CITY OF SASKATOON

Circle Drive West
Clancy Drive to Laurier Drive

Functional Plan
FINAL REPORT

CIMA+ file: E00747A
June 2, 2022 – Rev. 4

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Association of Professional Engineers & Geoscientists of Saskatchewan

CERTIFICATE OF AUTHORIZATION
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Confidentiality and ownership

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In addition, we would like to sincerely thank the following people from the City of Saskatoon who supported and provided background information for the study:

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Review and submission register			
Review No.	**Reviewed by**	**Date**	**Description of the change or submission**
1	H.D./J.M.	02/16/22	Draft Report
2	H.D./J.M.	02/22/22	Draft Report and Appendices
3	H.D./J.M.	04/11/22	Final Draft Report
4	H.D./J.M./C.H.	06/02/22	Final Report and Appendices

Executive Summary

Circle Drive is a core route (inner circulatory road[1]) in the City of Saskatoon's (Saskatoon) road network. It supports mobility not only for City residents but for inter-regional traffic flows through Saskatoon. Saskatoon recently constructed Circle Drive South to a freeway standard from Idylwyld Drive to 11th Street. This new crossing of the South Saskatchewan River resulted in two significant changes for Circle Drive West. It permits traffic to bypass Idylwyld Drive and the downtown, and Circle Drive West now connects Highways 7 & 14 west and Highway 16 north (via Neault Road) with Highways 11 & 16 south.

In response to these changes and the resulting increase in congestion levels and safety concerns, Saskatoon plans to continue upgrading Circle Drive to a freeway standard. Saskatoon retained CIMA Canada Inc. (CIMA+) to complete a long-term functional plan for Circle Drive West, between Clancy Drive and Laurier Drive. The goal of this project is to improve safety by removing the traffic signals at the Clancy and Laurier Drive intersections and upgrading Circle Drive West to free-flow standards.

Key Technical Challenges

To improve safety, Saskatoon must finish upgrading Circle Drive West to freeway standards by removing the traffic signals at Laurier and Clancy Drives. Achieving freeway standards is significantly constrained by three conditions (among others):

1. Existing intersection/interchange spacing along Circle Drive West ranges between 600m and 900m. The preferred spacing between interchanges (based on best practices) is 1.5 to 2 km[2] to best achieve safe, efficient, freeway operation and avoid complex and costly access management measures.
    + To achieve a freeway design that meets best practices, the signalized intersections at Clancy and Laurier Drives should be removed to establish cost-effective interchange spacing. However, Saskatoon intends to replace the intersections with interchanges, introducing complex and costly freeway/interchange configurations.
2. The existing interchange configuration at Circle Drive/22nd Street was designed to emphasize free-flow traffic movements between Highways 7 & 14 (22nd Street) west and Circle Drive north, occupying a relatively large footprint. The addition of Circle Drive South altered the traffic patterns at this junction.
    + To achieve the most practical, technically effective, solution the existing interchange configuration should be replaced, not salvaged.
3. Intersection spacing along 22nd Street is substandard for an arterial roadway, less than 100m between Confederation Drive and Circle Drive[3], and the intersection with Confederation Drive mixes local access with interchange operations. Roadway performance is generally poor and residents west of Circle Drive have come to rely, in part, on the two existing signalized intersections along Circle Drive West for travel in/out of their neighbourhoods.

To achieve freeway standards and retain all current traffic movements along the affected section of Circle Drive requires complex and costly measures.

[1] Construction of a ring road in Saskatoon was first proposed in 1913 by city commissioner Christopher J. Yorath. He conceived the first comprehensive town plan, which included inner and outer "encircling boulevards". (Wikipedia)
[2] Preferred interchange spacing is subject to the freeway design speed.
[3] TAC recommends a minimum intersection spacing of 400m for signal progression based on a 60 km/h operating speed.

The Recommended Plan

The Recommended Plan (**Figure ES-1**) includes the following key features:

- The existing unconventional interchange configuration with 22nd Street will be replaced with a more compact Single-Point Urban Interchange (SPUI) design that better accommodates all current movements on/off Circle Drive and improves mainline geometry.
- The Laurier Drive and Clancy Drive traffic signals are removed and replaced with grade separations that accommodate turning movements off/on Circle Drive, to/from the north at Laurier Drive, and to/from both directions at Clancy Drive. In addition, traffic from Clancy Drive can now reach 22nd Street (without entering Circle Drive), a movement not currently permitted. Access to Clancy Drive from 22nd Street using Circle Drive is not possible because of the short 800m distance along a freeway (a movement the traffic signals currently make possible).
- The existing southbound exit from Circle Drive to Fairmont Drive is retained.
- Eastbound 22nd Street includes a new right/off movement to Fairmont Drive (to the south mall area) and the existing right/on movement from Fairmont Drive (to 22nd Street eastbound) has been relocated south to Fairlight Crescent. This permits traffic to cross 22nd Street from the south mall to the north mall via Confederation Drive, a movement not currently permitted.
- The southbound exit from Circle Drive to 11th Street is moved to the south side of 11th Street, converting the interchange to an all-movement Parclo AB configuration. This change permits restoring all turning movements at the Clancy Drive interchange.
- The design speed along Circle Drive is increased from 90 to 100 km/h by removing the low-speed curves through the existing interchange crossing 22nd Street.

Benefits of the Recommended Plan

The Recommended Plan achieves:

1. Improved Circle Drive West performance and safety as a freeway facility.
2. Improved 22nd Street roadway performance and safety as an expressway facility.
3. Consistent facility design better meeting driver expectations on Circle Drive, and on 22nd Street West through the interchange.
4. Improved capacity and cross-city travel times.
5. Better support for Circle Drive's long-term role in both the Saskatoon and provincial roadway networks.
6. Expanded multi-use pathway network and improved pedestrian safety.
7. Improved visibility of the north mall area from 22nd Street.[4]
8. Clear direction for investments to support traffic growth on 22nd Street West.

Project Objectives

The recommended plan balanced two objectives. First, it achieved free-flow operation and improved traffic safety and capacity. Removing the traffic signals brought design consistency and considerably reduced the risk of unsafe movements along Circle Drive West.

Second, it eliminated the significant hazard posed by the unusual left-hand merges occurring at both Clancy and Laurier Drives leading to improved access to/from Clancy Drive and retaining partial access

[4] The southbound Circle Drive bridge structure is removed and the elevated southbound-to-westbound ramp crossing Confederation Drive in front of the mall is removed.

to/from Laurier Drive in the exceptionally short distances between 11th Street, Clancy Drive, 22nd Street, and Laurier Drive[5].

Limited Project Scope

Solution finding in the constrained project site encountered several issues during the study process that would be impacted by, or affect, the recommendations. These issues were outside the study scope and will require future study. These included:

+ Improving the 11th Street / Circle Drive interchange.
+ Grade-separating at-grade railway crossings near 11th Street.
+ Improving the Diefenbaker Drive / 22nd Street intersection.

Stakeholder Concerns

There were three stakeholder concerns with the Recommended Plan that stand out.

Revised Travel Paths

The two traffic signals at Clancy and Laurier Drives were included in Circle Drive's original design, to accommodate convenient local access, as an interim stage. If the traffic signals were to continue to be retained, it would lead to increased traffic congestion and safety concerns as traffic in Saskatoon and the surrounding region grows. This will include traffic diverted through Saskatoon from the south end of the future Saskatoon Freeway's west leg and the regional highways.

Circle Drive West's original design, which retained intersections in the short distance between interchanges, unfortunately resulted in area residents and business owners relying on now long-established, but what were intended to be interim, travel patterns. Removing the signals after these many years will change the routes in/out of some neighbourhoods and business areas and is viewed as disruptive by the affected residents and businesses.

The Recommended Plan is long-term. Upgrading Circle Drive West to free-flow standards is considered a long-term project. Saskatoon hopes that preparing the plan at this still early stage will give area residents and business owners time to adjust their plans (where possible) before the changes are implemented.

Major transportation projects with the potential to affect large areas and/or existing development are commonly planned long in advance of anticipated construction timelines. The original interim plans for Circle Drive West and its interchange with 22nd Street did not foresee the Saskatoon Freeway (and the absence of a southwest leg) and did not foresee the implications of the then missing south Circle Drive. Saskatoon has revisited its plans for Circle Drive West to reflect these changing circumstances.

Pedestrian Crossings Under Circle Drive and the Canadian National Railway

Three existing narrow pedestrian underpasses will be replaced when Circle Drive West is upgraded. The current underpasses are considered unsafe and unsanitary. The recommended plan will take two of the pedestrian crossings over Circle Drive West and one underneath but alongside Clancy Drive. However, the shorter segment of the crossings under the Canadian National Railway (CN) line will need to remain underpasses because of the overhead power transmission lines. Saskatoon will continue to discuss improvements for these underpasses with CN.

[5] Laurier Drive has the lowest interchange spacing (600m from 22nd Street), only 40% of a preferred 1.5 km, and 60% of an absolute minimum 1000m. Therefore, there is no practical means to provide access to Laurier Drive to/from south on Circle Drive.

At-Grade Rail Crossings

The third concern occurs outside the project scope. 11th Street connects to Circle Drive West at a problematic interchange, complicated by several rail crossings that have been a long-standing concern for area residents. Saskatoon has a proposed interchange plan (prepared by others) that would grade separate the rail lines; however, it is a complex plan and construction is a long-term consideration.

Implementation

Upgrading Circle Drive West is a complex undertaking in a highly constrained corridor. The transition from the existing roadway infrastructure to the approved configuration will be a challenging process and will not lend itself to completion in standalone stages. Once the project begins, it will largely need to continue through completion. A preliminary description of the anticipated project staging is provided, however, the design and tender process, including the involvement of experienced contractors, will revisit/refine the staging sequence with a view to balancing cost and traffic disruption.

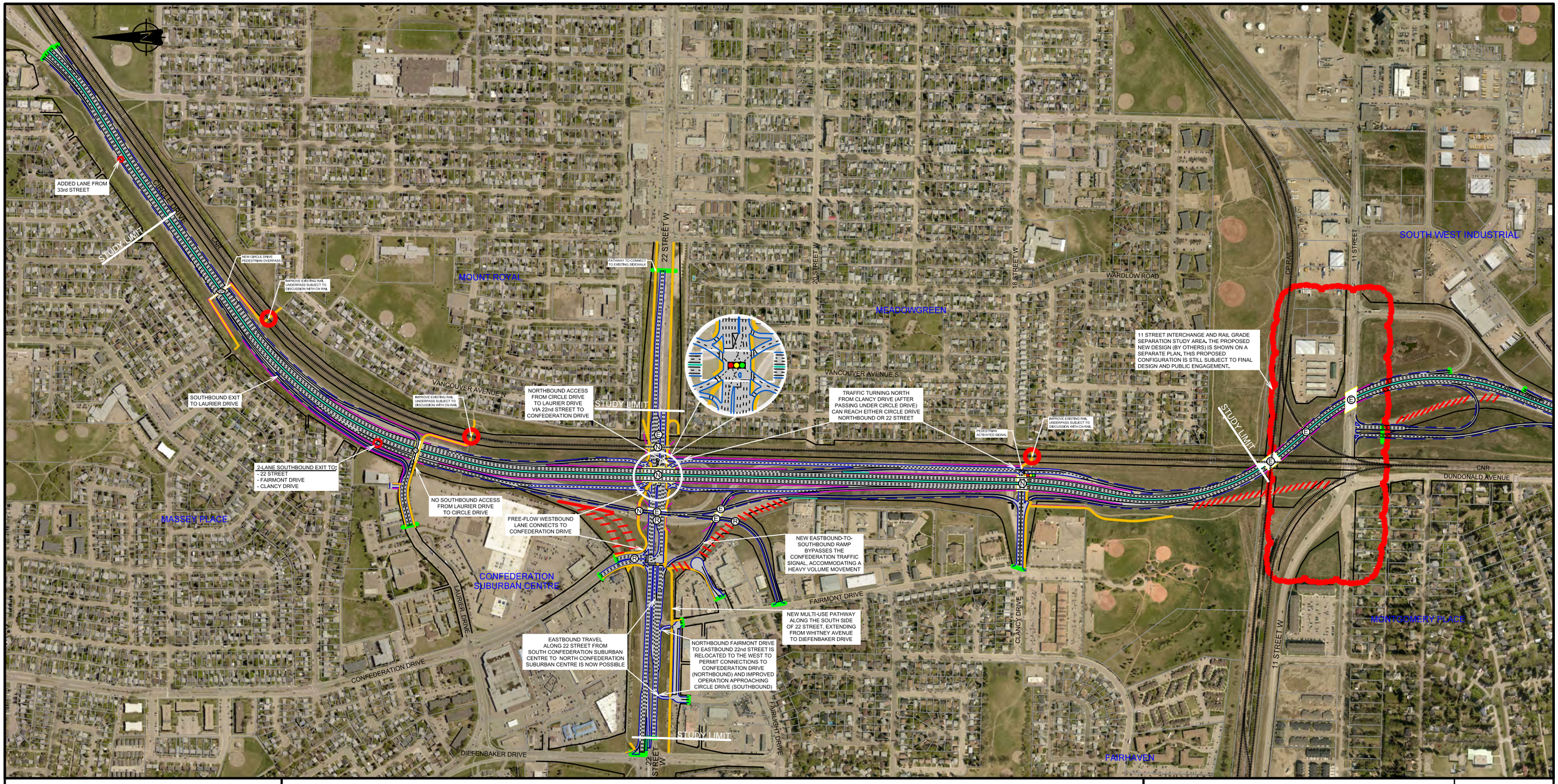
Given the potentially long timeline to implementation, Saskatoon should consider evaluating roadway performance and safety along Circle Drive West in the interim as traffic volumes continue to grow.

Given the absence of a southwest leg in the future Saskatoon Freeway and the deferred planning of the northwest leg, the performance of Saskatoon's road network (22nd Street West and Circle Drive West/South) will be increasingly at risk as local and regional traffic volumes grow. Saskatoon should explore the long-term implications that the missing southwest leg in the Saskatoon Freeway may have on their road network and how to mitigate long-term demand along 22nd Street West and Circle Drive West/South. This may be of particular concern for 22nd Street West as Saskatoon considers migration from a freeway/expressway classification to a more multi-modal arterial configuration and operation.

City Commitments

The following actions are required to finish consolidating the long-term plan for Circle Drive West and the affected section of 22nd Street West.

- Widen 22nd Street eastbound, from Diefenbaker Drive to the Collector/Distributor (C/D) ramps, to provide a third (outside) lane
- Construct a slotted left-turn eastbound at Confederation Drive, including crosswalks.
- Accommodate a future BRT Station at Diefenbaker Drive.
- Widen 22nd Street eastbound and westbound between Diefenbaker Drive and Neault Road.
- Begin engagement with CN to replace the three pedestrian underpasses.
- Complete functional planning study to grade separate the rail crossings at the 11th Street interchange.
- Complete functional planning study to upgrade the 22nd Street / Diefenbaker Drive intersection.



LEGEND:

- LANE DIVIDING LINE
- LANE EDGE LINE OR DIRECTIONAL DIVIDING LINE
- CONCRETE BARRIER
- PATHWAY
- EDGE OF PAVEMENT (RURAL SECTION)
- CURBLINE
- RETAINING WALL
- PROJECT LIMIT

- (E) EXISTING STRUCTURE
- (N) NEW STRUCTURE
- (R) WIDENED STRUCTURE
- (NEW) NEW PEDESTRIAN STRUCTURE
- (D) REMOVE EXISTING STRUCTURE

DATE: 08 APRIL 2022

SCALE: 0 50 100 150 200

RECOMMENDED PLAN

CIRCLE DRIVE WEST
FUNCTIONAL PLANNING STUDY

FIGURE
ES-1

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1. Introduction

Circle Drive is a core route (inner circulatory road) in the City of Saskatoon's (Saskatoon) road network. Circle Drive was first conceived in 1913, built in sections. The final leg was built 100 years later in 2013, when Saskatoon constructed Circle Drive South to freeway standards, from Idylwyld Drive across the South Saskatchewan River to 11th Street.

Other sections of Circle Drive now require upgrading to improve both safety and capacity and to achieve free-flow standards throughout. Clancy Drive and Laurier Drive are at-grade signalized intersections that increasingly cause congestion and safety concerns along Circle Drive West. A road design that alternates between interchanges and intersections in short distances fails design consistency and is both increasingly unsafe and not sustainable as traffic volumes grow. A functional plan is required to grade-separate these intersections and minimize the safety concerns and traffic delay that Saskatoon commuters increasingly experience daily, and to accommodate Saskatoon's continued growth.

Circle Drive West from 11th Street (south of Clancy Drive) to Laurier Drive is a highly constrained corridor, with limited space (narrow right-of-way) available to upgrade the roadway. The many constraints include railway lines, power transmission lines, pedestrian crossings, existing bridge structures, urban development, and parkland.

In response to public concerns regarding roadway safety, Saskatoon identified three primary objectives, among others, for upgrading Circle Drive West between Clancy and Laurier Drives. The development of a long-term functional plan will:

- Achieve free-flow travel along Circle Drive, removing traffic signals and left-hand exits/entries,
- Retain the currently available travel paths at Clancy and Laurier Drives, and
- Upgrade performance of Circle Drive's interchange with 22nd Street West.

Ideally, these three objectives would be achieved within the existing corridor and right-of-way and preserve/enhance multi-use pathway (MUP) connections.

The key deliverable is a functional plan that prioritizes safety improvements, meets driver expectations, addresses wayfinding, minimizes disruption to travel patterns, and achieves a free-flow Circle Drive. The engineering component includes justification for the recommended plan confirming feasibility. The consultation component summarizes the study's response to public engagement and input. The plan for the upgrading work includes a budget estimate, to guide future project programming.

1.1 Background

The City of Saskatoon has approached sections of Circle Drive as a retrofit project, incrementally upgrading to complete the corridor's transition to its ultimate freeway standard. The primary safety and performance issues along Circle Drive West are the two signalized 'T' intersections, with northbound-to-westbound left-turns creating long queues and the associated weaving maneuvers and safety concerns. The most significant obstacle to replacing the traffic signals with grade separations is the prohibitively short spacing along Circle Drive between 11th Street, Clancy Drive, 22nd Street, and Laurier Drive. Applying current freeway design standards through the study section would require both a much wider corridor and substantially increased spacing between interchange locations at the intersecting roadways.

The 22nd Street interchange with Circle Drive West is located near the convergence of three other roadways, Confederation Drive, Fairlight Drive, and Fairmont Drive. The interchange configuration was

therefore significantly complicated by 22nd Street intersecting these roadways only 100m west of Circle Drive. This has resulted in several unusual turning movements off/on Circle Drive West, including the southbound-to-eastbound jughandle design via Fairmont Drive; the west ramp terminal intersection that combines movements to and from the south on Circle Drive with both Confederation Drive and Fairlight Drive; and the dual southbound-to-westbound ramps, one that overpasses Confederation Drive to 22nd Street westbound and one that connects directly to Confederation Drive.

Another condition adding to the operational complexity in this relatively short study area is the proximity to the Confederation Suburban Centre, a busy trip origin/destination north and south of 22nd Street.

Solution finding for the study corridor is further constrained by parallel rail and power transmission lines; rail line crossings at the south end of the study area; and developments that crowd the roadway, including a SaskTel facility in the southwest quadrant at 22nd Street and institutional and health care facilities in the northwest quadrant at Laurier Drive.

The Saskatoon Growth Plan[6] has proposed that bus rapid transit (BRT) be implemented along 22nd Street West, connecting the downtown with the Confederation Suburban Centre and, ultimately, the future Blairmore Station Suburban Centre. It is anticipated that the Confederation Transit Hub on Laurier Drive will play a role in the BRT service as the Confederation Suburban Centre is converted into a Transit Village.

Overall Role:

Circle Drive's overall role is primarily to:

- Function as a core route (inner circulatory road) in the City of Saskatoon's road network.
- Support uninterrupted travel within and through Saskatoon.
- Serve as the southwest leg of the proposed Saskatoon Freeway.
- Serve longer trip lengths. To operate as a freeway facility, ideally, Circle Drive would only connect with the key network roads, e.g., 11th, 22nd, and 33rd Streets.

1.2 Study Area

The study area extends along Circle Drive from the Clancy Drive intersection on the south to the Laurier Drive intersection on the north, and along 22nd Street from a short distance east of the CN rail overpass on the east to east of the Diefenbaker Drive intersection on the west. See **Figure 1.1**.

1.3 Study Objectives

The study objectives were to recommend improvements to roadway safety and capacity consistent with long-term freeway plans for the corridor. These included:

- Improve safety and achieve free-flow travel along Circle Drive West by removing the left-hand exits and entries at the Clancy and Laurier Drive intersections.
- Retain the current travel paths at both intersection upgrades along Circle Drive.
- Minimize right-of-way requirements and impacts on existing development, utilities, and rail lines.
- Accommodate the proposed transit / BRT objectives through the study area.
- Maintain or improve the multi-use pathways through the study area.

[6] BRT Redline, Plan for Growth, BRT Routes and Stations, Preferred Configuration, October 2017

- Engage the resident and business community in the development of the recommended plan.

1.4 Study Scope

Development of the long-term functional plan for Circle Drive West included:

- Achieving freeway standards, with a commensurate increase in design speed.
- Upgrading the Circle Drive / 22nd Street interchange.
- Upgrading the 22nd Street / Confederation Drive intersection.
- Preserving/improving the multi-use pathway network in the study area.
- Additional: Interim change to the 11th Street interchange (concept only).

Development of the Long-Term Plan did not include:

- An ultimate Circle Drive / 11th Street interchange configuration.[7]
- Railway crossings and grade separations.
- 22nd Street / Diefenbaker Drive intersection upgrading.

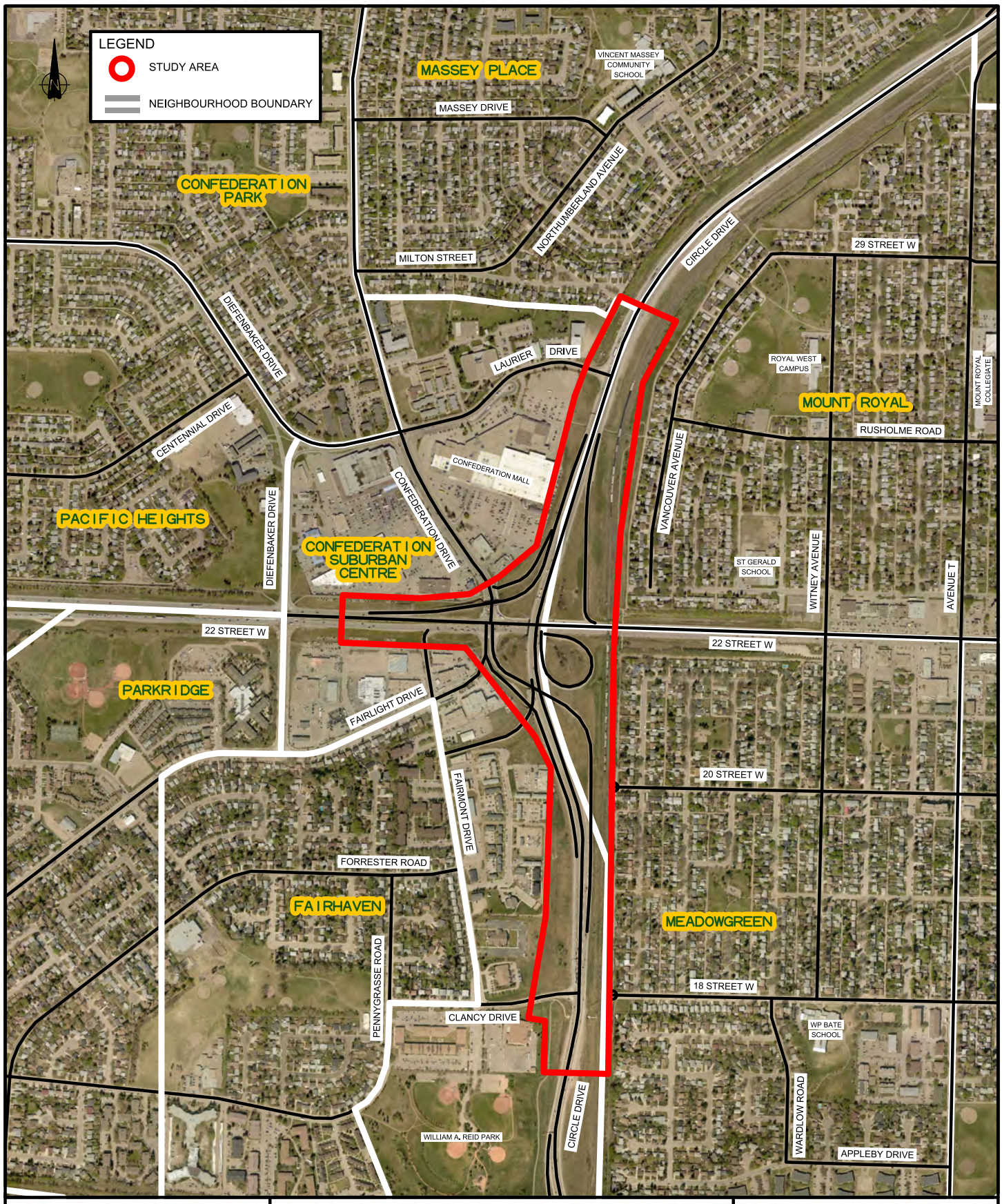
The study focus was to review the existing and future traffic demands and travel paths through the study area and the geometric upgrading required to achieve freeway standards along Circle Drive, including upgrading its interchange with 22nd Street. This involved identifying the issues and understanding how different options perform and their associated impacts, including removing/consolidating some of the turning movements. A challenge for Saskatoon was balancing the capital cost to maintain all current travel paths in a highly constrained setting with the long-established community and business expectations.

1.5 Study Process

The study process and timeline included:

- Gathering existing conditions and background information.
- Open House #1 – June 2019
  - Consult with the community.
- Development and evaluation of alternatives.
- Open House #2 – January 2020
  - Present the Preferred Plan and invite public input.
- COVID 19 Pandemic– March 2020 to September 2021
  - Public engagement process was paused due to public gathering restrictions.
  - Preferred plan was modified in response to public input.
- Open House #3 (virtual) – October 2021
  - Present the Recommended Plan.
  - Respond to final questions and gather comments.
- Prepare final report and plan.
- City Council Approval – Spring 2022

[7] 11th Street interchange options have been considered by a separate City undertaking.



STUDY AREA

CIRCLE DRIVE WEST
FUNCTIONAL PLANNING STUDY

FIGURE
1.1

2. Site Conditions and Constraints

This section reviews existing conditions along both the corridor itself and in the general study area that affected or constrained the solution finding and were likely to impact stakeholders and/or project requirements and costs.

2.1 Existing Circle Drive West

The section of Circle Drive from south of Clancy Drive to north of Laurier Drive, including its junction with 22nd Street, is currently operating as a mixed freeway-expressway, lacking design consistency, and affecting driver expectations, safety and capacity. The upgrading should meet driver expectations, based on converting Circle Drive West to a consistent urban freeway design standard and 22nd Street to a more consistent expressway design standard.

Best practices suggest that the minimum spacing[8] between service interchanges along a freeway facility should be between 1.5 and 2 km to minimize the congestion and safety issues associated with weaving and merge/diverge maneuvers. Existing spacing through the study area is 900m from 11th Street to Clancy Drive, 800m to 22nd Street, 600m to Laurier Drive, and 1.5 km to 33rd Street. The proposed design speed of 100 km/h (instead of 110 km/h) through the study area helps to mitigate the interchange spacing issue; however, the typical approach to address such exceptionally short spacing is to eliminate the left-turn movements and develop basketweave structures or parallel collector/distributor (C/D) roads to facilitate the otherwise lost movements. Both are costly and require a generous roadway right-of-way.

It is also noted that the existing intersections at Clancy and Laurier Drives provide alternate access to area shopping and neighbourhoods, relieving demand at the 22nd Street interchange and the 22nd Street/ Diefenbaker Drive intersection, which are already experiencing performance issues.

2.2 Existing Corridor Geometry

Based on the *target geometric design criteria*[9] for Circle Drive West, a review of the existing roadway geometrics within the study area was performed to determine where the target design criteria are met and identify areas where they fall short. The focus was on the horizontal geometry and the entrance and exit ramp terminals.

Overall, the current geometry and ramp design along Circle Drive meets the requirements for a 90 km/h design speed and 80 km/h posted speed, with many ramp geometries meeting a 50-60 km/h design speed and 40-50 km/h posted speed due to tight horizontal curvatures. The roadway geometry is restricted almost throughout by existing roadway and railway bridge structures, or existing development, which would require significant cost or impact to address.

The results of this review are summarized in **Appendix A**.

Cross-Section

The existing cross-section between 11th and 22nd Streets is semi-urban with a median barrier, raised median section, and outside ditches. The existing cross-section between 22nd and Laurier Drive is also semi-urban with a raised median and outside ditches. The existing cross-section between Laurier Drive and 33rd Street is full rural with a narrow, depressed grass median.

[8] Preferred interchange spacing is subject to freeway design speed.
[9] Appendix E – Design Criteria

2.3 West Saskatoon Road Network

This section describes the key road network elements in West Saskatoon that interact with Circle Drive West to understand what role, if any, they play in the problem definition and solution-finding.

2.3.1 East-West Corridors

Three east-west corridors connect with Circle Drive West at existing interchange locations. This section looks at their ability to help support the study objectives.

+ 11th Street West

11th Street West is a two-lane undivided roadway, 1.6 km south of 22nd Street, connecting Circle Drive with Highway 7. Posted at 50 km/h, 11th Street supports a mix of residential and industrial land uses and is not an access-controlled roadway. 11th Street connects to Circle Drive at a problematic interchange, complicated by several rail crossings that introduce traffic delays. The rail crossings have been a long-standing concern for area residents. Saskatoon has a proposed interchange plan that would grade-separate the rail lines; however, it is a complex plan and construction is a long-term consideration (**Appendix B**).

Conclusion: 11th Street is not a practical alternative to 22nd Street for traffic entering west Saskatoon.

+ 22nd Street West

22nd Street is part of Saskatoon's Major Street Network and one of several spokes connecting the future Saskatoon Freeway and provincial highway network with Circle Drive. Posted at 60 km/h, 22nd Street is a 4-lane divided roadway carrying both local commuter and inter-regional (e.g., Highways 7, 14 and 60 west, Highway 16 north) traffic flows into and through Saskatoon.

The Street Network Plan in Saskatoon's Transportation Master Plan (TMP) designates 22nd Street as a Freeway/Expressway facility between Circle Drive and Highways 7/14. Saskatoon's TMP defines 'Freeway/Expressway' as a '*High Speed Controlled Access*' facility. Saskatoon is protecting 22nd Street to ultimately achieve six core lanes (3 lanes each way).

Intersection spacing along 22nd Street near Circle Drive is substandard for an expressway. It is less than 100m between Confederation and Circle Drives, while TAC[10] recommends a desirable minimum of 400m to support signal progression. The 22nd Street intersection with Confederation Drive also mixes local access with interchange operations, complicating guide signing and signal operations.

Residents in the neighbourhoods immediately west of Circle Drive have come to rely on the two existing signalized intersections on Circle Drive for travel in/out of their neighbourhoods or the two shopping areas north and south of 22nd Street. A plan to convert the Clancy and Laurier Drive intersections to interchanges may be unable to restore all current travel paths, meaning more traffic will follow 22nd Street to Diefenbaker Drive to enter area neighbourhoods.

Conclusion: Saskatoon has recognized 22nd Street's long-standing role as a controlled-access, expressway link in the major street network that will ultimately be 6-lanes wide. The long-term traffic implications for 22nd Street West are similar to the increased demand and associated issues facing Circle Drive West. 22nd Street will continue to experience increasing truck and through traffic. This includes supporting future growth areas in west Saskatoon, e.g., Blairmore Development Area.

[10] TAC: Transportation Association of Canada

+ 33rd Street West

33rd Street West is a four-lane divided roadway, 1.6 km north of 22nd Street. Posted at 50 km/h, 33rd Street supports residential land uses and includes a parallel parking lane in sections. 33rd Street is not an access-controlled roadway, supporting driveways along the first 3 km west of Circle Drive and roundabouts in the final 2 km to Neault Road.

Conclusion: 33rd Street is not a practical alternative to 22nd Street for traffic entering west Saskatoon.

2.3.2 Existing Interchange Locations

There are three existing interchange locations along Circle Drive West. This section describes their configuration and issues based, in part, on meeting the desired 100 km/h design speed. The original design may have been based on a lower design speed.

+ 11th Street Interchange

The 11th Street interchange is 1.7 km south of 22nd Street. It is a Parclo A configuration in the northbound direction and a Simple Diamond configuration in the southbound direction. Although outside the study area, its proximity to Clancy Drive impacts the solution-finding.

The southbound exit ramp from Circle Drive crosses two at-grade rail lines before intersecting 11th Street opposite Dundonald Avenue. 11th Street crosses three rail lines between the southbound exit and entrance ramps. The five at-grade rail crossings periodically disrupt traffic accessing 11th Street and are a significant concern for area residents. In addition, there are four signalized intersections along 11th Street in the 600m distance crossing the interchange area.

The 11th Street bridge is a box structure that only accommodates Circle Drive's existing four-lane cross-section. Therefore, the loop ramp for traffic entering northbound Circle Drive is an elongated design to accommodate a parallel acceleration lane that must merge through a horizontal curve before the bridge structure.

The southbound exit ramp from Circle Drive to 11th Street begins a short distance south of the signalized Clancy Drive intersection. Therefore, there is no southbound acceleration lane from Clancy Drive since it would overlap with the exit to 11th Street and create an unacceptable weaving condition. The proximity of these two movements is only made possible by the Clancy Drive traffic signal which alternates the flows on-off Circle Drive. Saskatoon has a concept plan to upgrade the 11th Street interchange, however, it is a long-term consideration.

Conclusion: The 11th Street interchange requires upgrading; particularly because of the rail crossings, however, it is outside the study scope and interchange performance, e.g., levels-of service, was not evaluated. Design of the Clancy Drive interchange geometry is affected by its proximity to 11th Street, particularly the southbound exit ramp to 11th Street.

+ 22nd Street Interchange

The existing interchange configuration at Circle Drive/22nd Street is both unconventional and large. It was designed to emphasize traffic flows between Highways 7 & 14 (22nd Street) west and Circle Drive north. The recent addition of Circle Drive south altered the traffic flows at this junction.

The southbound-to-eastbound turning movement from Circle Drive to 22nd Street is not typical. It is a jughandle configuration south of 22nd Street. Traffic exits southbound Circle Drive to Fairmont Drive, turning north on Fairmont Drive towards 22nd Street, and is then forced to turn right towards downtown (eastbound). Drivers cannot access Confederation Drive or the north mall from the jughandle. Drivers

southbound along Circle Drive West must access the north mall area via Laurier Drive or the direct ramp onto Confederation Drive, before reaching/crossing 22nd Street.

There are several businesses inside the jughandle, mixing the turning freeway traffic with peak hour commercial traffic. To prevent weaving and safety concerns, a low mountable barrier was installed to keep the right-turns (both jughandle and commercial traffic) in the curb lane through the Confederation Drive intersection. The restricted turning movement entering 22nd Street from the jughandle may complicate wayfinding for drivers new to the area. Saskatoon has considered various means to prevent this unsafe movement.

Open house attendees confirmed study findings, that the westbound-to-northbound acceleration lane onto Circle Drive is too short. The distance from the physical gore to the end of the taper is approximately 250m. As a parallel lane entrance ramp design, TAC[11] Figure 10.8.5 recommends a 375m long distance from the physical gore to the end of the parallel lane taper, therefore 125m short for a 100 km/h design speed.

The elevated ramp carrying traffic from southbound Circle Drive to westbound 22nd Street enters an auxiliary lane that must turn right at Diefenbaker Drive. Drivers have 140m to merge left before reaching the intersection, which is challenging during the PM peak hour as queues form approaching an increasingly congested intersection with Diefenbaker Drive. The ramp from Circle Drive parallels 22nd Street as the westbound-to-southbound left-turn slot for Diefenbaker Drive begins. Traffic from Circle Drive that wishes to turn left at Diefenbaker Drive has approximately 100m to weave across two traffic lanes to reach the left-turn slot. This may be an even more challenging movement as westbound queues form during the PM peak hour.

Conclusion: To achieve the most practical, technically effective solution, the existing interchange configuration should be replaced, not salvaged.

+ 33rd Street Interchange

The 33rd Street interchange is 2.1 km north of 22nd Street, outside the study area. The interchange is a narrow, highly constrained, simple diamond configuration, bounded on the east by the CN rail line and by urban development on the west. The Circle Drive mainline jogs westerly (away from the parallel CN line) crossing 33rd Street to create space for the east (northbound) ramp terminal intersection. The CN rail crosses 33rd Street immediately east of the east ramp terminal, affecting intersection operations. The first local roads intersect 33rd Street only 100m from both ramp terminal intersections, creating weaving and potential safety issues on the 4-lane divided roadway.

Conclusion: The 33rd Street interchange is a highly constrained configuration; however, it is outside the study scope and its performance was not evaluated.

[11] Transportation Association of Canada

2.3.3 Existing Intersection Locations

Four existing intersection locations affect the solution finding for Circle Drive West.

+ Clancy Drive / Circle Drive Intersection

This is one of two interim signalized intersections built when Circle Drive West was first constructed. As a first stage, an intersection was expedient since the completion of Circle Drive South and the Saskatoon Freeway (and its missing southwest leg) were not on the horizon. The problems include:

1. Left-turn off of a freeway facility, northbound-to-westbound.

   Open house attendees confirmed the results of the recent Neighbourhood Traffic Reviews (NTR), the northbound left-turn volumes often exceed the length of the left-turn bay, backing the queue into the inside through lane. This creates an unsafe speed differential and increased collision potential.

2. Left-turn onto a freeway facility, eastbound-to-northbound, followed by a left-hand merge, which can be problematic for trucks and large vehicles and is unexpected by unfamiliar drivers.

   Open house attendees expressed concern that the left-hand acceleration is too short for a safe merge onto a congested Circle Drive, drivers experience near-misses and often come to a full abrupt stop when unable to merge before the lane ends.

   The study mandate is to remove this unconventional ramp design. It is difficult to specify what the design acceleration length should be for an unconventional left-hand merge. Drivers need more time to shoulder check/double-check through the vehicle's interior and confirm a safe merge can be made.

   There is no available design reference for a left-hand entrance ramp. If it is treated as a standard acceleration lane, assuming a turning speed of 20 km/h, and a highway design speed of 100 km/h, the acceleration lane would need to be 250m to 440m long plus a taper of 85m (TAC 10.6.5). Given that it is an unusual left-hand entrance, the design should at least be at the higher end of that range (440m + 85m taper) for a 525m length. Even 525m seems low for traffic entering from a low-speed turn to merge into the passing (fast) lane, not the driving lane. For reference, a similar design along Whitemud Drive in Edmonton (posted at 80 km/h) includes a left-hand entrance that is 950m long from gore to end of taper. The Clancy Drive acceleration lane is approximately 270m long. (Note, the City of Edmonton is removing the, what was originally supposed to be interim, left-hand entrance in the next year as part of a larger upgrading project. Edmonton's transit drivers have safety concerns with a left-hand merging operation.)

3. The northbound median acceleration lane merges just as the core lanes enter a horizontal curve.

4. The northbound median acceleration lane is separated from the northbound travel lanes by a 225m long barrier to prevent drivers from attempting an unsafe weave across the two travel lanes to exit at 22nd Street.

5. Southbound traffic is disrupted by a traffic signal resulting in queues forming while traffic in the parallel on-ramp from 22nd Street is accelerating in an attempt to merge. This creates a poor weaving maneuver leading to a stop condition.

6. The southbound exit ramp from Circle Drive to 11th Street begins a short distance south of the signalized Clancy Drive intersection. Therefore, there is no southbound acceleration lane from Clancy Drive since it would overlap with the exit to 11th Street and create an unacceptable weaving

condition. The proximity of these two movements is only made possible by the Clancy Drive traffic signal which alternates the flows on-off and along Circle Drive.

7. Traffic entering Circle Drive northbound from 11th Street (intending to turn left at Clancy Drive) travel 600m through two horizontal curves and three underpasses before the intersection becomes visible to the driver and then have 200m to complete their weave to the left-turn lane.
8. The intersection is located only 50m north of a pedestrian underpass and Circle Drive is located only 30m west of the CN line.

Conclusion: The signalized intersection at Clancy Drive must be removed.

+ Laurier Drive / Circle Drive Intersection

This is the second of two interim signalized intersections built when Circle Drive West was first constructed. As a first stage, an intersection was expedient since the completion of Circle Drive South and the Saskatoon Freeway (and its missing southwest leg) were not on the horizon. The problems include:

1. Left-turn off of a freeway facility, northbound-to-westbound.

   Open house attendees confirmed the results of the recent NTRs, the northbound left-turn volumes often exceed the length of the left-turn bay, backing the queue into the inside through lane. This creates an unsafe speed differential and increased collision potential.
2. The northbound left-turn lane is separated from the northbound core lanes by a 110m long barrier to prevent drivers entering from 22nd Street from attempting an unsafe weave across the two travel lanes to exit at Laurier Drive. There is a 130m long barrier along the on-ramp from 22nd Street for this same reason.
3. Left-turn onto a freeway facility, eastbound-to-northbound, followed by a left-hand merge, which can be problematic for trucks and large vehicles and is unexpected by unfamiliar drivers. Although the ramp is approximately 400m long, compared with the Clancy Drive ramp at 270m, the operational concerns are similar.
4. Southbound traffic is disrupted by a traffic signal resulting in queues forming, which required a 300m long right-turn lane approaching Laurier Drive to permit exiting traffic to avoid the queues.
5. The southbound exit ramp from Circle Drive to 22nd Street westbound begins a short distance south of the signalized Laurier Drive intersection. Therefore, there is no southbound acceleration lane from Laurier Drive since it would overlap with the exit to 22nd Street and create an unacceptable weaving condition. The proximity of these two movements is only made possible by the Laurier Drive traffic signal which alternates the flows on-off and along Circle Drive.
6. The intersection is located only 120m north of a pedestrian underpass and Circle Drive is located only 30m west of the CN line.

Conclusion: The signalized intersection at Laurier Drive must be removed.

+ Confederation Drive / 22nd Street Intersection

The 22nd Street interchange with Circle Drive West is located near the convergence of three other roadways, Confederation Drive, Fairlight Drive and Fairmont Drive. The interchange configuration was therefore significantly complicated by 22nd Street intersecting these roadways only 100m west of Circle Drive. This has resulted in several unusual turning movements off/on Circle Drive, including the southbound-to-eastbound jughandle design via Fairmont Drive; the west ramp terminal intersection that combines movements to and from the south on Circle Drive with both Confederation Drive and Fairlight Drive; and two southbound-to-westbound ramps, one elevated connecting with 22nd Street westbound and the second connecting directly to Confederation Drive inside the north mall area.

The presence or availability of some of these movements in such a complex setting, along either 22nd Street or Circle Drive, may only be readily apparent to local, frequent, drivers. This complexity can affect driver workload. Instead, a good design should be easy to guide sign, and the associated connections/ destinations be intuitive to drivers (i.e., easy to comprehend), to prevent unpredictable behaviour as unfamiliar drivers may make decisions too late to execute a safe lane change or turning movement.[12]

Many southbound-to-eastbound drivers entering 22nd Street from Confederation Drive often weave across to the curb lane to enter the northbound loop ramp to Circle Drive only 100m from the intersection, conflicting with right-turn traffic exiting northbound Circle Drive.

Open house attendees expressed concern that many eastbound drivers approaching Confederation Drive will drive along the shoulder (or even off of the shoulder) to reach the right-turn onto Circle Drive southbound and avoid waiting behind long queues stopped at the signal. This queue forming at the signal is largely the result of the northbound-to-eastbound right-turn from Fairmont Drive (the jughandle turning movement from Circle Drive South, combined with south mall traffic) that is trapped in the shoulder lane by the low-mount barrier and its pylons.

Conclusion: The combination of unconventional permitted, not-permitted/restricted, and circuitous movements can be confusing to unfamiliar drivers and inefficient, compromising safety and capacity.

+ Diefenbaker Drive / 22nd Street Intersection

The performance of the Diefenbaker Drive intersection with 22nd Street is already poor and expected to worsen as traffic volumes increase, including following Circle Drive West's conversion to freeway standards. If the current configuration is maintained, it is estimated that the intersection would experience LOS 'F' and a v/c ratio of 1.56 in the PM peak hour for the 500,000 population horizon.

Although this intersection was not included in the current study scope, its proximity to Confederation Drive required some preliminary review, indicating the solutions will involve significant upgrading.

Conclusion: The Diefenbaker Drive intersection with 22nd Street will need to accommodate increased traffic volumes following an upgraded Circle Drive West and the 22nd Street/Confederation Drive intersection. The intersection will be reviewed by the City and upgraded with consideration of this study's recommended plan.

[12] While crashes are complex and it is generally interactions between road users, vehicles, and the environment that lead to crashes, some form of driver error (e.g., recognition errors, decision errors, performance errors, and nonperformance errors) is a contributing factor in most crashes (HSM, 2010). "Error" means the driver did not perform his or her task optimally. Misperceptions, slow reactions, and poor decisions are the products of a poor match between the needs and capabilities of drivers and the task demands that they face on the roadway. [NCHRP 316, Human Factors Guidelines for Road Systems, 2021 Update]

2.3.4 Summary: Interchange/Intersection Performance

Roadway performance issues and safety concerns have increased since the completion of Circle Drive South and increasing traffic volumes to/from West Saskatoon. The concerns heard both at and following the open houses are largely consistent with the feedback from the Neighbourhood Traffic Reviews conducted in the study area and the traffic and collision data analyzed for this study.

Congestion at locations along Circle Drive and 22nd Street/Confederation Drive is increasingly leading to driver frustration and safety concerns for area residents. The identified concerns are being addressed by this study and inform the solution-finding. All open house respondents reported residing within the neighbourhoods affected by this study, confirming the problems to be addressed.

2.3.5 Design Consistency

The closely spaced mix of right-hand (freeway) and left-hand (expressway) exits challenges driver behaviour and leads to poor safety outcomes, increasing weaving maneuvers and places truck traffic in both travel lanes. This condition and the associated collision potential are exacerbated by the curvilinear design along Circle Drive West and increases with traffic volumes.

There are consecutive weaves northbound along Circle Drive between 11th Street, Clancy Drive, 22nd Street, Laurier Drive, and 33rd Street as Circle Drive West alternates between interchange, intersection, interchange, intersection, and interchange, respectively. The corridor fails driver expectations as the environment switches back-and-forth between free-flow and stop-controlled. [13]

Table 2.1 summarizes the lack of design consistency along Circle Drive West.

Table 2.1 : Lack of Design Consistency along Circle Drive West

Circle Drive Segment			Design Standard	Approx. Length (km)
Circle Drive East (Highway 11 South)	to	11th Street	Freeway	10
11th Street	to	22nd Street	Signalized: Clancy	1
Crossing 22nd Street			Interchange	1
22nd Street	to	33rd Street	Signalized: Laurier	1
Crossing 33rd Street			Interchange	2
33rd Street	to	Idylwyld Drive (Highway 11 North)	Signalized: Airport & Avenue C	1

[13] At a complex freeway interchange, where should guide signs be located and how should lane designations and destinations be displayed on these signs? Drivers should be able to quickly associate sign information with their current and desired lanes to safely position themselves well in advance of the [intended turning movement]. How well do different signing options (e.g., sign locations, layout of sign information, organization of multiple destinations on a sign) support driver expectations and performance, and what are the safety impacts of these options? (NCHRP 316, Human Factors Guidelines for Road Systems, 2021 Update]

2.4 Highway Network

This section describes the role that Circle Drive West and 22nd Street West play in the provincial highway network, before and after construction of the future Saskatoon Freeway.

2.4.1 National Highway System

Saskatoon serves as a hub in the National Highway System connecting five spokes, including Highway 16 west, Highway 16 east, Highway 11 north, Highway 11 southeast, and Highway 7 southwest. Two national highway routes follow 22nd Street and Circle Drive through west Saskatoon. One, from Highway 7 to Highway 11 north and the second from Highway 7 to Highways 11 and 16 south. Highway 7 reaches Highway 16 north via Neault Road.

Construction of the northwest leg of the Saskatoon Freeway (the Province of Saskatchewan recently halted planning for this segment) would become the national highway link connecting Highway 7 West with Highways 11 and 16 North. However, 22nd Street and Circle Drive West/South will remain the national highway link to Highways 11 and 16 south.

2.4.2 Provincial Highway Network

Several provincial highway routes entering west Saskatoon follow 22nd Street and Circle Drive. There is some duplication with the National Highway routing.

+ Existing Highway and Road Network

Figure 2.1 summarizes the provincial highway routes in the Saskatoon Region that currently follow Circle Drive West and South and 22nd Street. Note that Neault Road and 22nd Street serve as a northwest bypass via Circle Drive West/South, permitting drivers to avoid the congested north end of Circle Drive and Idylwyld Drive.

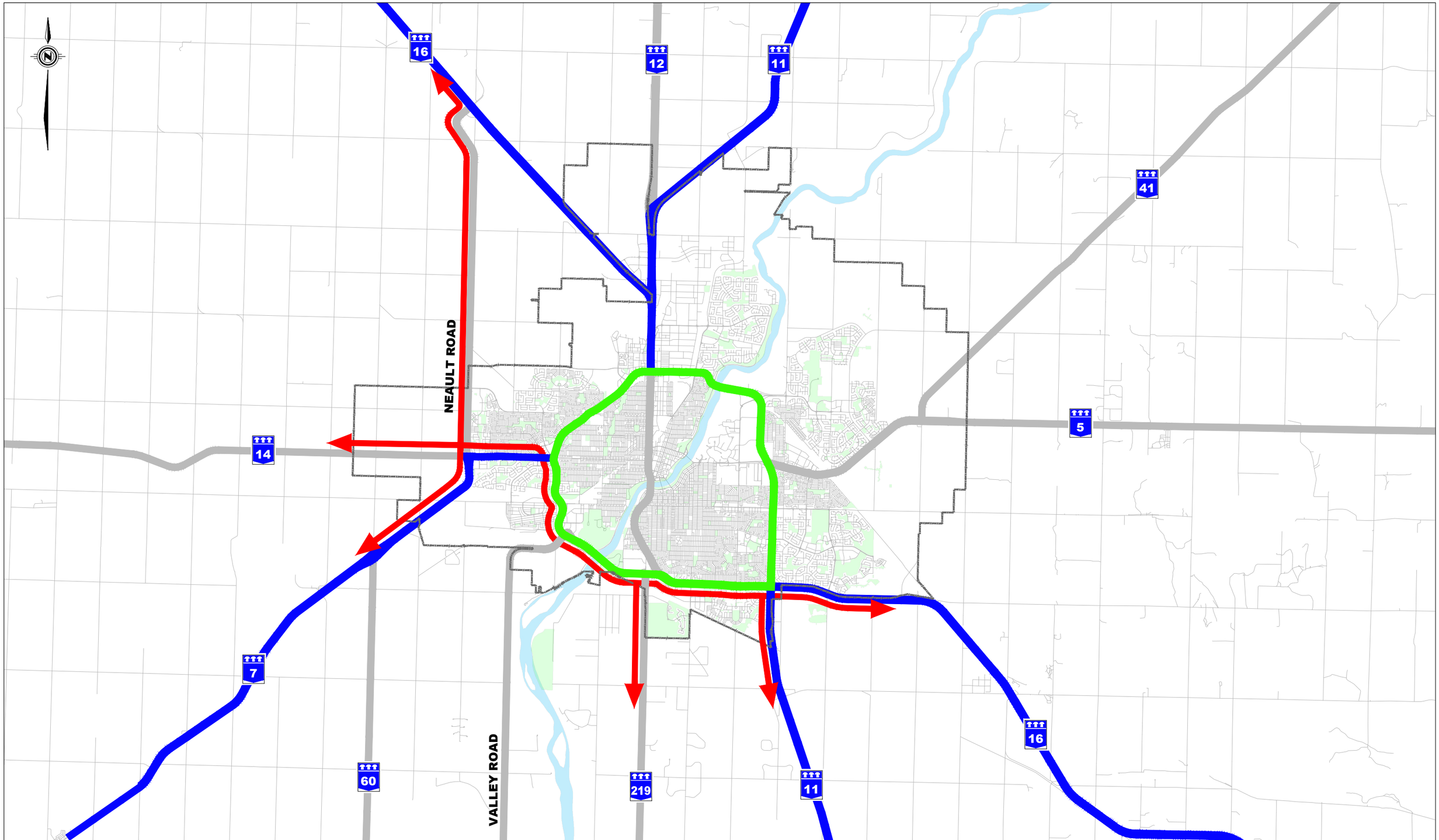
+ Potential Phase I & II of Saskatoon Freeway (10 to 20 years)

The Province's currently proposed Saskatoon Freeway does not include a southwest leg and river crossing. This will mean that growing regional traffic flows approaching from, or destined to, the south or west, not destined for Saskatoon, or points north, will continue to travel through Saskatoon along 22nd Street West, Circle Drive West/South to reach Highways 11 south and 16 east. The north and east legs of Circle Drive are likely to see comparatively less growth in regional travel demand following completion of the proposed Saskatoon Freeway. **Figure 2.2** shows the road network following completion of Phases I & II of the Saskatoon Freeway.

+ Potential Phase III of Saskatoon Freeway (20 to 30 years)

If there is a northwest leg in the Saskatoon Freeway, it would connect Highways 7/14/60 west with Highways 11, 12 & 16 north, relieving Circle Drive northwest and Neault Road. **Figure 2.3** shows the road network assuming the province completes Phase III (northwest leg) of the Saskatoon Freeway.

Conclusion: 22nd Street and Circle Drive West/Southwest will both play a long-term role in the provincial highway network, connecting the inter-regional traffic flows between west Saskatoon and south Saskatoon.



LEGEND:

- NATIONAL HIGHWAYS
- PROVINCIAL HIGHWAYS AND ROUTES (INCLUDING FUTURE SASKATOON FREEWAY)
- CIRCLE DRIVE
- HIGHWAY LINKS FOLLOWING SOUTHWEST CIRCLE DRIVE

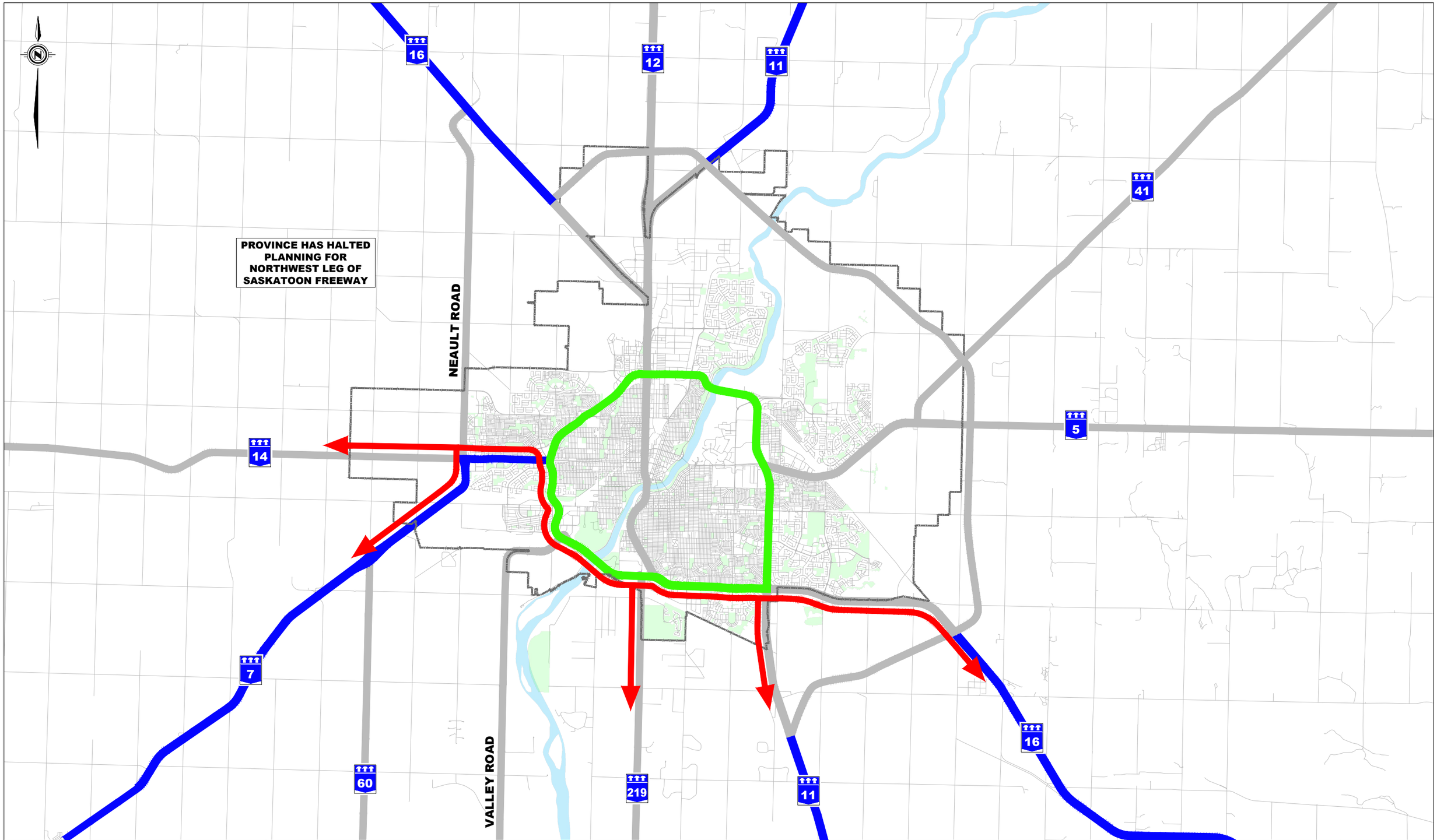
DATE : 13 MAY 2022

SCALE : 0 0.5 1.0 2.0 3.0 Km

EXISTING HIGHWAY AND ROAD NETWORK

CIRCLE DRIVE WEST
FUNCTIONAL PLANNING STUDY

FIGURE
2.1



LEGEND:

- NATIONAL HIGHWAYS
- PROVINCIAL HIGHWAYS AND ROUTES (INCLUDING FUTURE SASKATOON FREEWAY)
- CIRCLE DRIVE
- HIGHWAY LINKS FOLLOWING SOUTHWEST CIRCLE DRIVE

DATE : 13 MAY 2022

SCALE : 0 0.5 1.0 2.0 3.0 Km

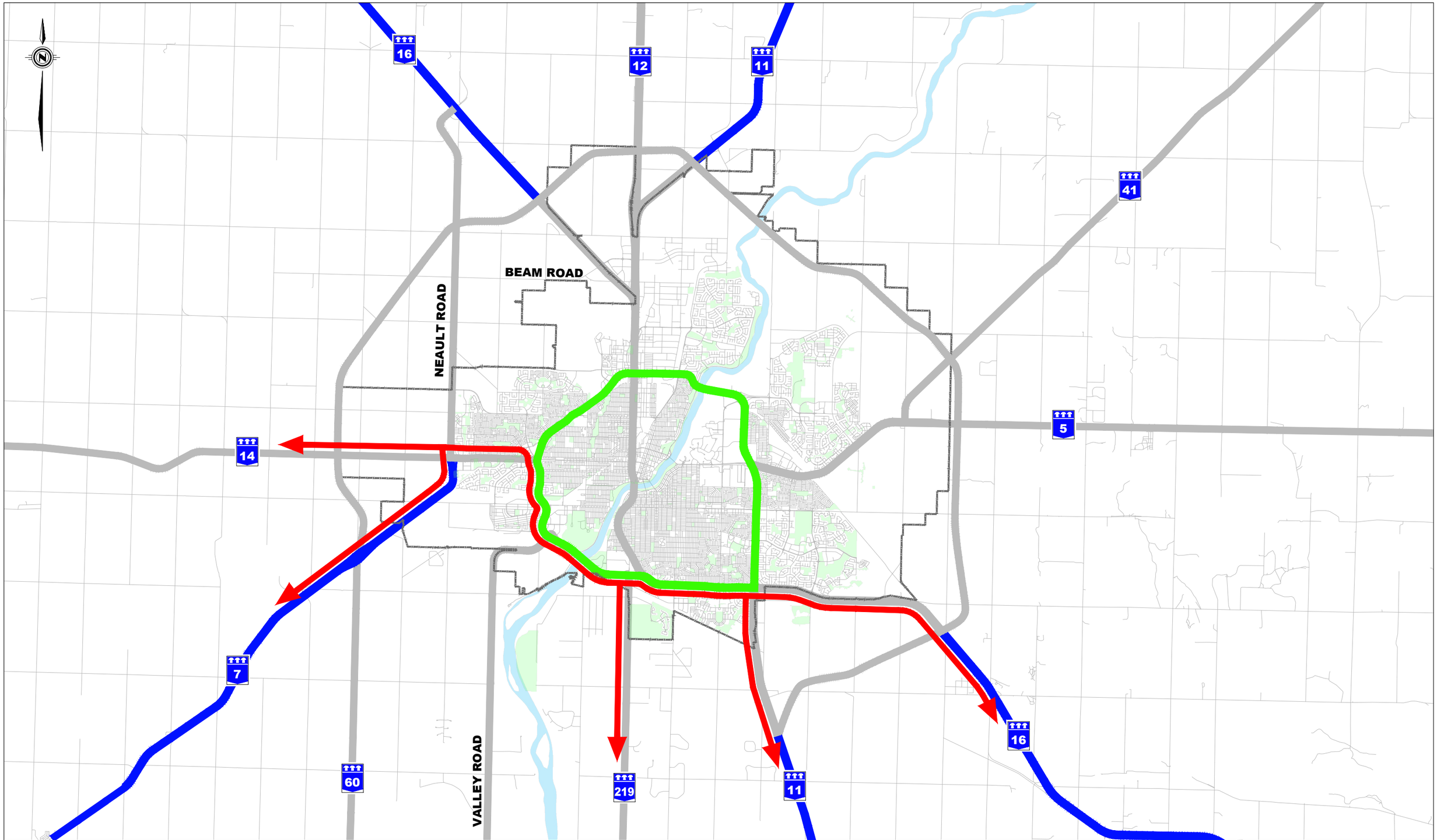
ROAD NETWORK AFTER PHASES I AND II OF SASKATOON FREEWAY

(POTENTIALLY 10 TO 20 YEARS)

CIRCLE DRIVE WEST
FUNCTIONAL PLANNING STUDY

FIGURE

2.2



LEGEND:

- NATIONAL HIGHWAYS
- PROVINCIAL HIGHWAYS AND ROUTES (INCLUDING FUTURE SASKATOON FREEWAY)
- CIRCLE DRIVE
- HIGHWAY LINKS FOLLOWING SOUTHWEST CIRCLE DRIVE

DATE : 13 MAY 2022

SCALE : 0 0.5 1.0 2.0 3.0 Km

ROAD NETWORK AFTER PHASE III OF SASKATOON FREEWAY

(POTENTIALLY 20 TO 30 YEARS)

CIRCLE DRIVE WEST
FUNCTIONAL PLANNING STUDY

FIGURE

2.3

2.5 Future Saskatoon Freeway

The City of Saskatoon's Street Network Plan (**Appendix C**) shows the province's proposed Saskatoon Freeway, the provincial highway system, and Saskatoon's Freeway/Expressway network. The future Saskatoon Freeway is described on the province's project website as follows:

> *The City of Saskatoon has undergone significant growth over the past decade. Since 2008, the population has increased at an annual rate of about 2.3 per cent: from 214,000 people to more than 270,000 people* [283,000 in July 2021]*[14]. Surrounding communities have undergone significant growth as well, which has resulted in higher demand on existing roadways.*
>
> *The Saskatoon Freeway will improve safety by diverting larger commercial vehicles from the City of Saskatoon and alleviating traffic congestion from busy sections of the city. This will improve efficiency for producers, shippers and truckers in moving goods to markets. Greenhouse gas emissions from vehicles will be reduced by improving the flow of traffic and reducing congestion.*
>
> *The Saskatoon Freeway is expected to be a minimum four-lane, 55-kilometre stretch of divided highway that will divert traffic [around] the City. It will improve traffic flow to and from the City and surrounding municipalities. It will connect with eight provincial highways, and some municipal roads. There is no southwestern leg in the Saskatoon Freeway since traffic studies indicate it would not be well-used by truck or commuter traffic.*
>
> *The general location study was completed in 2018 and the corridor for the Saskatoon Freeway was endorsed by the City of Saskatoon and the Rural Municipality of Corman Park.*
>
> *Once the functional planning study is complete, the Ministry of Highways will decide when and how to proceed. Currently, there is no timetable for construction. At a minimum, construction is not expected to start for 10 years, based on current population projections for Saskatoon and area.*

The functional planning study for the Saskatoon Freeway was divided into three phases.

- Phase 1 is the north leg, extending from Highway 16 North to the South Saskatchewan River crossing clockwise, and is nearly complete.
- Phase 2 is the east leg, extending from the South Saskatchewan River crossing to Highway 11 South clockwise, and is almost complete.
- Phase 3 is the northwest leg, extending from Highway 16 north to Highways 7/14/60 on the west. **Saskatchewan Ministry of Highways (MoH) have put Phase 3 on hold and "*Deferred to a future planning study*".**

Given continued urban development along the 22nd Street corridor, and the absence of a southwest leg in the future Saskatoon Freeway (and possibly also without the now delayed northwest leg), it will become increasingly important to have an expressway class connector through an expanding City to Circle Drive, connecting the provincial highway network and the region west of Saskatoon both into and through the city.

22nd Street is a key urban roadway. Saskatoon will need to continue to maintain 22nd Street as a consistent, high standard, access-managed facility, critical to the long-term performance of Saskatoon's

[14] Saskatoon Strategic Trends 2021

major street network and supporting the efficient movement of people and goods and economic development.

Reference: Alberta Transportation established *Penetrator Agreements* with the Cities of Calgary and Edmonton to ensure that traffic generated in the rural and urban areas outside the two Cities will retain efficient, high standard, access to ring roads inside the cities. *Highway Penetrators* refers to the extension of primary or secondary highways and other major arterials with provincial (or regional) significance, which enter the cities to reach the ring roads.

Regional Ring Roads[15], or perimeter highways, circling metropolitan centres are intended to serve primarily three functions:

- To restore inter-regional mobility passing the major urban regions;
- To support long-distance travel into and out of the urban regions (as a destination); and
- To assist the major cities, or metropolitan regions, in restoring efficient transportation systems, i.e., to help them grow.

Conclusion: In the absence of a southwest leg in the Saskatoon Freeway, it is the performance of Saskatoon's road network that will be increasingly at risk as local and regional traffic volumes grow.

2.6 Other Modes

+ Bus Rapid Transit

The Saskatoon Growth Plan[16] has proposed that bus rapid transit (BRT) be implemented along 22nd Street, connecting the downtown with the Confederation Suburban Centre and, ultimately, the future Blairmore Station Suburban Centre. There are two planned routes through the study area, Red Line and Green Line. There are no dedicated bus lanes planned as Saskatoon's modelling has suggested that there is enough capacity on 22nd Street to meet BRT requirements.

- The red line will be the least impacted as it runs exclusively along 22nd Street with two stops near 22nd Street and Diefenbaker Drive.
- The green line will potentially be more impacted as it runs up Confederation Drive with three stops. Two stops near the mall and a stop at the end of the Laurier bus loop (Confederation Transit Hub).
- The BRT is now expected to be implemented in 2026.

+ Multi-Use Pathways

Saskatoon's existing Active Transportation network[17] includes a multi-use pathway along the north side of 22nd Street, extending east-west through the study area, as well as north-south along the east side of the CN line, leading to underpasses below the rail line and Circle Drive opposite both Rusholme Road and 29th Street to the north and 18th Street to the south. These crossings are considered unsafe and unsanitary. Their future replacement should meet CPTED[18] principles.

There are two existing pathway overpasses crossing 22nd Street near the study area and one proposed.

- 300m east of Confederation Drive, connecting the Mount Royal and Meadowgreen neighbourhoods.

[15] Assessment of Ring Road Warrants, Alberta Transportation, 2012
[16] BRT Redline, Plan for Growth, BRT Routes and Stations, Preferred Configuration, October 2017
[17] Active Transportation Plan, Final Report, June 2016, Figure 22
[18] CPTED: Crime Prevention Through Environmental Design

- 1.75 km west of Confederation Drive, connecting the Pacific Heights neighbourhood with the Shaw Centre.
- The proposed Confederation Transit Village[19] includes a centrally located pedestrian overpass of 22nd Street connecting the two shopping areas.

The proposed overpass would benefit the performance of both the Confederation Drive and Diefenbaker Drive intersections with 22nd Street and would be well received by the two business areas affected by the changes to Circle Drive, as well as the surrounding neighbourhoods. However, Saskatoon still intends to include at-grade pedestrian crossings.

2.7 Urban Development

+ City of Saskatoon – Projected Growth Concept Plan

The figure shown in **Appendix C** outlines the projected growth areas along Saskatoon's perimeter, including the *Saskatoon North Partnership for Growth* (P4G)'s outlines for the 700,000 and 1M regional population horizons.

+ Blairmore Growth Area

22nd Street extends west of the study area to the large future Blairmore Growth Area. Saskatoon's Long-Range Planning webpage defines the Blairmore Sector Plan as follows:

> *In 2005 the City's boundary was altered to include an additional 2,078 ha on the west edge of the City to accommodate the growth of the Blairmore Suburban Development Area. The Blairmore Suburban Development Area currently has land sufficient for eight neighbourhoods, a suburban centre, and a district commercial centre. The Blairmore Sector could have approximately 70,000 people within its boundaries at full build-out.*
>
> *Other projects in the Blairmore area include the Kensington neighbourhood. Kensington's Neighbourhood Concept Plan was approved by City Council in 2012.*

At full build-out, 70,000 additional people represents a 25% population increase for Saskatoon based on its 2021 population (not including other sector plans). Locating all these people, and future commuters, at the west end of 22nd Street will represent a significant increase in trip generation, split between BRT/transit and passenger vehicles.

+ The Confederation Suburban Centre Shopping Area

The shopping centre straddles 22nd Street immediately east of Circle Drive, extending from Laurier Drive on the north to Fairlight Drive on the south. Its overall size (approximately 40 hectares) makes it a regional shopping destination. The Saskatoon Growth Plan[20] identifies the Confederation Suburban Centre as having significant redevelopment potential as a Transit Village. It is:

> "*A large, suburban hub with long-term potential to redevelop into a mixed use, transit-oriented node with future rapid transit on 22nd Street*".

[19] Transit Villages Report, Appendix 2, Confederation Demonstration Plan
[20] City of Saskatoon, Growing Forward, Technical Report, 2.0 Corridor Growth, February 2016

Transit Villages Report[21]

Urban Transit Villages are existing single-use commercial centres [including the Confederation Mall] that have been constructed over the past 10 to 50 years. As Saskatoon makes investments in BRT and updates the planning policy that applies to these sites, it is anticipated that they will be prime candidates for infill, intensification, and diversification of land use following principles of transit-oriented development.

+ Agpro Industrial Cluster

The Agpro industrial cluster, including a Viterra grain terminal, is located along 11th Street west of Circle Drive. It attracts truck traffic through the study area and its location next to the rail lines suggests there is opportunity for continued growth.

2.8 Railways

A north-south CN rail line and an east-west Canadian Pacific (CP) rail line intersect on an overpass of Circle Drive a short distance south of Clancy Drive. The north-south CN rail line runs immediately east of and parallel to the length of Circle Drive West, including an overpass of 22nd Street immediately east of its interchange with Circle Drive. 11th Street, 22nd Street, and 33rd Street each cross the parallel CN rail line, but there are no other local road crossings in between. The proximity of the rail line constrains the upgrading of Circle Drive and also serves as the boundary with the residential neighbourhoods to the east of Circle Drive.

2.9 Utilities

A north-south Saskatoon Light and Power transmission line extends from Dundonald Avenue, south of 11th Street, north along the east side of Circle Drive (immediately west of the CN line), to opposite a substation on Camponi Place west of Circle Drive, 500m south of 22nd Street. The transmission line continues north along the east side of Circle Drive to 400m north of 22nd Street, where the line crosses to the east of the CN rail line.

There is a SaskTel Facility at the north end of Camponi Place, west of Circle Drive, 300m south of 22nd Street. There are two cell towers, one on the SaskTel property and one 150m to the north, in the southwest quadrant of the Circle Drive/22nd Street interchange.

2.10 Parkland and Greenspace

There are three parks in the study vicinity that constrain roadway upgrading.

+ William A. Reid Park

The William A. Reid Park is located in the northwest quadrant of 11th Street and Circle Drive West. This park limits the options affecting the development of both the Clancy Drive and 11th Street interchange configurations.

+ Charlottetown Park

Charlottetown Park is located along the boundary between Massey Place and the Confederation Shopping Centre district. This park limits the options to modify Laurier Drive, and the associated access management, in support of grade separating Laurier Drive's connection with Circle Drive.

[21] City of Saskatoon, Transit Villages Report, Appendix 2, December 2019

+ Atlantic Park

The Atlantic Park is located in the northwest quadrant of 22nd Street and Diefenbaker Drive. Although outside the study area, this park limits the options for upgrading the intersection between these two arterials.

2.11 Stormwater Management

In general, the as-built stormwater management information received[22] provided a thorough overview of the stormwater infrastructure along 22nd Street West, the 22nd Street/Circle Drive interchange, and the 11th Street/Circle Drive interchange. The Stormwater Drainage As-Built Information Mapping of the larger study area (see **Appendix D**) shows where the information received applied and broke it into three categories.

- Much of Circle Drive West drains toward a 2100mm trunk which runs north-south under Confederation Drive from Laurier Drive, through the north mall to Fairmont Drive before turning towards Circle Drive at Clancy Drive and south towards the South Saskatchewan River.
- In the red area along Circle Drive and the yellow area directly west of Clancy Drive, Saskatoon's database does not show any underground storm infrastructure within Circle Drive, therefore the roadway must drain overland into the adjacent ditches and flow towards low points where it can enter the storm sewer through catch basins.
- The 2100mm trunk heading south along Fairmont Drive is over capacity and does not meet Saskatoon's current design standards of handling a one in two-year storm. This also applies to the dry pond within Charlottetown Park which similarly does not have any capacity for additional runoff volume.

  The December 2019 Transit Villages Report reported frequent flooding at the intersection of Confederation and Laurier Drives.
- Additional runoff created by changes to the roadway/catchment area would require storm water management (such as additional storage) in order to maintain the current release rate into the system. Major system storage is typically designed for a 100-year return period as per City design standards.
- The Charlottetown Park dry pond is located northeast of the Laurier Drive and Confederation Drive intersection. The City provided CAD drawings and the information regarding high water levels, but not the pond's design report. The information supplied did not help resolve the existing capacity and flooding issues in the study area.

Recommendations

A standard approach would be to quantify the increment and identify how the required retention could be accommodated. This would be a relatively straightforward approach; however, would be irrelevant without first addressing the larger study area's underlying stormwater management issues and associated storage requirements.

[22] Information received from Saskatoon Water, Utilities & Environment.

3. Problem Definition

This section summarizes the key issues identified by the review of site conditions and constraints that led Saskatoon to initiate the study and that pose the greatest challenges for the solution-finding.

+ Circle Drive South

Construction of Circle Drive South completed the last gap in Circle Drive and connected 22nd Street West and Idylwyld Drive across the South Saskatchewan River. This connection redistributed traffic flows in Saskatoon's road network, including Circle Drive West, by diverting flows away from Idylwyld Drive and the downtown. This increased congestion levels and safety concerns along Circle Drive West between 11th Street and 33rd Street because of the two signalized intersections between three interchanges, with turning movements alternating between the left and right-hand sides of the roadway.

Conclusion: Existing Circle Drive West (with traffic signals) was not intended to function as a high volume through-route, accommodating the increasing traffic volumes now experienced as a complete circulatory road.

+ Circle Drive West

Upgrading Circle Drive West to freeway standards is constrained by three conditions, which include the short intersection/interchange spacing, the highly unconventional Circle Drive/22nd Street interchange configuration, and the exceptionally short offset along 22nd Street between Circle Drive and Confederation Drive.

Conclusion: To achieve full freeway standards and retain all current movements along Circle Drive West would require complex and costly measures.

+ Design Consistency

The mix of right-hand (freeway) and left-hand (expressway) exits challenges driver behaviour and leads to poor safety outcomes, increasing weaving maneuvers and truck traffic in both travel lanes. This condition, and the associated collision potential, is exacerbated by the curvilinear design along Circle Drive West and will increase with traffic volumes.

Conclusion: A safe freeway facility is best achieved using consistent design standards throughout the corridor.

+ Highway Network

The future Saskatoon Freeway will not include a southwest leg crossing the South Saskatchewan River. Therefore, 22nd Street and Circle Drive West/South will connect the south end of the future Saskatoon Freeway (and Highways 7, 14 & 60) with Highways 11, 16 & 219 South.

Conclusion: 22nd Street and Circle Drive West/South will play a long-term role in the provincial (and National) highway network, emphasizing the need to achieve high mobility and design standards.

4. System Requirements

Section 4 describes the design context and requirements for both Circle Drive West and 22nd Street West.

4.1 Overview

This section outlines the high-level parameters that guide development of the upgrading plan.

+ Planning and Design Context

The design of high-speed roadways requires baseline geometric and safety standards. These standards must be applied consistently. Circle Drive's design parameters are defined by its role as a core route (inner circulatory road) in Saskatoon's overall road network, and it must achieve the corresponding design consistency to be a safe facility. However, to achieve freeway standards and retain all current movements along Circle Drive West would require highly complex and costly measures; and would expand the right-of-way requirements, potentially impacting the power transmission and CN rights-of-way, as well as parkland spaces and private development. Expanding the right-of-way is therefore not a preferred option.

+ Roadway Classification

Circle Drive West and 22nd Street West are classified as Freeway/Expressway facilities by Saskatoon's Transportation Master Plan (TMP) and are intended to achieve high design speed and access management standards. Access to Circle Drive West will be via interchanges only. Access to 22nd Street West will be via public road intersections only, with intersections spaced to protect its higher posted speed.

+ Interchange Spacing (Circle Drive)

Minimum interchange spacing along Circle Drive West is preferably 1.5 km to adequately accommodate the merge/diverge maneuvers and to avoid short weaving zones. This is a challenging standard to achieve along Circle Drive West and the short existing spacing would commonly require costly features, e.g., basketweave structures or collector/distributor lanes.

+ Intersection Spacing (22nd Street)

Intersection spacing along 22nd Street, west of Circle Drive, should facilitate signal progression, estimated at 400m for a 60 km/h posted speed. Generous spacing is important to minimize turbulence and facilitate lane selection in advance of turning movements. This cannot be achieved between the Circle Drive and Confederation Drive intersections, requiring unique solutions.

+ Roadway Cross-Section

The existing CN/CP and 11th Street underpasses are recognized as constraints; however, an ultimate six-lane cross-section (3 lanes each way) is assumed for Circle Drive through the entire study area. The three existing underpasses will eventually (e.g., 30 years in the future) be widened.

As the primary corridor entering Saskatoon from the west, Saskatoon is protecting 22nd Street to ultimately achieve six core lanes (3 lanes each way). The existing CN overpass crossing 22nd Street immediately east of Circle Drive will need to be lengthened to accommodate a six-lane 22nd Street and two multi-use pathways when the Circle Drive West project proceeds.

+ Planning Horizon

The overall plan to upgrade Circle Drive West, including the 22nd Street intersection with Confederation Drive, is considered long-term, potentially decades away. City staff provided peak hour traffic forecasts for 2 population horizons (3 scenarios).

1. 500,000 population with the Saskatoon Freeway.
2. 400,000 population with the Saskatoon Freeway.
3. 400,000 population without the Saskatoon Freeway.

4.2 Design Standards

An upgraded Circle Drive West should achieve a 100 km/h design speed, 90 km/h posted speed. The associated design criteria have been established based on the following hierarchy of reference documents:

1. City of Saskatoon Design and Development Standards – Volume 8 Transportation System (Version 11)
2. City of Saskatoon Complete Streets Design & Policy Guide (September 2017)
3. City of Saskatoon Specifications & Standard Drawings (February 2019)

Where specific information was not available within the City of Saskatoon's standards and guidelines, the following documents were utilized to supplement the design criteria for the project:

4. Transportation Association of Canada Geometric Design Guide for Canadian Road (TAC-GDG, 2017)
5. Saskatchewan Highways and Infrastructure Geometric Design Guide Supplement Interim (September 2018) and Design Manual Volume 2 (October 2017)

The design criteria are presented in **Appendix E**. The design criteria served as the starting point for the functional design along the corridor and may be refined as the project progresses through future stages.

4.3 Proximity to CN Rail Right-of-Way

The CN rail right-of-way is close to the east side of an expanded Circle Drive cross-section, particularly at the proposed grade separations for Clancy and Laurier Drives. The three apparent options include right-of-way acquisition, easements, or full avoidance (minimizing impact). The potential cross-section options to address the right-of-way requirement affecting CN's lands were considered at Clancy Drive, with Clancy Drive under Circle Drive, which assumes snow clearing along potential C/D roads to one side only and are shown in **Appendix F**.

+ **Option XS-1:** Drop the C/D roads, grading design affects the CN lands.

  Three geometric configurations were considered:

  1. A1 – Semi-Rural Cross-Section requiring a 12m encroachment into CN right-of-way.
  2. A2 – Urban Cross-Section, two options:
     a. Backslope with ditch requiring a 6m encroachment into CN right-of-way.
     b. Backslope accommodating a boulevard and localized trail for crossing Circle Drive, requiring a +/- 1m encroachment into CN right-of-way.

There were two options regarding right-of-way acquisition:

a. Acquire land from CN wherever possible to accommodate the backslopes, short of impacting the rail line; or

b. Secure agreements/easements from CN to allow the backslopes to exist within CN-owned lands. Retaining walls may still be required in the future if CN requires the affected lands.

+ **Option XS-2:** Drop the C/D roads and use retaining walls to avoid CN lands.

Two geometric configurations were considered.

1. B1 – Semi-Rural Cross-Section with no encroachment.
2. B2 – Urban Cross-Section with no encroachment.

Both options posed similar right-of-way implications. Impacts to CN lands were minimized, or eliminated where possible, by using retaining wall structures. Temporary construction easements may still be required.

+ **Option XS-3:** Drop Circle Drive and use retaining walls to avoid CN lands.

Roadway Maintenance

Saskatoon's maintenance/operations group was consulted regarding any implications associated with depressed cross-sections, e.g., snow clearing. Their group could work with a 3.0m shoulder on the mainline and a 2.5m shoulder along C/D roads. Whatever solution is selected, it was important that snow clearing be considered by the functional plan, identifying any additional maintenance considerations associated with the preferred plan to understand unique future maintenance procedures and associated costs.

Conclusion

City staff indicated support for solutions that avoid acquiring right-of-way from CN, the exception being a temporary construction easement. The easement area could then be graded to drain towards Circle Drive. This requires the use of retaining walls. Assuming all design and safety requirements are met, Saskatoon prefers the lower-cost solutions.

4.4 Network Connection with the Saskatoon Freeway

+ Introduction

Saskatoon plans to maintain/upgrade 22nd Street as an urban arterial corridor, including multi-modal features, e.g., BRT and multi-use pathways. The absence of a southwest leg in the future Saskatoon Freeway may have long-term implications for 22nd Street. Traffic approaching from the north on the future Saskatoon Freeway and from the west on Highways 7, 14 and 60 will use 22nd Street and Circle Drive West/South as the *de facto* missing leg in what would otherwise have been a provincial circulatory road.

Conclusion: In the absence of a southwest leg in the Saskatoon Freeway, it is the performance of Saskatoon's road network that will be increasingly at risk as local and regional traffic volumes grow. 22nd Street and Circle Drive West/Southwest will both play a long-term role in the provincial highway network.

+ Background Study

Ministry of Highways (MoH) collaborated with Saskatoon on the *West Connector Route Feasibility Study* (WCRFS) Stantec, June 2016. The study considered the development of interim connector routes around Saskatoon's west perimeter, prior to construction of the northwest leg of the proposed Saskatoon Freeway. Figure 3.1 in the WCRFS shows three southern connector options, intended to bridge the gap between the first Phase of the Saskatoon Freeway (the north leg east of Highway 16) and Saskatoon's existing south Circle Drive. The connectors were intended to divert traffic around Saskatoon and reduce volumes using an already congested Idylwyld Drive through central Saskatoon or following a circuitous path along east Circle Drive. Drivers may also avoid following an even longer route along the east Saskatoon Freeway in the future.

In the June 2016 figure, the south terminus of the Saskatoon Freeway's west leg was shown as Highway 14 (22nd Street). The currently proposed south terminus of the Saskatoon Freeway is the intersection of Highways 7 and 60, almost 4 km further south.

+ Conclusions

The WCRFS suggested the following as a Future Consideration for the Saskatoon Freeway:

> *There was consensus that there may be a feasible and more preferred connection for the Saskatoon Freeway. Should the southern (S3) option be selected for the West Connector Route, it would appear logical to connect the southwest leg of the Freeway to the intersection of Highway 60/Highway 7, which could then connect to the south leg of the West Connector Route.* ***Doing so would provide a southern connection onto Circle Drive South and complete the Saskatoon Freeway connectivity with a southern leg.***

22nd Street is the default connector route between the south end of the west Saskatoon Freeway and Circle Drive. It is understood that Saskatoon intends to develop 22nd Street as a more 'multi-modal' urban arterial corridor. Therefore, based on the 2016 assessment, a connection with the southwest leg of Circle Drive would complete the Saskatoon Freeway.

A designated connector between the future northwest leg of the Saskatoon Freeway and Circle Drive is expected to be a long-term need and only presents planning requirements at this time; however, planning should be initiated soon to permit protection of the needed right-of-way and early involvement with affected stakeholders.

+ Recommendations:

Although a long-term requirement, a decision should be made soon, in conjunction with MoH and the Rural Municipality (RM) of Corman Park, to conduct a planning study leading to identification of a connecting link between the south end of the west Saskatoon Freeway and Circle Drive.

Since it is understood that no actions were taken as a result of MoH's West Connector Route Feasibility Study, Saskatoon should consider approaching MoH regarding their involvement in a southwest (final) link in the Saskatoon Freeway (as it was described by MoH's 2016 study).

5. Preliminary Options

This section describes the initial options considered for upgrading Circle Drive to freeway standards, including the Circle Drive / 22nd Street interchange.

5.1 Retain the Existing Circle Drive Mainline

This section addresses options that retain the existing Circle Drive mainline alignment and interchange with 22nd Street. This was the starting point to determine if there was a cost-effective solution that could salvage much of the existing Circle Drive infrastructure.

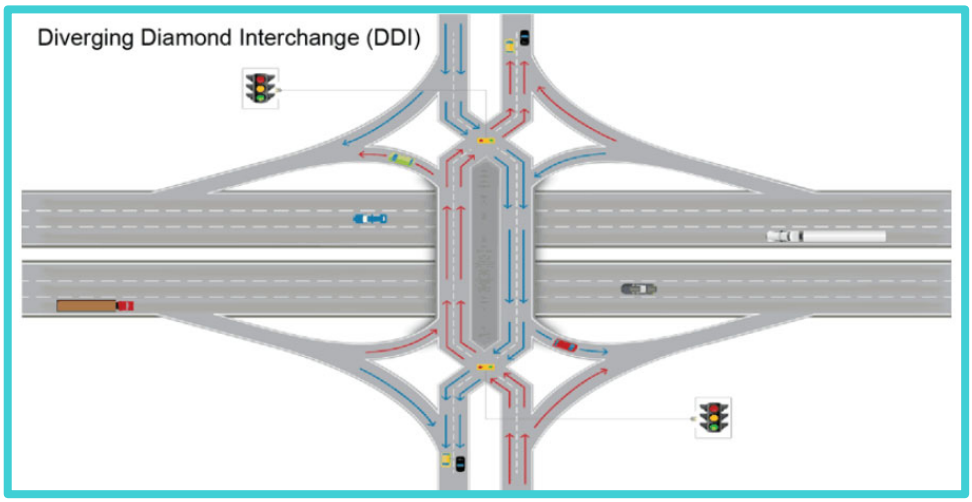
5.1.1 22nd Street Interchange Options

The development of potential options for the Circle Drive/22nd Street/Confederation Drive junction, largely west of Circle Drive, would have a significant effect on traffic patterns and access affecting the large commercial areas (and future Transit Village) on both sides of 22nd Street.

The interchange options were developed based on achieving free-flow travel along Circle Drive, retaining the existing turning movements, and retaining the existing lower-speed mainline alignment and structures.

Four potential Diverging Diamond Interchange (DDI) configurations were prepared. The options differ in which existing movements were accommodated at Confederation Drive and by the associated connecting roadway configurations. The options developed could be accommodated by the existing opening under Circle Drive. **Figure 5.1** shows a schematic of a DDI layout.

Figure 5.1 : Schematic of Diverging Diamond Interchange



+ **Acronyms:**
  - DDI: Diverging Diamond Interchange configuration
  - SPUI: Single Point Urban Interchange configuration
  - Parclo: Partial Cloverleaf Interchange configuration
  - C/D: Collector/Distributor Road parallel to Circle Drive
  - BRT: Bus Rapid Transit

Features common to all four options:

- The east ramp terminal configurations are the same and meet current DDI practice.
- The existing southbound ramp from Circle Drive to northbound Confederation Drive is modified to include the eastbound movement onto 22nd Street. The current circuitous jughandle turning movement from southbound Circle Drive to Fairmont Drive to reach 22nd Street from the south becomes redundant.
- The southbound-to-westbound ramp to Fairmont Drive is retained for two purposes. This ramp (no longer a jughandle function) retains the existing relatively direct access to the Fairhaven community, and it replaces the existing direct westbound/southbound access from the Confederation Drive intersection onto the east end of Fairlight Drive and the commercial area south of 22nd Street. The direct connection to Fairlight Drive was not compatible with the DDI configuration.
- The direct connection from Confederation Drive to Circle Drive southbound is removed and rerouted.
- The westbound right-turn from 22nd Street to the south mall area is rerouted.
- The northbound exit ramp from Circle Drive to 22nd Street opposite Confederation Drive and the eastbound-to-northbound loop ramp are removed, and the movements replaced.

The concepts were preliminary and draft, for discussion purposes only. The above interchange options were combined with the Circle Drive options discussed in Section 5.1.2. The Circle Drive options are shown in **Appendix G**. They have not been tested by traffic modelling. The differences between the four options are:

- **Option DDI-1**

  The unique feature is the southbound-to-eastbound turning movement (southbound Confederation Drive to eastbound 22nd Street) using a long slip-lane located opposite the end of the exit ramp from existing Circle Drive southbound connecting with Confederation Drive northbound.

- **Option DDI-2**

  The unique feature is a ‘Michigan Left-Turn’ (a ‘U-turn’) accommodating turning movements from westbound 22nd Street and southbound Confederation Drive to southbound Circle Drive (and eastbound 22nd Street). This replaces the slip lane in Option DDI-1.

- **Option DDI-3**

  The unique feature is a new structure under the elevated ramp from Circle Drive southbound to 22nd Street westbound. This new structure accommodates access onto 22nd Street eastbound from both Circle Drive southbound and Confederation Drive.

  A second feature is the turning movement from eastbound 22nd Street to northbound Confederation Drive. It is a separated (long) left-turn slot that begins west of Fairmont Drive to eliminate weaving across three through lanes between Fairmont and Confederation Drives.

- **Option DDI-4**

  The unique features are the C/D roads parallel to 22nd Street and a service interchange at Diefenbaker Drive. The C/D roads (or one-way service roads) improve access to the commercial areas and permit upgrading the west ramp terminal at Circle Drive to only the conventional movements, meeting current DDI practice. Although Saskatoon does not generally support

interchanges at the intersection of two arterials, 22nd Street may have been an exception. The absence of a southwest leg in the future Saskatoon Freeway may have long-term implications for 22nd Street.

The four preliminary DDI concepts along 22nd Street were developed in an incremental fashion. Each new version attempted to address a shortcoming or challenge in the previous version. These options reflect a general geometric fit but did not necessarily accommodate all existing movements, since movements on/off Circle Drive to/from 22nd Street take precedence. Local access movements were eliminated in some locations, resulting in some new traffic patterns. The new patterns would need to be accommodated by upgraded connections along Diefenbaker, Laurier, or Clancy Drives.

The two current restrictions along Circle Drive were retained; traffic entering Circle Drive northbound at Clancy Drive cannot immediately exit at 22nd Street, and traffic entering Circle Drive northbound from 22nd Street cannot immediately exit at Laurier Drive. This is consistent with Best Practices for freeway planning, which do not support short local trips on/off a freeway facility.

Comments:

+ More conventional movements were restored to the Circle Drive/22nd Street interchange, recognizing that some commercial access trips may be rerouted as a result.
+ Where the southbound movement from Confederation Drive to eastbound 22nd Street is retained, its capacity is expected to be exceeded. There would need to be some redistribution of turning movements generally, and that may include this movement where demand exceeds capacity.
+ Worobetz Place is a public road that enters the Confederation Mall from Diefenbaker Drive. It is approximately 170m long. For DDI options that reroute some movements to Diefenbaker, Worobetz Place may need to be extended east as an established roadway through north mall lands to intersect Confederation Drive.
+ 22nd Street will ultimately achieve six core lanes (3 each way). There is a challenge in the westbound direction where the southbound-to-westbound ramp joins 22nd Street too close to Diefenbaker Drive. The additional lane would significantly complicate an existing weave condition for ramp traffic wishing to turn left at Diefenbaker Drive.
+ The future BRT may ultimately occupy a dedicated lane each way along 22nd Street.
+ The combined Circle Drive/22nd Street concepts considered the continuity of the multi-use paths.

DDI-3 appeared to be the preferred concept overall. Saskatoon's evaluation process did not result in a large spread in ranking across the four interchange concepts. The DDI concepts along 22nd Street were prepared independent of the C/D Road concepts along Circle Drive. The C/D Road concepts were modified to be compatible with the DDI concepts.

5.1.2 Circle Drive Options

The four DDI interchange options were combined with C/D road options along the east side of Circle Drive West, parallel to the CN line. The plans discussed in this section are shown in **Appendix G**.

+ **CIR-1: Partial C/D Roads**

  The following three options each present a unique variation. 1A is the base case and 1B and 1C are shown using insets on the CIR-1 plan.

  - Option 1A: DDI with two southbound left-turns from Confederation Drive.
  - Option 1B: DDI with a southbound tunnel under 22nd Street from Confederation Drive.
  - Option 1C: DDI with a roundabout on Confederation Drive north of 22nd Street.

+ **CIR-2: Two-Way C/D Roads**

  The following four options each present a unique variation. 2A is the base case and 2B, 2C and 2D are shown using insets on the CIR-2 plan.

  - Option 2A: DDI with C/D Road east of Circle Drive; Two southbound left-turn lanes from Confederation Drive.
  - Option 2B: DDI with C/D Road crosses Circle Drive on a skew north of Laurier and Clancy Drives.
  - Option 2C: DDI with a roundabout on Confederation Drive north of 22nd Street (combined with options 2A or 2B).
  - Option 2D: Parclo interchange at Circle Drive and 22nd Street (combined with options 2A or 2B).

    Access from 22nd Street eastbound to Fairmont Drive is modified to right-off/right-on.

+ **CIR-3: Two-Way C/D Roads**

  The following two options both present a unique variation. 3A is the base case and 3B is shown using an inset on the CIR-3 plan.

  - Option 3A: SPUI located on the 2-way C/D road at 22nd Street.
  - Option 3B: Partial SPUI located on the 2-way C/D road at 22nd Street.

5.1.3 Laurier Drive and Clancy Drive Interchanges

Placing half-diamond interchange configurations at Laurier and Clancy Drives recognized that these two intersections are located too close to 22nd Street to permit construction of conventional interchanges, leading to complex solution-finding. The half-diamond configurations (to the north at Laurier and to the south at Clancy) significantly reduced the complexity and cost of the concepts along Circle Drive, by mitigating the proximity to 22nd Street.

The half-diamond interchange configurations should not significantly introduce circuitous travel for local residents. Drivers north of 22nd Street could continue to use Laurier Drive to travel to/from the north on Circle Drive; however, 22nd Street would provide access to Circle Drive South. Drivers south of 22nd Street could continue to use Clancy Drive to travel to/from the south on Circle Drive; and 22nd Street would provide access to Circle Drive North.

The half-diamond configurations were included in the solution finding, resulting in Circle Drive Options **CIR-1H, CIR-2H, and CIR-3H**. All three options included a northbound connection from Clancy Drive to

22nd Street and from 22nd Street to Laurier Drive, potentially keeping traffic off of 22nd Street under Circle Drive. See **Appendix G**.

5.1.4 Conclusions

The three concepts (and various sub-options) presented a complex and costly upgrading project. The selected plan would be accompanied by a comprehensive signing plan to ensure driver workload and human factors are addressed. Although DDI interchange configurations are being implemented across Canada, including Regina, city staff expressed concern that many drivers in the Saskatoon region have little experience with traffic systems this complex. These solutions may represent too great a departure from current traffic operations in the City of Saskatoon and region.

In addition, these options retained the existing lower design speed along the Circle Drive mainline crossing 22nd Street.

In response, options were developed to replace the existing 22nd Street interchanges as described in Section 5.2.

5.2 Replace the Existing Circle Drive Mainline

5.2.1 Introduction

Concept Option CIR-3 incorporated a SPUI instead of DDI at the interchange with 22nd Street. However, the SPUI was placed on the two-way service road between Circle Drive and the CN line because the existing two mainline Circle Drive structures are too close to the Confederation Drive intersection. Overall, this concept was viewed as being more readily embraced by local drivers than the other options.

The existing Circle Drive / 22nd Street interchange was constructed before Circle Drive was extended south across the South Saskatchewan River. The primary turning movement accommodated by the existing configuration is eastbound-to-northbound and return. The northwest portion of Circle Drive was initially seen as a bypass (from the north to the west and return) of Saskatoon's congested Idylwyld Drive and downtown; however, this plan did not adequately consider Circle Drive's ultimate function as an inner circulatory road and the revised traffic demands that this would place on its interchange with 22nd Street.

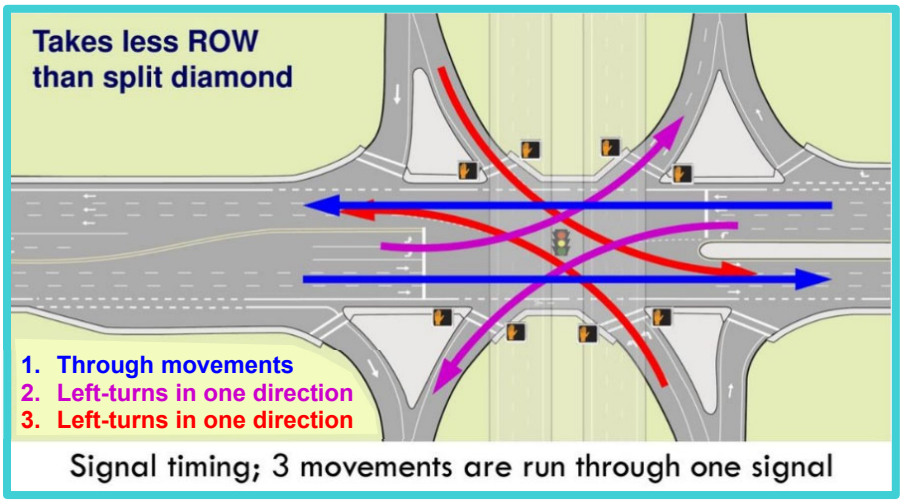
Upgrading concepts developed above were based on two assumptions, retaining all existing turning movements along Circle Drive and preserving the existing bridges crossing 22nd Street (only 20 years old). These two requirements exacerbated the cost and complexity of the concepts developed thus far. Simpler, less complex, concepts may be developed based on abandoning the two existing structures and straightening the Circle Drive alignment crossing 22nd Street.

5.2.2 22nd Street – Single Point Urban Interchange

+ Option CIR-4

A Single Point Urban Interchange (SPUI) configuration was developed for comparison with the existing three options considering reduced complexity and an improved Circle Drive alignment. This removed the existing south-bound ramps into the Confederation Mall and 22nd Street West; however, the jughandle to Fairmont Drive was retained because of community interests. **Figure 5.2** shows a schematic of a SPUI interchange layout.

Figure 5.2 : Schematic of Single Point Urban Interchange



To reduce complexity and costs, Option CIR-4 also included the half-diamond interchange configurations at Laurier and Clancy Drives. See **Appendix G**.

Conclusions:

1. Option CIR-4 was preferred, subject to traffic modelling and analysis outcomes.
2. Option CIR-4 included the southbound ramp from Circle Drive to Fairmont Drive, utilizing the existing northbound Circle Drive structure.
3. Option CIR-4 included the half-diamond interchange configurations at Laurier and Clancy Drives.
4. To reduce increased complexity and cost, a northbound connection from Clancy Drive to 22nd Street and from 22nd Street to Laurier Drive, potentially keeping traffic off of 22nd Street under Circle Drive was not included in Option CIR-4 at this stage of the solution-finding[23].

5.3 Laurier Drive Access Management

Existing development along the north side of Laurier Drive includes accesses to four individual parcels at 100m, 120m, 160m, 180m, and 200m from the existing intersection with Circle Drive. Since the Circle Drive profile cannot absorb the full depth of the grade-separation, these accesses would have to be reconfigured/relocated to accommodate raising Laurier Drive approaching Circle Drive. This poses significant change for the two properties.

Three access management options were considered to permit raising Laurier Drive over Circle Drive. **Appendix H** shows three early preliminary options.

1) **LAU-1: Backage Road, accesses moved to the rear of the affected properties**

   Reorient the accesses via a public “backage road” through city-owned lands (Charlottetown Park) to the west and north of the affected parcels. This would require reorienting traffic patterns and probably expanding a City parking lot to the north of these lands. Access is consolidated to a signalized intersection east of the transit terminal.

[23] Note: Following Open House #2 a northbound C/D road connection from Clancy Drive to 22nd Street was included in the final recommended plan.

This is the technically preferred option, with access consolidated to one signalized intersection on Laurier Drive. However, the loss of existing park space is not acceptable and this option was rejected.

2) LAU-2: Frontage Road, tight to affected buildings, narrower Laurier Drive

Reorient the accesses via a "frontage road" requiring land acquisition with at least three of the buildings becoming non-compliant with their setback to a public road. The frontage road (with sidewalk) would almost abut three of the buildings. Access is consolidated to two closely spaced 'T' intersections with a pair of synchronized traffic signals.

The roadway's close proximity to buildings is not desirable and this option was rejected.

3) LAU-3: Frontage Road, partially realigning Laurier Drive onto north mall lands

Realign Laurier Drive southerly onto Confederation Mall lands. The building setbacks to Laurier Drive would remain as they are today. Access is consolidated between the two affected properties.

This is the preferred plan, using private property, not park space; however, it assumes that Saskatoon can provide the Confederation Mall with replacement lands nearby, from surplus lands near the Circle Drive/22nd Street interchange.

Conclusion: The final plan eliminated the frontage road concept shown in Option 3 and elevated Laurier Drive over Circle Drive. The embankment extended onto mall property and placed a shared access between the two properties closest to Circle Drive. The access is a ramp-like design that could be improved by shifting the elevated Laurier Drive further onto mall property. The final Laurier Drive access management plan is shown on the final functional plans and is not included in **Appendix H**.

5.4 Fairlight Drive at 22nd Street

The Confederation Drive/22nd Street intersection became a 'T' configuration with preferred Option CIR-4 (and ultimately the Recommended Plan). The south leg is unused. The 'T' configuration is more efficient for 22nd Street than an all-movement intersection. It is expected that some area residents and business owners may request that Fairlight Drive be connected to 22nd Street, opposite Confederation Drive, occupying the empty south leg, however, this would significantly reduce intersection performance.

Saskatoon confirmed that a portion of the road right-of-way along Fairlight Drive, between Fairmont Drive and Confederation Drive, has been released for use by the West Winds Primary Health Centre. The remaining road right-of-way (approximately 12.5m wide) is substandard and too narrow to adequately accommodate a standard two-way roadway cross-section as well as an all-movement access to the West Winds Centre.

+ Existing Conditions

- The south leg of the Confederation Drive intersection accommodates a southbound connection to the east end of Fairlight Drive from both Confederation Drive and 22nd Street.
- Traffic from Fairlight Drive to the north mall crosses 22nd Street at Diefenbaker Drive.
- Eastbound traffic from Fairlight Drive follows Fairmont Drive to turn right onto 22nd Street.
- Northbound traffic continues from the right-on movement to 22nd Street to the eastbound-to-northbound loop ramp onto Circle Drive.
- Southbound traffic from Fairlight Drive follows Fairmont Drive to Clancy Drive to Circle Drive.
- The jughandle configuration from southbound Circle Drive brings traffic directly to Fairmont Drive.

+ **Preferred Plan**

  – The higher-volume and congested 22nd Street results in more traffic delay than Circle Drive. Creating a 3-legged intersection at Confederation Drive considerably improves the east-west movement along 22nd Street. The ramps off/on Circle Drive are moved to the new SPUI interchange and the access to Fairlight Drive was removed.

+ **Changes to Travel Paths**

  – Southbound traffic returning to Fairhaven from the Confederation north mall area will need to follow 22nd Street and turn left (south) at Diefenbaker Drive; or reach Diefenbaker Drive directly from the north mall and travel south across 22nd Street.

Conclusion: A one-way southbound connection from 22nd Street to Fairlight Drive was not included in preferred Option CIR-4. This would require an additional westbound left-turn slot, complicate the signal phasing and significantly reduce efficiency along 22nd Street. Maintaining long-term efficient east-west traffic flow along 22nd Street is a significant operational challenge.

6. Preliminary Traffic Analysis

This section outlines the results of the preliminary traffic analysis for Circle Drive **Option CIR-4**, a Single Point Urban Interchange (SPUI) concept at Circle Drive West and 22nd Street, including the adjacent 22nd Street intersection with Confederation Drive. Traffic analysis was performed at this stage of project development to help inform the information presented at Open House #2.

6.1 Introduction

Option CIR-4 (see Appendix G) was preferred, subject to traffic modelling and analysis outcomes, and was analyzed here. The SPUI concept was initially developed for comparison with the previous options (which retained the existing bridge structures) considering cost and complexity, based on an improved Circle Drive alignment. Option CIR-4 replaces, rather than upgrades, the existing interchange.

The existing southbound Circle Drive ramps into the Confederation Mall and onto 22nd Street West are removed; however, the jughandle to Fairmont Drive was retained (utilizing the existing northbound Circle Drive structure) because of the long-established community and business interests. To further reduce cost and complexity, this concept includes half-diamond interchange configurations on Circle Drive at Laurier and Clancy Drives. Best practices would simply remove the Laurier and Clancy Drive connections completely.

The following summarizes the analysis performed for the tentative Option CIR-4 road network in the vicinity of Circle Drive West and 22nd Street.

6.2 City Modelling Inputs

Saskatoon provided AM and PM peak hour traffic forecasts for 2 population horizons (3 scenarios):

- 500,000 population with the Saskatoon Freeway,
- 400,000 population with the Saskatoon Freeway, and
- 400,000 population without the Saskatoon Freeway.

In addition, Saskatoon provided a select-link analysis for 22nd Street approaching Diefenbaker Drive to help understand the origins and destinations of traffic approaching this intersection via Circle Drive.

6.3 Analysis Undertaken

The 2 peak hours for each of the 3 forecast scenarios were analyzed in detail using Synchro 10 for the following intersections:

- Circle Drive & 22nd Street
- 22nd Street & Confederation Drive
- 22nd Street & Diefenbaker Drive

Synchro analysis was used to optimize the signal timings for each scenario. A common cycle length and coordinated timings were developed for the three-intersection network. Pedestrian crossing intervals were estimated and accounted for in the signal timing optimization.

HCS 7[24] was used to evaluate the merge and diverge segments along Circle Drive at its interchanges

[24] HCS: Highway Capacity Software

with Laurier Drive, Clancy Drive and 22nd Street.

6.4 Analysis Results

The peak hour traffic volumes (vehicles per hour) approaching the interchange for the 500,000 population horizon are 2600/2200 (AM/PM) on the west leg; 1600/2900 on the east leg; 600/800 on the north leg and 800/1200 on the south leg. It is interesting to note that the east-west 22nd Street volumes are roughly three times higher than the north-south Circle Drive volumes. This difference may not be as great based on average daily traffic volumes or weekend volumes, but these represent the design hour for planning purposes.

With the tentative Option CIR-4 network geometry and the forecast traffic volumes, the same operating problems are indicated for all 3 scenarios (2 population horizons). In general, the same movements experience problems in both the AM and PM peak hours, with slightly worse performance in the PM.

- Circle Drive at 22nd Street (SPUI interchange configuration)

  LOS 'C' ['B' AM]: No movements were overcapacity. The eastbound left-turn and the west-bound-through volume-to-capacity (v/c) ratios >0.95 (i.e., near capacity). The HCS analysis of the merging/diverging movements for Circle Drive north and south of 22nd Street indicates Level-of-Service 'B' or better for each segment.

- Circle Drive at Laurier Drive and Clancy Drive (half-diamond interchange configurations)

  LOS 'C': Analysis was performed for the merging/diverging operations of the proposed ramps on/off Circle Drive. For both interchanges, at the **500,000 population horizon**, the peak hours are expected to operate at Level-of-Service 'C' or better, suggesting that there is reserve capacity for movements to/from the areas west of Circle Drive opposite Laurier Drive and Clancy Drive, respectively.

- 22nd Street at Confederation Drive ('T' intersection to the north; only two northbound receiving lanes)

  LOS 'C': The eastbound left-turn is overcapacity and the westbound-through is slightly overcapacity. The westbound right-turn is free-flow and maintains LOS 'A'. Section 6.5 describes relevant improvements considered.

- 22nd Street between Confederation Drive and Circle Drive

  SimTraffic indicated some congestion and the potential for exit blocking queues. However, final adjustment of signal timings will occur when actual volumes are realized.

- 22nd Street at Diefenbaker Drive (full intersection failure, no apparent improvement options)

  LOS 'F': Figure CIR-4 shows some modest intersection improvements permitted by the surrounding constraints. Several movements are over-capacity, including the eastbound left-turn, the eastbound-through, the westbound left-turn, the westbound-through, the northbound left-turn queue, and the southbound left-turn queue. The eastbound right-turns are blocked from their exclusive lane due to the long through-queue, making the through-queue even longer.

The key factors contributing to the operating problems are the very high eastbound and westbound through volumes on 22nd Street at both Diefenbaker Drive and Confederation Drive, and the high left-turn volumes at both these two intersections. Figures 5A & 5B (Option 5 in **Appendix G**) were subsequently prepared for Open House 2.

6.5 Potential Improvements

Improvements to Circle Drive Option CIR-4 were tested at two locations:

- 22nd Street at Confederation Drive: Added a second eastbound left-turn lane and a corresponding receiving lane on the north leg for an eastbound dual left-turn lane.
- 22nd Street at Diefenbaker Drive: Added a second northbound left-turn lane and a second westbound left-turn lane. Pedestrian Walk and flashing Don't Walk intervals for the northbound and southbound approaches were not included. Including at-grade pedestrian crossings increases the length of the southbound green beyond what is required to service vehicle demand, increases the cycle length requirements, and exacerbates an already failing intersection. However, Saskatoon is not prepared to grade-separate the pedestrian crossings.

Conclusion: Implementing these changes, the predicted operating problems are expected to persist, with minor relief. Diefenbaker Drive still fails, and it will be made worse with north-south at-grade pedestrian crossings. Confederation Drive will fail with the inclusion of the proposed at-grade north-south pedestrian crossing.

6.6 Future Network Connection to Saskatoon Freeway

As described in Section 6.4, the east-west peak-hour volumes along 22nd Street are roughly three times higher than the north-south Circle Drive volumes. The greatest long-term (500,000 population horizon) performance issues affecting project outcomes occur along 22nd Street. These concerns may be exacerbated as 22nd Street evolves into a multi-modal facility. As a long-term planning study, options to address these concerns were considered, including a future network connection between Circle Drive and the proposed Saskatoon Freeway.

The potential to relieve 22nd Street passing Diefenbaker and Confederation Drives using a new east-west connector from the south end of the Saskatoon Freeway to Circle Drive was considered. This connector would follow an alignment south of the CN rail yard, from the Valley Road (Trumpet) interchange with Circle Drive to the future Saskatoon Freeway near the present intersection of Highways 7 and 60.

Based on select-link analysis for 22nd Street, it was estimated that 50% of the volume travelling between Highway 7/Highway 14/Saskatoon Freeway and 22nd Street at Confederation Drive might be diverted to the new link. For the 500,000 PM peak hour scenario, this would reduce the eastbound PM peak hour volume on 22nd Street by 200 veh/hr and the westbound PM peak hour volume on 22nd Street by 400 veh./hour. Analysis indicated that the same operating problems are expected, with or without the turn lane and signal operation improvements.

Note that the select-link analysis identified Blairmore Development Area Zone A as the origin and destination for most of the east-west traffic flow through the study intersections. It was assumed that these volumes would not easily divert to a new east-west link south of the rail yard. This is based on an implied significant desire line along 22nd Street to the Confederation Mall area and to Saskatoon's downtown.

6.7 Summary

This summary of the preliminary traffic analysis informed modification of Circle Drive Option CIR-4, leading to Option CIR-5 for presentation as the Preferred Plan at Open House #2.

1. Forecast volumes for the 400,000 population (with or without the Saskatoon Freeway) and the 500,000 population with the Saskatoon Freeway yield similar analysis results. These results do not indicate any value in interim staging that could be applicable between 400,000 and 500,000 population (although there may be value in interim staging between the present and the 400,000 population horizon).
2. In practice, if the forecast demand (and associated congestion) is realized, drivers may find other routes to/from the areas west of Circle Drive and north and south of 22nd Street to avoid congestion and delays, particularly at the Diefenbaker Drive intersection. Access to Circle Drive via Laurier and Clancy Drives may provide attractive alternates since there is expected to be reserve capacity, however, there may be bottlenecks elsewhere in the neighbouring networks that have not been analyzed.
3. Dual left-turn lanes will be required for all approaches at Diefenbaker Drive and are desirable for the eastbound left-turn at Confederation Drive. Adding a 4th (south) leg to the Confederation Drive intersection would further degrade performance.
4. A grade-separated pedestrian crossing of 22nd Street between Confederation and Diefenbaker Drives, as part of an overall multi-use pathway network, would benefit traffic operations.
5. The potential volume of traffic that could be attracted by an additional east-west connection to Saskatoon Freeway/Highway 7 south of the CN rail yard may not sufficiently reduce the volume on 22nd Street to solve the operating problems at the Diefenbaker Drive and Confederation Drive intersections. However, forecast growth west of the Saskatoon Freeway (and south of Highway 14) may change in the future in response to the improved mobility associated with the new freeway facility and the upgraded Circle Drive.
6. The Blairmore Development Area is expected to contribute significantly to eastbound and westbound trips approaching Diefenbaker Drive via 22nd Street, with over 1,000 vehicles per hour in each direction for the 500,000 PM peak hour scenario.

7. Public Engagement Process

This section describes the public engagement process undertaken during the development of the Circle Drive functional plans. The resulting stakeholder concerns are identified and addressed in Section 8, Development of the Recommended Plan. Any outstanding stakeholder concerns, the concerns that could not be resolved, are identified in Section 8.6 (Planning and Design Issues).

Three public open house events were held for the Circle Drive, Clancy Drive to Laurier Drive, Functional Planning Study. The first two events were held at the City of Saskatoon's Shaw Centre, 122 Bowlt Crescent, from 4:00 PM to 7:00 PM. The third event was held virtually. The public engagement reports for the three open house events are included in **Appendix I**.

+ Open House No. 1

The first event took place on Wednesday, June 19, 2019. In advance of the open house, invitations were mailed to 371 property owners abutting Circle Drive through the study area. Saskatoon advertised the open house on their website Engage Page to alert the general public.

The public engagement process leading to the first open house began by reaching out to the Community Associations within and surrounding the study area to alert them to the study and invite their input concerning the study corridor. Their input was intended to supplement the concerns and issues already identified by the communities through Saskatoon's Neighbourhood Traffic Review program. Approximately 25 people attended the first open house event.

The purpose of the first open house was to alert the community to the planning study and gather preliminary input regarding the constraints and issues affecting development of the functional plan.

+ Open House No. 2

The second event took place on January 22, 2020. Efforts to advertise the open house were expanded in response to public feedback at the first open house. In advance of the open house, invitations were mailed to the 371 property owners abutting Circle Drive through the study area as well as 13 attendees from Open House 1 who had requested notification. Notifications of the project were also sent to the 110 businesses and institutions in the mall area north and south of 22nd Street. Notifications were also sent to all the Community Associations within and surrounding the study area. Saskatoon advertised the open house on their website Engage Page and also erected roadside billboards to alert the general public.

Comment sheets were provided for attendees to provide feedback on the open house format and information that was presented, and to collect general information on attendees' location of residence, work, and travel patterns. Optional contact information was also collected from those who wished to receive notification of future events.

The purpose of the second open house was to present the options considered and the preferred upgrading plan and to gather the public's input.

Approximately 50 people attended the second open house. The open house was an informal drop-in format, no formal presentation was made. Representatives from the City of Saskatoon and the CIMA+ project team were available to discuss the information presented and to answer questions. Of the 73 written or called-in responses, ten were from comment sheets filled in at the event, six were comment sheets emailed or mailed-in following the open house, eight were phone calls and 49 were emails sent in with comments.

The higher attendance at the second open house may have resulted from greater public awareness of the event. The exceptionally high response rate following the open house largely resulted from stakeholder concerns with potential impacts to local travel patterns.

+ Open House No. 3

The third open house was a Virtual Event (due to COVID restrictions in the Province of Saskatchewan) and took place on October 21, 2021. Advertising for the third open house included:

- Invitation flyers delivered in the Fairhaven, Parkridge, Confederation Suburban Centre, Pacific Heights, Confederation Park, Massey Place, and Montgomery Place neighbourhoods to residences and businesses.
- Invitation flyers delivered in the Meadowgreen and Mount Royal neighbourhoods to residences that back the study area.
- The online Engage! page.
- Invitations to the impacted Community Associations and their Community Consultants.
- Billboard advertisements.
- Emails to those registered to receive project updates.
- The Ward Councilors were requested to advertise via their platforms.

The purpose of the third open house was to present the Recommended Plan for upgrading Circle Drive West, to share the changes that were made following Open House 2, and to respond to final questions and gather comments.

Approximately 75 people attended the third open house online, 50% more than the second open house. CIMA+ presented the Recommended Plan and the City of Saskatoon moderated the event, including the question-and-answer period.

+ Summary

There was a mix of support and some concerns expressed that were considered in the final plan. The questions and answers in the open house report (**Appendix I**) capture the range of questions posed during and following the third open house.

8. Development of Recommended Plan

This section describes the primary components and changes as the development of the recommended plan evolved during the study process. Development of the preferred plan began with Option CIR-5A/5B (Appendix G) leading to Figure 8.1 shown at Open House #2. Changes were made to the preferred plan in response to public input and the resulting recommended plan (Figure 8.2) was presented at Open House #3.

8.1 Preferred Plan – Open House 2

The preferred plan (**Figure 8.1**) shown at Open House #2 included the following key features:

- The existing unconventional interchange configuration was replaced with a current design (Single-Point Urban Interchange) that accommodates all movements on/off Circle Drive.
- The Laurier and Clancy Drive traffic signals were removed and replaced with half-diamond interchange configurations that accommodated partial movements off/on Circle Drive, to/from the north at Laurier Drive, and to/from the south at Clancy Drive.
- The southbound exit from Circle Drive to Fairmont Drive was retained.
- Eastbound 22nd Street included a new right/off movement and retained the existing right/on movement at Fairmont Drive.
- The southbound exit to 11th Street was moved to the south side of 11th Street, converting the interchange to an all-movement Parclo AB configuration.
- The design speed along Circle Drive was increased from 90 to 100 km/h, removing the low-speed curves crossing 22nd Street.

This plan balanced two objectives. First, it achieved free-flow (higher-speed) standards and improved traffic safety (eliminating the risk of unsafe movements) along Circle Drive by removing the traffic signals. Second, it retained partial access in the exceptionally short distances between 11th Street, Clancy Drive, 22nd Street, and Laurier Drive.

8.2 Changes to Preferred Plan

The following changes were made to the Preferred Plan following Open House #2.

8.2.1 Six-Lane Cross-Section Between Retaining Walls

A key issue was how to treat the additional 3.7m width between the edge of the 4-lane cross-section and the retaining walls positioned to accommodate the ultimate 6-lane cross-section. This area will need an urban drainage design between the retaining walls and therefore should not be a gravel surface. Generally, it would be easiest to build a 6-lane core from north of the rail box structures (north of 11th Street) to 33rd Street.

Conclusion: The Recommended Plan included the ultimate 6-lane cross-section between the rail box structures north of 11th Street and south of the 33rd Street interchange, with transitions to the existing 4-lane cross-section at both ends.

8.2.2 Southbound Loop Ramp Exit to 11th Street

Advancing the future southbound loop ramp exit to 11th Street at the 4-lane stage has made the need for drivers to follow a long C/D Road exit to 11th Street redundant and has eliminated the need for a costly transfer lane or basketweave structure.

This also removes the existing southbound ramp to 11th Street, which is too close to Clancy Drive and must ultimately be removed. Traffic from Clancy Drive will access 11th Street via Circle Drive and the new loop ramp. Retaining the existing connection would only benefit traffic from Clancy Drive and would make it increasingly difficult to remove in the future.

Removing the existing southbound exit ramp also mitigates intrusion into the adjacent William A. Reid Park. Including the loop ramp in first stage Circle Drive reduces throwaway costs, removes public concern with the long southbound C/D road/exit ramp but would not address public concerns about the rail crossings.

Conclusion: The existing southbound ramp to 11th Street was removed from the recommended plan.

8.2.3 22nd Street Eastbound to Circle Drive Southbound

The eastbound-to-southbound turning movement (22nd Street eastbound to Circle Drive southbound) is the highest volume turning movement at the new interchange. It is understood that this turning movement includes a heavy truck volume and that trucks often back up in the curb lane along 22nd Street eastbound from the Confederation Drive traffic signal. This concern was confirmed by the open house attendees.

In response, a new ramp was introduced immediately south of Confederation Drive (avoiding the Confederation Drive traffic signals), utilizing existing structures under existing Circle Drive. This is an opportunistic upgrade that recognizes the heavy truck movement from west Saskatoon to south Saskatoon which may be exacerbated by the missing southwest link in the future Saskatoon Freeway.

This change also moved the existing right-on ramp from Fairmont Drive onto 22nd Street eastbound, to Fairlight Crescent (180m further west). The new eastbound right-off ramp into Fairmont Drive from 22nd Street will remain, replacing the existing right-turn exit at Confederation Drive to Fairlight Drive. This concept facilitates trips from the south mall to the north mall, a movement currently not permitted.

8.2.4 Fairhaven Traffic

The following changes to the travel paths occur for Fairlight Drive traffic.

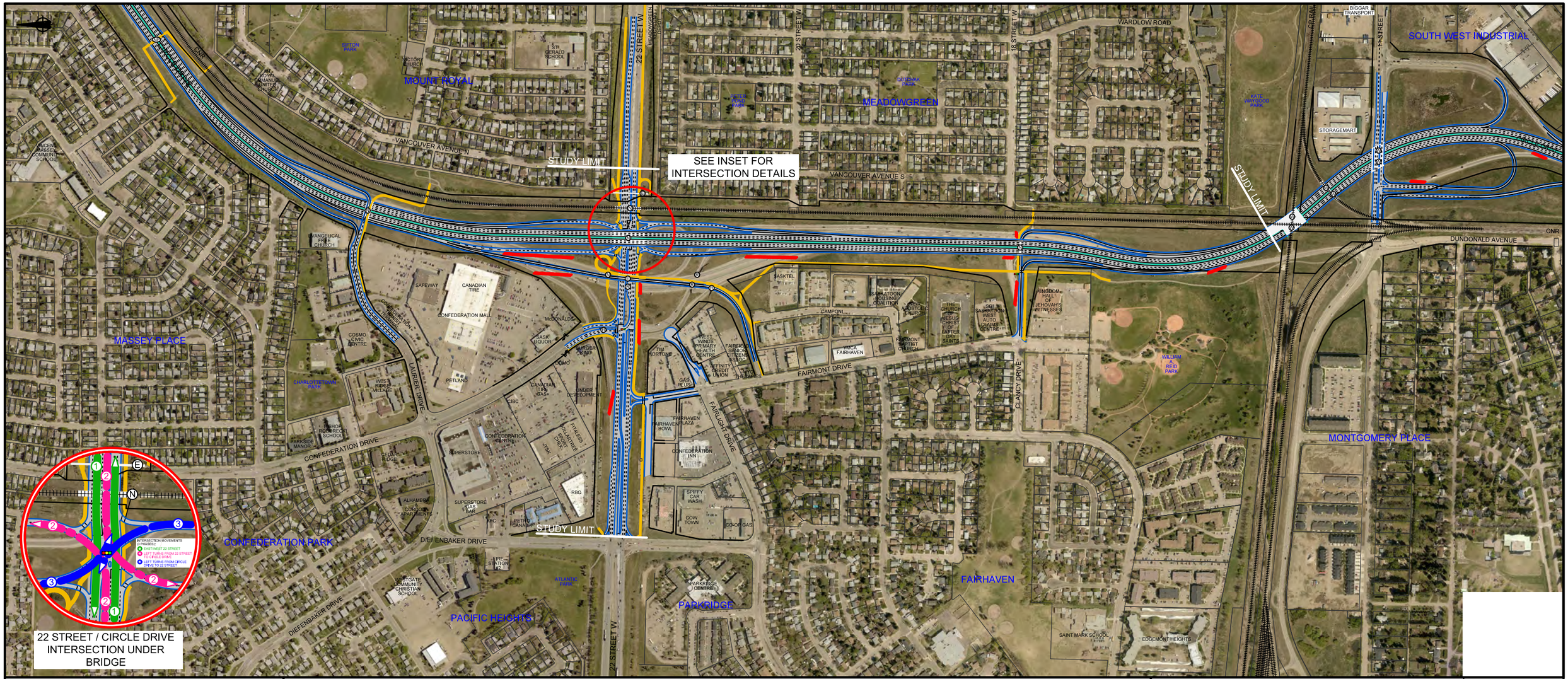
- Eastbound Fairhaven traffic can cross under Circle Drive at Clancy Drive and follow an uninterrupted C/D road northbound to 22nd Street, a new movement (eastbound Fairhaven traffic can still follow Diefenbaker Drive to 22nd Street eastbound).
- Northbound Fairhaven traffic can cross under Circle Drive at Clancy Drive and follow an uninterrupted C/D road onto Circle Drive northbound.
- South mall traffic can reach the north mall by following Fairlight Crescent to a right-turn onto 22nd Street eastbound. This will permit turning left (north) into Confederation Drive from 22nd Street, a new movement (Fairhaven traffic can still follow Diefenbaker Drive to 22nd Street eastbound).
- Southbound traffic returning to Fairhaven from the Confederation north mall area will need to follow 22nd Street and turn left (south) at Diefenbaker Drive; or reach Diefenbaker Drive directly from the north mall and travel south across 22nd Street.

- Southbound traffic from Fairlight Drive will continue to follow Fairmont Drive to Clancy Drive to Circle Drive southbound (Fairhaven traffic can still follow Fairlight Drive south to its existing intersection with 11th Street West).

8.2.5 Other Changes to Preferred Plan Following Open House #2

1. Added a new connection from southbound Circle Drive to Clancy Drive, by extending the shared C/D road exit to 22nd Street and Fairmont Drive further south to Clancy Drive.
2. Added connection from Clancy Drive eastbound to 22nd Street eastbound and Circle Drive northbound via reconfigured C/D road/ramp network.
3. Revised access strategy for parcels along the north side of Laurier Drive, west of Circle Drive.
4. Revised Clancy Drive to southbound Circle Drive ramp alignment to meet maximum grades.
5. Multi-use pathway along west side of Circle Drive between Clancy Drive and 22nd Street removed and realigned south along Clancy Drive to Fairmont Drive.
6. Added dual left-turn from eastbound 22nd Street to northbound Confederation Drive.

See Figures CIR-5A and CIR-5B in **Appendix G**.



LEGEND:

- CURBLINE OR EDGE OF PAVEMENT
- LANE DIVIDING LINE
- LANE EDGE LINE OR DIRECITONAL DIVIDING LINE
- BARRIER AND/OR RETAINING WALL
- PATHWAY
- (E) EXISTING STRUCTURE
- (N) NEW STRUCTURE
- (W) WIDENED STRUCTURE
- (NPS) NEW PEDESTRIAN STRUCTURE
- (R) REMOVE EXISTING STRUCTURE

DATE : 12 APRIL 2022

SCALE : 0 50 100 150 200

PREFERRED PLAN SHOWN AT OPEN HOUSE #2

CIRCLE DRIVE WEST
FUNCTIONAL PLANNING STUDY

FIGURE 8.1

8.3 Recommended Plan – Open House 3

This section describes the recommended plan.

8.3.1 Introduction

The Recommended Plan (**Figure 8.2**) presented at the third open house included the following key features:

- The existing unconventional interchange configuration with 22nd Street will be replaced with a more compact Single-Point Urban Interchange design that better accommodates all current movements on/off Circle Drive and improves mainline geometry.
- The Laurier Drive and Clancy Drive traffic signals are removed and replaced with grade separations that accommodate turning movements off/on Circle Drive, to/from the north at Laurier Drive, and to/from both directions at Clancy Drive. In addition, traffic from Clancy Drive can now reach 22nd Street, a movement not currently permitted.
- The existing southbound exit from Circle Drive to Fairmont Drive is retained.
- Eastbound 22nd Street includes a new right/off movement to Fairmont Drive (to the south mall area) and the existing right/on movement from Fairmont Drive (to 22nd Street eastbound) has been relocated west to Fairlight Crescent. This permits traffic to cross 22nd Street from the south mall to the north mall via Confederation Drive, a movement not currently permitted.
- The southbound exit from Circle Drive to 11th Street is moved to the south side of 11th Street, converting the interchange to an all-movement Parclo AB configuration. This change permits restoring all turning movements at the Clancy Drive interchange.
- The design speed along Circle Drive is increased from 90 to 100 km/h by removing the low-speed curves through the existing interchange crossing 22nd Street.
- The Recommended Plan may benefit the north mall with increased visibility. The existing southbound-to-westbound elevated ramp over Confederation Drive hides the north shopping mall area. Removing this ramp, as well the existing southbound Circle Drive structure, will improve the visibility of the north mall area from 22nd Street.

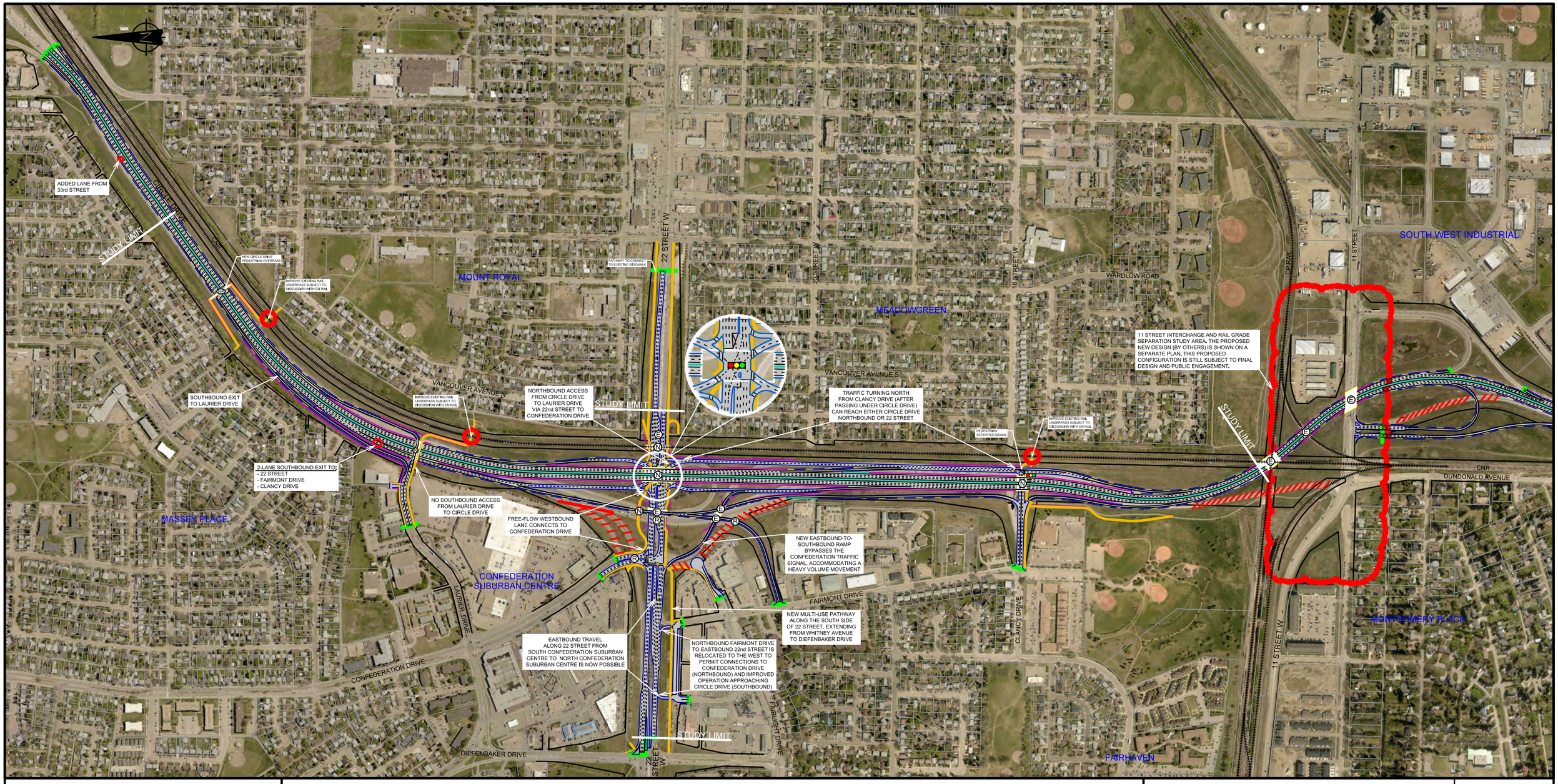
The Circle Drive West Functional Plans are included in **Appendix J**.

8.3.2 Multi-Use Pathways

Extending the southbound exit from Circle Drive to Clancy Drive displaced the proposed multi-use path (MUP) parallel to Circle Drive. The constrained right-of-way means the pathway coming north from 11th Street must follow Clancy Drive to Fairmont Drive.

Saskatoon anticipates MUPs along both sides of its arterial roadways. Although still aspirational at this stage, a MUP is shown along the south side of 22nd Street as well. Subject to detail design, a potential first stage could retain the CN bridge crossing 22nd Street immediately east of Circle Drive. However, if the south side MUP is included it triggers the replacement of the CN bridge.

See **Figure 8.3**, Multi-Use Pathways



LEGEND:

- LANE DIVIDING LINE
- LANE EDGE LINE OR DIRECTIONAL DIVIDING LINE
- CONCRETE BARRIER
- PATHWAY
- EDGE OF PAVEMENT (RURAL SECTION)
- CURBLINE
- RETAINING WALL
- PROJECT LIMIT
- (E) EXISTING STRUCTURE
- (N) NEW STRUCTURE
- (R) WIDENED STRUCTURE
- (NEW) NEW PEDESTRIAN STRUCTURE
- (D) REMOVE EXISTING STRUCTURE

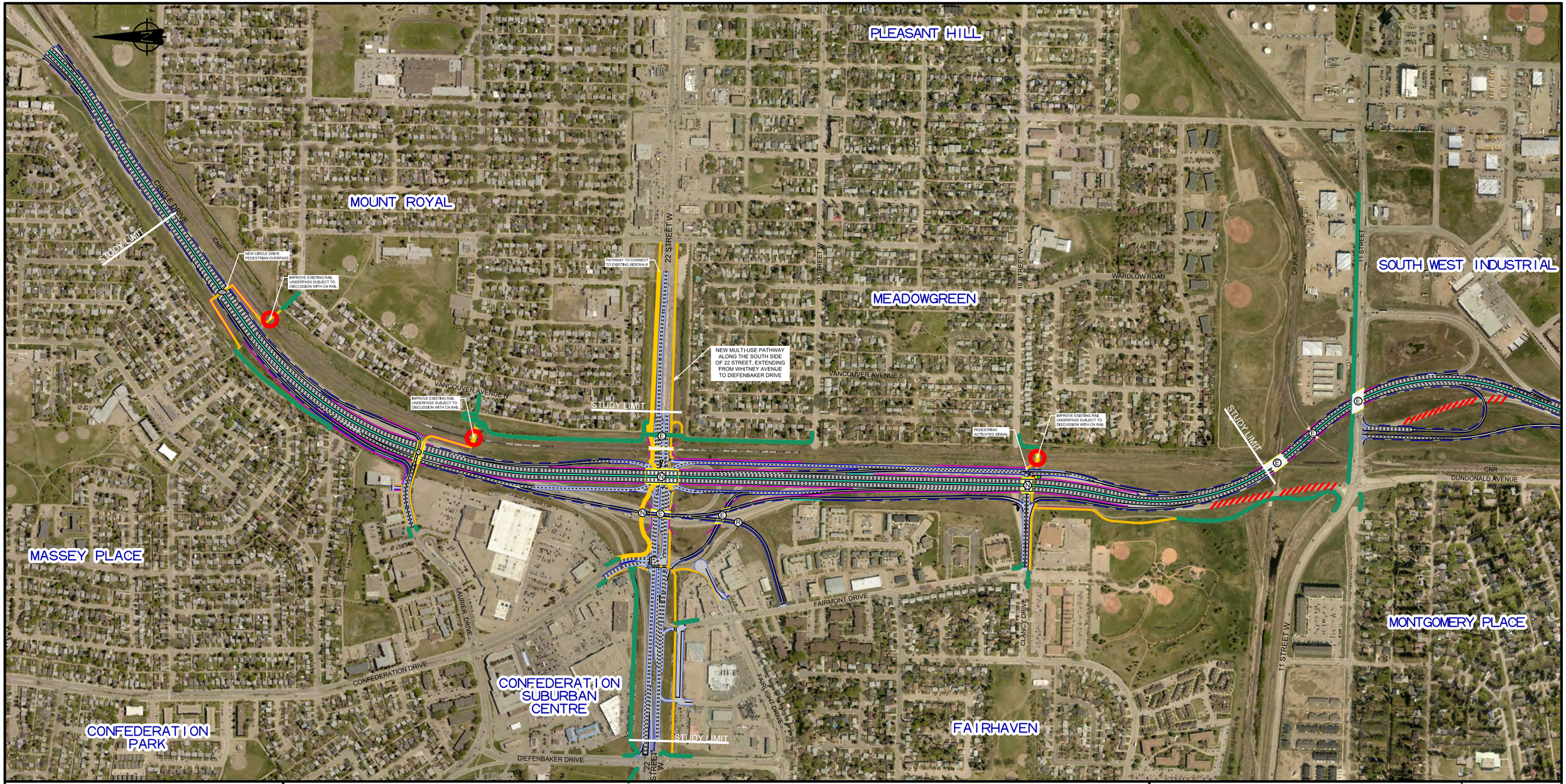
DATE: 12 APRIL 2022

SCALE: 0 50 100 150 200

RECOMMENDED PLAN

CIRCLE DRIVE WEST
FUNCTIONAL PLANNING STUDY

FIGURE
8.2



LEGEND:

- NEW PATHWAY
- EXISTING PATHWAY TO REMAIN
- LANE DIVIDING LINE
- LANE EDGE LINE OR DIRECTIONAL DIVIDING LINE
- CONCRETE BARRIER
- EDGE OF PAVEMENT (RURAL SECTION)
- CURBLINE
- RETAINING WALL

- (E) EXISTING STRUCTURE
- (N) NEW STRUCTURE
- (W) WIDENED STRUCTURE
- (NPS) NEW PEDESTRIAN STRUCTURE
- (R) REMOVE EXISTING STRUCTURE

DATE: 12 APRIL 2022

SCALE: 0 50 100 150 200

MULTI-USE PATHWAYS RECOMMENDED PLAN

CIRCLE DRIVE WEST
FUNCTIONAL PLANNING STUDY

FIGURE 8.3

8.3.3 Future Consideration: Confederation Drive / 22nd Street Intersection

The study team recommends that Saskatoon consider the following change to the recommended plan as the project moves forward into future design stages.

The right-hand southbound-to-eastbound left-turn lane from Confederation Drive should be changed to a shared left-turn/through lane. The through-lane connects with the currently proposed eastbound-southbound ramp onto Circle Drive. This was considered earlier, however, before the eastbound-to-southbound right-turn was added (west of the Confederation Drive intersection) which saved the two existing underpass structures.

This change would:

1. Not compromise the efficient 'T' intersection design and 3-phase signal operation. This change takes advantage the existing southbound signal phase out of Confederation Drive without the need to introduce a new phase or alter signal timing. Including the westbound-to-southbound turning movement, and the associated additional signal phase, would impact overall performance.
2. Make a small improvement in overall efficiency, reducing congestion/queuing in the short distance between the Confederation Drive and Circle Drive signals by sending vehicles straight south across (instead of along) 22nd Street onto Circle Drive southbound.
3. Require a yield sign for the eastbound-to-southbound right-turn (22nd Street to Circle Drive) to enter this ramp. An acceleration lane through the curve leading to the first underpass would be a poor design and will not be used.
4. Not compromise truck flows. The eastbound-to-southbound bypass of the two traffic signals was included in response to a concern regarding truck traffic. The duration of the eastbound-through movement at the Confederation Drive traffic signal is estimated at almost 2 minutes. Truck traffic will have a generous unimpeded window to complete the right turn onto Circle Drive.
5. Retain the short eastbound-to-southbound right-turn lane approaching the Circle Drive signal should drivers miss the on-ramp at Confederation Drive.

There are two other benefits of this configuration:

1. From the stakeholder perspective, it retains an existing movement and should help compensate for the loss of the eastbound-to-southbound right-turn from Laurier Drive to Circle Drive.
2. It reduces the perception that a southbound right-turn lane can be added from Fairlight Drive. The interchange configuration itself would still only accommodate turning movements between 22nd Street and Circle Drive.

8.3.4 Future Consideration: MUP Crossing 22nd Street Near Confederation Drive

The study team recommends Saskatoon consider the following change to the recommended plan as the project moves forward into future design stages.

Pedestrians wishing to cross 22nd Street between Circle Drive and Diefenbaker Drive (between the Confederation (north mall) and Fairlight Drive (south mall) shopping areas would need to use either the already congested Diefenbaker Drive intersection, the pedestrian overpass near the CN tracks immediately east of Circle Drive, or an at-grade crossing along the west side of the signalized Confederation Drive intersection.

Issue: At the 500,000 population horizon, an at-grade pedestrian crossing of 22nd Street at Confederation Drive (and at Diefenbaker Drive) will impact performance along 22nd Street as east-west traffic volumes increase.

+ Proposed Changes to the 22nd Street West/Confederation Drive Intersection

To compensate for the exceptionally short offset from Circle Drive and to improve intersection performance consistent with 22nd Street's classification as a high-speed Freeway/Expressway facility, the intersection will be converted from a four-legged to a 'T' configuration. Access to Circle Drive West is focused on the Single Point Urban interchange and the intersection will primarily provide access to Confederation Drive and the north mall.

The Confederation Drive traffic signal will be coordinated with the ramp terminal signal at Circle Drive. The short spacing between the two intersections requires additional lanes to accommodate turning and queuing volumes resulting in an 8-lane cross-section between Confederation and Circle Drives.

+ Impact of an At-Grade Pedestrian Crossing

Performance of the proposed 'T' intersection configuration was assessed based on including an at-grade pedestrian crossing, north-south along the west side of Confederation Drive, as follows:

- Pedestrians would need to cross 8 traffic lanes plus the median/island widths, measuring at least 36m, from outside face-of-curb to outside face-of-curb. See **Appendix K**.
- Total available north-south pedestrian crossing time in the assumed signal timing for the 500,000 population horizon is 30 seconds, based on meeting the required east-west green signal time along 22nd Street. Total north-south pedestrian crossing (walking) time at 1.0 m/s to clear the approximately 36m distance is 36 seconds.
- Assuming 1.0 m/s pedestrian crossing speed and a minimum 7-second leading (green) "walk" indicator (before the last pedestrian steps off the curb, per TAC MUTCD[25], 6th Edition, Section 2.2), the north-south pedestrian clearance phase (flashing "Don't Walk" indicator) needs to be 36 seconds long (would not accommodate persons with mobility issues). Total available maximum crossing time is (7 + 36 + 6) 49 seconds. This is 19 seconds (2/3rds) greater than the 30 seconds provided by the signal timing.
- Increasing the southbound signal phase to allow a single-stage pedestrian crossing would worsen intersection operations to the point where traffic demand exceeds intersection capacity, particularly the east-west flows along 22nd Street. This will lead to congestion across multiple signal cycles and queues reaching beyond the Circle Drive interchange.
- Using a two-stage pedestrian crossing, the island between the dual left and the eastbound-through lanes is 3.6m wide from face-of-curb to face-of-curb. This would separate the crossing into 20.9m (north side to median) and 11.5m (median to south side). Total crossing time would exceed 2 minutes (including a 110-second median wait), still assuming a 1.0 m/s pedestrian crossing speed.
- The median refuge would meet TAC minimums (2.4m wide per TAC GDG[26] 6.4.1.1) but would be a very uncomfortable space for many pedestrians given the high traffic volumes, high truck presence and 60 km/h posted speed (average speeds probably greater). The minimum width to

[25] Transportation Association of Canada – Manual of Uniform Traffic Control Devices
[26] Transportation Association of Canada – Geometric Design Guide

accommodate wheelchairs plus shy distance and ramps is 4.1m. Some pedestrians may refuse to wait in the median and attempt to complete the crossing against the “Do Not Walk”.

- The median refuge could be widened to 4.0m by narrowing the separator between the dual left-turn and westbound-through lanes. The separator island is currently 2.0m from face-to-face, narrowing it to 1.6m. However, it is difficult to recommend a two-stage crossing here unless the median refuge could be made even wider to create a comfortable sense of separation and protection for pedestrians and cyclists. Additional widening is not feasible because of the intersection’s proximity to the existing Circle Drive bridge to the east.
- **Conclusion**: The new Confederation Drive intersection with 22nd Street will have significant operational issues with a single-stage pedestrian crossing based on the 500,000 population horizon. A 2-stage pedestrian crossing will be a challenging/unpleasant experience for pedestrians and take more than three times as long as a single stage. At the 500,000 population horizon, an at-grade pedestrian crossing of 22nd Street at Confederation Drive is not recommended.

+ Conclusions

This brief comparison of the pedestrian crossing options to connect the Confederation Mall and Fairlight Drive shopping areas, and possibly the Confederation Park/Pacific Heights and the Fairhaven/Parkridge neighbourhoods, led to the following conclusions:

- 22nd Street West and Circle Drive have an important role in the regional and provincial highway network.
- 22nd Street West (and Circle Drive West) will face increasing demand from municipal growth, from traffic diverted by the loss of some travel paths along Circle Drive West, and from growth in inter-regional through traffic.
- An at-grade pedestrian crossing at the Confederation Drive/22nd Street intersection will experience significant operational issues at the 500,000 population horizon, affecting east-west flows along 22nd Street, including the long-distance inter-regional flows and the local commuter trips, warranting grade separation.
- Although Hart Road, Betts Avenue, Diefenbaker Drive and Confederation Drive currently include at-grade pedestrian crossings, the volumes along 22nd Street increase from west to east (to/from downtown), creating increasing congestion at Diefenbaker, Confederation and Circle Drives respectively. The need for grade separation will increase with traffic volumes both along and accessing 22nd Street.
- An MUT Pathway overpass connecting the two shopping areas and the surrounding four neighbourhoods, will preserve the long-term performance of 22nd Street and benefit both the Confederation Drive and Diefenbaker Drive intersections.
- 22nd Street West’s existing classification as a Freeway/Expressway (high-speed controlled-access facility) outside Circle Drive will be modified by Saskatoon as 22nd Street is now planned to become a multi-modal facility. If 22nd Street’s capacity is compromised, flow is unlikely to divert to the parallel, and narrower, 11th and 33rd Street corridors. Instead, traffic will remain on the wide (originally a provincial highway) corridor along 22nd Street.

8.4 Right-of-Way Requirements

The right-of-way lines shown on the functional plans reflect the toe of slope.

1. Access to two properties along the north side of Laurier Drive, adjacent to Circle Drive, would use a new joint access.
   - Retaining walls will be used to mitigate the right-of-way requirements affecting the two properties; however, construction easements will be required.
2. South side of Laurier Drive just west of Circle Drive affecting the Confederation Mall adjacent to the Canadian Tire parking lot; and between the north mall building and southbound Circle Drive.
   - The affected property in these two locations will be shown as replaceable by an equal area of surplus right-of-way in the southeast corner of the mall property, where two existing ramps are being removed.
3. Townhouse complex on the west side of Circle Drive south of the Sasktel facility.
   - Urban drainage along the southbound C/D road will be extended south passing the townhouse complex to eliminate the right-of-way requirement.
4. Sports fields in William A. Reid Park south of Clancy Drive (though a ROW limit is not shown crossing City land). Removing the direct ramp connection between Clancy Drive and 11th Street reduced impacts to the sports fields.
5. Right-of-way changes/upgrades at Diefenbaker Drive / 22nd Street are not in the project scope.

See **Figure 8.4**, Right-of-Way Requirements and Impacts.

8.5 Noise Attenuation

Patching Associates Acoustical Engineering Ltd. completed a transportation Noise Impact Assessment (NIA) to assess the future noise impacts for an upgraded Circle Drive West.

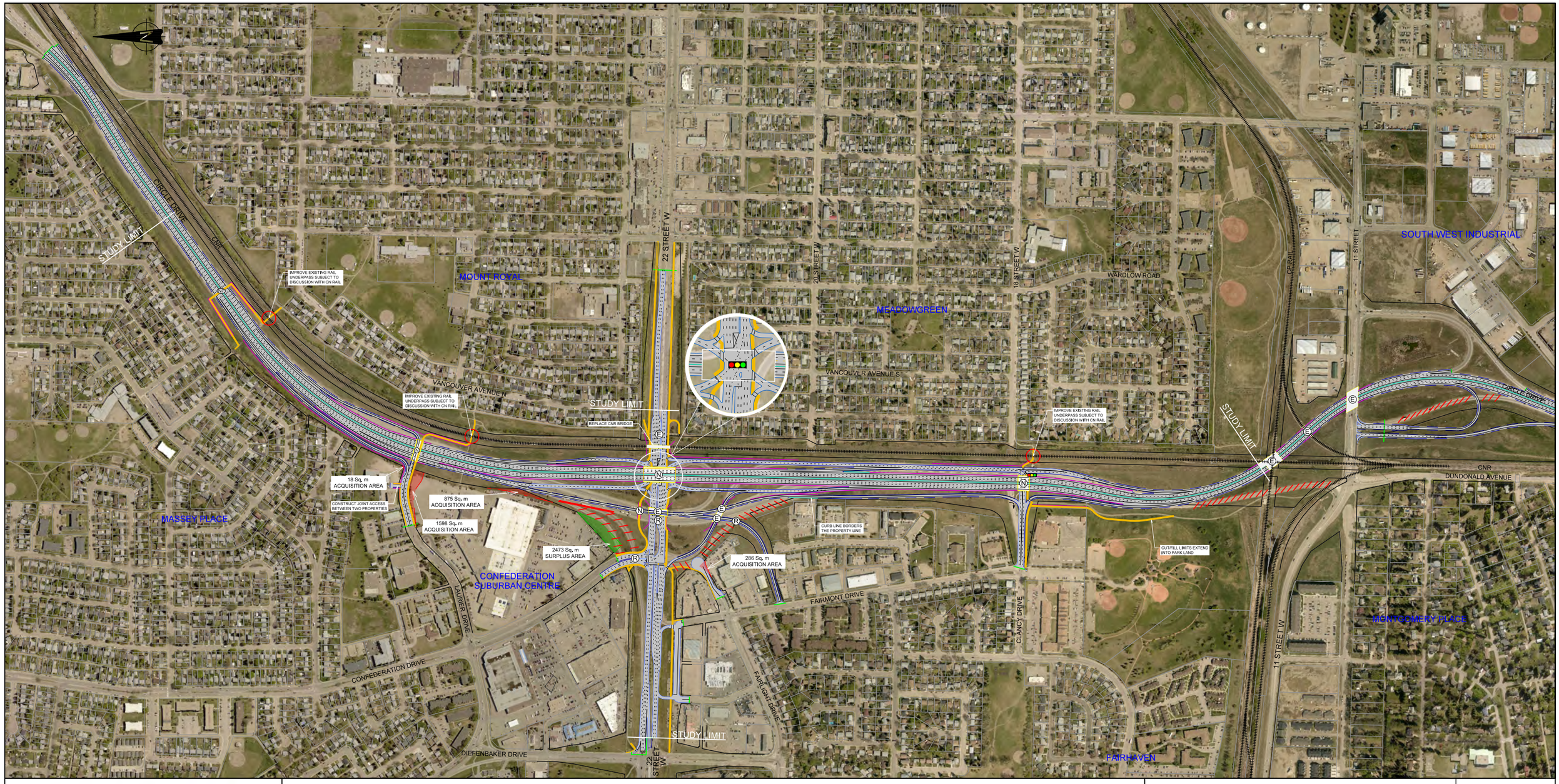
The purpose of the study was to assess Circle Drive's predicted traffic noise levels at the 500,000 population horizon against the City of Saskatoon's Traffic Noise Sound Attenuation Policy's threshold day-night Design Noise Level (DNL) of 65 dBA L_{DN} and to design noise mitigation if the DNL is exceeded at residential receivers adjacent to Circle Drive. An NIA is warranted for this project as it is an upgraded transportation corridor adjacent to existing developments.

The day-night sound level, or L_{DN}, is the A-weighted equivalent sound level for a 24-hour period with an additional 10 dB imposed on the equivalent sound levels for nighttime hours of 10 PM to 7 AM. Noise predictions for road traffic were developed using SoundPLAN with the TNM 2.5 module corrected for known deficiencies based on the proposed alignment, surface elevation, design speed, and forecasted daytime and nighttime traffic volume data. The most recent elevation data was collected in 2017, prior to the installation of sound barriers along Circle Drive immediately south of 33rd Street. These barriers were approximated in the predictive model based on their alignment visible in satellite imagery. The barriers east and west of Circle Drive were modelled as 3.0m and 1.83m high respectively based on sound attenuation design information published by the City of Saskatoon Transportation and Utilities.

Receivers were located in accordance with the policy 1.5m above ground, 5m from the adjacent property line, and 3m away from any obstructions in the outdoor rear amenity area of single-family residential or townhouse type multi-family land use in the area. The modelled results indicate that the predicted L_{DN}

noise levels meet the 65 dBA DNL at all residences in the area for the forecasted traffic horizon, and that no additional noise attenuation is required.

See **Appendix L**, Traffic Noise Impact Assessment.



LEGEND:

- LANE DIVIDING LINE
- LANE EDGE LINE OR DIRECTIONAL DIVIDING LINE
- CONCRETE BARRIER
- PATHWAY
- EDGE OF PAVEMENT (RURAL SECTION)
- CURBLINE
- RETAINING WALL
- PROJECT LIMIT

- (E) EXISTING STRUCTURE
- (N) NEW STRUCTURE
- (W) WIDENED STRUCTURE
- (NP) NEW PEDESTRIAN STRUCTURE
- (R) REMOVE EXISTING STRUCTURE

DATE: 18 FEBRUARY 2022

SCALE: 0 50 100 150 200

RIGHT OF WAY REQUIREMENTS AND IMPACTS

CIRCLE DRIVE WEST
FUNCTIONAL PLANNING STUDY

FIGURE
8.4

8.6 Planning and Design Issues

The following stakeholder issues warrant further consideration during future planning and design stages.

8.6.1 11th Street Rail Crossings

This concern occurs outside the project scope.

11th Street connects to Circle Drive West at a problematic interchange, complicated by several rail crossings that introduce frequent traffic delay. The five at-grade rail crossings periodically disrupt traffic accessing 11th Street and have been a significant, long-standing, concern for area residents. Saskatoon has a proposed interchange plan (prepared by others) that would grade separate the rail lines; however, it is a complex plan and construction is a long-term consideration.

8.6.2 Changes to Travel Patterns

Changes to the local travel patterns are seen as a chief concern with the recommended plan for affected stakeholders.

The two traffic signals at Clancy and Laurier Drives were retained by Circle Drive West's original, interim[27], design to accommodate convenient local access. If the traffic signals were to continue to be retained, it would lead to increased traffic congestion and safety concerns as traffic in Saskatoon and the surrounding region grows. This will include traffic diverted through Saskatoon from the south end of the future Saskatoon Freeway's west leg and the regional highways.

Circle Drive West's original, interim, design, unfortunately resulted in area residents and business owners relying on now long-established, but (what were intended to be) interim, travel patterns.

The recommended plan is long-term. Removing the signals after these many years will change the routes in/out of some neighbourhoods and business areas and will be seen as disruptive by many of the affected drivers. Upgrading Circle Drive West to free-flow standards is considered a long-term project. Saskatoon hopes that preparing the plan at this still early stage will give area residents and business owners time to adjust their plans (where possible) before the changes are implemented.

Major transportation projects with the potential to affect large areas and/or existing development are commonly planned long in advance of anticipated construction timelines. The original plans for Circle Drive West did not foresee the Saskatoon Freeway, and the absence of a southwest leg, or the Circle Drive South extension. Saskatoon has revisited its plans for Circle Drive West to reflect these changing circumstances.

8.6.3 Other Stakeholder Concerns

The following stakeholder concerns result from other changes along the Circle Drive West corridor.

+ **Connection from Confederation Drive to Fairlight Drive**

  The 22nd Street westbound left-turn at the intersection with Confederation Drive has been removed. Converting this intersection to a 'T' configuration preserves the intersection's long-term performance. The southbound exit from Circle Drive to Fairmont Drive is retained. An eastbound right-turn onto Fairmont Drive and into the south mall area is provided from 22nd Street.

[27] Circle Drive was intended to be a freeway facility. The "interim" design refers to the two traffic signals retained along Circle Drive West.

+ **Direct Southbound Exit into the Confederation Mall**

  A direct southbound exit from Circle Drive into the north mall has been removed. The new interchange configuration includes a conventional southbound-to-westbound ramp that becomes an auxiliary lane, providing drivers with an uninterrupted path to a simple free-flow right-turn into the north mall from 22nd Street at Confederation Drive. The southbound exit onto Laurier Drive is retained providing access to the north end of the north mall area.

+ **Pedestrian Underpasses of the CN Rail Line**

  The pedestrian crossings no longer pass under Circle Drive, however, they cannot be elevated over the CN line because of overhead power transmission lines. Saskatoon will explore upgrading the pedestrian tunnels under the rail line with CN nearer to construction.

8.7 Traffic Analysis – Recommended Plan

8.7.1 22nd Street / Confederation Drive

The 22nd Street/Confederation Drive intersection is assumed to be signalized, with the following geometry:

+ Eastbound – one right-turn bypass lane (free-flowing, bypassing the signal), three through lanes, dual left-turn bay
+ Westbound – three through lanes, one free flow channelized right-turn lane
+ Southbound – one channelized right-turn lane drop, dual left-turn lanes

Assuming that no north-south pedestrian crossing is provided, at the 500,000 horizon, the intersection will experience congestion and will be approaching capacity, particularly during the PM peak. During the PM peak, the 95th percentile westbound through queues are expected to extend between the single point interchange intersection (common ramp terminal) and the Confederation Drive intersection. Coordination of the signals at the two intersections will be necessary to manage traffic flows.

East-west pedestrian crossings can be permitted at the intersection without degrading intersection operations. The green time for the east-west movements is more than sufficient to accommodate a pedestrian crossing interval. **Table 8.1** summarizes intersection performance without the north-south pedestrian crossing.

The first half of Table 8.1 represents the AM peak hour movements, while the second half of the table represents the PM peak hour movements. In the AM peak hour, the predominant movements are eastbound (towards downtown / Circle Drive), so the westbound free-flow right-turn has lower volumes and southbound right-turn has less opposing traffic. In the PM, the westbound right-turn decreases to LOS ‘C’, while the southbound right-turn remains at LOS ‘A’ due to the lower anticipated volumes (at just 130 vehicles/hour in the PM peak hour).

Table 8.1 : 22nd Street / Confederation Drive Intersection – No N/S Pedestrian Crossing

	Eastbound			Westbound			Northbound			Southbound		
Movement	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**
500,000 AM Peak – Signalized (140s Cycle, EB LT pt, EB RT bypass, no N/S peds)												
Geometry	L/L/T/T/T			T/T/T/R						L/L/R		
Volume	278	1998			1867	510				559		272
v/c	0.75	0.65			0.76	0.35				0.77		0.18
Delay (s)	67.6	10.9			23.0	0.5				57.5		0.2
LOS	E	B			C	A				E		A
95th Queue (m)	m34.8	m156.8			168.3	0.0				#118.1		0.0
Intersection Delay (s)						**21.2**	**Intersection LOS**					**C**
500,000 PM Peak – Signalized (140s Cycle, EB LT pt, EB RT bypass, no N/S peds)												
Geometry	L/L/T/T/T			T/T/T/R						R/L/L		
Volume	322	1656			2722	1061				504		130
v/c	0.99	0.49			0.92	0.96				1.00		0.09
Delay (s)	98.9	1.6			21.3	24.5				95.9		0.1
LOS	F	A			C	C				F		A
95th Queue (m)	m39.4	m5.8			175.5	m#123.7				#116.5		0.0
Intersection Delay (s)						**26.1**	**Intersection LOS**					**C**

Notes:
1. #: 95th percentile volume exceeds capacity, queue may be longer
2. M: Volume for 95th percentile queue is metered by upstream signal

At Saskatoon's request, operations were also explored with a north-south pedestrian crossing on the west side of the intersection. Assuming a 1.0 m/s walking speed, pedestrians would require 35 seconds to clear the intersection. Utilizing a minimum 7.0 second walk time indicator (per MUTCD-C, 6th Edition), a 3.5 second yellow time, and a 2.5-second all-red time, a 29.3-second pedestrian clearance interval is required. To maintain some level of coordination between the single point interchange intersection, a 140s cycle time would need to be provided.

As shown in the table below, intersection operations exceed capacity when a north-south pedestrian crossing is included. The westbound movements in particular exhibit failure and queues that would extend beyond the single-point interchange intersection. **Table 8.2** summarizes intersection performance with the north-south pedestrian crossing.

In the AM peak hour, the LOS 'E' movements are at v/c 0.75 (eastbound left-turn) and 0.77 (southbound left-turn), which indicates that there is still capacity in the intersection. The southbound left-turn has the highest v/c (volume-to-capacity ratio) of the intersection. LOS 'E' for long-term urban operation is generally considered acceptable.

In the PM peak hour, the intersection is operating at capacity in the 500,000 horizon. Several of the movements (eastbound left-turn, eastbound right-turn, southbound left-turn) are operating at v/c > 0.95, with the westbound-through at v/c 0.92. This, combined with the long cycle time (140 seconds) required to clear the westbound-through queues, results in delay based LOS 'F' for the eastbound left-turn and southbound left-turn. It should be noted that the 95th percentile queues for the LOS 'F' movements (eastbound left-turn and southbound left-turn) are manageable, at 39 m and 116 m, respectively, which indicates that the any vehicle stopped in the queue would generally be anticipated to clear the intersection within one cycle.

Table 8.2 : 22nd Street / Confederation Drive Intersection – With N/S Pedestrian Crossing

	Eastbound			Westbound			Northbound			Southbound		
Movement	**L**	**T**	**R**	**L**	**T**	**R**				**L**	**T**	**R**
500,000 AM Peak – Signalized (140s Cycle, EB LT pt, EB RT bypass, 29.3s N/S ped clearance)												
Geometry	L/L/T/T/T			T/T/T/R						L/L/R		
Volume	278	1998			1867	510				559		272
v/c	0.73	0.64			0.74	0.55				0.81		0.18
Delay (s)	83.9	4.3			21.6	5.0				60.7		0.2
LOS	F	A			C	A				E		A
95th Queue (m)	m38.2	m21.3			110.2	27.6				99.1		0.0
Intersection Delay (s)						**19.8**	**Intersection LOS**					**B**
500,000 PM Peak – Signalized (140s Cycle, EB LT pt, EB RT bypass, 29.3s N/S ped clearance)												
Geometry	L/L/T/T/T			T/T/T/R						R/L/L		
Volume	322	1656			2722	1061				504		130
v/c	1.05	0.52			0.96	0.73				0.82		0.09
Delay (s)	108.2	2.1			33.1	4.5				64.6		0.1
LOS	F	A			C	A				E		A
95th Queue (m)	m#51.5	m7.8			237.7	m25.3				92.7		0.0
Intersection Delay (s)						**25.9**	**Intersection LOS**					**C**

Notes:
1. #: 95th percentile volume exceeds capacity, queue may be longer
2. M: Volume for 95th percentile queue is metered by upstream signal

+ Summary

It is the queues and volume-to-capacity (v/c) ratios that degrade performance along 22nd Street with the at-grade pedestrian crossing. In the case of v/c's, particularly in the PM, the eastbound movement begins to exceed capacity while the westbound is bordering on the verge of going overcapacity. The queues for westbound (in the PM peak) also become a concern.

Without the at-grade pedestrian crossings, the 95th percentile westbound PM peak queues effectively stretch between the stop bar and the end of the intersection. The queues would not block the SPUI intersection, but they would be close to it.

An observation regarding Synchro analysis is relevant here. As the intersections begin to approach capacity, as they do in this case, the results may become unstable. For example, and that may not be the case for this analysis, adding just 5 more vehicles to a movement can push results to some combination of LOS 'F', v/c>1, and/or long queues. Without pedestrian crossings, in the PM peak, there are 4 movements with v/c > 0.90 (eastbound left, westbound through, westbound right, southbound left), with three of those at over 0.95. With pedestrian crossings, there is one movement (westbound through) at v/c of 0.96 and one (eastbound left-turn) at v/c of 1.05. The risk for instability is much greater with the at-grade pedestrian crossing of 22nd Street.

8.7.2 22nd Street / Circle Drive – Signalized SPUI Intersection

The 22nd Street/Single Point Interchange intersection is assumed to be signalized, with the following geometry:

+ Eastbound – one channelized right-turn lane, three through lanes, dual left-turn bay
+ Westbound – one channelized right-turn lane, three through lanes, dual left-turn bay

- Southbound – one channelized right-turn lane, dual left-turn lanes
- Northbound – one channelized right-turn lane, dual left-turn lanes

At the 500,000 horizon, the intersection will experience congestion and will be approaching capacity, particularly for the westbound through movements in the PM peak. **Table 8.3** summarizes intersection performance.

Table 8.3 : 22nd Street / Circle Drive SPUI Intersection

	Eastbound			Westbound			Northbound			Southbound		
Movement	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**
500,000 AM Peak – Signalized (140s Cycle, all LT pt)												
Geometry	L/L/T/T/T/R			L/L/T/T/T/R			L/L/R			L/L/R		
Volume	158	2260	100	69	1568	54	227		87	39		580
v/c	0.60	0.75	0.10	0.34	0.50	0.05	0.74		0.40	0.11		0.39
Delay (s)	80.7	16.0	1.2	67.2	12.9	0.4	73.6		15.4	54.9		0.7
LOS	F	B	A	E	B	A	E		B	D		A
95th Queue (m)	m34.4	137.3	m3.9	18.6	99.4	0.9	48.7		16.3	11.1		0.0
Intersection Delay (s)						**18.4**	**Intersection LOS**					**B**
500,000 PM Peak– Signalized (140.5s Cycle, all LT pt)												
Geometry	L/L/T/T/T/R			L/L/T/T/T/R			L/L/R			L/L/R		
Volume	177	1847	193	58	2847	21	309		173	174		627
v/c	0.65	0.60	0.19	0.28	0.91	0.02	0.86		0.67	0.43		0.42
Delay (s)	72.5	14.0	3.7	66.1	26.6	0.0	81.8		36.0	59.9		0.8
LOS	E	B	A	E	C	A	F		D	E		A
95th Queue (m)	39.5	123.2	16.0	16.3	287.5	0.0	#71.2		45.6	37.5		0.0
Intersection Delay (s)						**25.1**	**Intersection LOS**					**C**

Notes:
1. #: 95th percentile volume exceeds capacity, queue may be longer
2. M: Volume for 95th percentile queue is metered by upstream signal

8.7.3 Clancy Drive / Northbound C/D Road

The Clancy Drive/Northbound C/D Road intersection is assumed to be signalized, with the following geometry:

- Eastbound – dual left-turn lanes
- Northbound – one free flow through lane, dual left-turn lanes

At the 500,000 horizon, the intersection will operate well. The northbound through movement is anticipated to be free-flowing (i.e., resting on green), except when the pedestrian actuated signal is called for, crossing the northbound through lanes. **Table 8.4** summarizes intersection performance.

Table 8.4 : Clancy Drive / Northbound C/D Road Intersection

	Eastbound			Westbound			Northbound			Southbound		
Movement	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**
500,000 AM Peak – Signalized (50s Cycle, all LT pt)												
Geometry	L/L/						L/L/T (free)					
Volume	308						814	278				
v/c	0.27						0.58	0.0				
Delay (s)	12.1						12.4	0.0				
LOS	B						B	A				
95th Queue (m)	17.7						42.3	0.0				
Intersection Delay (s)						**12.3**	**Intersection LOS**					**B**
500,000 PM Peak– Signalized (50s Cycle, all LT pt)												
Geometry	L/L/						L/L/T (free)					
Volume	354						1035	408				
v/c	0.31						0.73	0.0				
Delay (s)	12.3						15.0	0.0				
LOS	B						B	A				
95th Queue (m)	20.2						58.1	0.0				
Intersection Delay (s)						**14.3**	**Intersection LOS**					**B**

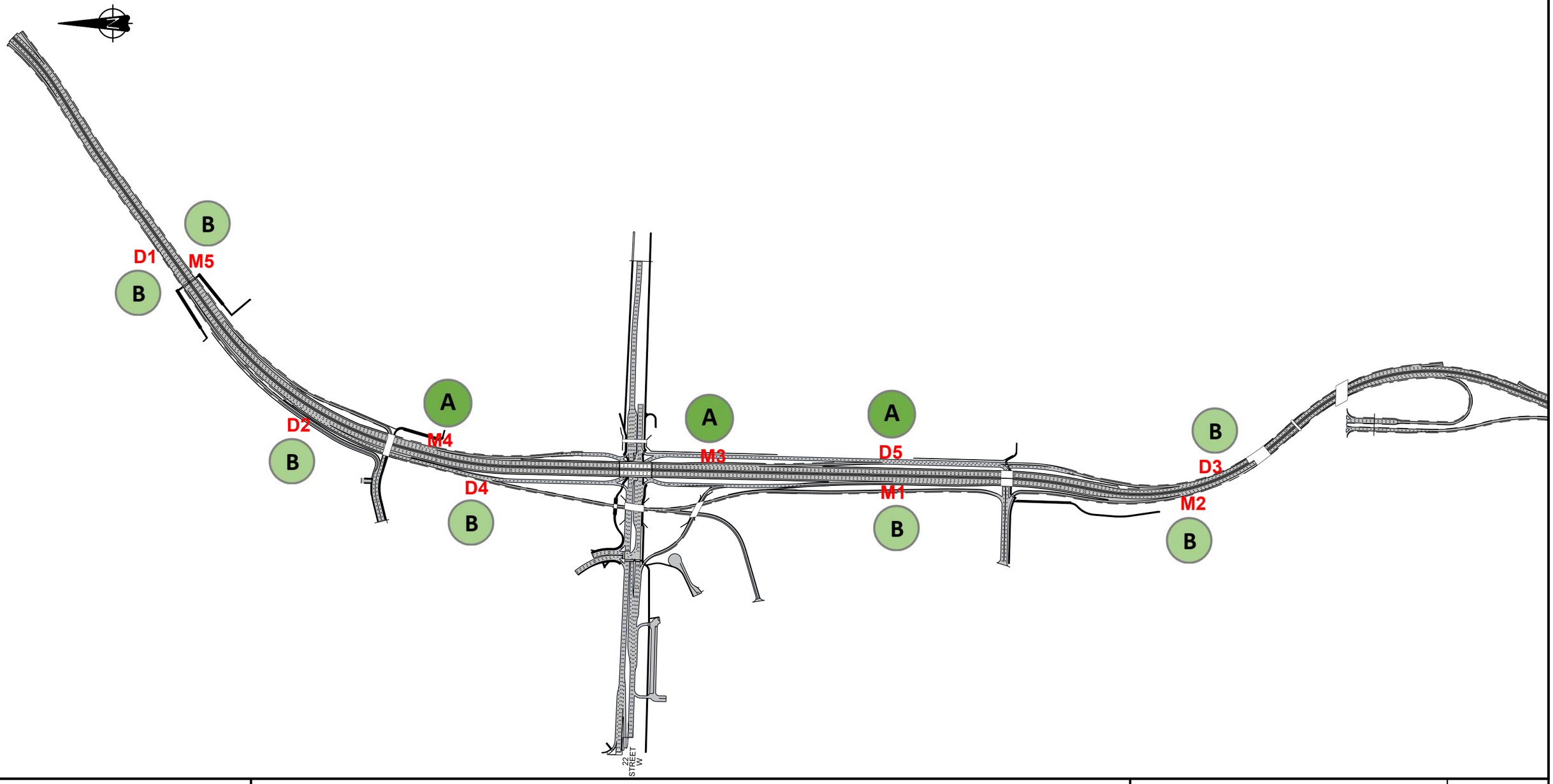
8.7.4 Circle Drive Freeway Segment

The Circle Drive freeway component was analyzed using HCS 7 methodology. A list of the specified Merge (M) and Diverge (D) locations and their LOS are show in **Table 8.5.**

Table 8.5 : HCS Merge / Diverge Locations

Location	Node	LOS	
		AM	PM
Circle Drive			
SB Circle Drive to Laurier Drive	D1	B	C
SB Circle Drive to 22nd Street, Fairmont Drive & Clancy Drive	D2	B	B
NB Circle Drive to Clancy Drive & 22nd Street	D3	B	C
22nd Street to SB Circle Drive	M1	B	B
Fairmont Drive & Clancy Drive to SB Circle Drive	M2	B	C
Clancy Drive to NB Circle Drive	M3	A	B
22nd Street to NB Circle Drive	M4	A	B
Laurier Drive to NB Circle Drive	M5	B	B
C/D Roads			
SB C/D to Fairmont Drive & Clancy Drive	D4	B	B
NB C/D to Circle Drive	D5	A	A

All relevant freeway components achieved LOS ‘C’ or better. A summary of HCS Freeway LOS values for the AM peak hour (**Figure 8.5)** and PM peak hour **(Figure 8.6)** can be seen below. The HCS analysis is included in **Appendix M**, Synchro and HCM Results for the Recommended Plan.



LEGEND:

- LANE DIVIDING LINE
- LANE EDGE LINE OR DIRECTIONAL DIVIDING LINE
- CONCRETE BARRIER
- PATHWAY
- EDGE OF PAVEMENT (RURAL SECTION)
- CURBLINE
- RETAINING WALL
- PROJECT LIMIT

DATE: 18 FEBRUARY 2022

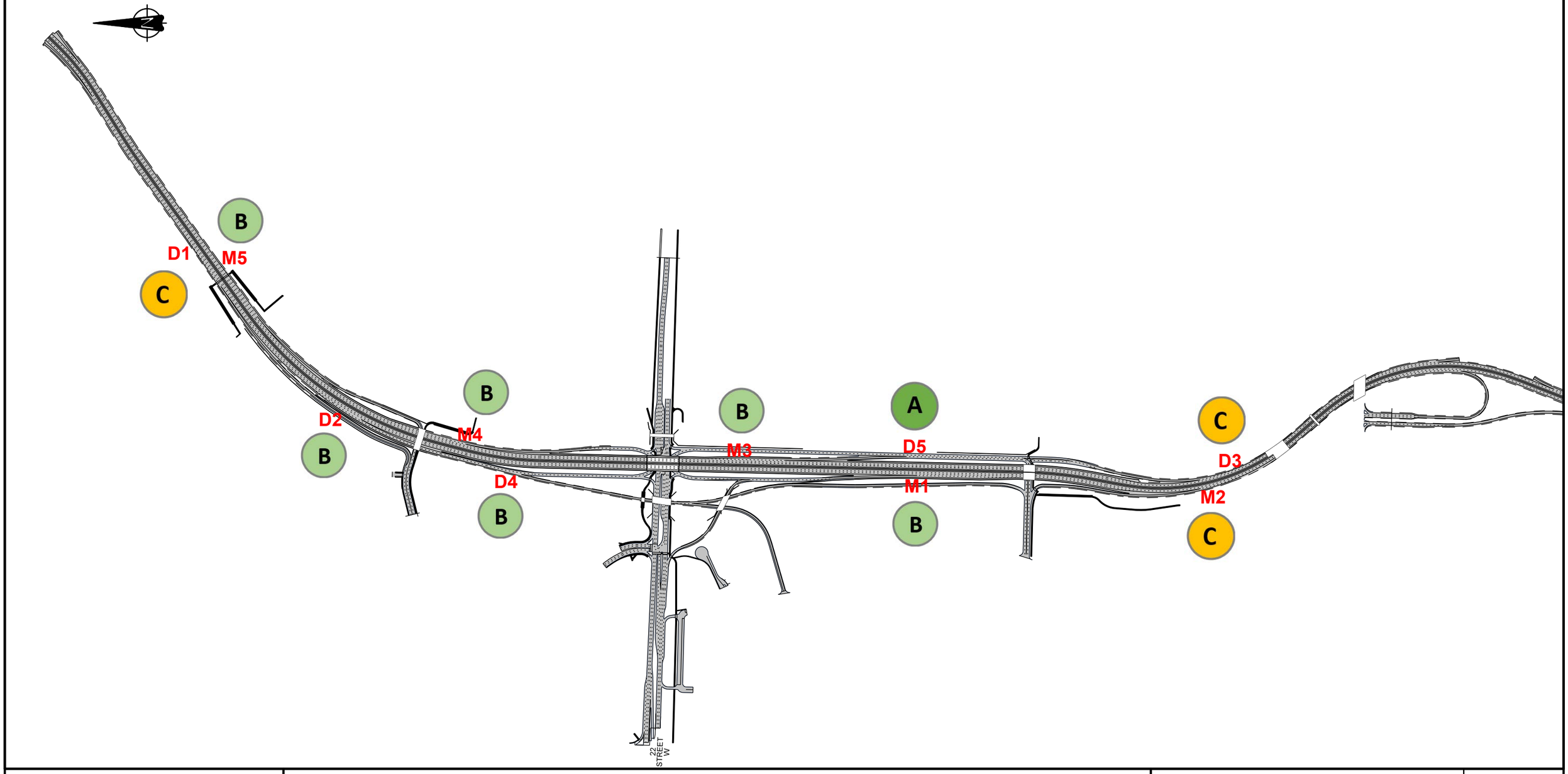
SCALE: 0 50 100 150 200

HCS Freeway LOS - AM Peak

CIRCLE DRIVE WEST
FUNCTIONAL PLANNING STUDY

FIGURE

8.5



LEGEND:

- LANE DIVIDING LINE
- LANE EDGE LINE OR DIRECTIONAL DIVIDING LINE
- CONCRETE BARRIER
- PATHWAY
- EDGE OF PAVEMENT (RURAL SECTION)
- CURBLINE
- RETAINING WALL
- PROJECT LIMIT

DATE: 18 FEBRUARY 2022

SCALE: 0 50 100 150 200

HCS Freeway LOS - PM Peak

CIRCLE DRIVE WEST
FUNCTIONAL PLANNING STUDY

FIGURE
8.6

9. Staging

+ Introduction

Upgrading Circle Drive West to free-flow standards is a highly complex undertaking in a highly constrained corridor. The transition from the existing roadway infrastructure to the approved configuration will be a challenging process, will incur extensive traffic disruption, and will not lend itself to completion in standalone stages. Once the project begins, it will largely need to continue through completion over at least three years. This highly complex project may lend itself to consideration of innovative delivery models to, among other things, minimize overall staging and disruption.

The following is a tentative description of the anticipated project staging. However, the design and tender process, including the involvement of experienced contractors, will revisit/refine the staging sequence with a view to balancing cost and traffic disruption. The staging and detour costs will be significant.

Note: 'Right-off' and 'Right-on' refers to traffic exiting or entering Circle Drive, respectively.

1. Preconstruction Stage – Impacted Stakeholder Agreements

Saskatoon will need to reach property and construction agreements with the following:

- **Confederation Mall**: To construct the embankment for Laurier Drive southerly onto mall lands. Compensation area can be provided in the northwest quadrant of the Circle Drive/22nd Street interchange.
- **Confederation Mall**: To acquire land between their parking lot and Circle Drive along the east side of their building, which will also be replaced in the northwest quadrant of Circle Drive/22nd Street.
- **Evangelical Free Church** and **Laurier Drive Medical Clinic**: To construct a shared access ramp between the two properties, requiring a construction easement from both landowners.
- **West Winds Primary Health Centre:** To construct a cul-de-sac at the east end of Fairlight Drive will need to acquire land.
- **CN**: Reach agreement regarding replacement of the rail overpass crossing 22nd Street and design of the three expanded multi-use pathway underpasses. The staging and detour plans may require construction easements.
- **William A. Reid Park**: Land required south of Clancy Drive; however, a right-of-way limit is not shown crossing city land.

See **Figure 8.4**, Right-of-Way Requirements and Impacts.

2. Stage 1 – CN Rail and 11th Street

- Construct a new 22nd Street CN rail overpass
  Note: This probably requires a temporary 'Shoofly' bypass. If widening the three MUP underpasses also require bypasses, all four CN locations may need to occur simultaneously.
- Construct new southbound on/off ramps to 11th Street

3. Stage 2 – Ramp Construction

All Circle Drive traffic remains on the existing mainline and access at Laurier Drive and Clancy Drive is unchanged.

3.1. Circle Drive at 22nd Street

+ **Phase 1**
  - Build a new northbound on-ramp from 22nd Street to Circle Drive
  - Build additional lanes under the new CN rail crossing
  - Transition all northbound entering traffic to the new ramp (including from the loop ramp)
+ **Phase 2**
  - Decommission and remove the existing loop ramp and northbound on-ramp
  - Construct a new northbound off-ramp from Circle Drive to 22nd Street once the loop ramp is removed
  - Transition all northbound exiting traffic to the new ramp
  - Begin embankment preloading for Circle Drive SPUI approaches and installing mechanically stabilized earth retaining walls
  - Complete substructure of Circle Drive SPUI bridge (abutments, piles, piers, etc.)
  - Complete work on the southbound on-ramp and northbound off-ramp approaches off 22nd where space allows.

3.2. Circle Drive at Laurier Drive

- Construct new southbound off-ramp and retaining walls
- Construct new northbound on-ramp and retaining walls
- Build new Laurier Drive alignment where possible without impacting existing operations (no structure at this stage)

3.3. Circle Drive at Clancy Drive

- Build new southbound C/D road between 22nd Street and Clancy Drive; including a temporary connection to Circle Drive southbound; Remove existing southbound exit to 11th Street
- Build new southbound Clancy Drive to Circle Drive ramp
- Build new Clancy alignment where possible without impacting existing operations

3.4. 29th Street Pedestrian Structures

- Build the 29th Street MUP overpass
- Improve the CN rail MUP underpass structure

  Note: The wider MUP underpasses probably also require temporary ‘Shoofly’ bypasses

4. Stage 3 – Mainline Construction Part I

Circle Drive mainline detours begin and access restrictions begin at Laurier Drive and Clancy Drive

4.1. Circle Drive at 22nd Street

+ **Phase 1**
  - Complete the Circle Drive SPUI interchange super-structure (Bridge Girders and Deck)
  - Complete tie-ins of the SPUI interchange approaches into the existing Circle Drive alignment.
  - Transition all Circle Drive through traffic to the SPUI interchange overpass
  - Construct consecutive eastbound 22nd Street right-on ramp (from Fairlight Crescent) and right-off ramp (to Fairmont Drive) into south mall lands. Upgrade Fairlight Crescent between the two ramps.

+ **Phase 2**
  - Complete tie-ins from the southbound on-ramp approach near the interchange to Circle Drive
  - Transition exiting southbound traffic to the new southbound on-ramp
  - Begin modifications to the existing Circle Drive roadway to accommodate the southbound off-ramp to C/D (frontage) road where space allows.
  - Begin modifications to the existing northbound off-ramp to covert it to a southbound on-ramp where space allows

4.2. Circle Drive at Laurier Drive

- Flip all traffic to the southbound lanes, including connection to the new SPUI
- Build the new northbound half of Circle Drive and finish the northbound on-ramp from Laurier Drive
- Laurier Drive restricted to southbound right-off and eastbound-to-northbound left-turn on
- Improve the CN rail MUP underpass structure

  Note: The wider MUP underpasses probably also require temporary ‘Shoofly’ bypasses

4.3. Circle Drive at Clancy Drive

- Build new southbound half Circle Drive lanes at Clancy Drive
- All traffic flipped to the northbound Circle Drive lanes
- Clancy Drive is restricted to southbound right-off/right-on using ramps constructed in Stage 2
- Construct a new, wider, CN rail MUP underpass structure

  Note: The wider MUP underpasses probably also require temporary ‘Shoofly’ bypasses

5. Stage 4 – Mainline Construction Part II

Circle Drive mainline detours continue and the access restrictions at Laurier Drive and Clancy Drive continue

5.1. Circle Drive at 22nd Street

+ **Phase 1**
  - Complete tie-ins from the northbound off-ramp approach near the interchange to Circle Drive
  - Transition entering southbound traffic to the new southbound off-ramp
  - Decommission and remove the existing southbound-to-westbound ramp bridge structure and large embankment
  - Complete modifications to the existing northbound off-ramp to convert it to a southbound on-ramp near the Confederation Drive/22nd Street intersection.
  - Transition exiting southbound traffic to the 2nd new southbound on-ramp
  - Complete the tie-in from the C/D (frontage) road to the southbound ramp to Fairmount Drive and transition traffic onto the ramp.
  - Construct the dead-end cul-de-sac at the east end of Fairlight Drive
+ **Phase 2**
  - Remove the existing southbound ramp bridge structure to Fairmont Drive
  - Construct additional lane and new MUP underpass beneath realigned southbound C/D road
  - Remove the existing southbound Circle Drive mainline structure
  - Add additional lanes to 22nd where required east and west of the Confederation Drive/22nd Street intersection.

5.2. Circle Drive at Laurier Drive

- Build the southbound Circle Drive lanes at Laurier Drive
- Circle Drive traffic utilizes ultimate northbound lanes in both directions
- Laurier Drive is restricted to southbound right-off only until the bridge is constructed (at end of Stage 6.2)

5.3. Circle Drive at Clancy Drive

- Build northbound Circle Drive lanes at Clancy Drive
- Build remainder of northbound and southbound C/D roads
- Realign the southbound C/D road onto the existing northbound mainline structure
- Reverse the existing northbound exit ramp (from Circle Drive to Confederation Drive intersection) to a southbound on-ramp (through to existing underpass structures)
- Circle Drive traffic utilizes ultimate southbound lanes in both directions
- Clancy Drive is restricted to southbound right-off/right-on using ramps constructed in Stage 2

6. Stage 5 – Clancy Drive and Laurier Drive Structures

6.1. Circle Drive at 22nd Street

- Construct any final clean-up at the SPUI
- Complete any remaining C/D road upgrades
- Complete any improvements to temporary roadway tie-ins (temporary median crossovers will be required to complete this work).

6.2. Circle Drive at Laurier Drive

- Build the Laurier Drive structure and remaining Laurier Drive roadway changes
- Laurier Drive is restricted to the southbound exit only until the bridge is constructed
- Complete the Laurier Drive MUP connection
- Once the bridge is in place, open Laurier interchange and MUP
- Laurier Drive access now follows the ultimate configuration, southbound right-off exit, northbound left-on entrance

6.3. Circle Drive at Clancy Drive

- Build remaining Clancy Drive roadway changes
- Clancy Drive restricted to southbound right-off/right-on until all roadway and C/D road changes are complete
- Complete the Clancy Drive MUP connection
- Once work is complete, open the Clancy Drive interchange and MUP

7. Stage 6 – Complete 22nd Street upgrades

- 22nd Street / Confederation Drive intersection
- Finish final upgrades and transitions/clean up along Circle Drive
- Design and upgrade the 22nd Street intersection with Diefenbaker Drive

10. Cost Estimate

This section summarizes the Class 'C' planning level cost estimate.

1. Cost Estimate Summary

Table 10.1 summarizes the cost estimate shown in **Appendix N**. Item 3, retaining wall structures, is the largest cost item, almost 40% of the construction subtotal. This reflects the need to accommodate an expanded Circle Drive in a narrow right-of-way, constrained by the CN line on the east and development on the west.

Table 10.1 : Class 'C' Planning Level Cost Estimate Summary

Item	Description		Totals ($M)
Construction			
1	Roadway: Removals		$4
2	Roadway: New Construction		$42
3	Structures: Retaining		$105
4	Structures: Bridges		$95
5	Utilities & Signages		$8
6	Stormwater Upgrades		$18
7	Right-of-Way Acquisition		$0.5
Subtotal			**$273**
Provisional			
	Engineering	12%	$33
	Staging & Detours (incl. rail)	10%	$27
	Contingency	40%	$109
Subtotal			**$169**
Grand Total			
Total			**$442**

2. Right-of-Way

The estimated right-of-way costs reflect the following:

1. Laurier Drive Medical Clinic for access easement.
2. Evangelical Free Church for access easement and corner cut.
3. Confederation Mall for Laurier Drive and Circle Drive embankments. Replacement land area to be provided to the mall in northwest Circle Drive/22nd street interchange quadrant.
4. West Winds Primary Health Centre for cul-de-sac construction.

Note: Only simple land costs are provided in right-of-way acquisition. Restoration and compensation may also be required.

3. 11th Street Southbound Ramps

The changes to the on/off ramps to/from 11th Street to southbound Circle Drive have not been included in the high-level cost estimate.

4. Stormwater Management

As described in the report, an understanding of stormwater management requirements in the broader study area is needed before being able to define how Circle Drive's contribution can best be accommodated. The cost estimate includes a $5M provisional amount for underground storage. This will need to be revisited during future design stages.

5. Saskatoon Transit

The BRT is to be implemented in 2026. There may be a cost to relocate transit stops in the future. Saskatoon Transit has estimated $500k per stop for new construction. The current Circle Drive West plans do not identify specific transit impacts, including the existing Laurier Bus Loop (Confederation Transit Hub). Potential BRT impacts and costs are not reflected in the cost estimate.

11. Conclusions

The functional planning study process reached the following conclusions regarding the technical and the stakeholder engagement outcomes.

+ Traffic Volumes

The peak hour traffic volumes approaching the Circle Drive/22nd Street interchange for the 500,000 population horizon are roughly three times higher on east-west 22nd Street than north-south Circle Drive. This difference may not be as great based on average daily traffic volumes or weekend volumes, but these represent the design hours for planning purposes. The study's initial focus was on Circle Drive West; however, the solution-finding was equally driven by the east-west performance of 22nd Street through the study area. See **Figures 11.1 and 11.2**, AM and PM Peak Hour Volumes and Intersection LOS, respectively, for the 500,000 population horizon.

+ Circle Drive / 22nd Street Interchange

The Diverging Diamond Interchange configuration presented an option with the potential to retain the existing Circle Drive infrastructure, however, the concept would not have improved Circle Drive's mainline geometry, was too great a departure from Saskatoon's current traffic operations and was unlikely to improve concerns regarding driver workload and comprehension. The Single-Point Urban Interchange configuration replaces the existing large unconventional interchange with a compact, simple, design that also improves Circle Drive's mainline geometry. It is assumed that by the time construction proceeds, the existing infrastructure will be nearer the end of its service life.

+ Circle Drive / Clancy Drive Interchange

Clancy Drive is lowered under Circle Drive. The Simple-Diamond Interchange configuration provides all-movement access off/on Circle Drive, including access to 22nd Street, a movement not currently permitted. The 800m spacing to 22nd Street does not meet best practices, therefore parallel collector/ distributor roads are used to permit all-movement access at Clancy Drive. This is a costly solution to accommodate the short spacing. The design places precedence on establishing all-movement access at the 22nd Street / Circle Drive interchange, the junction of two core routes. Circle Drive does not accommodate access from 22nd Street in the short distance to Clancy Drive. As a freeway facility, Circle Drive is not intended to accommodate short 800m long trips.

+ Circle Drive / Laurier Drive Interchange

Laurier Drive is elevated over a depressed Circle Dive. The half-diamond Interchange configuration, with access to/from the north on Circle Drive, recognizes Laurier Drive's proximity to the 22nd Street interchange. Laurier Drive is only 600m from 22nd Street, less than half the minimum spacing meeting best practices. Access to/from the south on Circle Drive cannot be accommodated without significant additional cost and property impacts.

+ Laurier Drive Access Management

Laurier Drive will be partially elevated overtop a partially depressed Circle Drive. The embankment to elevate Laurier Drive extends south onto Confederation Mall lands. Access to the two properties nearest Circle Drive is consolidated to a shared, slightly elevated, access point. This plan is preferred, taking up mall lands, not park space; however, it assumes that Saskatoon can provide the Confederation Mall with replacement lands nearby, from surplus lands near the Circle Drive/22nd Street interchange.

+ 22nd Street West

22nd Street is the primary entranceway into the City of Saskatoon from the west, carrying more than three times the peak hour traffic flows on Circle Drive West. Saskatoon proposes transitioning 22nd Street West from its current designation as a major Freeway/Expressway facility to a more urban arterial/multi-modal configuration. In the absence of any practical alternatives to 22nd Street entering Saskatoon from the west, it will be important to protect 22nd Street as a high-volume facility, carrying both commuter traffic and inter-regional flows.

System performance reaches capacity along 22nd street through the study area, based on the traffic volume forecasts the city provided, at the 500,000 population horizon. However, the city's proposed BRT services beginning in 2026 are expected to change the modal split, diverting more drivers to transit, reducing the number of vehicles on the road and roadway congestion.

+ Stakeholder Engagement

- **Neighbourhoods**:

  Several stakeholder concerns remain. Saskatoon's (or any proponent's) ability to address all stakeholder concerns is inversely proportional to the project scope. Therefore, a project of this scope will rarely resolve all stakeholder concerns and still achieve all the project's technical objectives. The City has committed to addressing seven of the public's key concerns as development of the long-term plan is consolidated moving forward. The concerns are listed at the end of this section.

- **Businesses**:

  North Mall Visibility: The existing southbound-to-westbound elevated ramp over Confederation Drive largely hides the north mall shopping area. Removing this ramp, as well the existing southbound Circle Drive structure, will generally improve the visibility of the north shopping mall area from 22nd Street.

- **CN**:

  Replacement of the CN bridge is the first stage in the project, requiring early engagement with CN. Engagement with CN will include upgrading the three pedestrian tunnels connecting the neighbourhoods east and west of the joint Circle Drive-CN corridor.

+ Multi-Use Pathways

The recommended plan includes an expanded multi-use pathway system. In addition to upgrading three pedestrian underpasses of Circle Drive, there are two existing pedestrian overpasses of 22nd Street near the study area. The recommended plan includes an at-grade crossing of 22nd Street on the west leg at Confederation Drive.

The proposed Confederation Transit Village[28] included a centrally located pedestrian overpass of 22nd Street connecting the north and south malls. An additional grade-separated crossing of 22nd Street near Confederation Drive will be warranted by the 500,000 population horizon as the traffic volumes and cross-section increase. Although Saskatoon intends to retain an at-grade crossing on the west leg, an overpass would benefit the performance of both the Confederation Drive and Diefenbaker Drive intersections with 22nd Street, including east-west capacity along 22nd Street.

[28] Transit Villages Report, Appendix 2, Confederation Demonstration Plan

+ Saskatoon Light & Power

The most significant utility affecting the Circle Drive West corridor is Saskatoon Light & Power's transmission lines. Circle Drive's lanes have moved closer to the power lines but do not pass underneath. Vertical clearances should be confirmed at the preliminary design stage

+ Project Scope and Cost

The project scope is significant, with the total project cost approaching $500M dollars, not including the cost to upgrade the Circle Drive/11th Street interchange or the 22nd Street/Diefenbaker Drive intersection. The construction process will likely be staged over several years and is expected to be highly disruptive to two core city corridors. Saskatoon should consider exploring the potential for other area road network solutions outside the immediate project limits that may reduce the project cost and disruption.

+ Noise Attenuation

The modelled results for the outdoor rear amenity areas of single-family residential or townhouse type multi-family land uses adjacent to the affected corridor indicate that the predicted L_{DN} noise levels meet the 65 dBA DNL at all residences in the area for the forecasted traffic horizon, and that no additional noise attenuation is required.

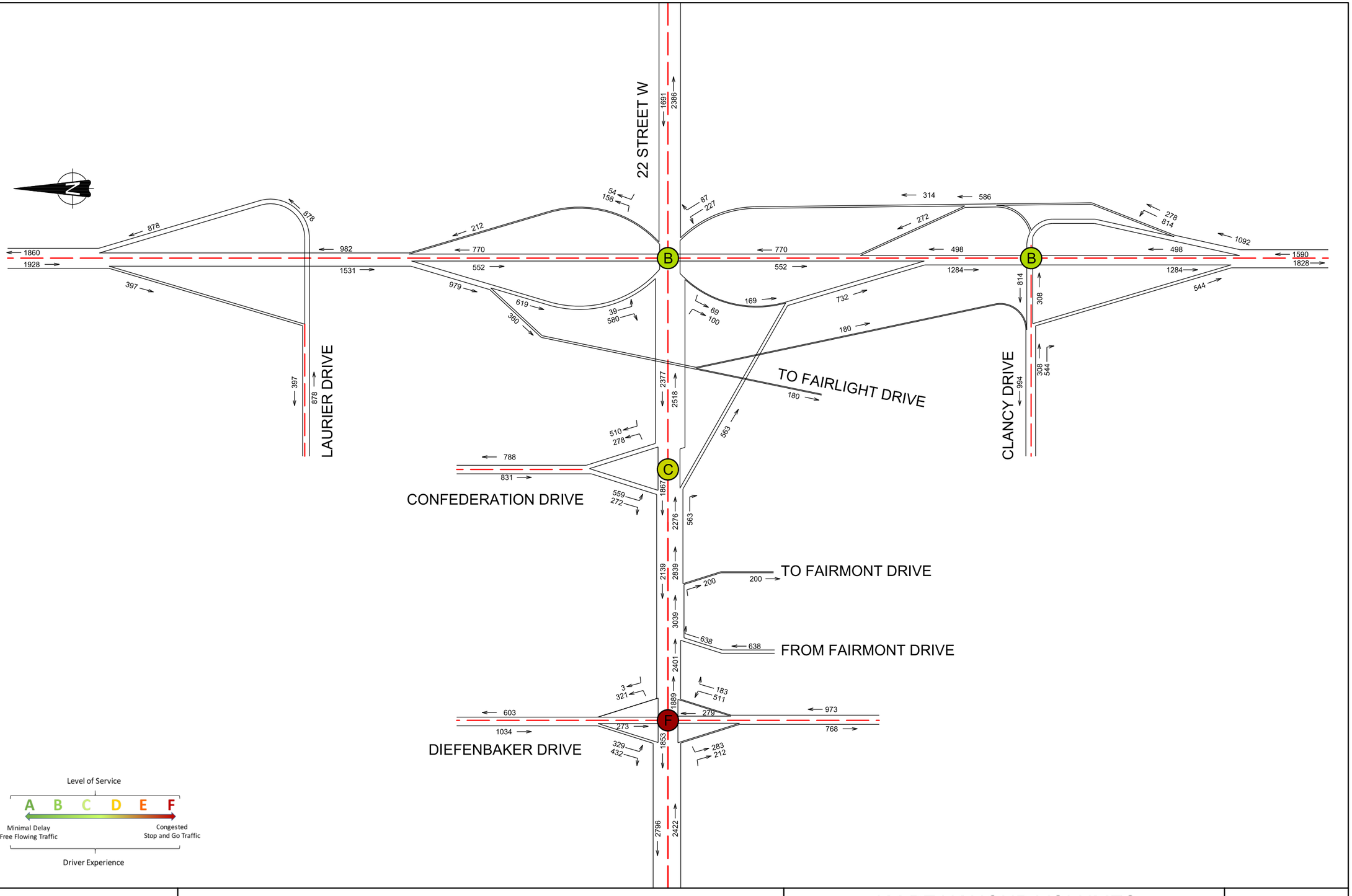
+ Stormwater Management

The larger study area surrounding the Circle Drive West corridor has an underlying stormwater management issue involving storage requirements. A standard approach would be to quantify the increment associated with Circle Drive West and identify how the required retention could be accommodated. However, this would be irrelevant without first addressing the larger study area's underlying stormwater management requirements.

+ City Commitments

Assuming that the recommended functional plan is moved forward, the transportation department will need to undertake the following actions to finish consolidating the long-term plan for Circle Drive West and the affected section of 22nd Street.

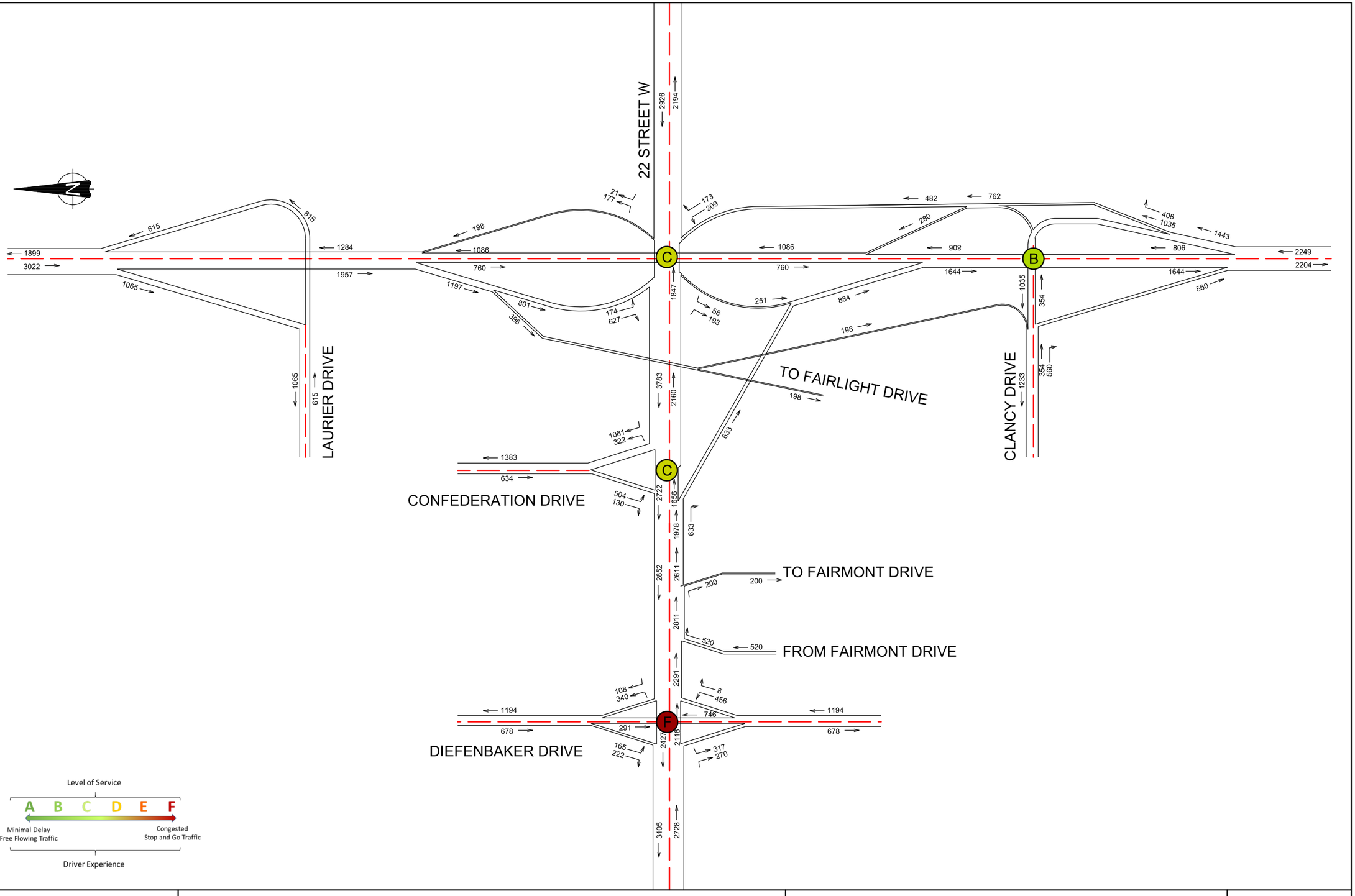
- Widen 22nd Street eastbound, from Diefenbaker Drive to the C/D ramps, to provide a third (outside) lane
- Construct a slotted left-turn eastbound at Confederation Drive, including crosswalks.
- Accommodate a future BRT Station at Diefenbaker Drive.
- Widen 22nd Street eastbound and westbound from Diefenbaker Drive to Neault Road.
- Begin engagement with CN to replace the three pedestrian underpasses.
- Complete functional planning study to grade separate the rail crossings at the 11th Street interchange.
- Complete functional planning to upgrade the 22nd Street / Diefenbaker Drive intersection.



AM PEAK HOUR VOLUMES
INTERSECTION LEVEL OF SERVICE
500K POPULATION HORIZON

CIRCLE DRIVE WEST FUNCTIONAL PLANNING STUDY

FIGURE
11.1



PM PEAK HOUR VOLUMES
INTERSECTION LEVEL OF SERVICE
500K POPULATION HORIZON

CIRCLE DRIVE WEST FUNCTIONAL PLANNING STUDY

FIGURE

11.2

12. Recommendations

The functional planning study process reached the conclusions described in Section 11, defining the recommended plan. The recommendations below address the process moving forward, identifying various collateral issues central to successfully implementing the recommended plan.

+ Diefenbaker Drive / 22nd Street Intersection

Complete a functional planning study for the Diefenbaker Drive intersection with 22nd Street and consolidate with the recommended plan for Circle Drive West. The intersection with Diefenbaker Drive is integral to the overall network and its upgrade supports the recommended 22nd Street / Circle Drive plan.

+ 11th Street / Circle Drive Interchange

Complete a full functional planning study for the 11th Street / Circle Drive interchange, as proposed by Saskatoon's current concept plan, and consolidate with the recommended plan for Circle Drive West. Implementing the currently recommended plan is contingent on changes to the 11th Street interchange.

+ Impacts to CN

Prepare a concept plan to lengthen the existing CN overpass of 22nd Street for discussion with CN. Investigate the design of a temporary rail line bypass (Shoofly).

Prepare a concept plan to expand the three existing pedestrian underpasses beneath the CN line. Investigate the need to temporarily realign the rail line during construction and whether it would be most effective to bypass all four CN locations at the same time.

+ Stormwater Management

To receive the greatest benefit from the roadway upgrading project, undertake a stormwater management study through the study corridor and surrounding neighbourhoods. Identify/quantify the current overall stormwater management system requirements through the larger study area. This will map where and how much the system is currently overcapacity and combine the retention requirements for the expanded road surface and the current flooding volume.

+ Confederation Drive /22nd Street Intersection

Consider extending the right-hand southbound-to-eastbound left-turn lane from Confederation Drive to a shared left-turn/through lane. The through-lane would connect with the proposed eastbound-southbound ramp onto Circle Drive. This change takes advantage of existing signal phasing and does not affect signal timing or performance.

+ Project Scope and Cost

Explore the potential for other area road network solutions that may reduce project cost and disruption and improve network performance.

+ Implementation

Upgrading Circle Drive West to free-flow standards is a highly complex undertaking in a highly constrained corridor. The transition from the existing roadway infrastructure to the approved configuration will be a challenging process, will incur extensive traffic disruption, and will not lend itself to completion in standalone stages. This highly complex project may lend itself to consideration of innovative delivery models to, among other things, minimize overall staging and disruption.

A

Appendix A
Existing Corridor Geometry

B

Appendix B
Proposed 11th Street / Circle Drive Interchange Concept (by others)

C

Appendix C
City of Saskatoon – Street Network and Project Growth Concept Plans

CIMA+

D

Appendix D
Compiled Stormwater Management As-Built Plan

E

Appendix E
Proposed Design Criteria

F

Appendix F
CN Encroachment Options

G

Appendix G
Circle Drive West Freeway Options

H

Appendix H
Laurier Drive Access Management Options

Appendix I
Open House Reports

J

Appendix J
Circle Drive West Functional Plans

CIMA+

K

Appendix K
Multi-Use Pathway Crossing Concept, 22nd Street at Confederation Drive

L

Appendix L
Traffic Impact Noise Assessment

M

Appendix M
Synchro and HCM Results for the Recommended Plan

N

Appendix N
Class ‘C’ Planning Level Cost Estimate