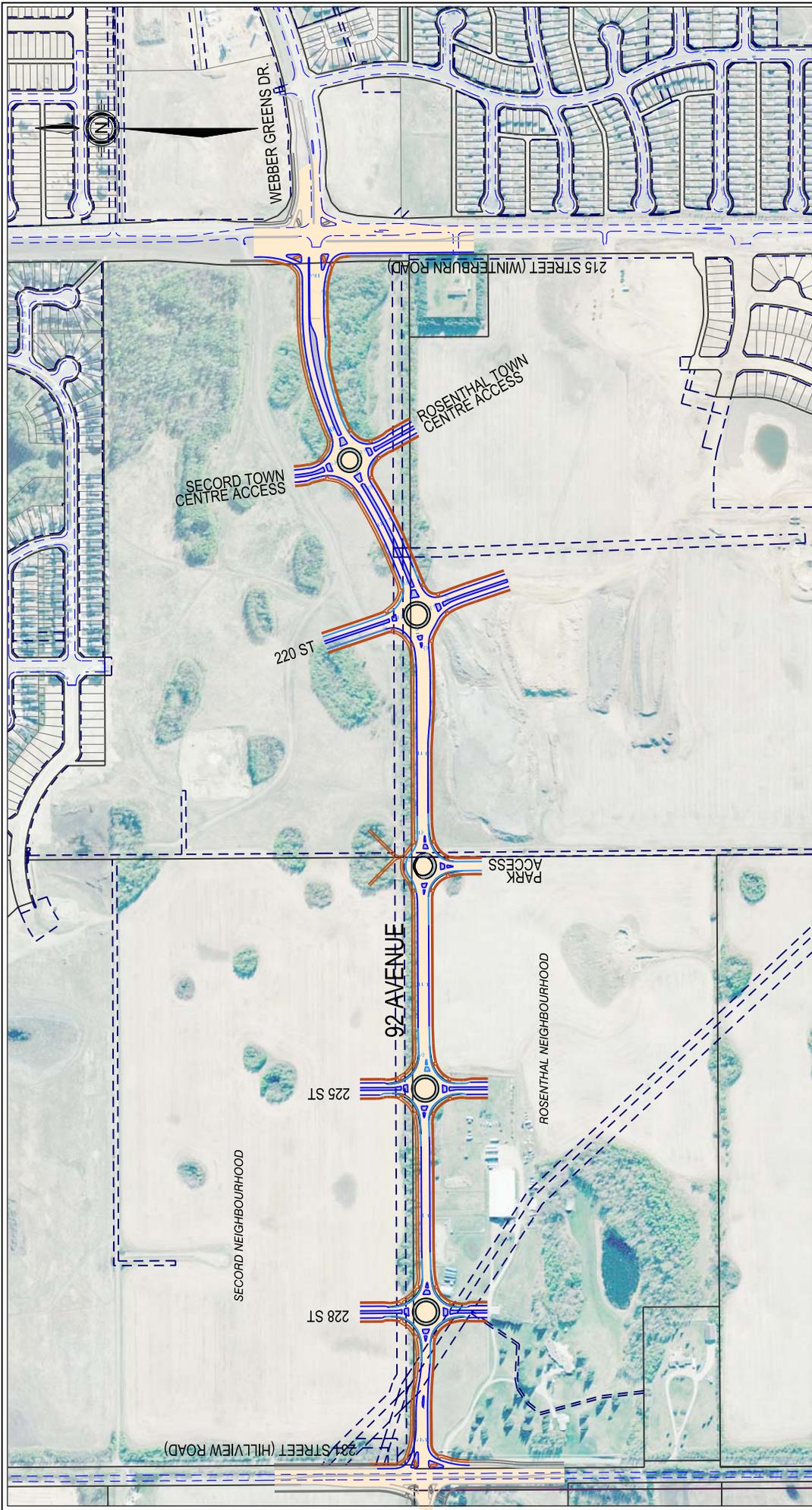
1. National Cooperative Highway Research Program Report 672 – Roundabouts: An Informational Guide (Second Edition), 2010, US Department of Transportation, Federal Highway Administration
2. Roundabout Guide: Facilities Development Manual, March 2013, Wisconsin Department of Transportation
3. Insurance Institute for Highway Safety – Highway Loss Data Institute, April 2015
<http://www.iihs.org/iihs/topics/t/roundabouts/ganda>
4. Manual of Uniform Traffic Control Devices for Canada, January 2014, Transportation Association of Canada
5. Manual of Uniform Traffic Control Devices, December 2009, US Department of Transportation
6. Technical Bulletin: Lane Use Signs and Pavement Markings at Multi-Lane Roundabouts, July 2005, British Columbia Ministry of Transportation
7. Highway Capacity Manual, 2010, Transportation Research Board of the National Academies
8. Roundabout Articles, by R. Akçelik and Others, Sidra Solutions
www.sidrasolutions.com/resources/articles

LONG TERM TRAFFIC - AM(PM) - Vehicles/hour



**92 AVENUE (EDMONTON) ARTERIAL ROUNDABOUTS
PROJECTED TRAFFIC VOLUMES**

FIGURE 2



92 AVENUE APPROVED CONCEPT PLAN

FIGURE 3