RILEY COMMUNITIES MOBILITY PLAN

May 1, 2024

URBAN SYSTEMS

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OVERVIEW

The City of Calgary (The City) has developed a Local Area Plan (LAP) for the Riley Communities ("The Plan"), which include the Hillhurst, Hounsfield Heights/Briar Hill, Sunnyside, and West Hillhurst neighbourhoods. The Plan will be used to guide where and how future growth and redevelopment will happen in these communities. The Plan aims to integrate and enhance the existing fabric of the area and ensure the area is vibrant and thriving in the future.

PURPOSE AND CONTENT OF THE MOBILITY PLAN

This Mobility Plan was developed as part of the Riley Communities LAP process to help inform the understanding of the community context and mobility trends in these communities. The purpose of the Mobility Plan is to provide a long-term roadmap for The City to guide mobility improvement projects and investments to address issues and opportunities over the next several years.

PROJECT IDENTIFICATION PROCESS

After gathering background information to understand the local context and the needs of the Riley Communities, a list of mobility improvement projects was developed. This list was determined based on the findings of the background review (see the *Background Assessment Report* in **Appendix A**) and through engagement conducted during the development of The Plan. Some of the specific considerations in identifying projects included:

- Projects already identified in previous plans, programs, or studies, including identified efficiencies through already planned network improvements.
- Roadways that have excess vehicular capacity that could have road space reallocated to waking, wheeling, and/or transit.
- Identified efficiencies through already planned network improvements.
- Areas with identified traffic safety issues, including collision hotspots, and high collision or near-miss locations.
- Areas where speeding was identified as a potential issue through historical data, video-based conflict analysis or public engagement.
- Gaps in the pedestrian, wheeling, and/or transit networks.
- Community priorities identified through past engagement events and through engagement events associated with The Plan.

The project team worked closely with City staff to finalize a list of over 90 mobility improvement projects to be considered over the long-term within the Plan Area. Due to the expansive list, projects were divided into five project categories with some categories including several subcategories:

1. Improvements for people walking and wheeling.
    - Enhancements to the existing walking and/or wheeling networks (e.g., upgrades to existing infrastructure)
    - Enhancements to the future walking and/or wheeling networks (e.g., new facilities)
2. Improved transit connections.
    - Enhancements to the existing transit network and the walking and wheeling connections that enable people to access it.
3. Improvements for all modes of transportation.
    - Intersection improvements

    - Corridor improvements
4. Parking management review.
    - Reviewing current parking demands in an area to understand if the existing supply is sufficient.
5. Traffic calming
    - Volume and speed reduction.
    - Speed reduction.

Figure ES-1 provides a map of the mobility improvement projects within the Riley Communities.

PROJECT PRIORITIZATION

The "Making it Happen" section of the Mobility Plan begins with the process developed to prioritize the implementation of the mobility improvement projects and summarizes the established priorities.

Prioritization criteria were developed that built upon the unique range of amenities within the Plan Area and the general desire to improve mobility options for residents and visitors as highlighted within The Plan's Vision and Core Values. Seven prioritization criteria were identified and are described as follows:

- **Proximity to transit** – One of The Plan's Core Values is to improve movement to and through the Riley Communities which can be achieved through improvements to and around transit. This criterion measures the degree to which the proposed improvement increases access to transit facilities. Improvements located within the closest proximity to MAX and LRT transit stops received the highest score.
- **Proximity to key destinations** – Libraries, schools, parks, religious places of assembly, community centres, and commercial areas are important destinations within the community and highlighted in The Plan's Core Values. This criterion examined whether proposed projects were located within 400 metres of these key destinations and gave them a higher score accordingly.
- **Safety (Proximity to a location identified to have a higher number of collisions)** – Safe and accessible communities was identified as one of The Plan's Core Values. With a collision review of the Plan Area, high collision areas were identified. Mitigating safety issues throughout the transportation network will be key in improving safety and accessibility within the Riley Communities. Projects near a collision hotspot were given higher scores.
- **Relative cost** – Several of the identified projects are low cost, quick-wins that could lead to measurable improvements within the Riley Communities. Projects with lower relative costs were given higher scores.
- **Community interest** – Many projects were identified during The Plan's engagement process or through prior events. Residents have a first-hand experience on issues related to their communities. Projects that address issues that have been brought to The City's attention or were submitted to The City's 311 program were given higher scores.
- **Previously planned projects** – Several projects within the Plan Area have either carried out engagement, planning stages, or moved to more detailed designs. These projects were given higher scores.
- **Maintenance or lifecycle replacement projects** – Efficiencies with time and cost may be realized with projects that are located in the same place as other maintenance or rehabilitation projects planned by The City. Projects overlapping with known maintenance and replacement projects were given higher scores.

These seven criteria enabled the projects to be sorted into “high priority”, “medium priority”, and “low priority” categories. While it is recommended that The City begin with implementing the high-priority projects, **the ultimate order of implementation could change over time based as factors such as operational needs, joint funding opportunities with other Capital Projects, and community feedback, among other considerations.**

IMPLEMENTATION FRAMEWORK

Successful implementation of the identified projects will rely on appropriate financial commitments from The City and sustained efforts to enable and encourage behavioural change at the individual level. The Riley Communities Mobility Plan has also developed an implementation framework intended to serve as a quick reference guide to enable further dialogue, collaboration, and development of resources to support each project. The framework includes implementation timeframes, review of the project’s alignment with The Plan’s Vision and Core Values, and high-level cost ranges.

Figure ES-2 illustrates the prioritized mobility improvement projects with the high-priority projects shown in **red**, the medium-priority projects shown in **yellow** and the low-priority projects shown in **green**. A detailed table is provided within the Mobility Plan that describes each mobility project along with additional implementation considerations. As previously stated, while it is recommended that The City begin with implementing the high-priority projects, **the ultimate order of implementation could change over time based as factors such as operational needs, joint funding opportunities with other Capital Projects, and community feedback, among other considerations**

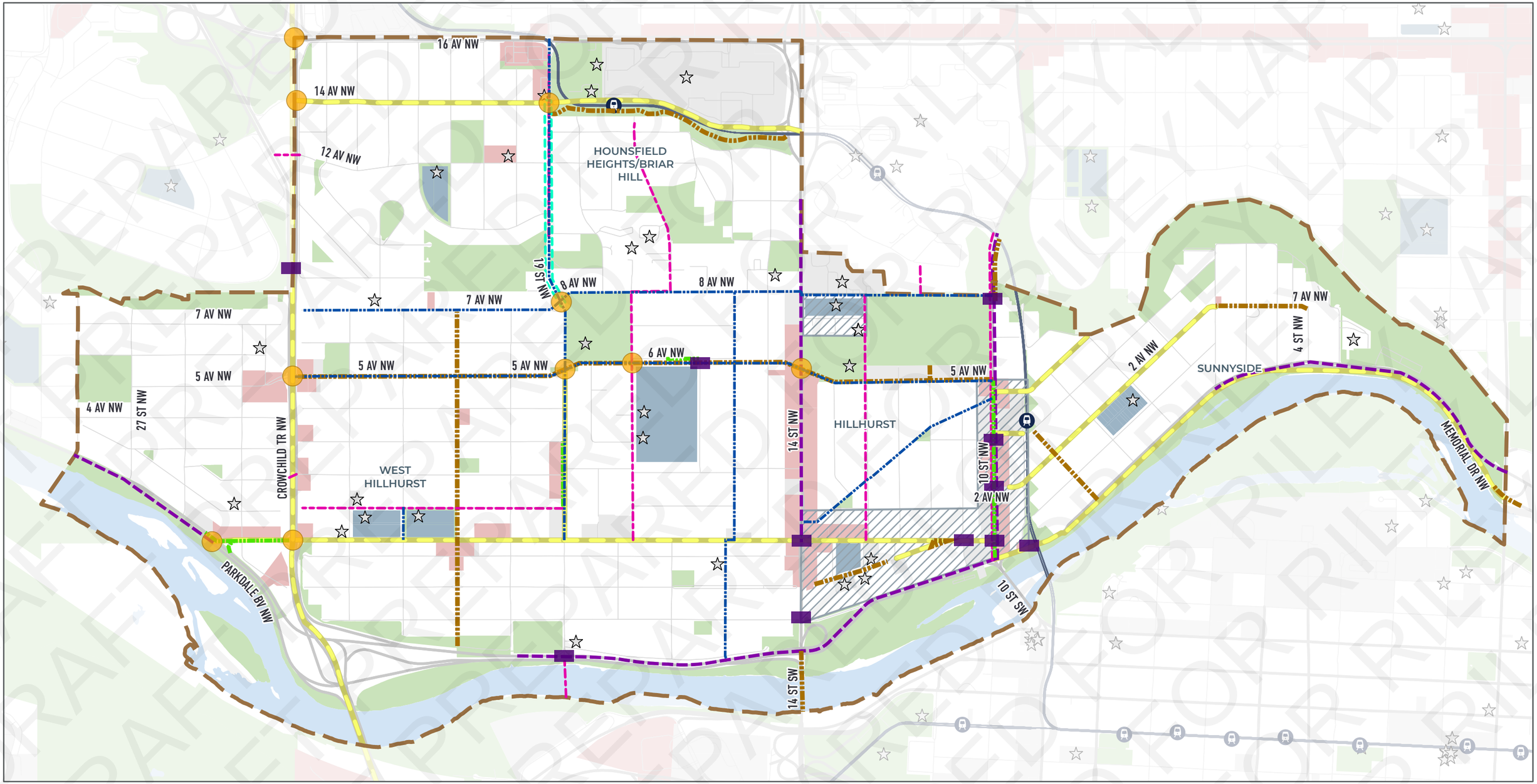
HIGH-PRIORITY PROJECT PROFILES

A series of 20 Project Profiles detail the high-priority projects. Each Project Profile will allow a newly assembled project team to easily and quickly understand the project background and potential options and next steps to begin moving the project forward.

A large focus of these projects is on improvements to movement and safety for those walking and wheeling. This focus aligns with the several of The Plan’s Core Values including improving access to parks, recreation and public space, climate action and safe and accessible communities.

The content of each Project Profile includes:

- A high-level overview of the project, including existing conditions and the reason for the project.
- A map illustrating the project location within the Plan Area.
- Steps that have already been completed (if any) such as engagement activities and previously considered or preferred designs.
- The mobility mode(s) that the project is prioritizing.
- Project goals (if they have already been identified).
- The opportunities and challenges the project presents.
- The City policies that the project aligns with.
- The relative project scoring developed in the prioritization process and the result.
- Some profiles provide photos illustrating existing conditions.
- Some profiles include examples of potential improvement measures to consider moving forward.



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Project #: 1057.0189.01
Author: SDF

Revision: FINAL
Date: 2024 / 2 / 6

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Meters

Coordinate System:
NAD 1983 3TM 114

Scale: 1:12,000
(When plotted at 11"x17")

Legend

- Points of Interest
- LRT Station
- School
- Park
- Commercial
- Commercial (Direct Control)
- Study Area
- Transit Connections
- Parking Management Review

Improvements for All Modes
- Intersection Improvements
- Corridor Improvements

Improvements for People Walking and Wheeling
- Crossing Improvements
- Crossing Improvements
- Network Enhancements - New Connections
- Network Enhancements - Existing Network

Traffic Calming
- Speed Reduction
- Volume and Speed Reduction

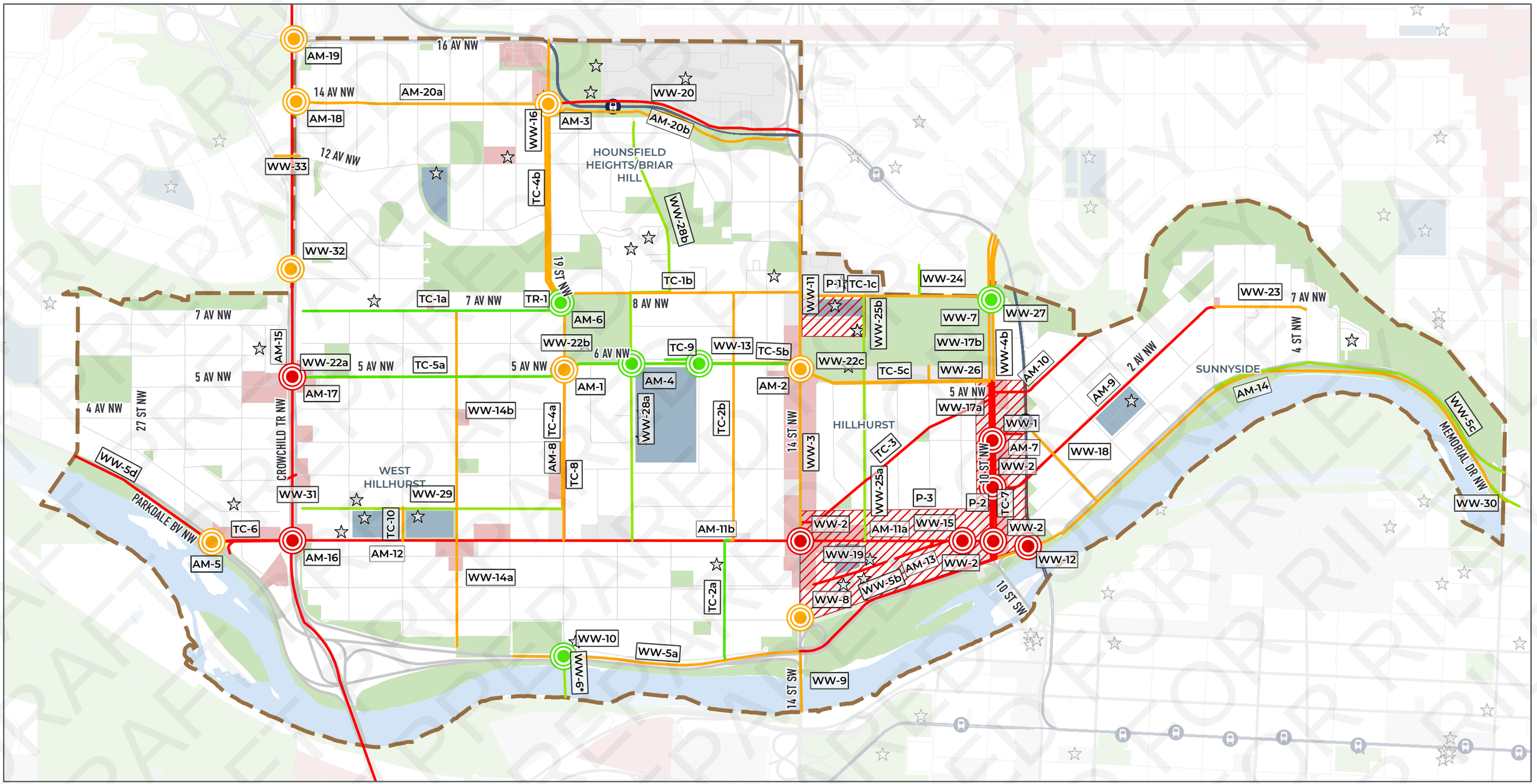
*Projects that apply to the whole project area were excluded from the map.

Calgary

Riley Communities Mobility Plan

FIGURE ES-1

Mobility Improvement Projects



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Legend

- Points of Interest
- LRT Station
- Park
- Commercial
- Commercial (Direct Control)
- Study Area

- High Priority
- Medium Priority
- Low Priority

- High Priority
- Medium Priority
- Low Priority
- High Priority

*Projects that apply to the whole project area were excluded from the map.

Calgary

Riley Communities Mobility Plan

FIGURE ES-2

Mobility Projects Prioritization

(Source: Riely Communities Local Area Plan – Draft Chapter 1)

Overview

The City of Calgary (The City) has developed a Local Area Plan (LAP) for the Riely Communities ("The Plan"), which include the Hillhurst, Hounsfield Heights/Briar Hill, Sunnyside, and West Hillhurst neighbourhoods. The Plan will be used to guide where and how future growth and redevelopment will happen in these communities. The Plan aims to integrate and enhance the existing fabric of the area and ensure the area is vibrant and thriving in the future.

PURPOSE AND CONTENT OF THE MOBILITY PLAN

This Mobility Plan was developed as part of the Riley Communities LAP process to help inform the understanding of the community context and mobility trends in these communities. The purpose of the Mobility Plan is to provide a long-term roadmap for The City to guide mobility improvement projects and investments to address issues and opportunities over the next several years.

The Mobility Plan is organized into four parts:

Part 1: Where We Are Now summarizes the existing conditions for mobility and previously developed plans for the Riley Communities, along with anticipated population growth in the Plan Area. This section is a summary of the *Background Assessment Report* completed in 2023 and included in **Appendix A**.

Part 2: A Vision for the Future details the process for establishing the recommended long-term mobility improvement projects for the Riley Communities and provides a map summarizing the projects.

Part 3: Making it Happen outlines the process developed to prioritize the implementation of the mobility improvement projects and summarizes the established priorities. This also includes an implementation framework to serve as a quick reference guide to enable further dialogue, collaboration, and development of resources to support carrying out each project.

Part 4: Moving Forward summarizes some key guiding principles for implementation of the Mobility Plan and establishes some targets for The City to work toward.

1.0 WHERE WE ARE NOW

This section summarizes the findings of a comprehensive review of the existing mobility conditions and previously developed plans for the Riley Communities. It should be noted that this review was completed in 2023 and conditions may have changed since the time of writing.

Many mobility-related plans, programs, and projects have previously been developed for the Plan Area. As such, it was important to fully understand the recommendations and lessons learned from each of these studies and to incorporate them in this Mobility Plan. This review also included a transportation safety review of the entire Plan Area and a detailed safety review of five key intersections in the Plan Area.

Refer to **Appendix A** for the corresponding *Background Assessment Report* for more detailed summaries of each background document and for a more detailed summary of the existing mobility conditions.

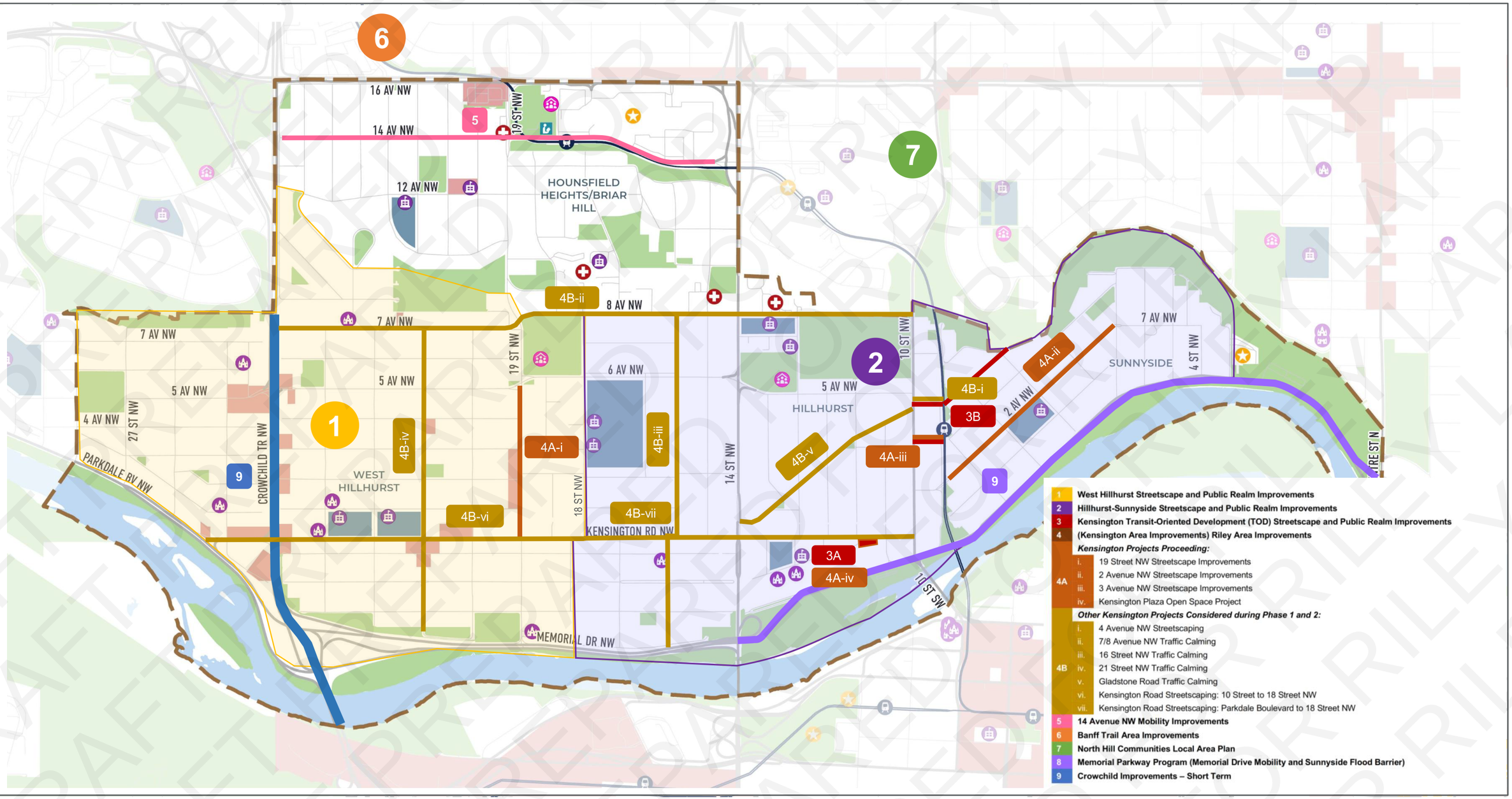
1.1 BACKGROUND PLANS, PROGRAMS, AND PROJECTS

A comprehensive review of relevant background plans, programs, projects, and other relevant documents was conducted to ensure that these initiatives align with the Mobility Plan and that the Mobility Plan integrates their recommendations. **Table 1-1** summarizes the relevant documents and projects reviewed. **Figure 1-1** illustrates the location of the infrastructure projects reviewed. For more detailed summaries of each background document, refer to the **Background Assessment Report**.

Table 1-1: Summary of Reviewed Plans, Programs, and Projects

	Project Name		Est. Timeline	Riley Communities Impacted	Status
Established Area Growth and Change Strategy (EAGCS)					
1	West Hillhurst Streetscape and Public Realm Improvements		2021-2023	West Hillhurst	Phase 1 – Identifying Opportunities engagement completed (April 2021)
2	Hillhurst-Sunnyside Streetscape and Public Realm Improvements		2021-2023	Hillhurst Sunnyside	Phase 1 – Project Prioritization engagement completed (June 2021)
3	Kensington Transit-Oriented Development (TOD) Streetscape and Public Realm Improvements		2021-2023	A. Hillhurst (Kensington Plaza) B. Sunnyside (3 Avenue NW/4 Avenue NW)	Initial engagement survey launched. No public results from survey.
4	(Kensington Area Improvements) Riley Area Improvements		2021-2023	West Hillhurst Hounsfield Heights/ Briar Hill Hillhurst Sunnyside	SEE BELOW for projects moving forward.
	Riley Area Improvement Projects Proceeding:				
4A	i.	19 Street NW Streetscape Improvements	2022-2024	Hillhurst West Hillhurst Sunnyside	Phase 3 engagement completed. Design and construction anticipated for Spring 2023-Fall 2024.
	ii.	2 Avenue NW Streetscape Improvements			
	iii.	Grasshopper Hill Off-Leash Park			
	v.	Kensington Plaza Open Space Project			
	Other Kensington Projects Considered during Phase 1 and 2:				
4B	i.	4 Avenue NW Streetscaping	2021	West Hillhurst Hounsfield Heights/ Briar Hill Hillhurst Sunnyside	Phase 2 – Proposed Improvement engagement completed (Aug/Sept 2021). Project identified, but not shortlisted.
	ii.	7 Avenue NW/8 Avenue NW Traffic Calming	2021		
	iii.	16 Street NW Traffic Calming	2021		
	iv.	21 Street NW Traffic Calming	2021		
	v.	Gladstone Road NW Traffic Calming	2021		
	vi.	Kensington Road NW Streetscaping: 10 Street NW to 18 Street NW	2021		
	vii.	Kensington Road NW Streetscaping: Parkdale Boulevard to 18 Street NW	2021		
5	14 Avenue NW Mobility Improvements		2021	Hounsfield Heights/ Briar Hill	Deferred in 2022.
6	Banff Trail Area Improvements		2018-2022	Hounsfield Heights/ Briar Hill (north limits)	Construction primarily completed October 2022.

	Project Name	Est. Timeline	Riley Communities Impacted	Status
7	North Hill Communities Local Area Plan	2021	None (includes communities to the NE of the project area)	Completed.
8	Memorial Parkway Program (Memorial Drive Mobility and Sunnyside Flood Barrier)	2022-2023	Hillhurst Sunnyside	Phase 2 completed (WWHR2 Dec 2022). Next step is developing concepts for potential public realm improvements. Sunnyside Flood Barrier construction planned for 2023.
9	Crowchild Improvements	2017-2027+	West Hillhurst, Hounsfield Heights/ Briar Hill	Short-term upgrades completed. Medium-term construction for 2027 and beyond.
	Zoning By-law 1P2007	2007	All	N/A.



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Legend

- Attraction
- Community Centre
- Library
- Health Clinic/Care Centre
- School
- Place of Worship
- LRT Station
- LRT
- Commercial
- Park
- School
- Study Area

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Riley Communities Mobility Plan
FIGURE 1-1
Reviewed Policies, Programs, and Projects

1.2 MOBILITY NETWORK

The existing mobility network within the Plan Area was examined to gain an understanding of the existing conditions for all modes of transportation and set the stage for establishing gaps and opportunities within the network.

Pedestrian Network

The existing pedestrian network within the Plan Area is well established with over 100 km of sidewalks and almost 4 km of paved foot pathways. Sidewalks are located on both sides of almost all roadways. The sidewalk network is supported by several clusters of pathways, most of which are located throughout parks and green spaces and adjacent to major roadways. Crosswalks are also located throughout the Plan Area. Most crosswalks are located on higher volume roadways and clustered near the LRT stations, facilitating pedestrian movement to transit. In addition to painted crosswalks, there are three locations that provide an extra level of safety for pedestrians with Rectangular Rapid Flashing Beacons (RRFBs).

Because of the extensive sidewalk network, there are no major pedestrian connectivity gaps to highlight in the Plan Area. However, there are a few barriers in the Plan Area that limit pedestrian comfort, safety, and convenience, including the steep grades along the escarpment and limited crossings along the busier roadways such as Memorial Drive NW, Crowchild Trail NW, and 14 Street NW.

There are also several accessibility challenges within the Plan Area. Most street corners have sidewalk ramps to accommodate wheelchairs, strollers, and other assistive devices. However, most corners do not meet current standards that specify one ramp for each direction of travel. Most street corners in the Plan Area have one ramp angled toward the centre of the intersection that is intended for traveling in either direction from the corner. There are some exceptions in areas that have recently been upgraded/repaved. In addition, most sidewalks in the Plan Area are not comfortable, as most of them are less than the desired width of 1.8 m and are monowalks with no space between the edge of the sidewalk and the curb. **Figure 1-2** illustrates the existing pedestrian network including sidewalks, pathways, and crosswalks.

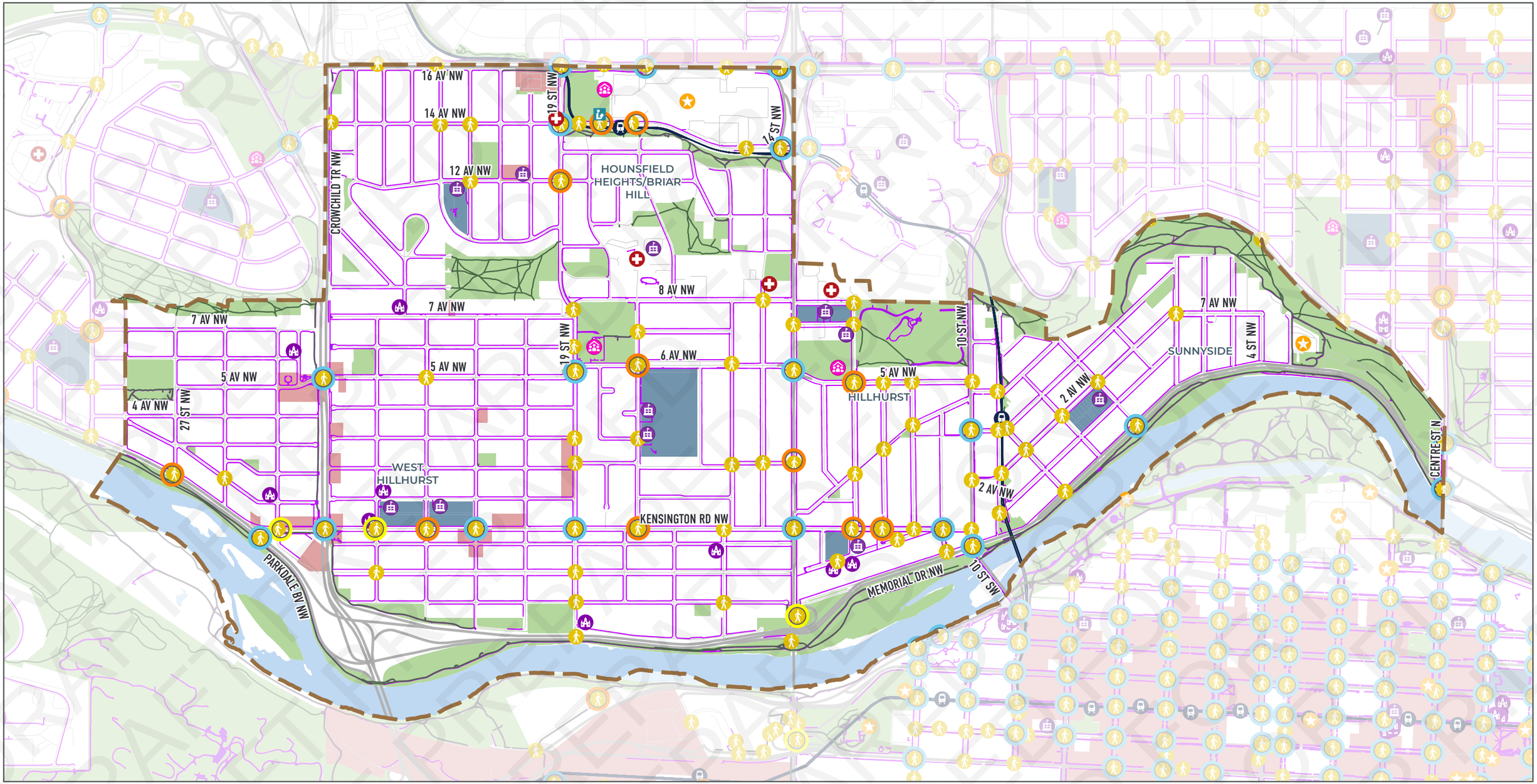
Wheeling Network

The wheeling network in the Plan Area is made up of over 40 km of facilities, including approximately 2.3 centreline km of wheeling lanes, 13.8 km of signed routes, 2.3 km of shared lanes, and 22.3 km of trails.

A significant portion of the Plan Area's wheeling network consists of local and regional pathways. These facilities are considered 5A facilities (Always Available for All Ages and Abilities). The dedicated facilities that are generally more comfortable for people wheeling (although not considered 5A) within the Plan Area include dedicated wheeling lanes on 6 Avenue NW/5 Avenue NW from 19 Street NW to 10 Street NW and on 10 Street NW from 16 Avenue NW to 3 Avenue NW. Further, there is a northbound contraflow wheeling lane (a wheeling lane where people on bicycles or other wheeling devices are permitted to travel in the opposite direction of traffic flow) on 9A Street NW between 4 Avenue NW and Memorial Drive NW.

While the dedicated wheeling network is minimal, the shared routes provide supporting connections facilitating good wheeling movement throughout the Plan Area. The routes within the Plan Area include 14 Avenue NW, 21 Street NW, 19 Street NW, Juniper Road NW, 5 Avenue NW, Broadview Road NW, 10 Street NW, etc. While most of these routes are on low volume, low speed roadways and are comfortable for many people wheeling, some routes, such as 10 Street NW and 19 Street NW,

experience higher traffic volumes and are not comfortable for most people. Only one set of dedicated wheeling traffic control signals are provided in the Plan Area. These are located at the intersection of 5 Avenue NW and Crowchild Trail NW. It should be reiterated that most of the existing wheeling network within the Plan Area is not suitable for many wishing to wheel as none of the on-street wheeling network facilities are considered to be 5A facilities. **Figure 1-3** illustrates the existing wheeling network, including the wheeling lanes, pathways, and shared routes. **Figure 1-4** illustrates the existing wheeling network with the 5A network overlayed to highlight the gaps in the network.



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Legend

- Crosswalk with Pedestrian RRFB
- Crosswalk with Pedestrian Overhead Flasher
- Crosswalk with Signal
- Crosswalk
- Trail / Pathway
- Sidewalk
- Attraction
- Community Centre
- Library
- Health Clinic/Care Centre
- School
- Place of Worship
- LRT Station
- LRT
- School
- Park
- Commercial
- Study Area

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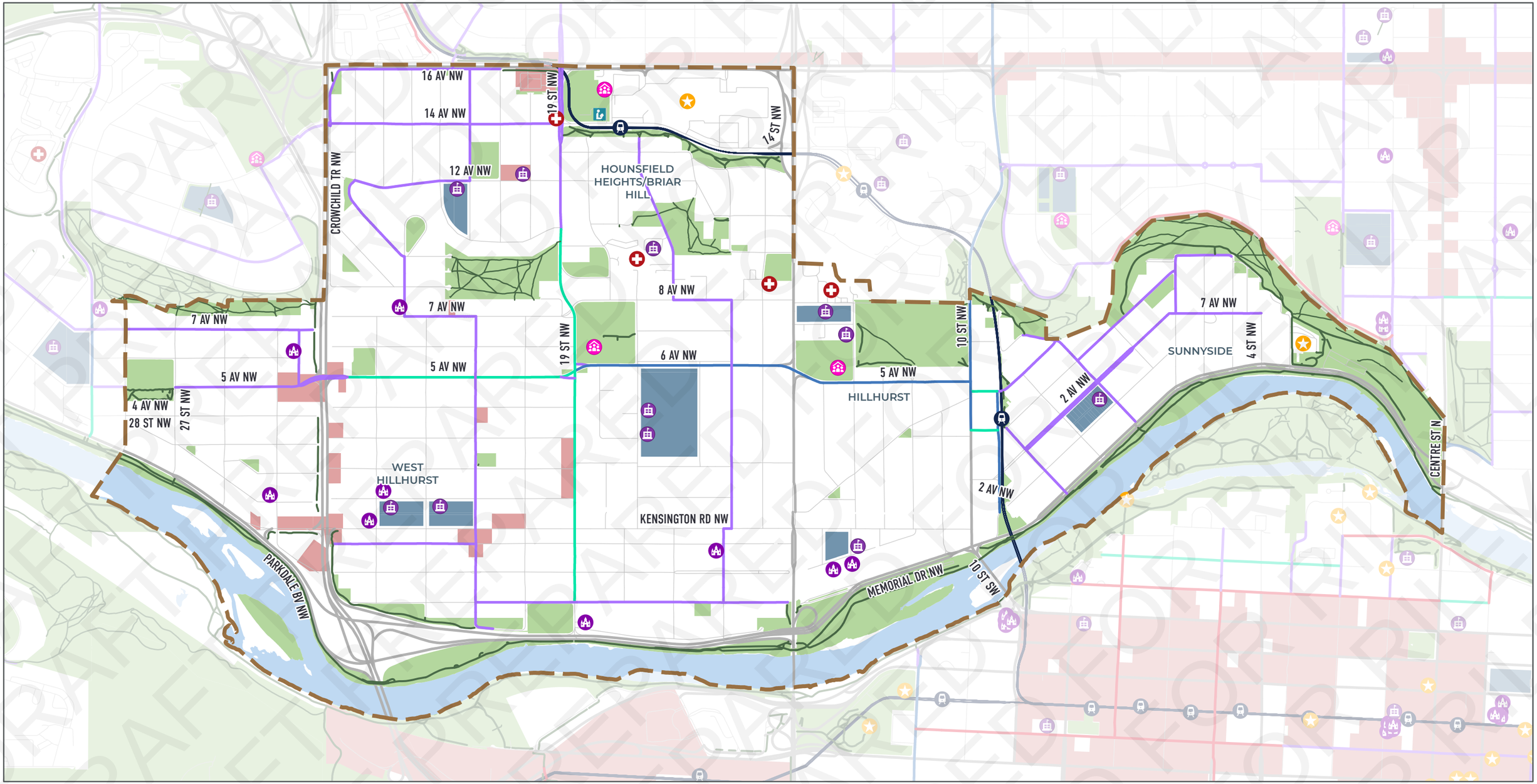
Riley Communities Mobility Plan

FIGURE 1-2

Existing Pedestrian Network



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Legend

- Trail / Pathway
- Wheeling Lane
- Cycle Track
- Shared Lane
- Signed Bikeway
- Attraction
- Community Centre
- Library
- Health Clinic/Care Centre
- School
- Place of Worship
- LRT Station
- LRT
- School
- Park
- Commercial
- Study Area

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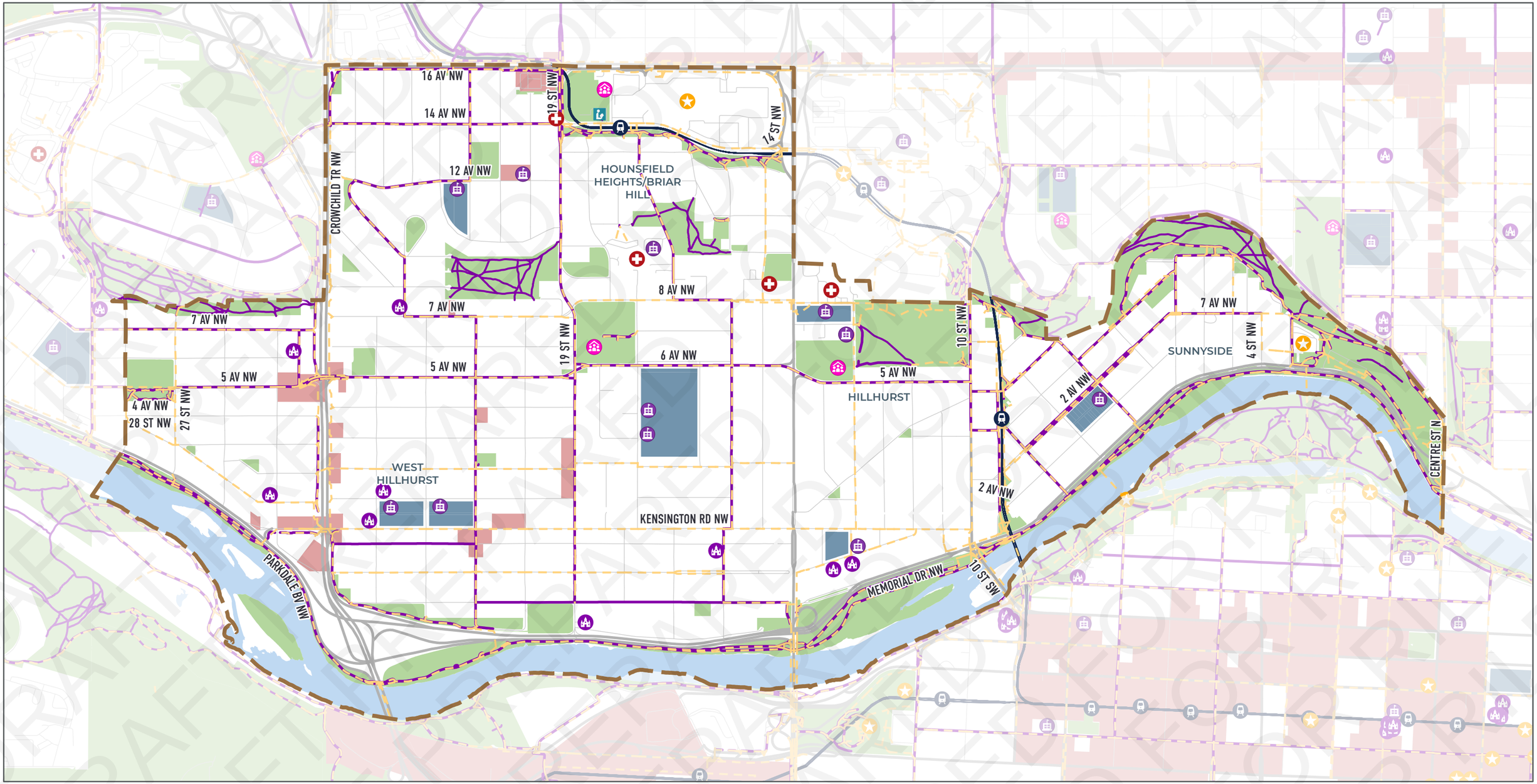
Riley Communities Mobility Plan

FIGURE 1-3

Existing Wheeling Network



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Legend

- Existing Wheeling Network
- 5A Network*
- Attraction
- Community Centre
- Library
- Health Clinic/Care Centre
- Place of Worship
- LRT Station
- School
- LRT
- Park
- Commercial
- Study Area

*5A refers to the "Always Available for All Ages and Abilities" pathway and bikeway network that is accessible by people of all physical abilities. (Some existing routes require upgrades to be considered 5A facilities)

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Riley Communities Mobility Plan

FIGURE 1-4
Existing Wheeling Network with 5A Network

Transit Network

The existing transit network within the Plan Area consists of 16 regular bus routes, two bus rapid transit (BRT) routes, six school routes, and a Light Rail Transit (LRT) line.

The 16 regular bus routes provide good transit connectivity throughout the Plan Area with main north-south routes on Crowchild Trail NW, 14 Street NW and 10 Street NW, and main east-west routes on Kensington Road NW/2 Avenue NW, 5 Avenue NW/6 Avenue NW, and 16 Avenue NW. It is noted that no regular routes are provided on 19 Street NW, one of the major north-south connections through the Plan Area; filling this gap in the network would result in a more complete network.

The two BRT routes through the Plan Area provide east-west connections – one on Kensington Road NW and the other on 16 Avenue NW. The BRT route on 16 Avenue NW is a MAX route (MAX Orange). Since finalizing the Background Assessment Report, the BRT route on Kensington (Route 305) has been cancelled. There are two LRT stations within the Plan Area: Lions Park LRT and Sunnyside LRT. Eight bus routes provide service to Lions Park LRT station and three bus routes provide service to Sunnyside LRT station. The remaining regular bus routes within the Plan Area link to other LRT stations. **Figure 1-5** illustrates the transit network within the Plan Area.

Bus stop amenities within the area consist of any combination of benches, shelters, garbage bins, and concrete waiting areas.

All Calgary Transit buses and LRT vehicles are equipped with ramps or are ground-level accessible to make it easier for transit users with mobility issues to board and alight the vehicle. These vehicles also have priority seating areas reserved for the same users. The Plan Area's sidewalk network provides good connections to all bus stops. However, it is noted that at some locations that are designated for future bus stops, proper crossing facilities are lacking.

Road Network

The road network within the Plan Area is comprised of a variety of roadway types. This variety supports efficient and comfortable movement for all travel types (walking, wheeling, transit, and personal vehicles). The roadway network consists of mostly collector and residential roadways that facilitate lower traffic volumes and slower moving vehicles which support more comfortable environments for individuals walking or wheeling. The existing road classification and goods movement network within the Plan Area is illustrated in **Figure 1-6**.

Average Daily Traffic (ADT) volumes (data collected from 2012-2019, and in 2022) for roadways in the Plan Area were obtained and compared to their assigned road classification's capacity. The roads with ADTs greater than the volume guidelines of their assigned road classification include:

- 16 Avenue NW
- 19 Street NW from 8 Avenue NW to 16 Avenue NW
- 19 Street NW from 2 Avenue NW to 3 Avenue NW
- Various sections of 5 Avenue NW/6 Avenue NW
- Most of Memorial Drive NW
- Parkdale Boulevard
- 14 Avenue NW
- 3 Avenue NW from 10 Street NW to 9a Street NW

The roads with ADTs less than the volume guidelines of their assigned road classification include:

- Kensington Road NW from 22 Street NW to 10 Street NW

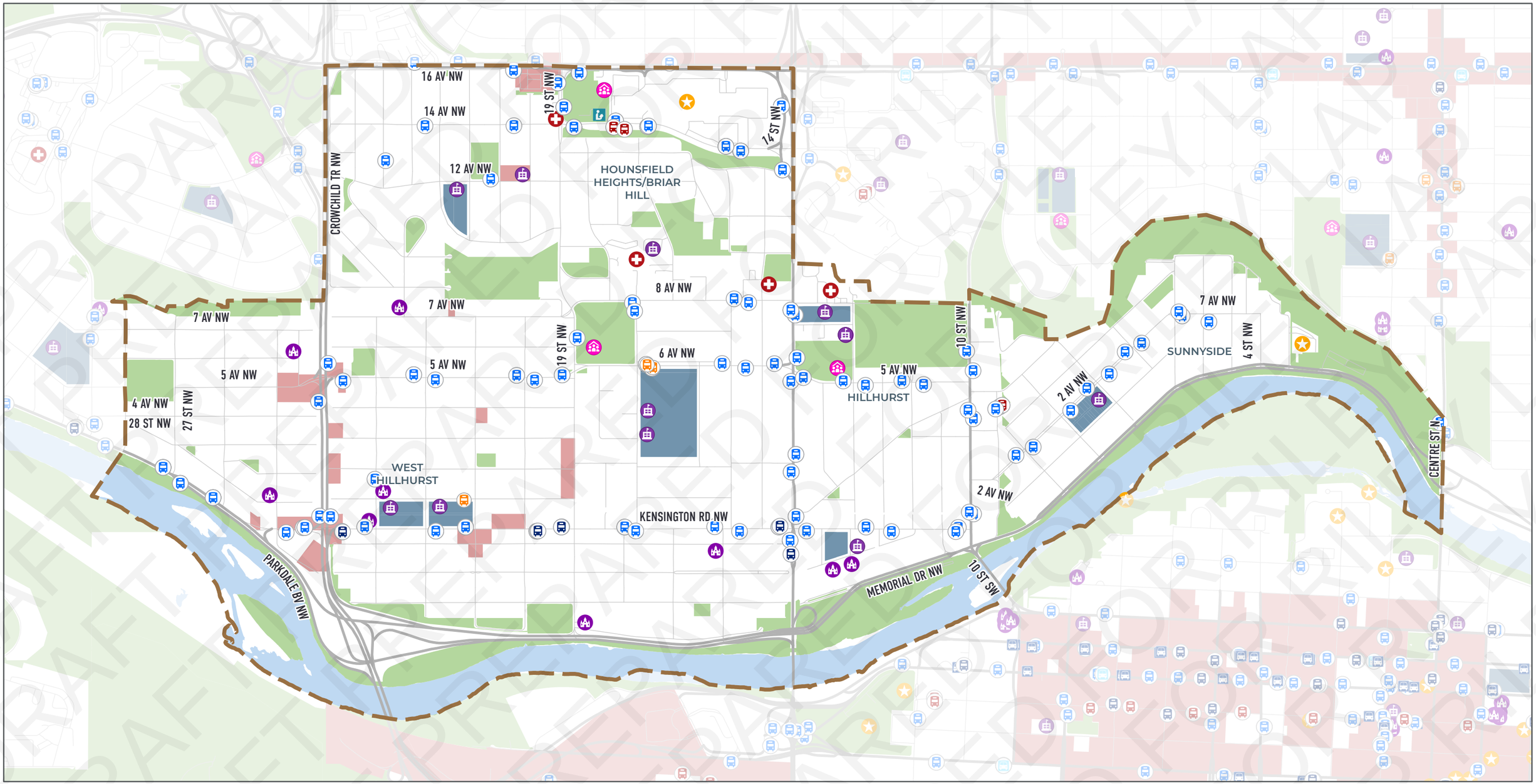
- Kensington Road NW from Crowchild Trail NW to Parkdale Boulevard NW
- 10 Street NW from the north end of Riley Park to 5 Avenue NW
- 2 Avenue NW east of 6 Street NW

Posted speed limits within the Plan Area vary between 70 km/h on Crowchild Trail NW and Memorial Drive NW, 50 km/h on collector roads, and 40 km/h on most residential roads. It is noted that this 40 km/h speed limit on residential roads came into effect on May 31, 2021. Prior to this, the speed limit on residential roads was 50 km/h. Scattered throughout the community are playground zones which restrict vehicle speeds to 30 km/h, between 7:30 a.m. and 9:00 p.m., seven days a week, year-round.

Traffic controls in the Plan Area consist of 21 full traffic signals, two half traffic signals, 11 crosswalks with pedestrian overhead flashers, three crosswalks with RRFBs, and many non-signalized intersections (e.g., stop- or yield-controlled). There is also one dedicated wheeling signal at the intersection of Crowchild Trail NW and 5 Avenue NW for the eastbound/westbound direction.

Traffic signals are limited to the collectors, urban and neighbourhood boulevards, arterials, and skeletal roads. The half traffic signals, pedestrian overhead flashers, and RRFBs improve the connectivity for people walking and wheeling and are generally located along main walking and wheeling corridors or near attractions such as schools and parks.

Observed 85th percentile vehicular speed data from The City was compiled to understand speeding issues in the Plan Area. The data was filtered to exclude data collected during the COVID-19 pandemic (2020-2021). The 85th percentile speeds were compared to the posted speed limits. Roads identified with multiple locations where the 85th percentile speeds were greater than the posted speed limits were Kensington Road NW, Memorial Drive NW/Parkdale Boulevard NW, 16 Avenue NW, and 5 Avenue NW. This exercise was also completed for the school zones. Most playground zones in the Plan Area identified at least one location where the 85th percentile speeds were higher than 30 km/h.



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Legend

Transit Stop
- LRT
- BRT
- Regular
- School
- Express
- Max

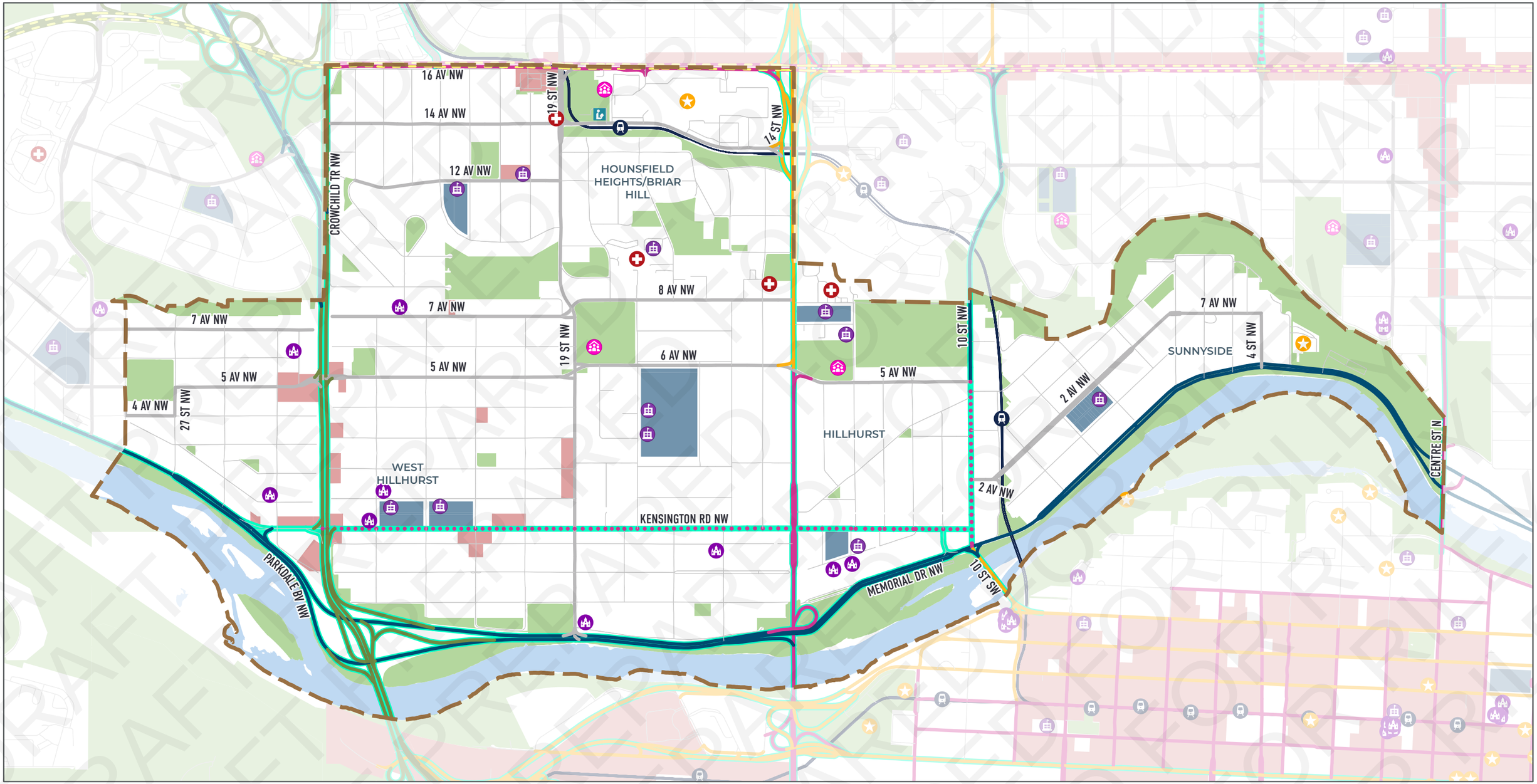
- Attraction
- Community Centre
- Library
- Health Clinic/Care Centre
- School
- Place of Worship

- School
- Park
- Commercial
- Study Area

Calgary

Riley Communities Mobility Plan

FIGURE 1-5
Existing Transit Network



URBAN SYSTEMS

Project #: 1057.0189.01
Author: SDF

Revision: FINAL
Date: 2023 / 4 /28

0 100 200 300
Meters

Coordinate System:
NAD 1983 3TM 114

Scale: 1:13,000
(When plotted at 11"x17")

Legend

- Skeletal Road
- Arterial Street
- Urban Boulevard
- Neighbourhood Boulevard
- Parkway
- Collector
- Residential Street
- Dangerous Goods Route
- Truck Route
- Attraction
- Community Centre
- Library
- Health Clinic/Care Centre
- School
- Place of Worship
- LRT Station
- LRT
- School
- Park
- Commercial
- Study Area

Calgary

Riley Communities Mobility Plan

FIGURE 1-6
Road Network Classification and Goods Movement

1.3 TRAFFIC CALMING

Existing traffic calming measures in the Riley Communities include curb bulbs, wheeling lanes, reduced posted speed limits, partial and full closures, and centre medians. The measures are located throughout the study, with the most measures found in the Hillhurst and Sunnyside communities.

A high-level review of vehicle speeds was completed along corridors where traffic calming measures were already in place. This review excluded areas with closures in place. Speed data was not available to compare vehicle travel speeds prior to the implementation of the traffic calming measures. The following is a summary of the review by location (note that this review consists of data from before the 40 km/h speed reduction was put in place):

- **2 Avenue NW (between 6 Street NW and 9 Street NW)**
  - Traffic calming measure: centre medians.
  - Posted speed: 30 km/h adjacent to school, 50 km/h outside of school zone.
  - Reported speeds: The 85th percentile speed varies between 39 km/h to 49 km/h. Within this range, higher speeds were found around the playground zone.
- **5 Avenue NW/6 Avenue NW**
  - **10 Street NW to 14 Street NW**
    - Traffic calming measures: painted wheeling lanes, and curb bulbs.
    - Posted speed: 40 km/h.
    - Reported speeds: the 85th percentile speed is just below 50 km/h.
  - **14 Street NW to 19 Street NW**
    - Traffic calming measure: painted wheeling lanes.
    - No speed data available.
  - **19 Street NW to Crowchild Trail NW**
    - Traffic Calming Measure: curb bulbs.
    - Posted speed: 50 km/h.
    - Reported speeds: the 85th percentile speeds are 56 km/h to 57 km/h.
  - **West of Crowchild Trail NW**
    - Traffic calming measures: none.
    - Posted speed: 50 km/h.
    - Reported speeds: the 85th percentile speeds are 56 km/h to 58 km/h.
- **10 Street NW, north of 5 Avenue NW**
  - Traffic calming measure: painted wheeling lane.
  - Posted speed: 50 km/h.
  - Reported speeds: the 85th percentile speeds vary between 56 km/h to 62 km/h.
- **19 Street NW (between Kensington Road NW and 5 Avenue NW)**
  - Traffic calming measures: curb bulbs and sharrows.
  - Posted speed: 50km/h.
  - Reported speeds: the 85th percentile speeds vary between 51 km/h to 52 km/h. 85th percentile speeds increase north of this segment from 55 km/h to 60 km/h.

1.4 SAFETY REVIEW

Video-based Conflict Analysis

Conflict analysis data, vehicular speed data, and traffic volume data were collected at five intersections within the Plan Area. These intersections were chosen based on collision data, observations from site visits, and overall potential for improvement. They are listed below and illustrated on a map of the Plan Area in **Figure 1-7**:

- 18 Street NW and 6 Avenue NW
- 14 Street NW and 6 Avenue NW/5 Avenue NW
- 14 Street NW and 14 Avenue NW
- 19 Street NW and 6 Avenue NW/5 Avenue NW
- 19 Street NW and 14 Avenue NW

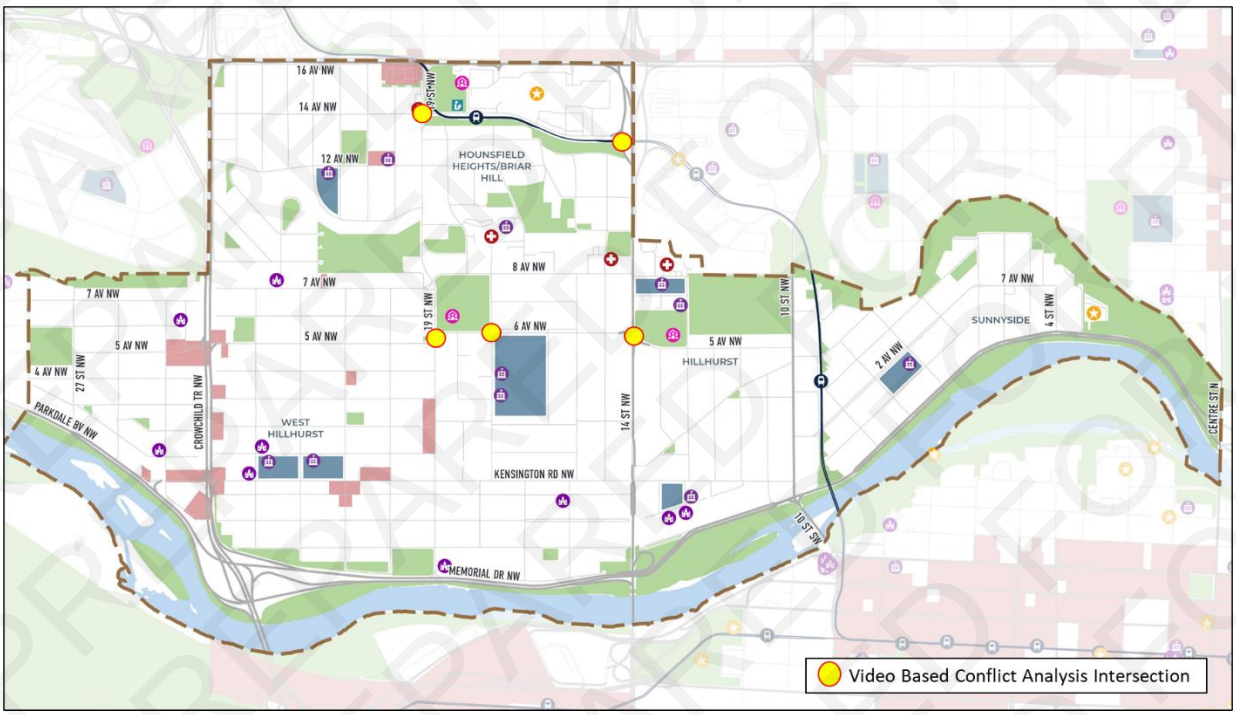


Figure 1-7: Locations of Video Based Conflict Analysis

Safety issues were identified at each intersection along with recommendations to potentially mitigate these concerns with a suggested priority level for implementation. Recommendations included measures such as ladder crosswalk markings, changes to traffic control, curb extensions, realignment of curb cuts and realignment of channelized turns. Additional investigative reviews were also recommended including reviewing street lighting levels and in-depth collision data reviews.

Each measure was also assigned a priority level. A higher-priority level represents a higher conflict and/or liability risk and that the recommendation should be prioritized by The City. Additional details on the recommendations at each intersection can be found in the appendices of the *Background Assessment Report* (**Appendix A**).

Planning-level Safety Review

A planning-level safety review of the corridors and intersections within the Plan Area was completed using The City's historic traffic and collision data from 2016 – 2021. This data helped to gain an understanding of the types of exposures and interactions that are most associated with collisions within the Plan Area. A field visit was also completed to observe the road user behaviour, identify related contributing factors, and record site conditions that could warrant repairs or improvements.

A geospatial analysis was conducted to visually understand the distribution of collisions within the Plan Area. **Figure 1-8** illustrates a heatmap of all the collisions within the Plan Area from 2016 – 2021.

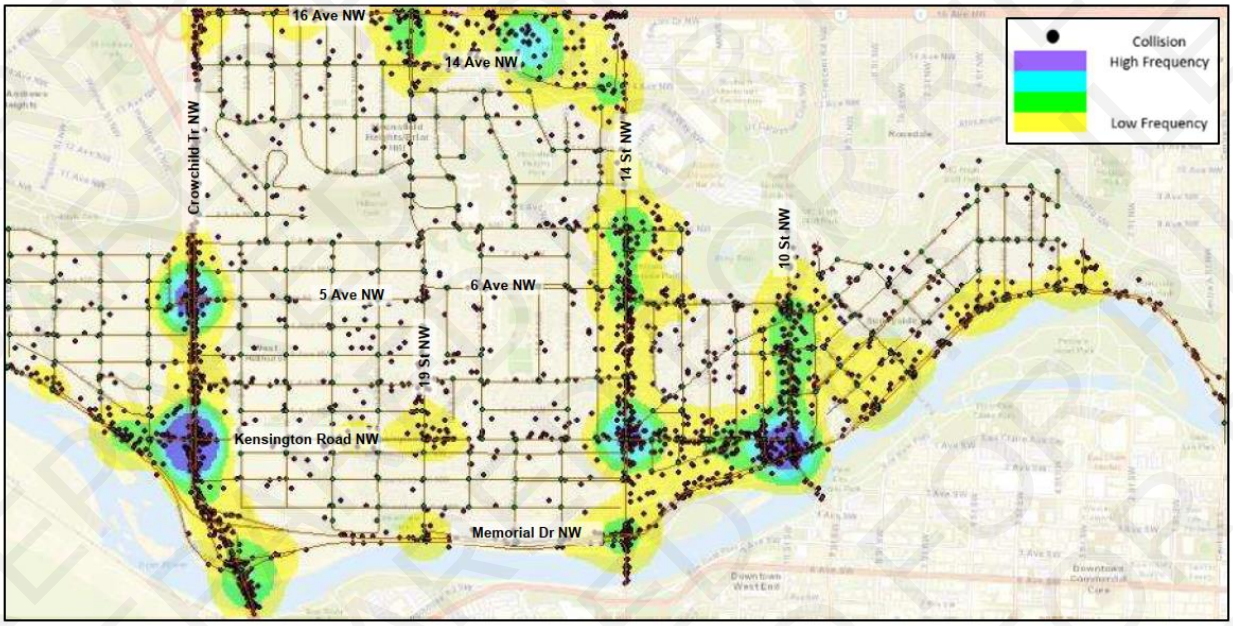


Figure 1-8: Heatmap of Plan Area Collisions

Field investigations were completed at ten intersections within the Plan Area. The selection of locations for detailed field investigations considered the following factors:

- Location received a high ranking in the network screening analysis.
- Location had a higher number of collisions involving pedestrians and cyclists.
- Geographical distribution of sites across the Plan Area.

The investigations established a list of countermeasures for each intersection. This list was similar to the list of countermeasures recommended through the video conflict analysis and includes measures such as modifications to turn channels and corner radii, modifications to the intersection that would slow down turning vehicles, relocating street furniture and sign poles, enhancing road paint (ex. Crosswalks and stop bars), enhancing curb ramps, improving sightlines for drivers, and expanding the wheeling network. Additional details on the recommendations at each intersection can be found in the appendices of the *Background Assessment Report* (**Appendix A**).

2.0 A VISION FOR THE FUTURE

The Riley Communities Mobility Plan presents a long-term vision for the future of mobility within the Plan Area. Building on The City's policies such as Vision Zero, the 5A wheeling network, Complete Streets, and other priorities outlined in the Calgary Transportation Plan, this Mobility Plan recognizes that creating more space and efficiency for vehicle travel may not be feasible or desirable given the built-out nature of the Riley Communities, the constraints of the road network, and the anticipated growth pressures. The Mobility Plan looks to instead accommodate growth by prioritizing safety improvements and by enhancing the non-vehicular transportation networks to encourage a shift in travel mode choice to more sustainable forms of transportation such as walking, wheeling, and transit through and within the Riley Communities. This section outlines how the mobility improvement projects were identified for the Riley Communities and provides a summary of these projects, including both a list and map of the projects.

2.1 PROJECT IDENTIFICATION PROCESS

The mobility improvement projects were determined based on the findings of the Background Assessment Report and through engagement conducted during the development of The Plan. Some of the specific considerations in identifying projects included:

- Projects already identified in previous plans, programs, or studies, including identified efficiencies through already planned network improvements.
- Roadways that have excess vehicular capacity that could have road space reallocated to waking, wheeling, and/or transit.
- Identified efficiencies through already planned network improvements.
- Areas with identified traffic safety issues, including collision hotspots, and high collision or near-miss locations.
- Areas where speeding was identified as a potential issue through historical data, video-based conflict analysis or public engagement.
- Gaps in the pedestrian, wheeling, and/or transit networks.
- Community priorities identified through past engagement events and through engagement events associated with The Plan.

2.2 MOBILITY IMPROVEMENT PROJECTS

The project team worked closely with City staff to finalize a list of over 90 mobility improvement projects to be considered over the long-term within the Plan Area. Due to the expansive list, projects were divided into various project categories where some included several subcategories. Projects were grouped into five categories as outlined below. **Figure 2-1** illustrates the location of each project. **Table 3-1** (Section 3.0) provides a detailed summary of all projects.

1. Improvements for People Walking and Wheeling

- Enhancements to the existing walking and/or wheeling networks (e.g., upgrades to existing infrastructure)
  - Project examples include: modifying an existing painted wheeling lane and separating it from traffic by providing physical separation or widening an existing sidewalk.
- Enhancements to the future walking and/or wheeling networks (e.g., new facilities)
  - Project examples include: implementing a planned protected wheeling lane or building a new crosswalk or sidewalk.

2. Improved Transit Connections

- Enhancements to the existing transit network and the walking and wheeling connections that enable people to access it.
  - Project examples include: improving access to transit through improved walking and wheeling connections or exploring closing gaps in the transit network.

3. Improvements for All Modes of Transportation

- Intersection improvements
  - Project examples include: improving crossing conditions for people walking, or modifications to traffic controls.
- Corridor improvements
  - Project examples include: widening sidewalks along a roadway, installing wheeling lanes along a roadway, decreasing the number of vehicle lanes, and/or installing curb extensions.

4. Parking Management Review

- Reviewing current parking demands in an area to understand if the existing supply is sufficient.
  - Project examples include: looking for opportunities to use existing on-street parking more efficiently by shifting spaces, adding/removing spaces, or implementing time restrictions.

5. Traffic Calming

- Volume and speed reduction
  - Project examples include: implementing measures such as road closures, traffic circles, reducing the number of vehicle lanes, and/or providing vertical or horizontal deflections (e.g., speed humps and chicanes).
- Speed reduction
  - Project examples include: reducing the posted speed limit in conjunction with traffic calming measures such as narrowing vehicle travel lane widths, message boards that display drivers' travel speed, and/or regular enforcement.

16 AV NW
14 AV NW
12 AV NW
HOUNSFIELD HEIGHTS/BRIAR HILL
19 ST NW
8 AV NW
7 AV NW
5 AV NW
6 AV NW
4 AV NW
27 ST NW
CROWCHILD TR NW
WEST HILLHURST
PARKDALE BV NW
14 ST NW
HILLHURST
10 ST NW
2 AV NW
2 AV NW
4 ST NW
SUNNYSIDE
MEMORIAL DR NW
10 ST SW
14 ST SW

URBAN SYSTEMS

0 100 200 300
Meters

N

Coordinate System:
NAD 1983 3TM 114

Scale: 1:12,000
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Project #: 1057.0189.01
Author: SDF

Revision: FINAL
Date: 2024 / 2 / 6

Legend

- Points of Interest
- LRT Station
- School
- Park
- Commercial
- Commercial (Direct Control)
- Study Area
- Transit Connections
- Parking Management Review

Improvements for All Modes
- Intersection Improvements
- Corridor Improvements

Improvements for People Walking and Wheeling
- Crossing Improvements
- Crossing Improvements
- Network Enhancements - New Connections
- Network Enhancements - Existing Network

Traffic Calming
- Speed Reduction
- Volume and Speed Reduction

*Projects that apply to the whole project area were excluded from the map.

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Riley Communities Mobility Plan

FIGURE 2-1

Mobility Improvement Projects

3.0 MAKING IT HAPPEN

The mobility improvement projects outlined in the following pages provide a list of over 90 projects for The City to consider over the long-term. The next step was creating a plan to prioritize implementation of these projects. This section outlines how this prioritization process was developed, the results of the prioritization process, and a subsequent breakdown of the high-, medium-, and low-priority projects. Finally, an implementation framework is included to enable further dialogue, collaboration, and development of resources to support each project.

3.1 PRIORITIZATION PROCESS

Once the list of mobility improvement projects was established, projects were assessed through a multiple accounts evaluation (MAE) as a first step in prioritizing their implementation. The criteria and considerations used in this evaluation were developed in consultation with City staff and considered the ***vision*** and ***core values*** outlined in The Plan.

Vision

Situated near the Bow River and the Downtown Core, the Riley Communities of Hillhurst, Hounsfield Heights-Briar Hill, Sunnyside, and West Hillhurst will continue to grow and build upon the unique assets and histories of the area. The variety of housing, amenities, attractions and mobility options will form a foundation to further the area as one of the most vibrant parts of the city. The area will see continued improvements and investments that enhance the diverse experiences and quality of life of those that live and visit.

Core Values

- **Housing Choice** - Expand the range of housing options in the Riley Communities to meet the evolving needs, life stages and household compositions of Calgarians. Ensure that as new housing is developed, it suits the evolving context of each of Riley's individual communities.
- **Moving to and through the Riley Communities** -. Support and provide increased ways to move to and through the Riley Communities that emphasize safe, accessible and efficient movement. Prioritize walking, transit and active modes as key ways to move around the Riley Communities and to surrounding destinations by building upon existing infrastructure such as the Red Line LRT system, regional pathway system and pedestrian network.
- **Parks, Recreation and Public Space** - Expand and enhance the inventory of parks, recreation facilities, natural areas and public spaces throughout the Riley Communities, including the McHugh Bluff and spaces along the Bow River. Focus on providing a range of parks and recreation spaces near all living in the Riley Communities.
- **Climate Resilience** - Improve long-term climate resiliency and reduce vulnerability to localized climate-related hazards such as flooding along the Bow River, heavy rainfall and extreme heat. Achieve this through supporting low-carbon lifestyles and area-specific improvements that mitigate the impacts of severe weather events and expand the urban tree canopy.
- **Aligning Improvements to Growth** - Enable continued mixed-use development along Main Streets and corridors such as 10th Street N.W., 14th Street N.W., Kensington Road and 19th Street N.W. as well as transit-oriented development around the Sunnyside and Lions Park LRT stations. Facilitate the creation of public amenities that support growth and change and further enhance the sense of place within these communities.
- **Safe and Accessible Communities** - Promote community safety and accessibility for all. Ensure that safety and accessibility are key considerations in public realm improvements, new building design, and in considering improved transportation options.

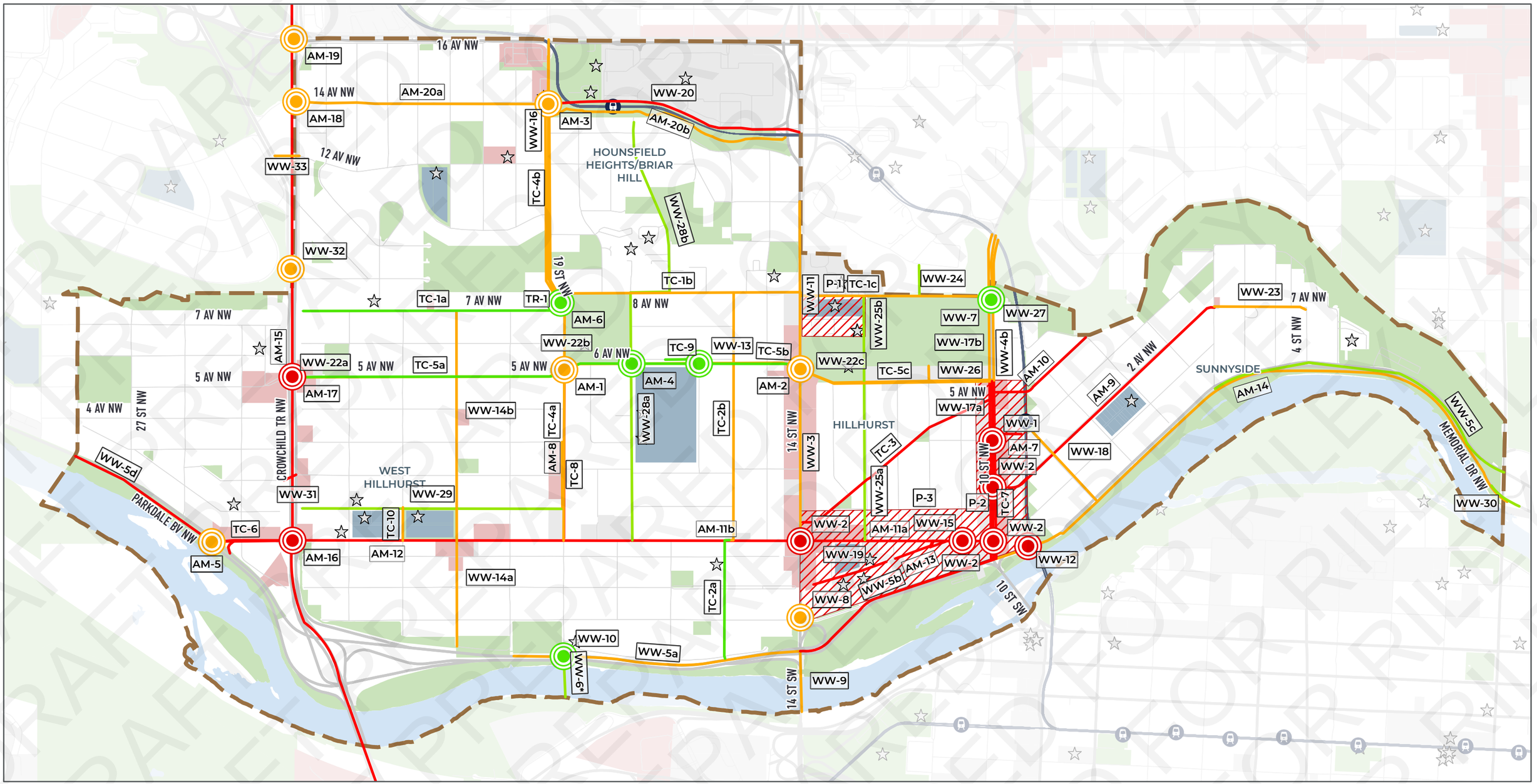
Prioritization criteria were developed that built upon the unique range of amenities within the Plan Area and the general desire to improve mobility options for residents and visitors as highlighted within The Plan Vision and Core Values. Each criterion contains scorable information, and the results were combined to generate an overall score for each project. Seven prioritization criteria were identified and are described as follows:

- **Proximity to transit** – One of The Plan's Core Values is to improve movement to and through the Riley Communities which can be achieved through improvements to and around transit. This criterion measures the degree to which the proposed improvement increases access to transit facilities. Improvements located within the closest proximity to MAX and LRT transit stops received the highest score.
- **Proximity to key destinations** – Libraries, schools, parks, religious places of assembly, community centres, and commercial areas are important destinations within the community and highlighted in The Plan's Core Values. This criterion examined whether proposed projects were located within 400 metres of these key destinations and gave them a higher score accordingly.
- **Safety (Proximity to a location identified to have a higher number of collisions)** – Safe and accessible communities was identified as one of The Plan's Core Values. With a collision review of the Plan Area, high collision areas were identified. Mitigating safety issues throughout the transportation network will be key in improving safety and accessibility within the Riley Communities. Projects near a collision hotspot were given higher scores.
- **Relative cost** – Several of the identified projects are low cost, quick-wins that could lead to measurable improvements within the Riley Communities. Projects with lower relative costs were given higher scores.
- **Community interest** – Many projects were identified during The Plan's engagement process or through prior events. Residents have a first-hand experience on issues related to their communities. Projects that address issues that have been brought to The City's attention or were submitted to The City's 311 program were given higher scores.
- **Previously planned projects** – Several projects within the Plan Area have either carried out engagement, planning stages, or moved to more detailed designs. These projects were given higher scores.
- **Maintenance or lifecycle replacement projects** – Efficiencies with time and cost may be realized with projects that are located in the same place as other maintenance or rehabilitation projects planned by The City. Projects overlapping with known maintenance and replacement projects were given higher scores.

These seven criteria were applied to each mobility improvement project to establish an overall score for each project. Once applied, this prioritization score enabled the projects to be sorted into "high priority", "medium priority", and "low priority" categories. It should be noted that these projects were ranked with the most up-to-date information available at the time of writing. While it is recommended that The City begin with implementing the high-priority projects, **the ultimate order of implementation could change over time based as factors such as operational needs, joint funding opportunities with other Capital Projects, and community feedback, among other considerations.**

3.2 PROJECT PRIORITIZATION

The prioritized project map is illustrated in **Figure 3-1** with the high-priority projects shown in **red**, the medium-priority projects shown in **yellow** and the low-priority projects shown in **green**. A detailed table (**Table 3-1**) is provided in Section 3.3 that describes each mobility project along with additional implementation considerations. As previously stated, while it is recommended that The City begin with implementing the high-priority projects, **the ultimate order of implementation could change over time based as factors such as operational needs, joint funding opportunities with other Capital Projects, and community feedback, among other considerations.**



URBAN SYSTEMS

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Meters

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The accuracy & completeness of information shown on this drawing is not guaranteed. It will be the responsibility of the user of the information shown on this drawing to locate & establish the precise location of all existing information whether shown or not.

Legend

- Points of Interest
- LRT Station
- Park
- Commercial
- Commercial (Direct Control)
- Study Area

- High Priority
- Medium Priority
- Low Priority

- High Priority
- Medium Priority
- Low Priority
- High Priority

*Projects that apply to the whole project area were excluded from the map.

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Riley Communities Mobility Plan

FIGURE 3-1

Mobility Projects Prioritization

3.3 IMPLEMENTATION FRAMEWORK

Successful implementation of the identified projects will rely on appropriate financial commitments from The City and sustained efforts to enable and encourage behavioural change at the individual level.

An implementation framework was developed for the identified projects. This framework is intended to serve as a quick reference guide to enable further dialogue, collaboration, and development of resources to support each project. The framework is shown in **Table 3-1** and includes:

- **Implementation timeframes** - Through technical evaluation and internal dialogue, each project was assigned a priority and suggested timeline for implementation. Short-term strategies are expected to be implemented within 0-5 years, medium-term strategies within ten years and long-term strategies beyond ten years.
- **Alignment with The Plan Vision and Core Values** – An indication of how well each project contributed to achieving The Plan's Vision and Core Values is provided.
- **Cost ranges** – Approximate order-of-magnitude costs are identified for all projects to provide an indication of the magnitude of investment required for implementation. The cost ranges, as outlined (at right), are representative of both the capital and programming costs required to implement.

Cost Symbol	Estimated Cost
$	< $9,999
$$	$10,000 – $99,999
$$$	$100,000 – $499,999
$$$$	> $500,000

3.3.1 HIGH-PRIORITY PROJECT PROFILES

Further details for those projects identified as High-Priority in **Section 3.2** have been provided in Project Profiles. Each Project Profile will allow a newly assembled project team to easily and quickly understand the project background and potential options and next steps to begin moving the project forward.

A large focus of these projects is on improvements to movement and safety for those walking and wheeling. This focus aligns with the several of The Plan's Core Values including improving access to parks, recreation and public space, climate action and safe and accessible communities, as highlighted in **Section 3.1**.

The content of each Project Profile includes:

- A high-level overview of the project, including existing conditions and the reason for the project.
- A map illustrating the project location within the Plan Area.
- Steps that have already been completed (if any) such as engagement activities and previously considered or preferred designs.
- The mobility mode(s) that the project is prioritizing.
- Project goals (if they have already been identified).
- The opportunities and challenges the project presents.
- The City policies that the project aligns with.
- The relative project scoring developed in the prioritization process and the result.
- Some profiles provide photos illustrating existing conditions.
- Some profiles include examples of potential improvement measures to consider moving forward.

The ability for The City to implement these projects depends on future funding. This list should be updated periodically to reflect new long-range planning efforts. Design and construction schedules of these projects will be driven by many factors, such as funding availability, coordination with other projects, or urgent safety or maintenance needs.

Table 3-1: Implementation Framework

Focus Area	Ref ID	Location	Description	Project Source	Policy Objectives Advanced	Priority	Timing	Cost
Improvements for Walking and Wheeling	WW-1	10 Street NW and 3 Avenue NW	Consider a pedestrian scramble phase	ECAR - public engagement	5A network guiding principles, complete streets, Vision Zero	High	Short-term	$
	WW-2	Signalized intersections in Kensington	Implement Leading Pedestrian Intervals	ECAR - public engagement	5A network guiding principles, complete streets, Vision Zero	High	Short-term	$
	WW-3	14 Street NW from Kensington Road NW to 8 Avenue NW	Increase and improve existing crossing opportunities for pedestrians	ECAR - public engagement and site visit	5A network guiding principles, complete streets, Vision Zero	Medium	Medium-term	$$
	WW-4a	10 Street NW from 5 Avenue NW to Memorial Drive NW	Increase and improve existing crossing opportunities for pedestrians	ECAR - public engagement and site visit	5A network guiding principles, complete streets, Vision Zero	High	Medium-term	$$
	WW-4b	10 Street NW from 5 Avenue NW to SAIT Way	Increase and improve existing crossing opportunities for pedestrians	ECAR - public engagement and site visit	5A network guiding principles, complete streets, Vision Zero	Medium	Short-term	$$
	WW-5a	Memorial Drive NW between 20 Street NW and 14 Street NW	Additional pedestrian crossing	ECAR - public engagement	5A network guiding principles, Vision Zero	Medium	Long-term	$$
	WW-5b	Memorial Drive NW between 14 Street NW and 10 Street NW	Additional pedestrian crossing	ECAR - public engagement	5A network guiding principles, Vision Zero	High	Medium-term	$$
	WW-5c	Memorial Drive NW between 5a Street NW and Centre Street N	Additional pedestrian crossing	ECAR - public engagement	5A network guiding principles, Vision Zero	Low	Long-term	$$
	WW-5d	Memorial Drive NW between 28 Street NW and Kensington Road NW	Pathway and crossing improvements	Public engagement	5A network guiding principles, Vision Zero	High	Medium-term	$$
	WW-6	Over Bow River near 19 Street NW (suggested to connect with Sunalta LRT station)	Additional River crossing	ECAR - public engagement	5A network guiding principles	Low	Long-term	$$$$
	WW-7	10 Street NW and 8 Avenue NW	Provide pedestrian crossing over 10 Street NW	ECAR - public engagement	5A network guiding principles	Low	Long-term	$$
	WW-8	Pedestrian underpass under 14 Street NW at east end of Broadview Road NW	Improve underpass	ECAR - public engagement	5A network guiding principles	Medium	Medium-term	$$$$
	WW-9	14 Street NW Bridge Improvements	Consider widening sidewalk to better accommodate people walking and wheeling	Riley Mobility Study, 5A Network	5A network guiding principles, Vision Zero	Medium	Long-term	$$$$
	WW-10	Memorial Drive NW at 19 Street NW	Additional pedestrian crossing (at grade assumed)	Riley Mobility Study	5A network guiding principles, Vision Zero	Low	Long-term	$$
	WW-11	14 Street NW between 8 Avenue NW and 10 Avenue NW	Provide Active Transportation Underpass	Riley Mobility Study - Existing Conditions Report	5A network guiding principles, Vision Zero	Medium	Long-term	$$$$
	WW-12	Pedestrian bridge over Memorial Drive NW east of 9a Street NW	Improve overpass by widening the bridge, enhancing the ramps and providing taller railings.	ECAR - public engagement	5A network guiding principles	High	Medium-term	$$$$
	WW-13	16a Street NW and 6 Avenue NW	Provide crosswalk over 6 Avenue NW	ECAR - public engagement	5A network guiding principles, Vision Zero	Low	Long-term	$
	WW-14a	21 Street NW - Memorial Drive NW to Kensington Road NW	Traffic Calming or 5A Wheeling Facility (long term)	City of Calgary - previously considered project	5A network guiding principles, complete streets, Vision Zero, EAGCS	Medium	Medium-term	$$$
	WW-14b	21 Street NW - Kensington Road NW to 7 Avenue NW	Traffic Calming or 5A Wheeling Facility (long term)	City of Calgary - previously considered project	5A network guiding principles, complete streets, Vision Zero, EAGCS	Medium	Medium-term	$$$
	WW-15	Kensington Plaza	Open Space improvements	City of Calgary - ongoing project	5A network guiding principles, EAGCS	High	Completed	$$$
	WW-16	19 Street NW, east side, north of 10 Avenue NW	Continue multi-use pathway on east side of road	ECAR - public engagement, 5A Network	5A network guiding principles, complete streets, Vision Zero	Medium	Short-term	$$$
	WW-17a	10 Street NW from 5 Avenue NW to Memorial Drive NW	Consider implementing 5A wheeling facilities	ECAR - public engagement, 5A Network	5A network guiding principles, complete streets, Vision Zero, EAGCS	High	Short-term	$$$
	WW-17b	10 Street NW from 5 Avenue NW to SAIT Way	Consider implementing 5A wheeling facilities	ECAR - public engagement, 5A Network	5A network guiding principles, complete streets, Vision Zero, EAGCS	Medium	Medium-term	$$$
	WW-18	9 Street NW from Memorial Drive NW to 3 Avenue NW	Improve sidewalk on east side	ECAR - public engagement	Vision Zero, 5A network guiding principles	Medium	Medium-term	$$$
	WW-19	Kensington Close NW	Allow wheeling in the eastbound direction	ECAR - public engagement	5A network guiding principles, complete streets, Vision Zero	High	Short-term	$$
	WW-20	Improvements to Multi-use pathway through Lion's Park and to SAIT	Enhance lighting to improve perceived safety in the park during sundown and widen narrow portions of the pathway	ECAR - public engagement and site visit	5A network guiding principles	Medium	Medium-term	$$$
	WW-21a	Area Bound by 25 Street NW, 7 Avenue NW, Crowchild Trail NW, Memorial Drive NW	Fill in gaps in sidewalk network to ensure sidewalks are provided along both sides of all roadways	Riley Mobility Study - Existing Conditions Report	Vision Zero, 5A network guiding principles	Low	Ongoing	$$
	WW-21b	Area Bound by Crowchild Trail NW, 5 Avenue NW, 19 Street NW, Memorial Drive NW	Fill in gaps in sidewalk network to ensure sidewalks are provided along both sides of all roadways	Riley Mobility Study - Existing Conditions Report	Vision Zero, 5A network guiding principles	Low	Ongoing	$$
	WW-21c	Area Bound by Crowchild Trail NW, 16 Avenue NW, 19 Street NW, 5 Avenue NW	Fill in gaps in sidewalk network to ensure sidewalks are provided along both sides of all roadways	Riley Mobility Study - Existing Conditions Report	Vision Zero, 5A network guiding principles	Low	Ongoing	$$
	WW-21d	Area Bound by 19 Street NW, 6 Avenue NW, 14 Street NW, Memorial Drive NW	Fill in gaps in sidewalk network to ensure sidewalks are provided along both sides of all roadways	Riley Mobility Study - Existing Conditions Report	Vision Zero, 5A network guiding principles	Low	Ongoing	$$

Focus Area	Ref ID	Location	Description	Project Source	Policy Objectives Advanced	Priority	Timing	Cost
	WW-21e	Area Bound by 19 Street NW, 16 Avenue NW, 14 Street NW, 6 Avenue NW	Fill in gaps in sidewalk network to ensure sidewalks are provided along both sides of all roadways	Riley Mobility Study - Existing Conditions Report	Vision Zero, 5A network guiding principles	Low	Ongoing	$$
	WW-21f	Area Bound by 14 Street NW, 8 Avenue NW, 10 Street NW, Memorial Drive NW	Fill in gaps in sidewalk network to ensure sidewalks are provided along both sides of all roadways	Riley Mobility Study - Existing Conditions Report	Vision Zero, 5A network guiding principles	Medium	Ongoing	$$
	WW-21g	Area Bound by 10 Street NW, McHugh Bluff, 3 Street NW, Memorial Drive NW	Fill in gaps in sidewalk network to ensure sidewalks are provided along both sides of all roadways	Riley Mobility Study - Existing Conditions Report	Vision Zero, 5A network guiding principles	Low	Ongoing	$$
	WW-22a	5 Avenue NW from Crowchild Trail NW to 19 Street NW	Provide protected bicycle facilities (5A) along corridor including better accommodation for transit stops	ECAR - public engagement, Riley Mobility Study - Existing Conditions Report	5A network guiding principles, complete streets, Vision Zero	Medium	Medium-term	$$$
	WW-22b	6 Avenue NW from 19 Street NW to 14 Street NW	Provide protected bicycle facilities (5A) along corridor including better accommodation for transit stops	ECAR - public engagement, Riley Mobility Study - Existing Conditions Report	5A network guiding principles, complete streets, Vision Zero	Medium	Short-term	$$$
	WW-22c	5 Avenue NW from 14 Street to 10 Street NW	Provide protected bicycle facilities (5A) along corridor including better accommodation for transit stops	ECAR - public engagement, Riley Mobility Study - Existing Conditions Report	5A network guiding principles, complete streets, Vision Zero	Medium	Short-term	$$$
	WW-23	7 Avenue NW from 5a Street NW to 4 Street NW	Provide protected bicycle facilities (5A) along corridor	Riley Mobility Study - Existing Conditions Report	5A network guiding principles, complete streets, Vision Zero	Medium	Medium-term	$$$
	WW-24	Hill north of Riley Park	Provide paved multi-use pathway (with switchbacks)	Riley Mobility Study - Site Visit	5A network guiding principles, complete streets, Vision Zero	Low	Long-term	$$$
	WW-25a	12 Street NW from Kensington Road NW to 5 Avenue NW	Provide 5A wheeling connection	ECAR - public engagement, 5A Network	5A network guiding principles, complete streets, Vision Zero	Low	Long-term	$$$
	WW-25b	12 Street NW from 5 Avenue NW to 8 Avenue NW	Provide 5A wheeling connection	ECAR - public engagement, 5A Network	5A network guiding principles, complete streets, Vision Zero	Low	Long-term	$$$
	WW-26	Riley Park entrance at 11 Street NW	Improve park/street interface to improve comfort, safety and wheeling connections	Riley Mobility Study - Existing Conditions Report	5A network guiding principles	Medium	Medium-term	$$
	WW-27	10 Street NW from Bow to Bluff Pathway to SAIT Way	Provide 5A off-street wheeling connection	ECAR - public engagement	5A network guiding principles, complete streets, Vision Zero	Medium	Medium-term	$$$
	WW-28a	18 Street NW from Kensington to 6 Avenue NW	Provide 5A wheeling connection	Riley Mobility Study - Existing Conditions Report	5A network guiding principles, complete streets, Vision Zero	Low	Long-term	$$$
	WW-28b	8 Avenue NW from 18 Street NW to 17 Street NW and 17A Street NW from 6 Avenue NW to Lions Park	Provide 5A wheeling connection	Riley Mobility Study - Existing Conditions Report, 5A Network	5A network guiding principles, complete streets, Vision Zero	Low	Long-term	$$$
	WW-29	1 Avenue NW from Crowchild Trail NW to 19 Street NW	Improvement to pedestrian facilities (and 5A network) in particular around schools	Riley Mobility Study - Existing Conditions Report, 5A Network	5A network guiding principles, complete streets, Vision Zero	Low	Long-term	$$$
	WW-30	River path near Centre Street N	Enhance protection between motor vehicle lanes and pathway	ECAR - public engagement, 5A Network	5A network guiding principles, complete streets, Vision Zero	Low	Long-term	$$$
	WW-31	2 Avenue NW over Crowchild Trail	Pedestrian bridge over Crowchild Trail NW	Crowchild Trail Improvements	5A network guiding principles	High	Long-term	$$$$
	WW-32	North of 9 Avenue NW over Crowchild Trail	Pedestrian bridge over Crowchild Trail NW	Crowchild Trail Improvements	5A network guiding principles	Medium	Long-term	$$$$
	WW-33	Connecting 12 Avenue NW to University Dr over Crowchild Trail NW	Pedestrian bridge over Crowchild Trail NW	Crowchild Trail Improvements	5A network guiding principles	Medium	Long-term	$$$$
Improved Transit Connections	TR-1	19 Street NW from 7 Avenue NW to 12 Avenue NW	Fill gap in transit network	ECAR - review of existing transit network	RouteAhead	Medium	Medium-term	$$
	TR-2	All of Plan Area	Improve cycling and walking access to transit stops within Plan Area		RouteAhead, 5A network guiding principles	High	Ongoing	$$
Improvements for All Transportation Modes	AM-1	19 Street NW and 5 Avenue NW/6 Avenue NW	Intersection improvements: - Improve crossing conditions for pedestrians and cyclists by painting ladder crosswalks and extending the wheeling lane pavement markings through the intersection - Install "no right turn on red" signs for NB and SB approaches. - Consider a Leading Pedestrian Interval - Review collision history to see if a pattern of WB through collisions with EB left turns. If so, implement protected only EB left turn phase - Provide protected left-turn signals - Consider modifying right-turn lanes to "smart channels" or consider removing right-turn channels - consider roundabout	ECAR - Video Based Conflict Analysis	5A network guiding principles, Vision Zero	Medium	Medium-term	$$$

Focus Area	Ref ID	Location	Description	Project Source	Policy Objectives Advanced	Priority	Timing	Cost
	AM-2	14 Street NW and 5/6 Avenue NW	Intersection improvements: - Improve crossing conditions for pedestrians and cyclists by painting ladder crosswalks and extending the wheeling lane pavement markings through the intersection. - Consider adding or extending NB and SB protected left-turn phases. - Consider modifying right-turn lanes to "smart channels" or consider removing right-turn channels	ECAR - Video Based Conflict Analysis	5A network guiding principles, Vision Zero	Medium	Medium-term	$$$
	AM-3	19 Street NW and 14 Avenue NW	Intersection improvements: - Consider reducing the corner radii - Provide a "smart channel" on the NW corner - Consider a leading pedestrian interval - Review collision history to determine patterns of SB left turn with NB through movements - Install left turn traffic calming measure on the east leg (ex. nose extension) - Assess the installation of wheeling facilities and consider making the wheeling lanes through the intersection. - Assess the lighting conditions at the intersection	ECAR - Video Based Conflict Analysis	5A network guiding principles, Vision Zero	Medium	Medium-term	$$$
	AM-4	Connecting 12 Avenue NW to University Dr over Crowchild Trail NW	Pedestrian bridge over Crowchild Trail NW	Crowchild Trail Improvements	5A network guiding principles	Low	Long-term	$$$
	AM-5	Parkdale Boulevard NW and Kensington Road NW	Review intersection for potential improvements (ex. Roundabout)	Riley Mobility Study - Site visit	Vision Zero	Medium	Medium-term	$$
	AM-6	6 Avenue NW and 18 Street NW	Intersection improvements: - Paint ladder crosswalks at north and south approaches - Consider installing a traffic signal. - Consider installing curb extensions on the SW and NW corners - Assess lighting conditions	ECAR - Video Based Conflict Analysis	5A network guiding principles	Low	Medium-term	$$
	AM-7	3 Avenue NW - 10 Street NW to 9a Street NW	Streetscape improvements	City of Calgary - ongoing project	5A network guiding principles, Vision Zero, Complete Streets, EAGCS	High	Short-term	$$
	AM-8	19 Street NW - Kensington Road NW to 5/6 Avenue NW	Streetscape improvements	City of Calgary - ongoing project	5A network guiding principles, Vision Zero, Complete Streets, EAGCS	High	Short-term	$$$
	AM-9	2 Avenue NW - 9a Street NW to 5a Street NW	Streetscape improvements	City of Calgary - ongoing project	5A network guiding principles, Vision Zero, Complete Streets, EAGCS	High	Short-term	$$$
	AM-10	4 Avenue NW - 10 Street NW to 7 Street NW	Streetscape improvements	City of Calgary - previously considered project	5A network guiding principles, Vision Zero, Complete Streets, EAGCS	High	Medium-term	$$$
	AM-11a	Kensington Road NW - 10 Street NW to 14 Street NW	Streetscape improvements	City of Calgary - previously considered project	5A network guiding principles, Vision Zero, Complete Streets, EAGCS	High	Short-term	$$$
	AM-11b	Kensington Road NW - 14 Street NW to 18 Street NW	Streetscape improvements	City of Calgary - previously considered project	5A network guiding principles, Vision Zero, Complete Streets, EAGCS	High	Short-term	$$$
	AM-12	Kensington Road NW - Parkdale Boulevard to 18 Street NW	Streetscape improvements	City of Calgary - previously considered project	5A network guiding principles, Vision Zero, Complete Streets, EAGCS	High	Short-term	$$$
	AM-13	Kensington Crescent from Kensington Road NW to underground parking access	Convert road to a Woonerf, limiting vehicle access.	ECAR - public engagement, 5A Network	5A network guiding principles, Vision Zero, Complete Streets, EAGCS	High	Medium-term	$$
	AM-14	Eastbound lanes on Memorial Drive NW from 10 Street NW to Centre Street NW	Regularly close eastbound lanes on Memorial to motor vehicles	ECAR - public engagement	5A network guiding principles, Vision Zero, Complete Streets	Medium	Ongoing	$$
	AM-15	Crowchild Improvements (medium and long term), excluding pedestrian overpasses	Roadway Improvements	City of Calgary - previously considered project	Vision Zero, Calgary Transportation Plan	High	Long-term	$$$$
	AM-16	Kensington Road NW and Crowchild Trail NW	Intersection Improvements - Detailed in the Crowchild Trail Improvements	Crowchild Improvements (medium and long term)	Vision Zero, Calgary Transportation Plan	High	Long-term	$$$
	AM-17	5 Avenue NW and Crowchild Trail NW	Intersection Improvements - Detailed in the Crowchild Trail Improvements	Crowchild Improvements (medium and long term)	Vision Zero, Calgary Transportation Plan	High	Long-term	$$$$
	AM-18	14 Avenue NW and Crowchild Trail NW	Intersection Improvements - Detailed in the Crowchild Trail Improvements	Crowchild Improvements (medium and long term)	Vision Zero, Calgary Transportation Plan	Medium	Long-term	$$$
	AM-19	16 Avenue NW and Crowchild Trail NW	Intersection Improvements - Detailed in the Crowchild Trail Improvements	Crowchild Improvements (medium and long term)	Vision Zero, Calgary Transportation Plan	Medium	Long-term	$$$
	AM-20a	14 Avenue NW from Crowchild Trail NW to 19 Street NW	Mobility Improvements	City of Calgary - previously considered project	5A network guiding principles, Vision Zero, Complete Streets, EAGCS	Medium	Medium-term	$$$

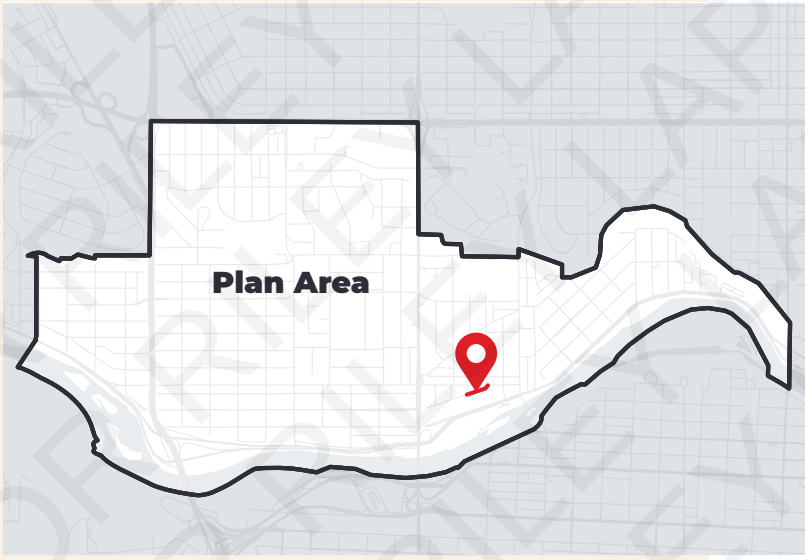
Focus Area	Ref ID	Location	Description	Project Source	Policy Objectives Advanced	Priority	Timing	Cost
	AM-20b	14 Avenue NW from 19 Street NW to 14 Street NW	Mobility Improvements	City of Calgary - previously considered project	5A network guiding principles, Vision Zero, Complete Streets, EAGCS	High	Medium-term	$$$
Parking Management Review	P-1	Schools around 7 Avenue NW and 8 Avenue NW east of 14 Street NW	School drop-off/pick-up circulation review	ECAR - public engagement	Vision Zero	High	Short-term	$
	P-2	10 Street NW from Kensington Road NW to 3 Avenue NW	Allow on-street parking on east side of roadway during afternoon and evening	ECAR - public engagement	-	High	Short-term	$
	P-3	Kensington Neighbourhood	Conduct parking study (goal would be to reduce provided on-street parking)	Riley Mobility Study - Existing Conditions Report	-	High	Short-term	$
Traffic Calming	TC-1a	7 Avenue NW /8 Avenue NW - Crowchild Trail NW to 19 Street NW	Traffic Calming - volume and speed reduction	City of Calgary - previously considered project	5A network guiding principles, Vision Zero, Complete Streets, EAGCS	Low	Long-term	$$
	TC-1b	7 Avenue NW /8 Avenue NW - 19 Street NW to 14 Street NW	Traffic Calming - volume and speed reduction	City of Calgary - previously considered project	5A network guiding principles, Vision Zero, Complete Streets, EAGCS	Medium	Medium-term	$$
	TC-1c	7 Avenue NW /8 Avenue NW - 14 Street NW to 10 Street NW	Traffic Calming - volume and speed reduction	City of Calgary - previously considered project	5A network guiding principles, Vision Zero, Complete Streets, EAGCS	Medium	Medium-term	$$
	TC-2a	16 Street NW - Memorial Drive NW to Kensington Road NW	Traffic Calming - volume and speed reduction	City of Calgary - previously considered project	5A network guiding principles, Vision Zero, Complete Streets, EAGCS	Low	Long-term	$$
	TC-2b	16 Street NW - Kensington Road NW to 8 Avenue NW	Traffic Calming - volume and speed reduction	City of Calgary - previously considered project	5A network guiding principles, Vision Zero, Complete Streets, EAGCS	Medium	Medium-term	$$
	TC-3	Gladstone Road NW - 14 Street NW to 10 Street NW	Traffic Calming - volume and speed reduction	City of Calgary - previously considered project	5A network guiding principles, Vision Zero, Complete Streets, EAGCS	High	Medium-term	$$
	TC-4a	19 Street NW from Kensington Road NW to 8 Avenue NW	Consider reclassifying road as a Primary collector and/or work to reduce traffic volumes through implementing traffic calming measures	ECAR - review of existing traffic volumes	Complete Streets, Vision Zero	Medium	Short-term	$$
	TC-4b	19 Street NW from 8 Avenue NW to 16 Avenue NW	Consider reclassifying road as a Primary collector and/or work to reduce traffic volumes through implementing traffic calming measures	ECAR - review of existing traffic volumes	Complete Streets, Vision Zero	Medium	Short-term	$$
	TC-5a	5 Avenue NW/6 Avenue NW from Crowchild Trail NW to 19 Street NW	Consider implementing traffic calming measures along the corridor to reduce traffic levels to match environmental road capacity.	ECAR - review of existing traffic speeds	Complete Streets, Vision Zero	Low	Long-term	$$$
	TC-5b	5 Avenue NW/6 Avenue NW from 19 Street NW to 14 Street NW	Consider implementing traffic calming measures along the corridor to reduce traffic levels to match environmental road capacity.	ECAR - review of existing traffic speeds	Complete Streets, Vision Zero	Low	Medium-term	$$$
	TC-5c	5 Avenue NW/6 Avenue NW from 14 Street NW to 10 Street NW	Consider implementing traffic calming measures along the corridor to reduce traffic levels to match environmental road capacity.	ECAR - review of existing traffic speeds	Complete Streets, Vision Zero	Medium	Medium-term	$$$
	TC-6	Parkdale Boulevard NW and 25 Street NW	Traffic calming improvements (to slow vehicles turning off of Parkdale to go to Crowchild)	ECAR - Issue identified during site visit	Complete Streets, Vision Zero	High	Medium-term	$$
	TC-7	10 Street NW from Memorial Drive NW to 5 Avenue NW	Consider lowering speed limit	ECAR - public engagement	Vision Zero	High	Short-term	$
	TC-8	19 Street NW from 1 Avenue NW to 3 Avenue NW	Consider lowering speed limit	ECAR - public engagement	Vision Zero	Medium	Medium-term	$
	TC-9	16a Street NW and 6 Avenue NW	Extend school zone east (lowering speed limit)	ECAR - public engagement	Vision Zero	Low	Long-term	$
	TC-10	22 Street NW between Kensington Road NW and 1 Avenue NW	Close street to vehicles	-	5A network guiding principles, Vision Zero	Medium	Long-term	$$

ECAR – Existing Conditions Assessment Report
EAGCS – Established Areas Growth and Change Strategy

Kensington Crescent

Kensington Road NW to Underground Parking Access

This section of Kensington Crescent has several restaurants fronting it that already see benefits from converting on-street parking in front of their establishments to seasonal patios. Further benefits may be realized with full conversion of the road to a Woonerf, similar to Stephen Avenue, limiting vehicle access.



Opportunities

- There is only one laneway on this stretch of road.
- The annual seasonal patios have allowed people to start seeing the roadway's potential and the benefits of increasing walkability over prioritizing parking.
- Potential to activate the space and bring more life to the neighbourhood.
- Potential to add more bicycle parking to the area.

Challenges

- Several businesses along the road are not restaurants and may not support reduced on-street parking for their patrons.

Priority

Travel Mode Focus

Relative Cost

Priority Scoring

- Proximity to Transit
- Proximity to Key Destinations
- Safety
- Relative Cost
- Community Interest
- Previously Planned Project
- Maintenance or Lifecycle

Low score ⟷ High score

Mobility Impacts

- Improvements to mobility for those walking and wheeling.
- Reduced mobility connections and parking for those driving.

Aligns With

- Complete Streets.
- 5A network guiding principles.
- Vision Zero.

Memorial Drive NW Additional Pedestrian Crossings

Memorial Drive NW is a busy thoroughfare, supporting over 50,000 vehicles per day in some sections. The Bow River, on the opposite side of the road from where people live in the Riley Communities, is a major destination for many people walking and wheeling. More opportunities for people walking and wheeling to safely cross Memorial Drive NW are required between 20 Street NW and 10 Street NW, between 5A Street NW and Centre Street, and between Kensington Road NW and 28 Street NW to allow these communities to access this beloved destination.


Memorial Drive NW at 10a Street NW Existing Conditions

Opportunities

- Travel to and from the Bow River is popular, especially in the summer, and would be well supported by residents.
- Sanitary pipe work is scheduled in the short term on the section of Memorial Drive NW from Kensington Road to 28 Street NW which could be coordinated with enhancing crossing opportunities along this portion of Memorial Drive NW.

Challenges

- Heavy traffic volumes on Memorial Drive NW make at-grade road crossings undesirable. However, bridges are costly and are not as direct, convenient, or accessible for people walking and wheeling.

Priority

Travel Mode Focus

Relative Cost*

Priority Scoring

- Proximity to Transit
- Proximity to Key Destinations
- Safety
- Relative Cost
- Community Interest
- Previously Planned Project
- Maintenance or Lifecycle

Low score ⟷ High score

Mobility Impacts

- Improved mobility for those walking.
- Potential increase in delay for drivers and transit users (if at-grade crossings provided).

Aligns With

- 5A network guiding principles.
- Vision Zero.

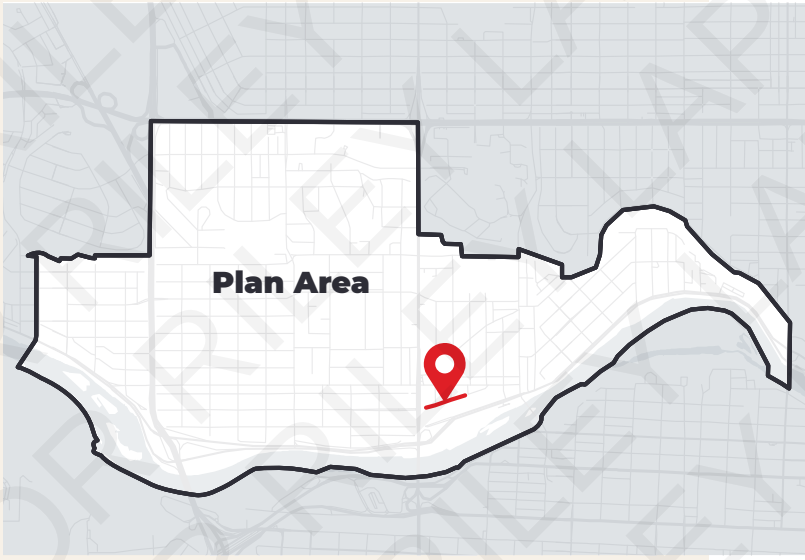
*cost will be dependent on the desired crossing type(s)

Reference ID: WW-5a / WW-5b / WW-5c / WW-5d

Kensington Close Wheeling Improvement

Kensington Close is a low volume road that mainly supports parking for adjacent residents and businesses. The current road operations and design do not promote wheeling, especially westbound. A cul-de-sac at Kensington Crescent inhibits wheeling in both directions. West of 12 Street, Kensington Close becomes a one-way road, preventing eastbound wheeling.

It is recommended that the road be modified to support wheeling in both directions including a break in the cul-de-sac at Kensington Crescent to allow continuous movement for people wheeling.



Opportunities

- Kensington Close is a low volume road with minimal driveway accesses.
- Angled parking on the south side of the road supports residents living nearby.
- The cul-de-sac at Kensington Crescent will ensure that traffic volumes remain low and can be modified to accommodate people wheeling.
- Wide road cross-section may permit a protected wheeling lane without the loss of on-street parking.

Challenges

- East and west of Kensington Close, there are no 5A wheeling connections.

Priority

Travel Mode Focus

Relative Cost

Priority Scoring

- Proximity to Transit
- Proximity to Key Destinations
- Safety
- Relative Cost
- Community Interest
- Previously Planned Project
- Maintenance or Lifecycle

Low score ⟷ High score

Mobility Impacts

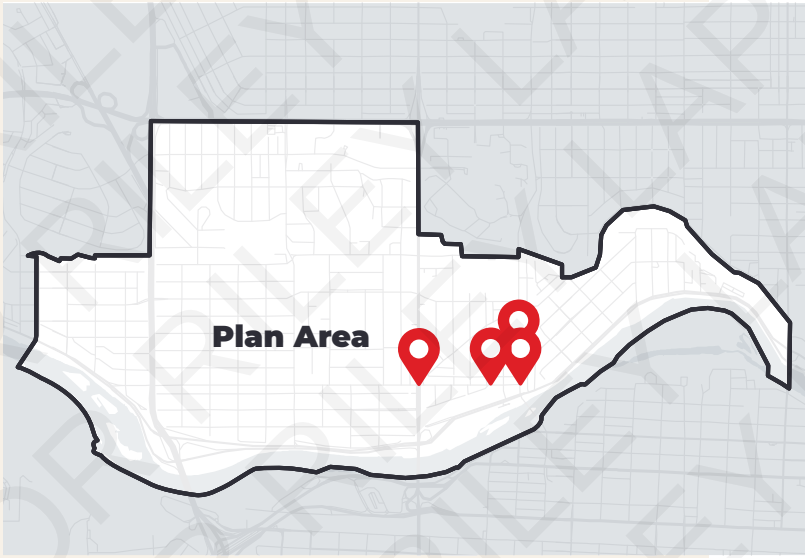
- Improvements to mobility for those wheeling.

Aligns With

- Complete Streets.
- 5A network guiding principles.
- Vision Zero.

LPIs at Signalized Intersections in Kensington

The project will implement Leading Pedestrian Intervals (LPIs). These intervals provide an opportunity for pedestrians to enter the intersection before vehicles. This head start allows them to better establish their presence and makes them more visible to drivers, improving pedestrian safety at the intersection.



Opportunities

- No new infrastructure is required.
- Will improve safety for vulnerable road users.

Challenges

- Potential learning curve for drivers (especially for right-turning vehicles).
- Potential perceived increase in delay to drivers.

Priority

Travel Mode Focus

Relative Cost

Priority Scoring

- Proximity to Transit
- Proximity to Key Destinations
- Safety
- Relative Cost
- Community Interest
- Previously Planned Project
- Maintenance or Lifecycle

Low score ⟷ High score

Mobility Impacts

- Improves walking level of service.
- Minimal delays for motor vehicles.

Aligns With

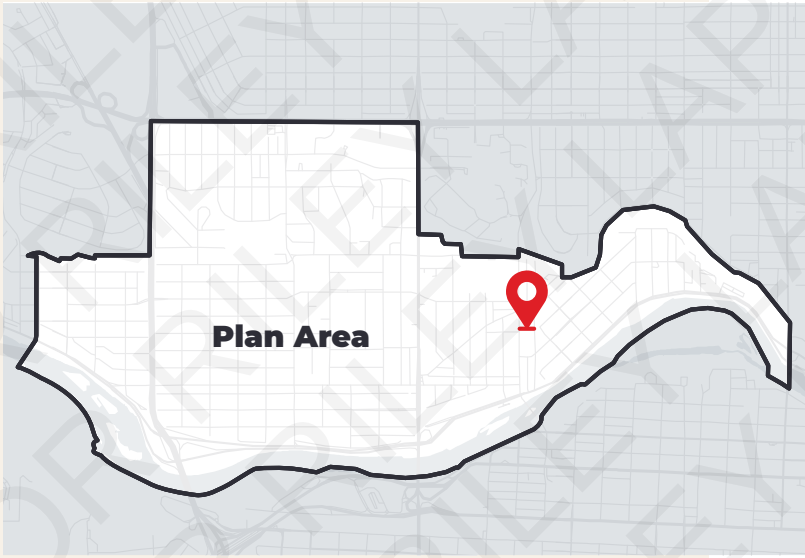
- 5A network guiding principles.
- Complete Streets.
- Vision Zero.

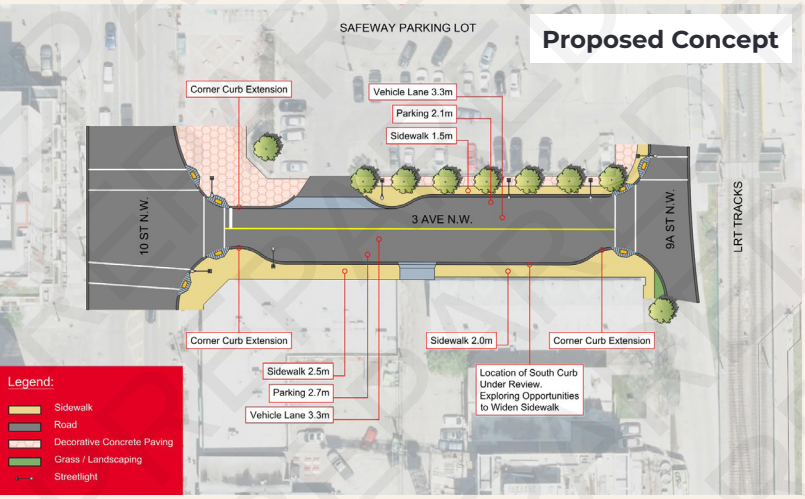
3 Avenue NW

10 Street NW to 9a Street NW

This project involves improvements to the pedestrian environment along 3 Avenue NW between 10 Street NW and 9a Street NW. Preliminary designs include improvements to existing sidewalks and installing corner curb extensions to reduce crossing distances.

Several projects were considered for the Kensington area with engagement conducted to help narrow down the preferred projects. Engagement specific to 3 Avenue NW involved citizens ranking their enthusiasm for changes along the corridor and ranking the effectiveness of two proposed streetscape conditions. The preferred concept is shown below.





Goals

- Create a more welcoming entrance to the Kensington commercial district for people arriving by LRT or from Sunnyside.
- Enhance the experience of pedestrians.
- Support the needs of local businesses.

Opportunities

- Project has already been identified as a capital project and more detailed design of the corridor has begun.
- Project connects to higher order transit (Sunnyside LRT station).
- Curb extensions will improve visibility of pedestrians at the intersections.
- Wider sidewalks will improve the pedestrian experience.

Challenges

- The constrained right-of-way cannot accommodate every mode.
- Parking availability will be impacted.
- Concerns were raised about increased traffic congestion on 10 Street NW, removal of parking, and changes not being a good use of public funds.

Priority

Travel Mode Focus

Relative Cost

Priority Scoring

- Proximity to Transit
- Proximity to Key Destinations
- Safety
- Relative Cost
- Community Interest
- Previously Planned Project
- Maintenance or Lifecycle

Low score ⟷ High score

Mobility Impacts

- Increased level of service for walking.
- Removing parking may improve operations for vehicles that no longer have to wait for other vehicles to park.

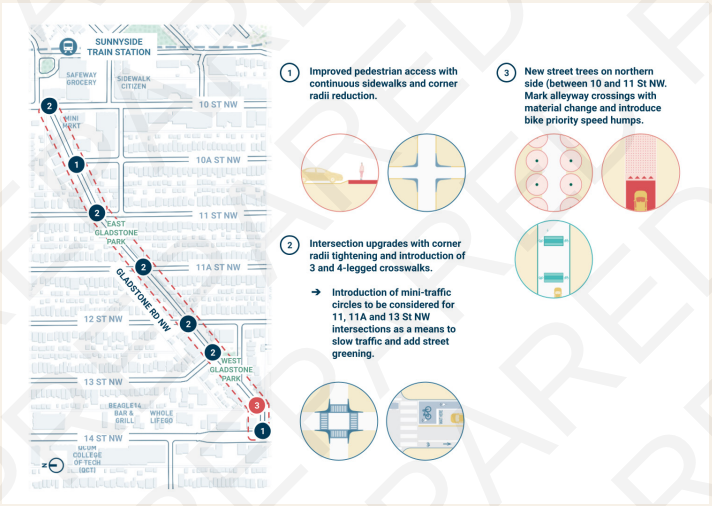
Aligns With

- Complete Streets.
- 5A network guiding principles.
- RouteAhead.
- EAGCS.

Gladstone Road

14 Street NW to 10 Street NW

Gladstone Road is a narrow roadway that cuts diagonally through the community of Hillhurst. The roadway was reviewed as part of the Kensington Area Improvements with the consideration to convert it to a Woonerf/"Slow Street". Several traffic calming measures were suggested along the corridor including continuous crossings, tighter turning radii, mini traffic circles, enhanced crosswalks, and bike priority speed humps.



Goals

- Reduce vehicle speeds and traffic volumes.
- Improve pedestrian safety.

Opportunities

- Road is very narrow and has minimal driveways, promoting lower traffic volumes and the potential to provide 5A facilities without separating people wheeling and driving.
- Initial engagment has been conducted with general support for improvements to mobility for those walking and wheeling.
- Corridor connects to higher order transit (Sunnyside LRT station).

Challenges

- Corridor is long.
- Some past engagement participants insisted on separated wheeling facilities. It may not be possible to accommodate vehicle traffic in both directions and separated wheeling lanes.

Priority

Travel Mode Focus

Relative Cost

Priority Scoring

- Proximity to Transit
- Proximity to Key Destinations
- Safety
- Relative Cost
- Community Interest
- Previously Planned Project
- Maintenance or Lifecycle

Low score ⟷ High score

Mobility Impacts

- Improvements to mobility for those walking and wheeling.
- Delays or rerouting for those driving.

Aligns With

- Complete Streets.
- 5A network guiding principles.
- Vision Zero.

10 Street NW Traffic Calming

Memorial Drive NW to 5 Avenue NW

This segment of 10 Street NW has four lanes of traffic, experiencing high vehicular volumes throughout the day. The corridor is lined with shops, condos, and apartments and provides an important connection to the Bow River. This variety in land uses also results in higher pedestrian volumes. To improve the corridor experience for all travel modes, traffic calming measures should be implemented. Measures that reduce vehicle speeds should be the focus.

10 Street NW Existing Conditions

Priority

Travel Mode Focus

Relative Cost

Priority Scoring

- Proximity to Transit
- Proximity to Key Destinations
- Safety
- Relative Cost
- Community Interest
- Previously Planned Project
- Maintenance or Lifecycle

Low score ⟷ High score

Opportunities

- The need for slower vehicle speeds was identified through the ECAR engagement process.
- Slower speeds would make the corridor more comfortable for people walking and wheeling and encourage more people to travel to the area without a car.

Challenges

- Those that use the road to travel through the community may not support slower speeds.

Mobility Impacts

- Improved mobility for those walking.
- Delays for those driving.
- Delays for transit users.

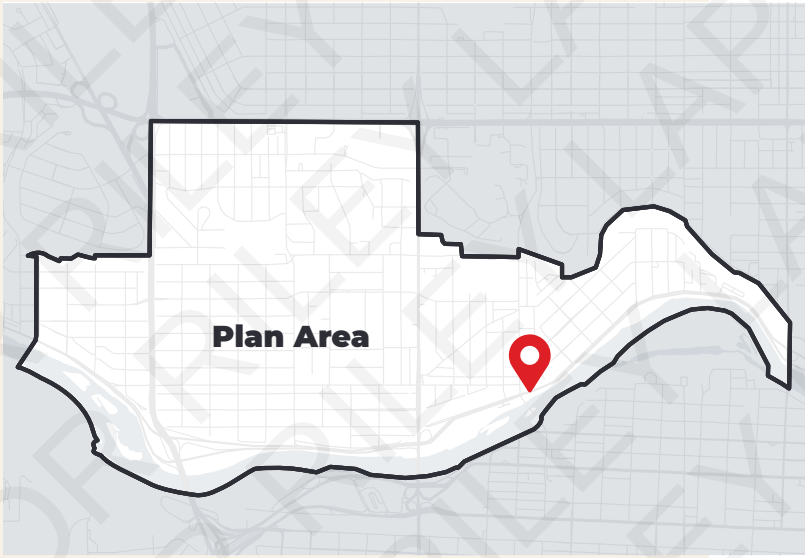
Aligns With

- Complete Streets.
- Vision Zero.

Pedestrian Bridge Enhancements

Memorial Drive NW east of 9a Street NW

The existing pedestrian bridge is narrow with low fall protection. The ramps leading up to the bridge are also narrow with tight turns. Widening and providing taller railings on the bridge, and enhancing the ramps would facilitate better movement for those walking and wheeling to and from Sunnyside.



Bridge Ramp on North Side of Memorial Drive NW

Opportunities

- Project improves access to higher order transit.
- This area of the Plan Area has higher employment and population and sees higher volumes of people walking and wheeling.
- Project was identified through ECAR public engagement.

Challenges

- Capital cost of improvements is high.
- Space for improving ramp on south side of Memorial Drive NW is limited.

Mobility Impacts

- Improved mobility for those walking and wheeling.

Aligns With

- 5A network guiding principles.
- Vision Zero.

Priority

Travel Mode Focus

Relative Cost

Priority Scoring

- Proximity to Transit
- Proximity to Key Destinations
- Safety
- Relative Cost
- Community Interest
- Previously Planned Project
- Maintenance or Lifecycle

Low score ⟷ High score

10 Street NW Crossing Improvements

Memorial Drive NW to SAIT Way NW

This segment of 10 Street NW has four lanes of traffic, experiencing high vehicular volumes throughout the day. The corridor is lined with shops, condos, and apartments, with the exception of Riley Park at the north end of the corridor. It also provides an important connection to SAIT. This variety in land uses also results in higher pedestrian volumes. To improve both safety and convenience for people walking, new crossings over 10 Street NW are required. Further, existing crossings should be enhanced to make pedestrians more visible to vehicles and to improve accessibility.


Accessibility Improvements Example

Opportunities

- The need for more/enhanced crossings was identified through the ECAR engagement process.
- Existing land use including retail, high density residential, and nearby Sunnyside LRT station set the stage for higher pedestrian volumes within the community.
- Improving walking connections may increase the number of people walking.

Challenges

- Drivers familiar with 10 Street NW may perceive enhancements as delays.
- The corridor is constrained with narrower vehicle lanes and insufficient sidewalk width given the high pedestrian traffic.
- Difficult to coordinate traffic signals along the corridor with pedestrian crossings.

Mobility Impacts

- Improved mobility for those walking.
- Potential increase in delay for drivers and transit users.

Aligns With

- 5A network guiding principles.
- Vision Zero.

Priority

Travel Mode Focus

Relative Cost

Priority Scoring

- Proximity to Transit
- Proximity to Key Destinations
- Safety
- Relative Cost
- Community Interest
- Previously Planned Project
- Maintenance or Lifecycle

Low score ⟷ High score

10 Street NW 5A Wheeling Facilities

Memorial Drive NW to SAIT Way

This segment of 10 Street NW has four lanes of traffic, experiencing high vehicular volumes throughout the day. The corridor is lined with shops, condos, and apartments, with the exception of Riley Park at the north end of the corridor. It also provides an important connection to SAIT. This variety in land uses also creates a latent demand for cycling and other forms of wheeling. To increase wheeling within the community, wheeling lanes, designed to comply with 5A guidelines, should be implemented on 10 Street NW. This will provide a safe space for people wheeling to travel along 10 Street NW.


10 Street NW Existing Conditions

Priority

Travel Mode Focus

Relative Cost

Priority Scoring

- Proximity to Transit
- Proximity to Key Destinations
- Safety
- Relative Cost
- Community Interest
- Previously Planned Project
- Maintenance or Lifecycle

Low score ⟷ High score

Opportunities

- Painted bicycle lanes already exist north of 5 Avenue NW.
- 10 Street NW is becoming increasingly popular with more store fronts and higher density residential buildings. Decreasing vehicle lanes will decrease traffic volumes and noise, creating a more welcoming environment for those walking and wheeling.
- Proximity to the Sunnyside LRT station will allow those from further away to wheel to transit and visit this area.

Challenges

- Due to high traffic volumes and narrow lanes, providing 5A protection to people wheeling will require decreasing the number of vehicle lanes and/or on-street parking.
- Frequent and off-set side streets with several driveways along the corridor will need special considerations to ensure adequate safety for people wheeling.

Mobility Impacts

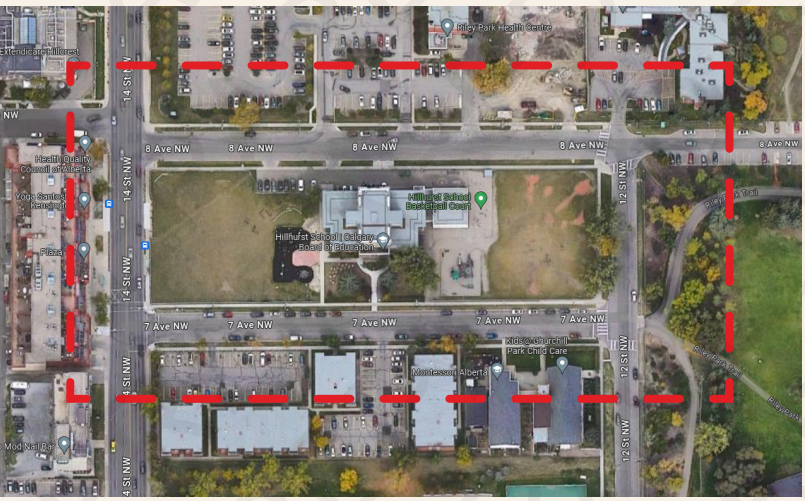
- Improved mobility for those wheeling.
- Could increase travel times for people driving.
- Could increase travel times for transit users.

Aligns With

- 5A network guiding principles.
- Vision Zero.

Hillhurst School and Surrounding Area Pick-up/Drop-off Circulation Review

Concerns over traffic congestion and pick-up/drop-off activities were raised for this area during engagement with the community. It is recommended that these concerns be investigated further and a circulation review be conducted to help optimize pick-up and drop-off procedures.



Opportunities

- Grid road network allows for good circulation around the school.
- 7 Avenue NW and 8 Avenue NW offer wide road cross-sections that would allow for various traffic calming measures or parking modifications to be implemented.

Challenges

- 14 Street NW, adjacent to the school, is a high volume road with higher rates of collisions near the school.
- The school does not provide off-street parking for parents or visitors.

Priority

Travel Mode Focus

Relative Cost

Priority Scoring

- Proximity to Transit
- Proximity to Key Destinations
- Safety
- Relative Cost
- Community Interest
- Previously Planned Project
- Maintenance or Lifecycle

Low score ⟷ High score

Mobility Impacts

- Improved mobility for pick-up/drop-off activities.
- Potential improvements for those walking and wheeling to school resulting from improved vehicle circulation.

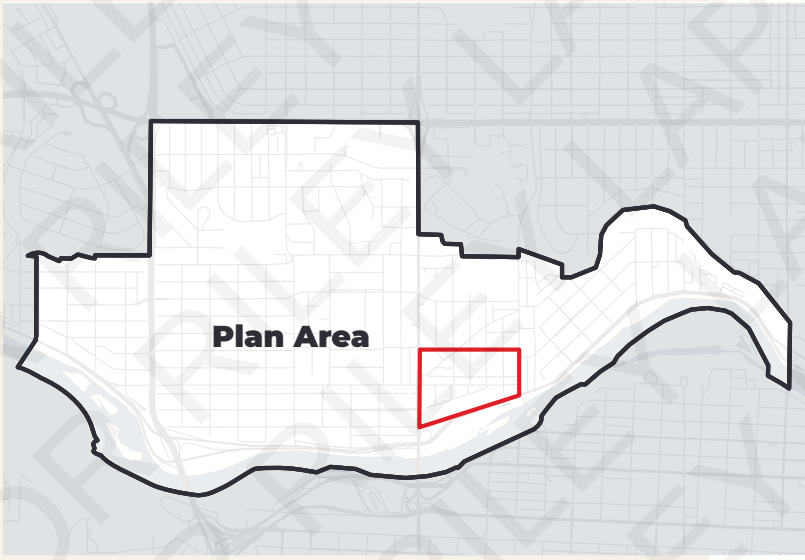
Aligns With

- Vision Zero.

Kensington Area Parking Study

This project will conduct a parking study to optimize efficiency of on-street parking in Kensington. Study should consider the feasibility of permitting on-street parking on the east side of 10 Street NW from Kensington Road to 3 Avenue NW.

Kensington Crescent Existing Conditions



Priority

To be determined. All modes could be impacted.

Travel Mode Focus

Relative Cost

Priority Scoring

- Proximity to Transit
- Proximity to Key Destinations
- Safety
- Relative Cost
- Community Interest
- Previously Planned Project
- Maintenance or Lifecycle

Low score ⟷ High score

Opportunities

- If a reduction in parking is determined appropriate, there is potential to repurpose valuable space with bicycle lanes, parklettes, patios, bicycle racks, street furniture, transit stops, etc.
- Redistribution of parking spaces may provide better service to Kensington businesses.
- The need for additional accessible parking spaces may be identified, improving accessibility for those who are currently unable to visit the corridor.
- Study could streamline Kensington Road NW streetscape improvements.

Challenges

- Potential for strong opposition to parking reductions/redistributions.
- The study may conclude that more parking is required, which may not align with the City's policies and planned projects.

Mobility Impacts

- To be determined — impacts to various transportation modes will depend on outcomes of the study.

Aligns With

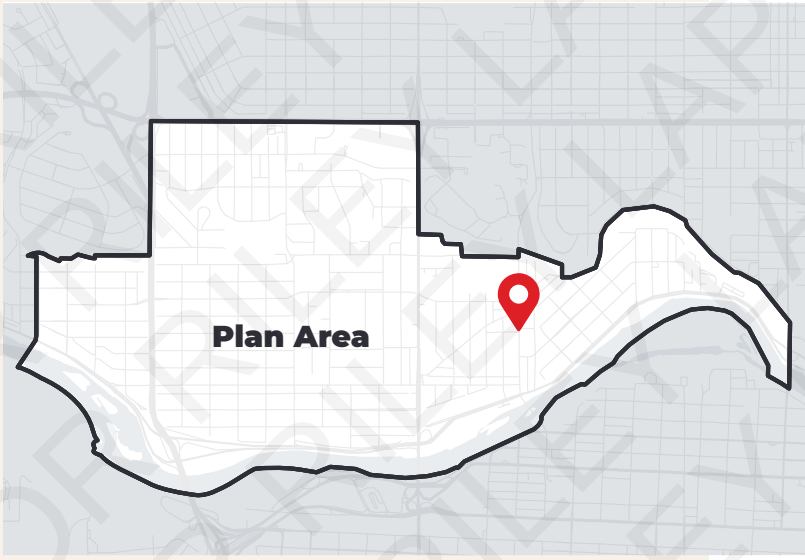
- Complete Streets.

10 Street NW and 3 Avenue NW

Provide a pedestrian scramble phase at the intersection. Because of high pedestrian volumes at this intersection, vehicles are required to wait longer periods for pedestrians to clear the intersection. This long wait can cause risky behaviour from vehicles and can even lead to collisions. Separating the vehicle phases from the pedestrian phases will improve safety at the intersection.

A pedestrian scramble phase is a traffic signal phase in which a WALK phase is given in all directions while vehicular traffic must stop in all directions. Pedestrians may cross in any direction they wish during this time.

Pedestrian Scramble Example



Opportunities

- Intersection is signalized.
- Many people cross the intersection on foot or wheels.
- A pedestrian-only scramble phase would allow pedestrians to travel through the intersection without having to worry about vehicle conflicts. Conversely, vehicles would not have to yield to pedestrians when proceeding through the intersection.

Challenges

- Motorists may perceive the added phase as an increase in delay.
- Learning curve — Since scramble phases are not common in Calgary, motorists may not understand how it works and may travel through the intersection during the scramble phase.

Priority

Travel Mode Focus

Relative Cost

Priority Scoring

- Proximity to Transit
- Proximity to Key Destinations
- Safety
- Relative Cost
- Community Interest
- Previously Planned Project
- Maintenance or Lifecycle

Low score ⟷ High score

Mobility Impacts

- Improvements for people walking and wheeling.

Aligns With

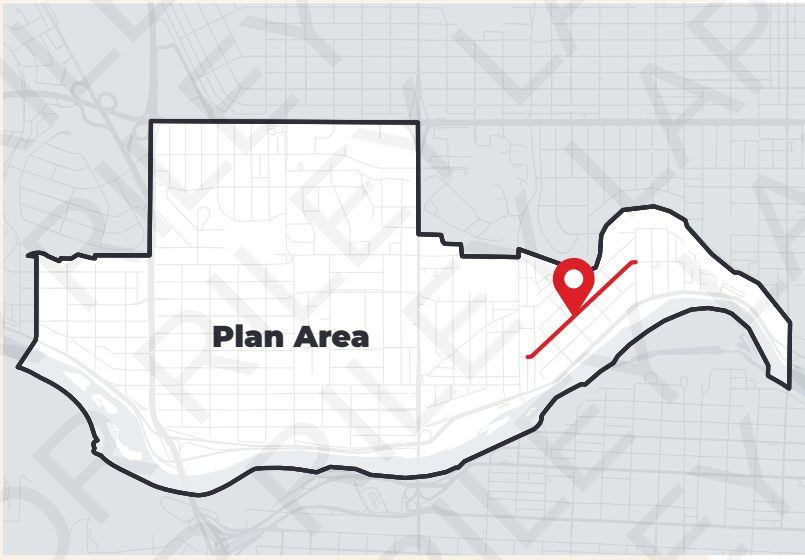
- 5A network guiding principles.
- Complete Streets.
- Vision Zero.

2 Avenue NW

9a Street NW to 5a Street NW

This project involves modifications to the corridor between 5a Street NW and 9a Street NW. Preliminary designs include wheeling lanes, floating bus stops, wider sidewalks, and curb extensions.

Several additional projects were considered for the Kensington area with engagement conducted to help narrow down the preferred projects. Engagement specific to 2 Avenue NW involved citizens ranking their enthusiasm for changes along the corridor and ranking the effectiveness of two proposed streetscape conditions.



2 Avenue NW Existing Conditions

Priority

Travel Mode Focus

Relative Cost

Priority Scoring

- Proximity to Transit
- Proximity to Key Destinations
- Safety
- Relative Cost
- Community Interest
- Previously Planned Project
- Maintenance or Lifecycle

Low score ⟷ High score

Goals

- To discourage short-cutting and encourage slower vehicle speeds by physically and visually narrowing the corridor.
- Provision of a buffer between parked vehicles and the wheeling lane to reduce the risk of an active mode coming into conflict with a vehicle door swing, and for snow storage.

Opportunities

- Project has already been identified as a capital project and more detailed design of the corridor has begun.
- Project connects to higher order transit (Sunnyside LRT station).
- Curb extensions will improve visibility of pedestrians at the intersections
- Wider sidewalks will improve the pedestrian experience.

Challenges

- Parking availability will be impacted.
- Accommodating bus stops with wheeling lanes will require extra attention and education within the community.

Mobility Impacts

- Improvements to mobility for people walking and wheeling.
- Potential slight increases in delay for people driving and for transit users.

Aligns With

- Complete Streets.
- 5A network guiding principles.
- RouteAhead.
- EAGCS.
- Vision Zero.

19 Street NW

Kensington Road NW to 5/6 Avenue NW

Project involves modifications to the corridor between Kensington Road NW and 5/6 Avenue NW. Preliminary designs include adding a buffer between wheeling lanes and parked vehicles, narrowing vehicle lanes, raised islands at intersections, and road widening on the east side to allow space for improvements.

Several additional projects were considered for the Kensington area, with engagement conducted to help narrow down the preferred projects. The first phase of engagement specific to 19 Street NW involved citizens ranking their enthusiasm for changes along the corridor and ranking the effectiveness of two proposed streetscape conditions. The most recent engagement included asking participants how well the proposed designs meet the project goals and for any suggestions or final comments.

19 Street NW Existing Conditions

Priority

Travel Mode Focus

Relative Cost

Priority Scoring

- Proximity to Transit
- Proximity to Key Destinations
- Safety
- Relative Cost
- Community Interest
- Previously Planned Project
- Maintenance or Lifecycle

Low score ⟷ High score

Goals

- Enhance the look and feel of the streetscape.
- Improve pedestrian safety.
- Enhance cycling and wheeling.

Opportunities

- Project has already been identified as a capital project and more detailed design of the corridor has begun.
- Curb extensions will improve visibility of pedestrians at the intersections.
- Corridor is planned for maintenance within the short-term.
- Corridor will connect two major east-west soon-to-be wheeling connections (5/6 Avenue NW and Kensington Road).

Challenges

- Corridor is constrained and will require widening to allow all changes to occur.
- North of 5/6 Avenue NW, 19 Street NW is very steep and does not provide a continuous wheeling connection.
- Sidewalks are not able to be widened due to corridor constraints.
- Parking availability will be impacted.

Mobility Impacts

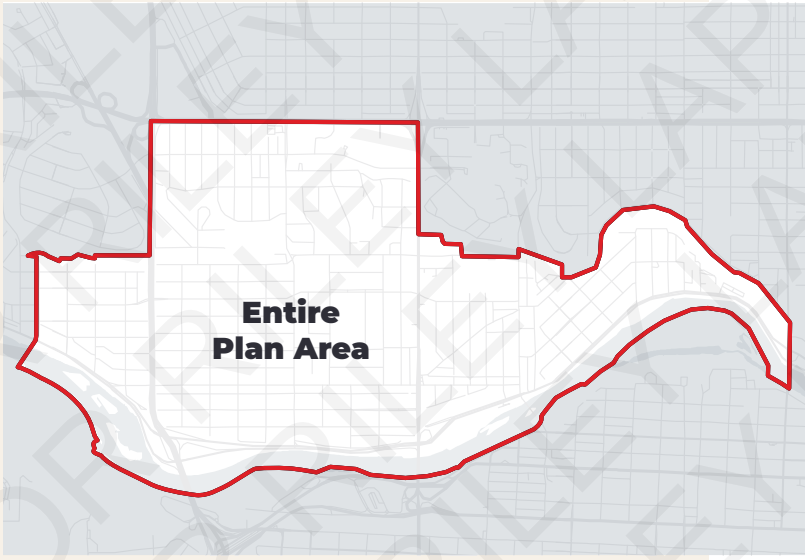
- Improvements to mobility for those wheeling.
- Potential delays for those driving and for transit users.

Aligns With

- Complete Streets.
- 5A network guiding principles.
- RouteAhead.
- EAGCS.
- Vision Zero.

Improve Access to Transit for People Walking and Wheeling

Improve walking and wheeling access to transit stops within Plan Area through measures such as extending and building new walking and wheeling infrastructure, installing directional curb ramps with tactile warning surface indicators, ensuring street furniture and other obstructions are removed from pedestrian right-of-way, and installing curb extensions.




Existing Conditions at Sunnyside LRT Station

Priority

Travel Mode Focus

Relative Cost

Priority Scoring

- Proximity to Transit
- Proximity to Key Destinations
- Safety
- Relative Cost
- Community Interest
- Previously Planned Project
- Maintenance or Lifecycle

Low score ⟷ High score

Opportunities

- Most of Plan Area is supported by sidewalks on both sides of roadways.
- Communities in Plan Area are well connected by transit (two LRT stations, 16 regular bus routes, one MAX route, and one BRT Route).
- Many improvements can be addressed through other Riley Communities projects.

Challenges

- Directional curb ramps and tactile warning surface indicators are needed at most road crossing locations.
- The Plan Area is large, project may be hard to justify as its own project. Likely to see incremental change as other Riley Communities projects are implemented.
- Difficult to quantify/measure direct impacts.

Mobility Impacts

- Improvements for those walking, wheeling, and taking transit.

Aligns With

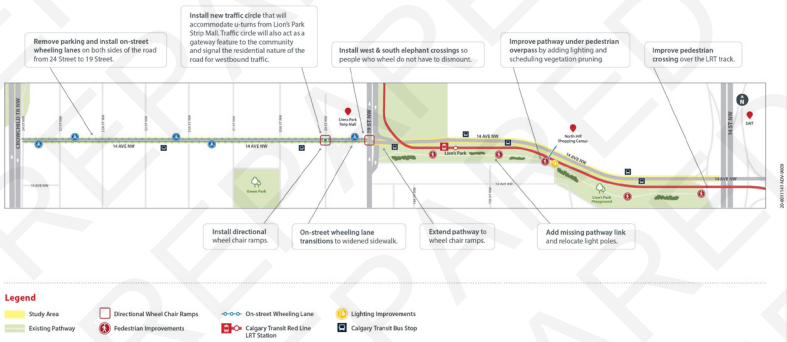
- Complete Streets.
- 5A network guiding principles.
- RouteAhead.

14 Avenue NW

Crowchild Trail NW to 14 Street NW

14 Avenue NW has been identified as requiring road rehabilitation which provides an opportunity to enhance existing infrastructure throughout the corridor. Opportunities include improvements to bicycle facilities, a new traffic circle at 20 Street NW, elephant crossings on 19 Street NW, improvements to transition ramps between bicycle facilities and wheelchair ramps at 19 Street NW, and improvements to the multi-use pathway in Lions Park.

Proposed Concept



Opportunities

- Corridor scheduled for maintenance within the next 5 years (ideally at the same time as the 14 Avenue/14 Street bridge rehabilitation).
- Corridor provides a direct connection to the Lions Park LRT station.
- Project is close to a high collision area and a higher impact would be realized from safety improvements.
- New roundabout will allow safe u-turns from those leaving Lions Park strip mall wanting to go north, east or south.

Challenges

- Potential opposition to the slight reduction in on-street parking.
- Desire to align project with bridge rehabilitation will delay project until sufficient funds are available.
- Difficult to accommodate wheeling lanes through roundabout.
- Mitigating impact to transit operations in and out of Lions Park LRT station.

Priority

Travel Mode Focus

Relative Cost

Priority Scoring

- Proximity to Transit
- Proximity to Key Destinations
- Safety
- Relative Cost
- Community Interest
- Previously Planned Project
- Maintenance or Lifecycle

Low score ⟷ High score

Mobility Impacts

- Improved mobility for those walking and wheeling.
- Improved mobility for those driving.

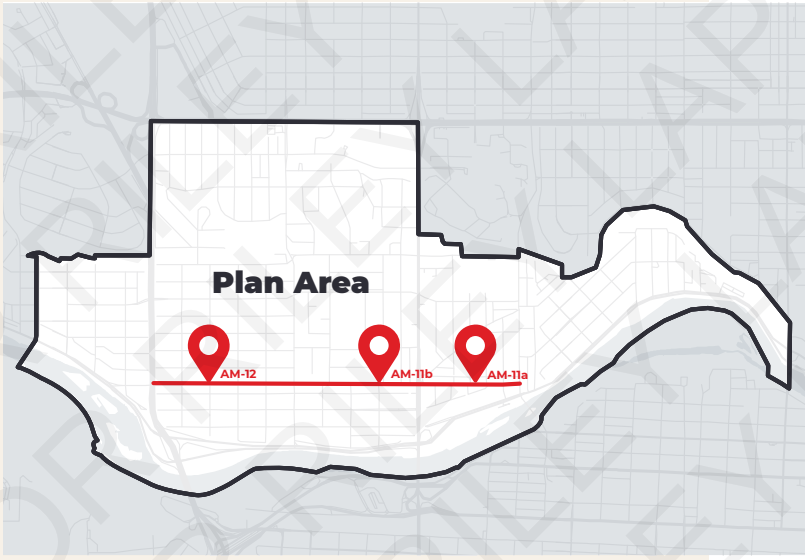
Aligns With

- 5A network guiding principles.
- Complete Streets.
- Vision Zero.

Kensington Road NW

A traffic safety improvements project has been initiated in response to a recent safety and operational review of collisions in the area. Recent changes include installation of temporary curb extensions, a speed reduction to 40km/h, and installing a rapid flashing beacon at 18A Street NW. Further modifications to the corridor are needed to improve safety and accommodate walking and wheeling along the corridor. Several streetscape improvements have been considered including:

- Wheeling lanes.
- Flexible summer/winter cross-section options.
- Wider sidewalks.
- Reducing to one vehicle travel lane in each direction.
- A median.




Kensington Road Traffic Calming Measures

Priority

Travel Mode Focus

Relative Cost

Priority Scoring

- Proximity to Transit
- Proximity to Key Destinations
- Safety
- Relative Cost
- Community Interest
- Previously Planned Project
- Maintenance or Lifecycle

Low score ⟷ High score

Goals

- Enhance the look and feel of the streetscape.
- Improve pedestrian safety.
- Enhance cycling and wheeling.

Opportunities

- Safety issues along corridor are creating a higher urgency and support for change.
- The area is popular and experiences high pedestrian activity.
- Project has been introduced to the public and the public has been formally engaged.
- Several improvements have already been implemented.
- Potential for bus stops to be located in curb extensions.

Challenges

- Changes may cause parking reductions.
- Not acting soon enough may allow more injuries/fatalities to occur.

Mobility Impacts

- Improved mobility for those walking.
- Potential increase in delay for those driving.
- Potential increase in delay for transit users.

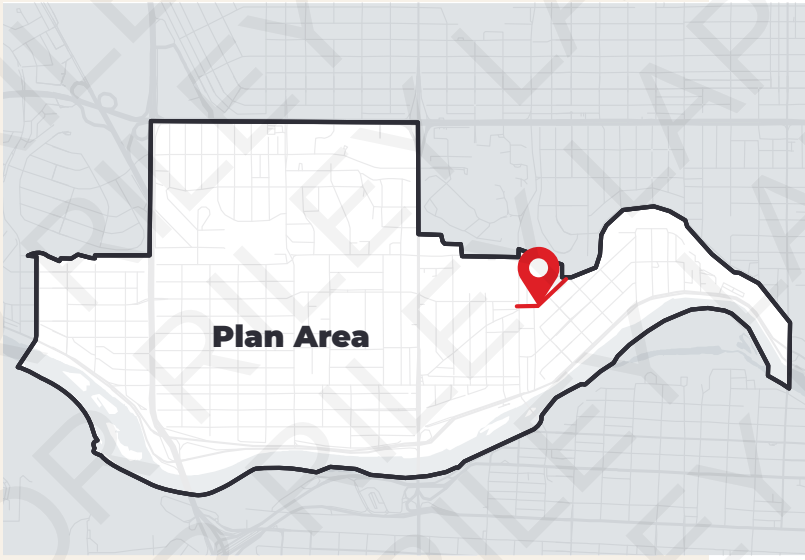
Aligns With

- 5A network guiding principles.
- Complete Streets.
- Vision Zero.

4 Avenue NW

10 Street NW to 7 Street NW

4 Avenue NW between 9A and 10 Street NW serves as one of the main connections between Sunnyside LRT station and the Kensington commercial district. Previous engagement provided options for the corridor including separated wheeling lanes on both sides or on one side of the road, and wider sidewalks. East of 9A Street NW, no plans have been initiated on 4 Avenue NW. Further streetscaping options for this section could consider extension of the west end infrastructure or transitioning to a neighbourhood bikeway. Existing traffic volumes and speeds should be reviewed to ensure 5A facilities are provided.



4 Avenue NW Existing Conditions

Priority

Travel Mode Focus

Relative Cost

Priority Scoring

- Proximity to Transit
- Proximity to Key Destinations
- Safety
- Relative Cost
- Community Interest
- Previously Planned Project
- Maintenance or Lifecycle

Low score ⟷ High score

Goals

- Create a more welcoming entrance to the Kensington commercial district for people arriving by LRT or from Sunnyside.
- Enhance the experience of pedestrians.
- Support the needs of local businesses.

Opportunities

- Project was identified in the Kensington Area Improvements (Phase 1 and 2) and some public consultation has been completed.
- Project connects to higher order transit (Sunnyside LRT station).
- Project is located near a collision hot spot and would see a greater benefit with improvements for people walking and wheeling.
- Project connects to the existing wheeling lanes on 5 Avenue NW.
- Minimal existing on-street parking between 10 Street NW and 9A Street NW.

Challenges

- Off-set intersections to the north (5 Avenue NW) and south (Gladstone Road) at 10 Street NW will require special consideration to ensure safety for people walking and wheeling.
- LRT crossing will also require special design considerations.
- Adding wheeling lanes would impact parking availability.

Mobility Impacts

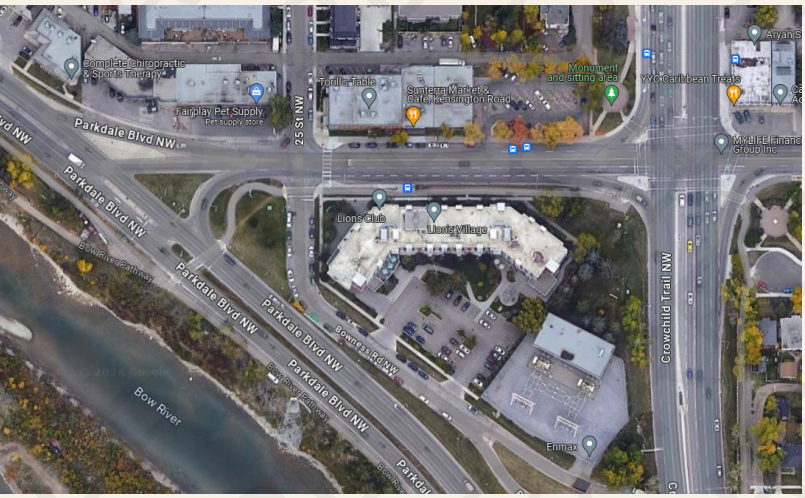
- Improvements for those walking and wheeling.
- Minimal impacts to those driving.

Aligns With

- 5A network guiding principles.
- Vision Zero.

Parkdale Boulevard and 25 Street NW

For drivers travelling westbound on Parkdale Boulevard, to travel southbound on Crowchild Trail NW, traffic must turn right onto Kensington Road (west of 25 Street NW) and then turn right again onto Crowchild Trail NW. This movement regularly experiences high traffic volumes. This area also sees high walking and wheeling volumes with people trying to get to and from the Bow River Pathway. The area would benefit from additional traffic calming measures to slow vehicles making this turn, improving safety for people walking and wheeling.



Opportunities

- A pedestrain half-signal is provided over Parkdale Boulevard.
- A pedestrian crossover with rectangular rapid flashing beacons and curb extensions is provided at Kensington Road and 25 Street NW.

Challenges

- Turning volumes from westbound Parkdale Boulevard onto southbound Crowchild Trail NW are high.
- Restricted sight lines and constrained space:
  - Intersection of Kensington Road and Parkdale Boulevard is skewed.
  - Kensington Road's intersections with Parkdale Boulevard and 25 Street NW are closely spaced.
  - Several businesses front onto Kensington Road between Parkdale Road and 25 Street NW.

Priority

Travel Mode Focus

Relative Cost

Priority Scoring

- Proximity to Transit
- Proximity to Key Destinations
- Safety
- Relative Cost
- Community Interest
- Previously Planned Project
- Maintenance or Lifecycle

Low score ⟷ High score

Mobility Impacts

- Improvements to mobility for those walking and wheeling.
- Minimal delays for those driving and for transit users.

Aligns With

- Complete Streets.
- 5A network guiding principles.
- Vision Zero.

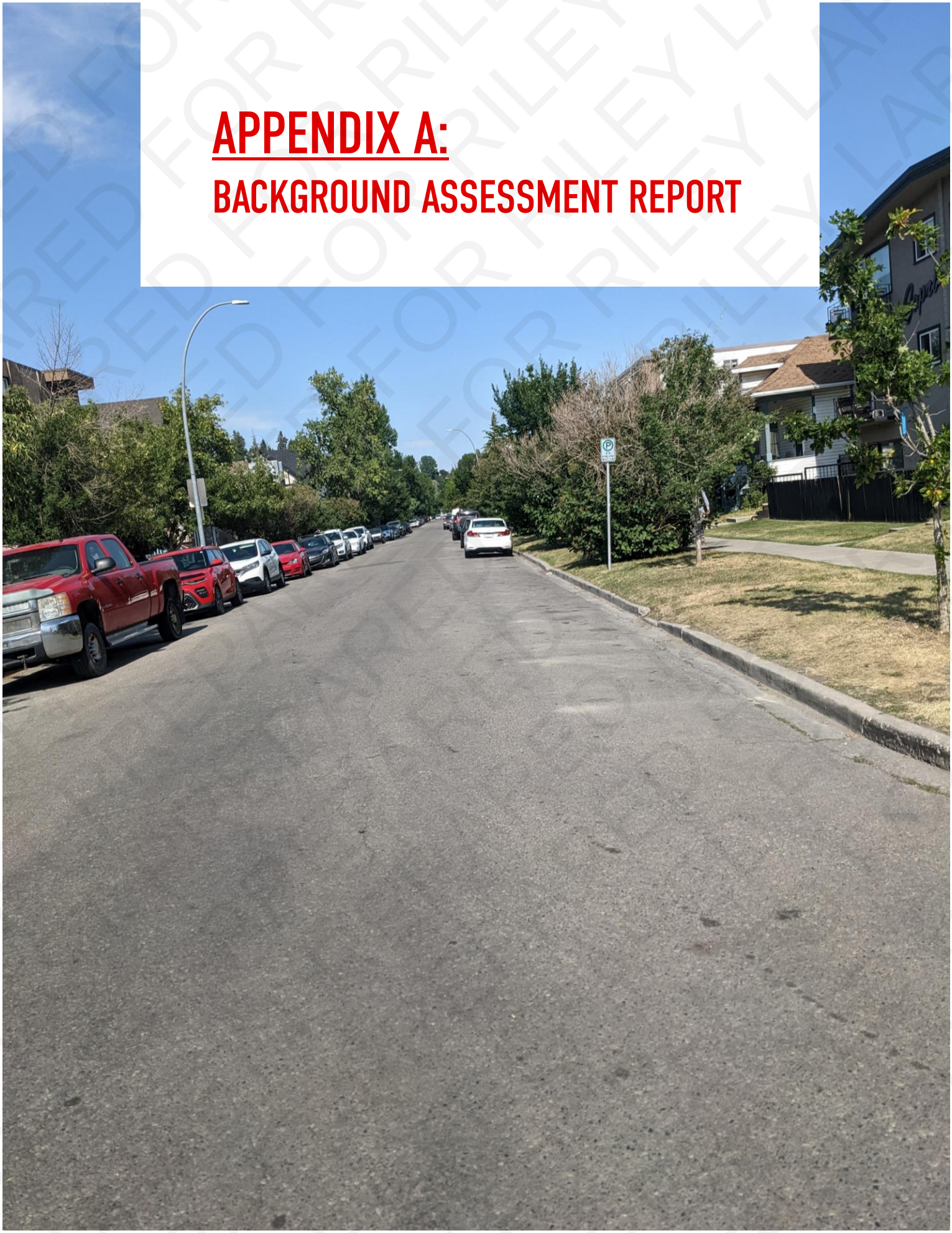
4.0 MOVING FORWARD

Implementation of the identified mobility improvement projects depends on several factors, available budget and resources, and both internal and external influences. Several key guiding principles for implementation include:

- **The Mobility Plan is one step** towards implementing the vision for mobility in the Riley Communities; **it is not the last step**. The recommended prioritization is intended to lay the groundwork for implementation over the long-term. To see them achieved, additional capital and operational investments and resources are required. Achieving The Plan's Vision and upholding the Core Values will require the ongoing support of The City, along with sustained and prioritized investments.
- The Mobility Plan will require **ongoing commitment and leadership, including resources and monitoring**. Achieving the Vision and upholding the Core Values will require leadership and commitment, and sufficient funding and staff resources to deliver on the priorities of the Plan and monitor progress to ensure the Plan is achieving its desired results.
- The Mobility Plan is a **flexible and living document**. For the long-term network plan, there is some level of flexibility for the specific projects that are recommended. The Mobility Plan presents recommendations based on public input and technical analysis; however, The City will need to review the feasibility and desirability of each infrastructure project. As this plan is a long-term, strategic document, it is anticipated that additional projects will emerge over time to reflect changing priorities.
- The City should **monitor, review, and update the Mobility Plan** on a regular basis, as needed. As The City begins implementing the projects outlined in the plan, a monitoring and reporting strategy will be needed to measure and communicate progress towards achieving the Vision and supporting the Core Values. As The City moves forward with implementing the plan, the document will need to be updated to reflect the changing priorities and conditions over time.
- The City should **engage further with the public** to implement the projects outlines in the Mobility Plan. Many of the initiatives require more detailed input and technical work. The City should work closely with partners, residents, and stakeholder groups to move forward with priorities in the plan.
- The City should incorporate as many of the **high-priority projects** as possible into its next budget cycle, and a new investment strategy should be developed for the long-term.

APPENDIX A:

BACKGROUND ASSESSMENT REPORT



RILEY COMMUNITIES MOBILITY STUDY AND IMPROVEMENTS PLAN

BACKGROUND ASSESSMENT REPORT

May 14, 2023

URBAN SYSTEMS

Suite 101, 134 - 11 Avenue SE, Calgary, AB T2G 0X5 | T: 403.291.1193

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File: 1057.0189.01

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TABLES

FIGURES

EXECUTIVE SUMMARY

The City of Calgary is in the process of developing a Local Area Plan (LAP) for the Riley Communities (Hillhurst, Hounsfield Heights/Briar Hill, Sunnyside and West Hillhurst). The LAP will guide where and how future growth and redevelopment will happen in these communities. The plan aims to integrate and enhance the existing fabric of the area and ensure the area is vibrant and thriving in the future. **Figure E-1** illustrates the Local Area Planning Boundary.

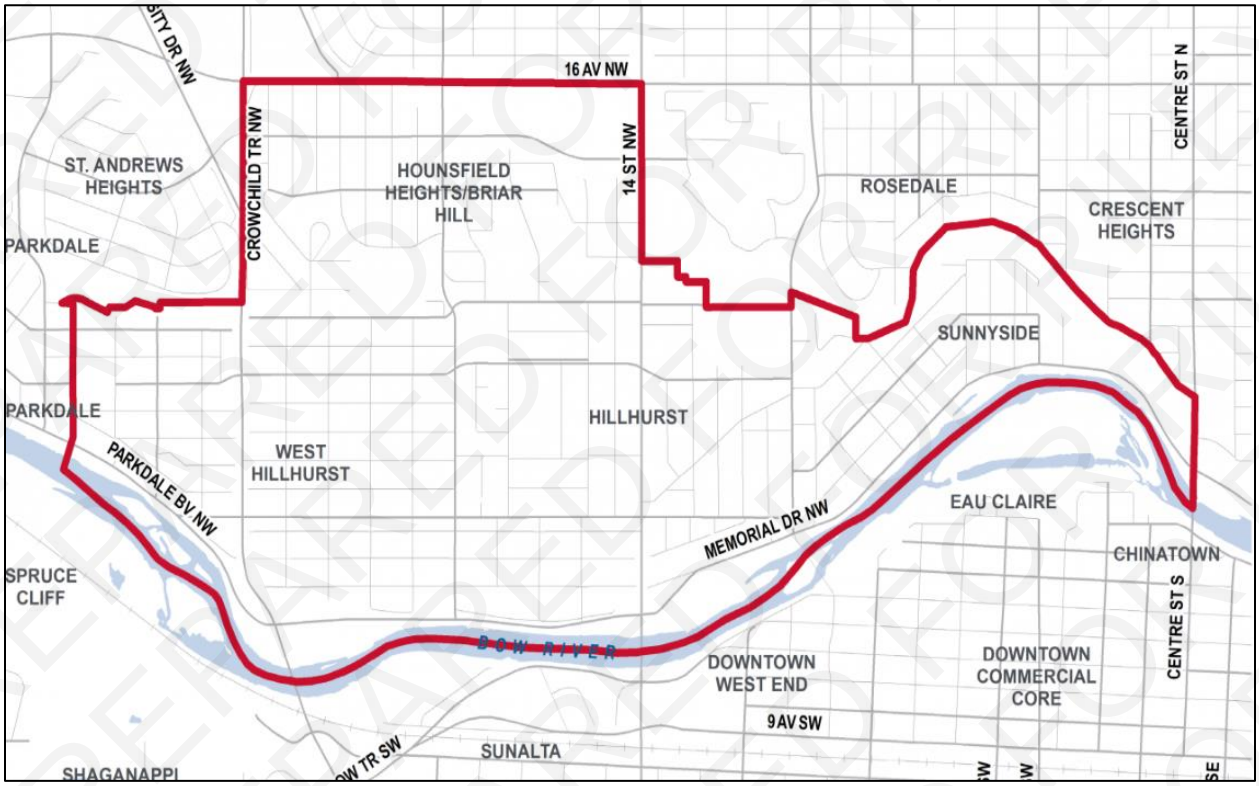


Figure E-1: Riley Communities Local Area Planning Boundary
(Source: https://engage.calgary.ca/Riley)

As part of this LAP, a Mobility Plan is being conducted. This mobility plan will review and analyze the current conditions for walking, wheeling (e.g., scooting, skateboarding and bicycling), transit, motor vehicle traffic and goods movement and recommend short-, medium- and long-term upgrades to the network to improve comfort, safety, and efficiency for all modes.

This report provides a background summary of the Riley Communities' demographics, the previously developed policies, plans and projects, and assessment of the existing conditions for all transportation modes including a transportation safety review and video based conflict analysis.

COMMUNITY CONTEXT

The land use within the Riley Communities is mostly low-density residential with some supporting commercial and higher density residential along the main corridors. Key destinations within the local plan area include several schools, commercial strips on Kensington Road NW, 19 Street NW, 10 Street NW and 14 Street NW. Further, Riley Park, and the North Hill Shopping Centre draw a lot of visitors.

Community demographics were summarized including age, average household size, average household income, travel mode to work, average commute time and time leaving for work. Most of this information was in line with the values reported for the city as a whole. One of the major differences was the amount of non-motor vehicle commuters. The average percentage of commuters driving to and from work city-wide is 71% whereas the average for the Riley Communities is 52%.

Background Policies, Programs and Projects

A comprehensive review of these studies and other relevant documents was conducted to ensure that the plans and policies align and that efforts are not duplicated or wasted. **Table E-1** summarizes the documents and projects reviewed. For the infrastructure projects reviewed, **Figure E-2** illustrates the location. For more detailed summaries of each background document, refer to **Section 3.0**.

Table E-1: Summary of Reviewed Policies, Programs and Projects

	Project Name		Est. Timeline	Riley Communities Impacted	Status
Established Area Growth and Change Strategy					
1	West Hillhurst Streetscape and Public Realm Improvements		2021-2023	West Hillhurst	Phase 1 – Identifying Opportunities engagement completed (April 2021)
2	Hillhurst-Sunnyside Streetscape and Public Realm Improvements		2021-2023	Hillhurst Sunnyside	Phase 1 – Project Prioritization engagement completed (June 2021)
3	Kensington Transit-Oriented Development (TOD) Streetscape and Public Realm Improvements		2021-2023	A. Hillhurst (Kensington Plaza) B. Sunnyside (3/4 Avenue NW)	Initial engagement survey launched. No public results from survey.
4	(Kensington Area Improvements) Riley Area Improvements		2021-2023	West Hillhurst Hounsfield Heights/ Briar Hill Hillhurst Sunnyside	SEE BELOW for projects moving forward.
	Riley Area Improvement Projects Proceeding:				
4A	i.	19 Street NW Streetscape Improvements	2022-2024	Hillhurst West Hillhurst Sunnyside	Phase 3 engagement completed. Design and construction anticipated for Spring 2023-Fall 2024.
	ii.	2 Avenue NW Streetscape Improvements			
	iii.	Grasshopper Hill Off-Leash Park			
	v.	Kensington Plaza Open Space Project			
	Other Kensington Projects Considered during Phase 1 and 2:				
4B	i.	4 Avenue NW Streetscaping	2021	West Hillhurst Hounsfield Heights/ Briar Hill Hillhurst Sunnyside	Phase 2 – Proposed Improvement engagement completed (Aug/Sept 2021). Project identified, but not shortlisted.
	ii.	7/8 Avenue NW Traffic Calming	2021		
	iii.	16 Street NW Traffic Calming	2021		
	iv.	21 Street NW Traffic Calming	2021		
	v.	Gladstone Road Traffic Calming	2021		
	vi.	Kensington Road Streetscaping: 10 Street to 18 Street NW	2021		
	vii.	Kensington Road Streetscaping: Parkdale Boulevard to 18 Street NW	2021		

	Project Name	Est. Timeline	Riley Communities Impacted	Status
5	14 Avenue NW Mobility Improvements	2021	Hounsfield Heights/ Briar Hill	Deferred in 2022
6	Banff Trail Area Improvements	2018-2022	Hounsfield Heights/ Briar Hill (north limits)	Construction primarily completed October 2022
7	North Hill Communities Local Area Plan	2021	None (includes communities to the NE of the project area)	Completed
8	Memorial Parkway Program (Memorial Drive Mobility and Sunnyside Flood Barrier)	2022-2023	Hillhurst Sunnyside	Phase 2 completed (WWHR2 Dec 2022). Next step is developing concepts for potential public realm improvements. Sunnyside Flood Barrier construction planned for 2023.
9	Crowchild Improvements	2017-2027+	West Hillhurst, Hounsfield Heights/ Briar Hill	Short-term upgrades completed. Medium term construction for 2027 and beyond.
	Zoning By-law 1P2007	2007	All	NA

1 West Hillhurst Streetscape and Public Realm Improvements
2 Hillhurst-Sunnyside Streetscape and Public Realm Improvements
3 Kensington Transit-Oriented Development (TOD) Streetscape and Public Realm Improvements
4 (Kensington Area Improvements) Riley Area Improvements

Kensington Projects Proceeding:

4A
- i. 19 Street NW Streetscape Improvements
- ii. 2 Avenue NW Streetscape Improvements
- iii. 3 Avenue NW Streetscape Improvements
- iv. Kensington Plaza Open Space Project

Other Kensington Projects Considered during Phase 1 and 2:

4B
- i. 4 Avenue NW Streetscaping
- ii. 7/8 Avenue NW Traffic Calming
- iii. 16 Street NW Traffic Calming
- iv. 21 Street NW Traffic Calming
- v. Gladstone Road Traffic Calming
- vi. Kensington Road Streetscaping: 10 Street to 18 Street NW
- vii. Kensington Road Streetscaping: Parkdale Boulevard to 18 Street NW

5 14 Avenue NW Mobility Improvements
6 Banff Trail Area Improvements
7 North Hill Communities Local Area Plan
8 Memorial Parkway Program (Memorial Drive Mobility and Sunnyside Flood Barrier)
9 Crowchild Improvements

URBAN SYSTEMS

0 100 200 300
Meters

Coordinate System:
NAD 1983 3TM 114

Scale: 1:13,000
(When plotted at 11"x17")

Legend

- Attraction
- Community Centre
- Library
- Health Clinic/Care Centre
- School
- Place of Worship
- LRT Station
- LRT
- Commercial
- Park
- School
- Study Area

Project #: 1057.0189.01
Author: SDF

Revision: A
Date: 2022 / 11 / 14

Calgary

Riley Communities Mobility Study

FIGURE E-2

Additional Project Areas

TRANSPORTATION NETWORK

The transportation network was examined to gain an understanding of the existing conditions and set the stage for establishing gaps and opportunities within the network.

Pedestrian Network

The existing pedestrian network within the study area is well established with over 100 kilometres of sidewalks and almost 4 kilometres of paved pathways. Sidewalks are located on both sides of almost all roadways. The sidewalk network is supported by several clusters of pathways, most located throughout parks and green spaces and adjacent to major roadways. Crosswalks are also located throughout the network. Most are located on higher volume roadways and clustered near the C-Train stations, facilitating pedestrian movement. In addition to painted crosswalks, there are three locations that provide an extra level of safety for pedestrians with Rectangular Rapid Flashing Beacons.

Because of the extensive sidewalk network, there are no major connectivity gaps to highlight. However, there are a few barriers in the study area that limit pedestrian comfort, safety, and convenience. These barriers include the steep grades along the escarpment, and limited crossings along the busier roadways such as Memorial Drive, Crowchild Trail, and 14 Street.

Most street corners have sidewalk ramps to accommodate wheelchairs, strollers, and other assistive devices. However, most corners do not meet current standards that specify one ramp for each direction of travel. Most street corners in the study area have one ramp angled toward the centre of the intersection that is intended for traveling in either direction from the corner. There are some exceptions in areas that have recently been upgraded/repaved. Further, most sidewalks in the study area are 1.5m monowalks, with no space between the edge of the sidewalk and the curb.

Wheeling Network

Within the study area, there are approximately 2.3 centreline kilometres of wheeling lanes, 13.8 km of signed routes, 2.3 km of shared lanes and 22.3 kms of trails.

A significant portion of the study area's wheeling network consists of local and regional pathways. These facilities are considered 5A facilities. The dedicated facilities, that are generally more comfortable for people wheeling (although not considered "5A"), within the study area include wheeling lanes on 6 Avenue/5 Avenue from 19 Street NW to 10 Street NW, on 10 Street NW from 16 Avenue NW to 3 Avenue NW. Further, there is a northbound contraflow lane (a wheeling lane where people on bicycles or other wheeling devices are permitted to travel in the opposite direction of traffic flow) on 9A Street NW between 4 Avenue NW and Memorial Drive.

There are many shared routes within the study area including 14 Avenue, 21 Street NW, 19 Street NW, Juniper Road NW, 5 Avenue NW, Broadview Road NW, 10 Street NW, etc. While most of these routes are on low volume, low speed roadways and are comfortable for many people wheeling, some routes, such as 10 Street NW and 19 Street NW, experience higher traffic volumes and are not comfortable for most people. Only one set of wheeling traffic control signals are provided in the study network. These are located at the intersection of 5 Avenue NW and Crowchild Trail.

While the dedicated bicycle network is minimal, the shared routes provide supporting connections facilitating good wheeling movement throughout the study area. It should be reiterated that most of these connections are not suitable for many wishing to wheel.

Transit Network

The existing transit network consists of 16 regular bus routes, two bus rapid transit (BRT) routes, six school routes and an LRT line.

The regular bus routes provide good connectivity throughout the study area with main north-south routes on Crowchild Trail, 14 Street and 10 Street and main east-west routes on Kensington Road / 2 Avenue, 5 Avenue / 6 Avenue, 16 Avenue and 16 Avenue. It is noted that no regular routes are provided on 19 Street NW, one of the major north-south connections through the study area. As such, 19 Street is identified as a gap in the transit network.

The two BRT routes through the project area provide east-west connections – one on Kensington Road and the other on 16 Avenue. The BRT route on 16 Avenue NW is a MAX route. There are two LRT stations within the study area, Lions Park and Sunnyside. Eight bus routes provide service to Lions Park Station and three bus routes provide service to Sunnyside Station. The remaining regular bus routes within the study area link to other LRT stations.

Bus stop amenities within the area consist of any combination of benches, shelters, garbage bins, and concrete waiting areas.

All Calgary Transit buses, and LRT vehicles are equipped with ramps or are ground-level accessible to make it easier for transit users with mobility issues to board. These vehicles also have priority seating areas reserved for the same users. The study area's sidewalk network provides good connections to all bus stops. However, it is noted that at some locations that are designated for future bus stops, proper crossing facilities are lacking.

Road Network

The study area road network is comprised of a variety of roadway types. This variety supports efficient and comfortable movement for all travel types (walking, wheeling, transit, personal vehicles). It consists of mostly collector and residential roadways that facilitate lower traffic volumes and slower moving vehicles which support more comfortable environments for individuals walking or wheeling.

Average Daily Traffic (ADT) volumes (data collected from 2012-2019, and in 2022) for roadways in the study area were obtained and compared to their assigned road classification's capacity. The roads with ADTs greater than the volume guidelines of their assigned road classification include:

- 16 Avenue NW
- 19 Street NW from 8 Avenue NW to 16 Avenue NW
- 19 Street NW from 2 Avenue NW to 3 Avenue NW
- Various sections of 5 Avenue NW/6 Avenue NW
- Most of Memorial Drive
- Parkdale Boulevard
- 14 Avenue NW
- 3 Avenue NW from 10 Street NW to 9a Street NW

The roads with ADTs less than the volume guidelines of their assigned road classification include:

- Kensington Road from 22 Street NW to 10 Street NW
- Kensington Road from Crowchild Trail to Parkdale Boulevard
- 10 Street NW from the north end of Riley Park to 5 Avenue NW
- 2 Avenue NW east of 6 Street NW

Posted speed limits within the study area vary between 70 km/h, on Crowchild Trail and Memorial Drive, and 40 km/h on most residential roads. It is noted that this 40 km/h speed limit on residential

roads came into effect on May 31, 2021. Prior to this, the speed limit on residential roads was 50 km/h. Scattered throughout the community are playground zones which restrict vehicle speeds to 30 km/h, between 7:30 a.m. and 9:00 p.m., seven (7) days a week, year-round.

Traffic controls in the study area consists of 21 full traffic signals, two (2) half traffic signals, 11 pedestrian overhead flashers, three (3) pedestrian rectangular rapid flashing beacons (RRFB), and many non-signalized intersections (i.e. stop or yield controlled). There is also one bicycle signal at the intersection of Crowchild Trail NW and 5 Avenue NW for the eastbound/westbound direction.

Traffic signals are limited to the collectors, urban and neighbourhood boulevards, arterials, and skeletal roads. The half signals, pedestrian overhead flashers and RRFBs improve the connectivity for people walking and wheeling and are generally located along main walking and wheeling corridors or near attractions such as schools and parks.

Observed 85th percentile vehicular speed data from the City of Calgary was compiled to understand if speeding is an issue in the study area. The data was filtered to exclude data collected during the COVID-19 pandemic (2020-2021). The 85th percentile speeds were compared to the posted speed limits. Roads identified with multiple locations were the 85th percentile speeds were greater than the posted speed limits were Kensington Road, Memorial Drive/Parkdale Boulevard, 16 Avenue NW, and 5 Avenue NW. This exercise was also completed for the school zones. Most playground zones in the study area identified at least one location where 85th percentile speeds were higher than 30km/h.

Existing traffic calming measures in the Riley Communities include curb bulbs, bicycle lanes, reduce posted speed limits, partial and full closures, and centre medians. The measures are located throughout all communities with the most measures in the Hillhurst and Sunnyside communities.

TRAFFIC CALMING

A high-level review of vehicles speeds was completed along corridors where traffic calming measures were in place. This review excluded areas with closures in place. Speed data was not available to compare vehicle travel speeds prior to the implementation of the traffic calming measures. The following is a summary of the review by location (note that this review consists of data from before the 40km/h speed reduction was put in place):

- **2 Avenue NW (between 6 Street and 9 Street)**
    - Traffic Calming Measure: Centre medians.
    - Reported speeds: The 85th percentile speed varies between 39 km/h to 49 km/h. Higher speeds around the playground zone.
- **5/6 Avenue NW**
    - **10 Street to 14 Street**
        - Traffic calming measures: posted speed at 40 km/h, painted bicycle lanes, and curb bulbs.
        - Reported speeds: The 85th percentile speed is just below 50 km/h.
    - **14 Street to 19 Street**
        - Traffic calming measure: Painted bicycle lanes.
        - No speed data available.
    - **19 Street to Crowchild Trail**
        - Traffic Calming Measures: Curb bulbs, posted speed 50 km/h.
        - Reported speeds: The 85th percentile speed is 56 km/h to 57 km/h.
    - **West of Crowchild Trail**

        - no traffic calming measures, posted speed 50 km/h.
        - Reported speeds: The 85th percentile speed is 56 km/h to 58 km/h.
- **10 Street NW, north of 5 Avenue**
    - Traffic calming measure: Painted bicycle lane, posted speed 50km/h.
    - Reported speeds: The 85th percentile speed varies between 56 km/h to 62 km/h,
- **19 Street NW (between Kensington Road and 5 Avenue)**
    - Traffic calming measures: curb bulbs and sharrows, posted speed 50km/h.
    - Reported speeds: The 85th percentile speed varies between 51 km/h to 52 km/h. Speed increases north of this segment from 55 km/h to 60 km/h.

SAFETY REVIEW

Planning Level Safety Review

A planning level safety review of the corridors and intersections within the study area was completed using the City's historic traffic and collision data from 2016 – 2021. This data helped to gain an understanding of the types of exposures and interactions that are most associated with collisions within the study area. A field visit was also completed to observe the road user behaviour, identify related contributing factors, and record site conditions that could warrant repairs or improvements.

The following summarizes the recommended countermeasures from the Planning-level Safety Review for the ten intersections examined during the field investigations.

1. **Crowchild Trail NW and Kensington Road NW** (it is noted that this intersection will be updated as part of the medium and long-term improvements for Crowchild Trail. These recommendations should be considered when revisiting the project during these stages):
    - Reduce width of right turn channels or consider elimination of the right-turn channels.
        - If right-turn channels are removed, provide crossride on south leg.
    - Consider converting right-turn channel on southbound approach to a smart channel.
    - Extend median on north leg to be closer to the crosswalk.
    - Consider median nose extensions on the northbound and southbound approaches (as a temporary measure, the City could install rubber bumps as a centreline hardening measure).
    - Relocate transit bench so that it does not impede on the bicycling facility (southwest corner).
    - Explore expansion of the wheeling network so that wheeling facilities aren't disconnected.
    - Install "Cyclists Dismount" signage on the southwest corner.
    - Remove empty pole mount at northwest corner of north sidewalk.
    - Trim vegetation to provide clear view of speed limit sign (west of intersection).
    - Add ladder markings in crosswalks.
2. **14 Avenue NW and 14 Street NW (also reviewed in Section 6.2):**
    - Add transit vehicle pre-emption on southbound traffic signal.
    - Remove one westbound though lane to maintain the cross-section of adjacent roadway segments.
    - Add roadway edge pavement marking for eastbound right-turn channel.
    - Relocate crosswalk obstructions – "Look both ways for train" signs and railings – at the eastbound right-turn channel (south side) to ensure crosswalks are visible to motorists.
    - Realign crosswalk on the southeast and northeast corners to align with curb ramps.
    - Install "Cyclists dismount" signage on the southwest corner.

3. **10 Street NW and Memorial Drive NW:**
    - Modify signals between Memorial Drive and Kensington Road to improve progression between intersections and reduce weaving maneuvers.
    - Reduce curb radius on SW corner.
    - Modify westbound right-turn channel from two lanes to one lane or consider providing a dedicated signal phase for the movement.
    - Convert northbound right-turn channel to a smart channel or reduce existing lane width.
    - Explore expansion of the wheeling network on 10 Street to connect with existing facilities north of 3 Avenue.
    - Provide a curb ramp for the north and west crosswalks.
    - Add ladder markings in all crosswalks.
    - Add yellow tactile plates at corners that do not have them.
4. **14 Street NW and Kensington Road NW:**
    - Implement leading pedestrian intervals on eastbound and westbound approaches.
    - Reduce curb radius of northwest, northeast, and southwest corners with pavement markings or truck aprons.
    - Extend median closer to crosswalk at north and south legs (temporary measure – install rubber bumps as a centreline hardening measure).
    - Remove private property accesses close to intersections.
    - Explore expansion of wheeling network along Kensington Road.
    - Re-paint stop bar at eastbound approach.
    - Assess lighting conditions and consider improvements.
    - Provide separate curb ramps for each crosswalk.
    - Add ladder markings in crosswalks.
    - Add yellow tactile plates at corners that do not have them.
5. **16 Avenue NW and 19 Street NW:**
    - Reduce width of northbound right-turn channel.
    - Consider eliminating right-turn channels.
    - Relocate eastbound stop bar closer to the crosswalk. Could also extend median into crosswalk (temporary measure – install rubber bumps as a centreline hardening measure).
    - Extend red pavement further east, to the end of the bus bay (eastbound curb lane, east leg).
    - Assess lighting conditions and consider improvements.
    - Relocate push buttons closer to crosswalks.
    - Add yellow tactile plates at corners that do not have them.
6. **19 Street NW and Kensington Road NW:**
    - Provide better clarity on lane drop for the southbound movement – there are two through lanes at the approach and only one, wide, receiving lane.
    - Review streetlight power source/light bulbs (streetlights were not illuminated during site visit).
    - Relocate bus stop closer to intersection to prevent midblock crossings.
    - Remove fencing that obstructs sightlines of the southbound motorists looking east (left).
7. **19 Street NW and 12 Avenue NW:**
    - Review streetlight power source/light bulbs (streetlights were not illuminated during site visit).
    - On 19 Street, implement on-street wheeling lanes.
    - Provide curb extensions on northwest and southwest corners.

- Trim vegetation to improve sightlines for eastbound motorists looking north.
- Add separate curb ramps for each crosswalk.
- Add yellow tactile plates at corners that do not have them.

8. **14 Street NW and 8 Avenue NW:**
    - Implement curb extensions at intersection.
    - To reduce the road width of 8 Avenue, implement road diet.
    - Add yellow tactile plates on all corners that do not have them.
    - Provide pavement markings and stop bars on the eastbound and westbound approaches.
    - Conduct a detailed safety review of the intersection
        - Potential countermeasures that could be determined form the review:
            - Convert east and west legs to right-in right-out accesses.
            - Make 8 Avenue west of 14 Street one-way westbound
            - Make 8 Avenue east of 14 Street one-way eastbound
9. **11 Street NW/Kensington Crescent NW and Kensington Road NW:**
    - Provide curb extension at the southeast corner for pedestrians crossing east-west on the south leg.
    - Provide a crosswalk with ladder markings on the south leg (south crosswalk).
    - Reduce the curb radius at the northeast corner.
    - Add ladder markings in the crosswalk on the west leg.
    - Provide RRFB on the west crosswalk.
    - Provide curb extensions on Kensington Road at the west crosswalk.
10. **19 Street NW and 7 Avenue NW/8 Avenue NW (also reviewed in Section 6.2):**
    - Consider implementing wheeling facilities on 19 Street.
        - In the southbound direction from 12 Avenue NW to 5 Avenue NW.
        - In the northbound direction from 8 Avenue NW to 6 Avenue NW.
    - Add crosswalks with ladder style pavement markings on the west, east and south legs.
    - Install overhead flashing pedestrian signal or install RRFB on south leg.
    - Provide curb extensions on east leg.
    - Assess and consider improving lighting conditions for the south crosswalk.
    - Trim vegetation on the southeast side of the intersection and relocate street light pole to improve visibility of pedestrians to motorists.

Video Based Conflict Analysis

Conflict analysis data, vehicular speed data, and traffic volume data were collected at five intersections within the study area. These intersections were chosen based on collision data, observations from site visits and overall potential for improvement. Safety issues were identified at each intersection along with recommendations to potentially mitigate these concerns with a suggested priority level for implementation. A higher priority level represents a higher conflict and/or liability risk and that the recommendation should be prioritized by the City. The following was suggested:

- 18 Street and 6 Avenue NW
    - Add crosswalk ladder markings to improve pedestrian visibility (lower priority).
    - Realign curb cuts on the southwest and northwest corners of the intersection (lower priority).
    - Consider installing a signalized intersection to better establish right-of-way (higher priority).

    - Add curb extensions on the southwest and northwest corners to reduce the right-turn radius and thus reduce vehicle turning speeds (lower priority).
    - Assess lighting conditions at the intersection to determine if improvements should be made (higher priority).
- 14 Street and 6 Avenue NW/5 Avenue NW
    - Extend the bicycle lane pavement markings through the intersection to increase bicyclist visibility (higher priority).
    - Paint ladder type crosswalks to increase pedestrian visibility (lower priority).
    - Consider implementing and/or extending northbound and southbound protected left-turn phases (lower priority).
    - Provide "smart channels" on the northwest and southeast corners to cause right-turning drivers to be more perpendicular with the intersection roadway and pedestrian crosswalks (lower priority).
- 14 Street and 14 Avenue NW
    - Provide a "smart channel" for right-turning traffic at the northwest corner of the intersection (lower priority).
    - Assess lighting conditions at the intersection (higher priority).
    - Assess the curb cuts and sidewalks widths to determine if facilities are wide enough to accommodate people with mobility devices (higher priority).
    - Install accessible pedestrian signals (APS) (higher priority).
- 19 Street and 6 Avenue NW/5 Avenue NW
    - Paint ladder type crosswalks to increase visibility of pedestrians for motorists (lower priority).
    - Install NO RIGHT TURN ON RED signs on the northbound and southbound approaches (higher priority).
    - Consider a Leading Pedestrian Interval (LPI) at the intersection (higher priority).
    - Review collision data at intersection to determine if there is a pattern of eastbound left-turn with westbound through collisions.
    - Extend the bicycle lane pavement markings through the intersection to increase visibility of bicyclists to motorists.
- 19 Street and 14 Avenue NW
    - Consider reducing the corner radius on the southeast corner to less than 12.0m or installing a curb extension on the southeast corner (higher priority).
    - Provide a "smart channel" on the northeast corner (higher priority).
    - Consider a Leading Pedestrian Interval (LPI) at the intersection (higher priority).
    - Review collision history to determine if there is a pattern of southbound left-turns with northbound through collisions. If so, implement southbound protected-only left-turn phases (lower priority).
    - Install a left-turn calming measure on the east leg (ex. Median nose extension). This would result in slower turning speeds and better visibility of VRUs for motorists (lower priority).
    - Assess the installation of bicycle facilities and consider marking the wheeling lanes through the intersection (lower priority).
    - Assess the lighting conditions at the intersection (higher priority).

PUBLIC FEEDBACK SUMMARY

From the feedback gathered for the LAP project, the mobility-related key themes included the following:

- Desire for more traffic calming due to speeding, especially around schools
- Desire for wider sidewalks
- Concerns about lack of parking (especially in Hillhurst and Sunnyside)
- Concern about increased traffic due to new development
- Concerns about existing cycling facilities not being up to par in the area (specifically 5 Avenue NW/6 Avenue NW)
- 14 Street is uncomfortable for walking and cycling despite its Urban Boulevard classification

From the previous engagement conducted for the projects in the Riley Communities in the past, the following key themes were noted:

- Support for traffic calming.
- Hesitation for implementation of traffic circles (mostly due to potential disruption to cyclists and vehicles).
- Desire for reduced cut through traffic.
- Desire for a reduction in vehicle speeds.
- Desire for improved conditions for active modes.
- Desire for more seating and landscaping.
- Desire for improvements to be permanent and year-round (as opposed to seasonal).
- Desire for continuous active modes connections.
- Concerns over impact of improvements to traffic flow and parking
- Individuals questioning whether improvements are a good use of public funds.

1.0 INTRODUCTION

The City of Calgary is in the process of developing a Local Area Plan (LAP) for the Riley Communities (Hillhurst, Hounsfield Heights/Briar Hill, Sunnyside and West Hillhurst). The LAP will guide where and how future growth and redevelopment will happen in these communities. The plan aims to integrate and enhance the existing fabric of the area and ensure the area is vibrant and thriving in the future. **Figure 1-1** illustrates the Local Area Planning Boundary.

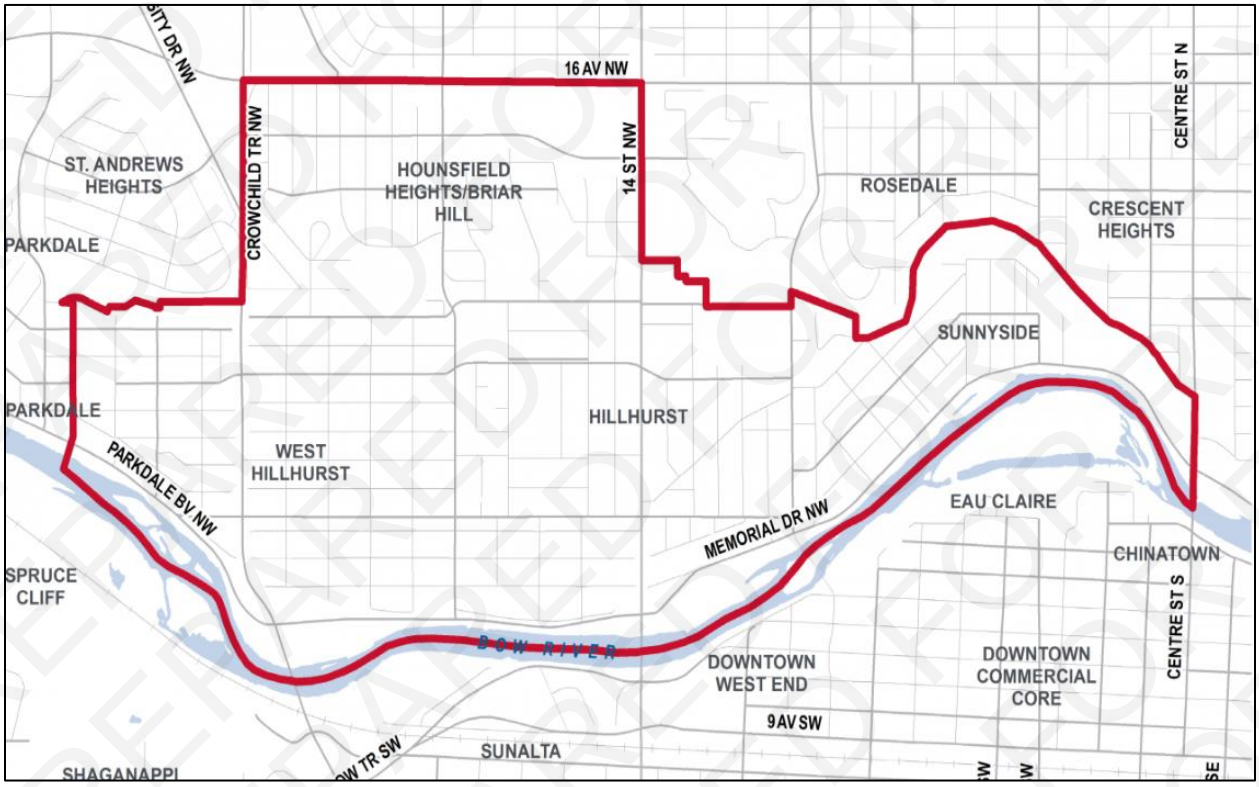


Figure 1-1: Riley Communities Local Area Planning Boundary
(Source: https://engage.calgary.ca/Riley)

As part of this LAP, a Mobility Plan is being conducted. This mobility plan will review and analyze the current conditions for walking, wheeling (e.g., scooting, skateboarding and bicycling), transit, motor vehicle traffic and goods movement and recommend short-, medium- and long-term upgrades to the network to improve comfort, safety, and efficiency for all modes.

This report provides a review of the existing conditions and previously developed plans for the communities. Many transportation-related studies and plans have been developed for the area. As such, it is important to understand the recommendations and lessons learned from each of these studies and to prevent duplication of work. Further, this report provides a transportation safety review of the entire study area and examines five key study intersections more closely. This was done to assist with determining what modifications might be required and what impacts these modifications could have on safety of the transportation network.

2.0 COMMUNITY CONTEXT

The Riley Communities consist of Hillhurst, Hounsfield Heights/Briar Hill, Sunnyside and West Hillhurst. These are some of the oldest communities in Calgary. The area is intriguing and complex, both in terms of its existing and potential future transportation network, but also due to its unique history, character, and built form. The Riley Communities are situated on the north side of the Bow River with a topography that gradually rises and then transitions to a steeper grade toward the escarpment at the north boundary of the communities. This increase in grade can be challenging for people walking and wheeling.

2.1 LAND USE AND KEY DESTINATIONS

The land use within the Riley Communities is mostly low-density residential with some supporting commercial and higher density residential along the main corridors. Key destinations within the local plan area include several schools, commercial strips on Kensington Road NW, 19 Street NW, 10 Street NW and 14 Street NW. Further, Riley Park, and the North Hill Shopping Centre draw a lot of visitors.

Figure 2-1 illustrates the existing land uses and **Figure 2-2** illustrates the key destinations within the Riley Communities.

2.2 DEMOGRAPHICS AND TRAVEL PATTERNS

The City provides summaries of demographics and household information for each community within Calgary on their website. This information is provided to the City through Statistics Canada's Community Data Program.

Information such as population, age, household size, incomes, and commuting patterns were summarized for each community within the study area. This information will help to guide potential improvements required to achieve long-term goals and provide a baseline for comparing before and after impacts of these improvements. **Table 2-1**, **Table 2-2**, **Table 2-3**, and **Table 2-4** summarize the relevant data. Brief commentary is provided below each table. Note that 2016 Census data was used as the 2021 community-level data was not available at the time of writing. Further, the 2021 data may not be reflective of current conditions due to the COVID-19 Pandemic.

Table 2-1: Demographics

Community	Population	Age (Years)				Average Household Size (person)	Median Household Income
		0-14	15-39	40-64	≥65		
Hounsfield Heights-Briar Hill	2,390	15%	32%	36%	17%	2.3	$110,913
West Hillhurst	6,300	17%	36%	30%	17%	2.2	$114,272
Hillhurst	5,395	15%	42%	29%	14%	2.0	$92,236
Sunnyside	3,865	7%	58%	23%	12%	1.7	$77,535
Riley Communities	**17,950**	**14%**	**42%**	**29%**	**15%**	**2.1**	**$98,739**
Calgary	**1,222,390**	**19%**	**37%**	**34%**	**10%**	**2.6**	**$97,329**

Source: 2016 Census Data

West Hillhurst has the highest population of the four communities. It also has the highest percentage of people under 15 years and the highest average household income. Sunnyside is the community with the lowest income, lowest household size and lowest percentage of people under 14 years of age. The largest proportion of the population is in the 15 to 39 years age group.

Table 2-2: Transportation Mode to Work

Community	Driver	Passenger	Transit	Walk	Bike	Other
Hounsfield Heights-Briar Hill	59%	2%	22%	9%	5%	3%
West Hillhurst	59%	5%	14%	10%	11%	1%
Hillhurst	49%	4%	17%	19%	9%	1%
Sunnyside	42%	2%	19%	27%	10%	2%
Riley Communities	**52%**	**3%**	**17%**	**17%**	**9%**	**2%**
Calgary	**71%**	**5%**	**16%**	**5%**	**2%**	**1%**

Source: 2016 Census Data

All communities in the study area have a lower percentage of trips to work made by a "driver" than the average for the city (71%). Walking and bicycling average mode share combined is 26% for the Riley Communities, significantly higher than the walking and bicycling mode share of the city as a whole (7%). This suggests that these communities (especially Sunnyside and Hillhurst) are more pedestrian and cyclist friendly compared to others within the city. This may be attributed to their proximity to the downtown core and the proximity to light rail transit. Sunnyside has the lowest percentage of trips to work made by a "driver" and the highest percentage of "walk" trips to work.

Table 2-3: Commute Duration

Community	<15 min	15-29 min	30-44 min	45-59 min	> 60 min
Hounsfield Heights-Briar Hill	28%	47%	20%	2%	3%
West Hillhurst	23%	50%	21%	4%	2%
Hillhurst	25%	46%	22%	4%	3%
Sunnyside	20%	56%	17%	4%	2%
Riley Communities	**23%**	**50%**	**20%**	**4%**	**3%**
Calgary	**17%**	**42%**	**26%**	**8%**	**6%**

Source: 2016 Census Data

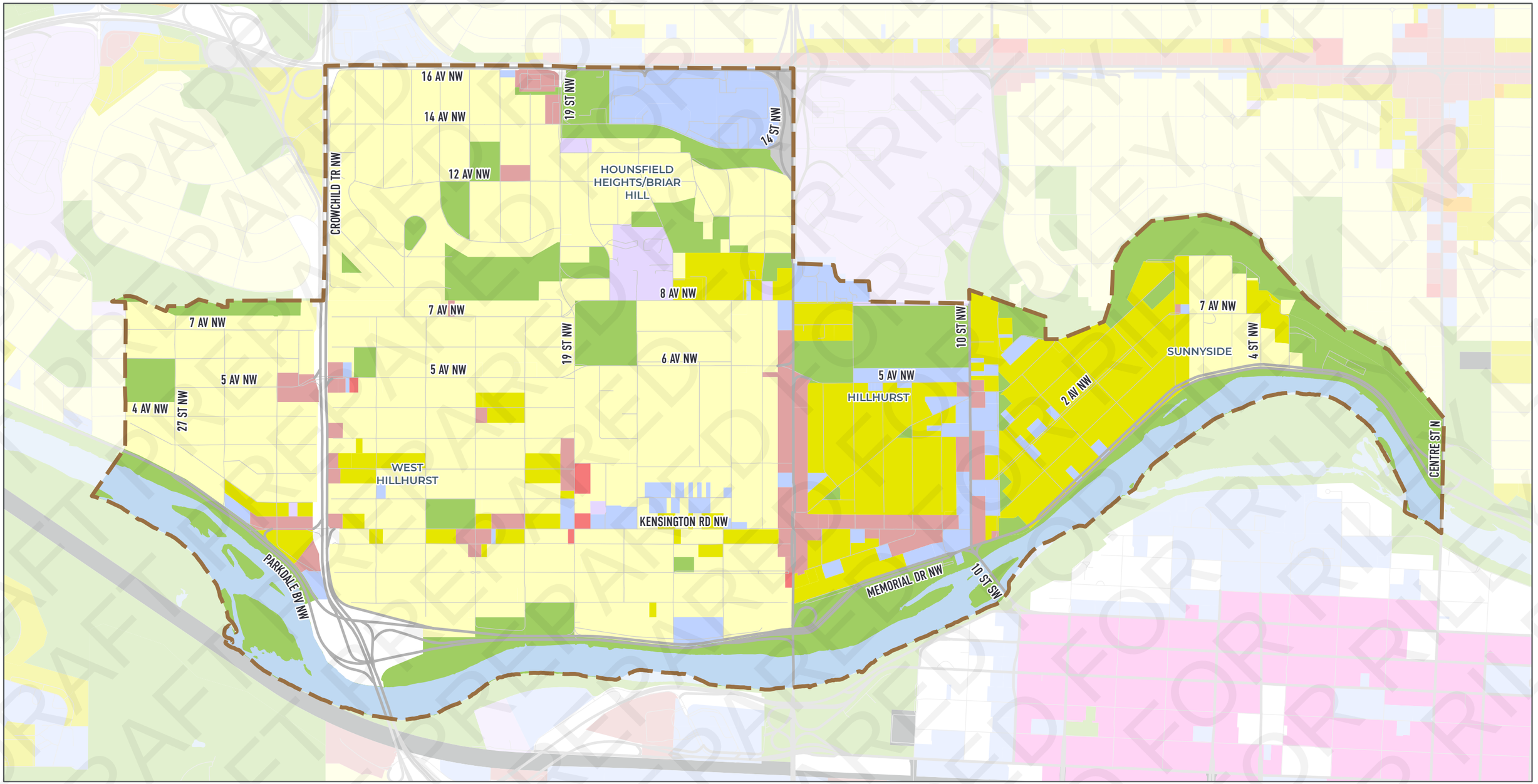
The commute time within all communities is similar, with the majority (73%) of commutes being less than 30 minutes, and almost all (93%) commute times less than 45 minutes. This aligns with the commute times within the city as a whole.

Table 2-4: Time Leaving for Work

Community	5:00am - 5:59am	6:00am - 6:59am	7:00am - 7:59am	8:00am - 8:59am	9:00am - 9:59am	12pm - 4:59pm
Hounsfield Heights-Briar Hill	4%	14%	29%	27%	15%	11%
West Hillhurst	4%	17%	34%	27%	9%	10%
Hillhurst	4%	10%	35%	26%	13%	12%
Sunnyside	3%	12%	38%	23%	13%	11%
Riley Communities	**4%**	**13%**	**35%**	**25%**	**12%**	**11%**
Calgary	**7%**	**20%**	**29%**	**18%**	**11%**	**15%**

Source: 2016 Census Data

Most people (60%) within the Riley Communities leave for work between 7:00am and 9:00am, indicating that this is the likely AM peak traffic hours for the communities.



URBAN SYSTEMS

0 100 200 300
Meters

N

Coordinate System:
NAD 1983 3TM 114

Scale: 1:13,000
(When plotted at 11"x17")

Project #: 1057.0189.01
Author: SDF

Revision: A
Date: 2023 / 4 / 27

Legend

- Study Area

Land Use Districts

- Commercial
- Commercial - Core
- Direct Control
- Future Urban Development
- Institutional
- Major Infrastructure
- Mixed Use
- Parks, Recreation and Public Education
- Residential - Low Density
- Residential - Medium Density
- Residential - High Density

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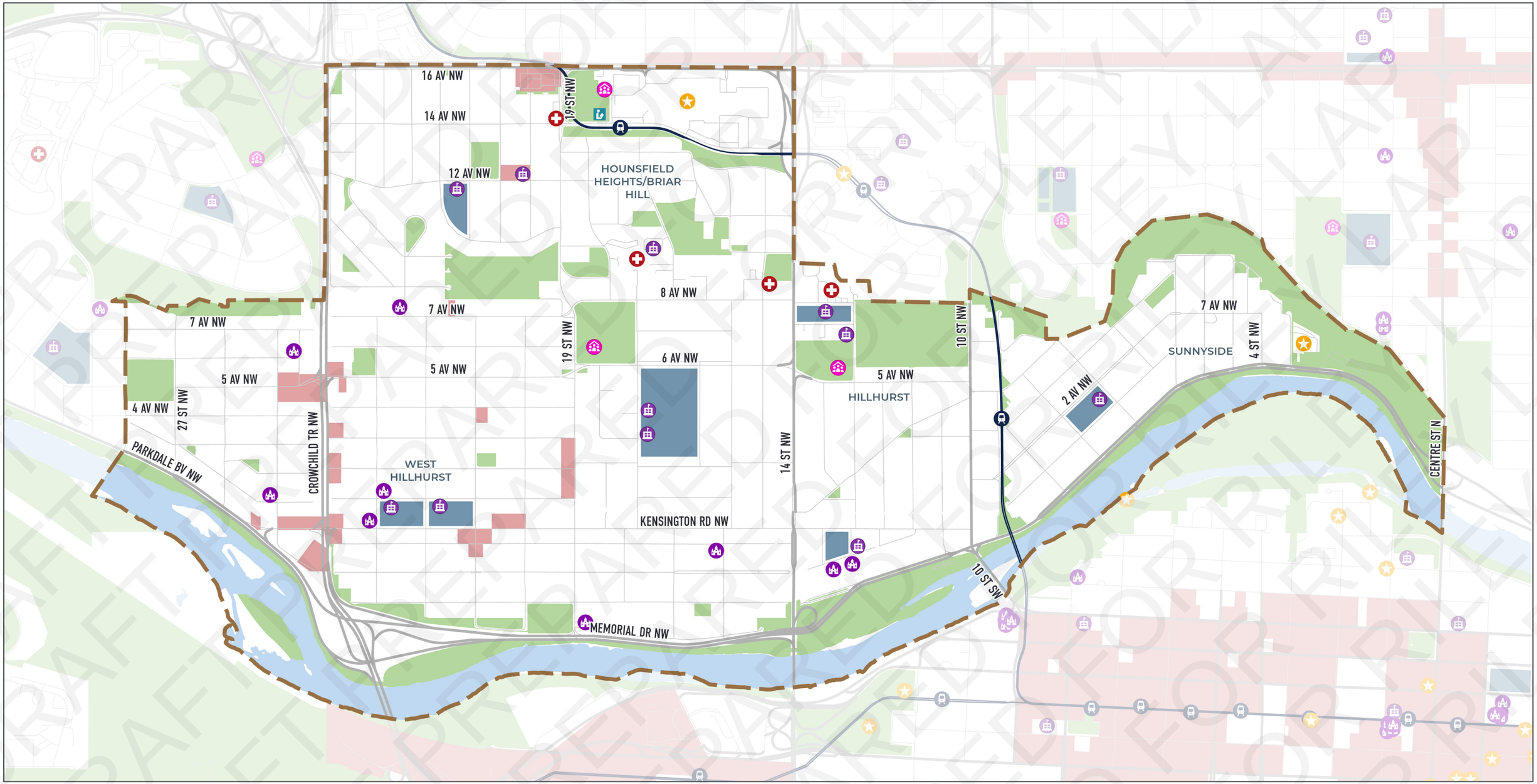
FIGURE 2-1

Land Use



URBAN SYSTEMS

0 100 200 300
Meters

Coordinate System:
NAD 1983 3TM 114

Scale: 1:13,000
(When plotted at 11"x17")

N

Project #: 1057.0189.01
Author: SDF

Revision: A
Date: 2022 / 9 / 12

The accuracy & completeness of information shown on this drawing is not guaranteed. It will be the responsibility of the user of the information shown on this drawing to locate & establish the precise location of all existing information whether shown or not.

Legend

- Attraction
- Community Centre
- Library
- Health Clinic/Care Centre
- School
- Place of Worship
- LRT Station
- LRT
- Commercial
- Park
- School
- Study Area

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FIGURE XX

Key Destinations

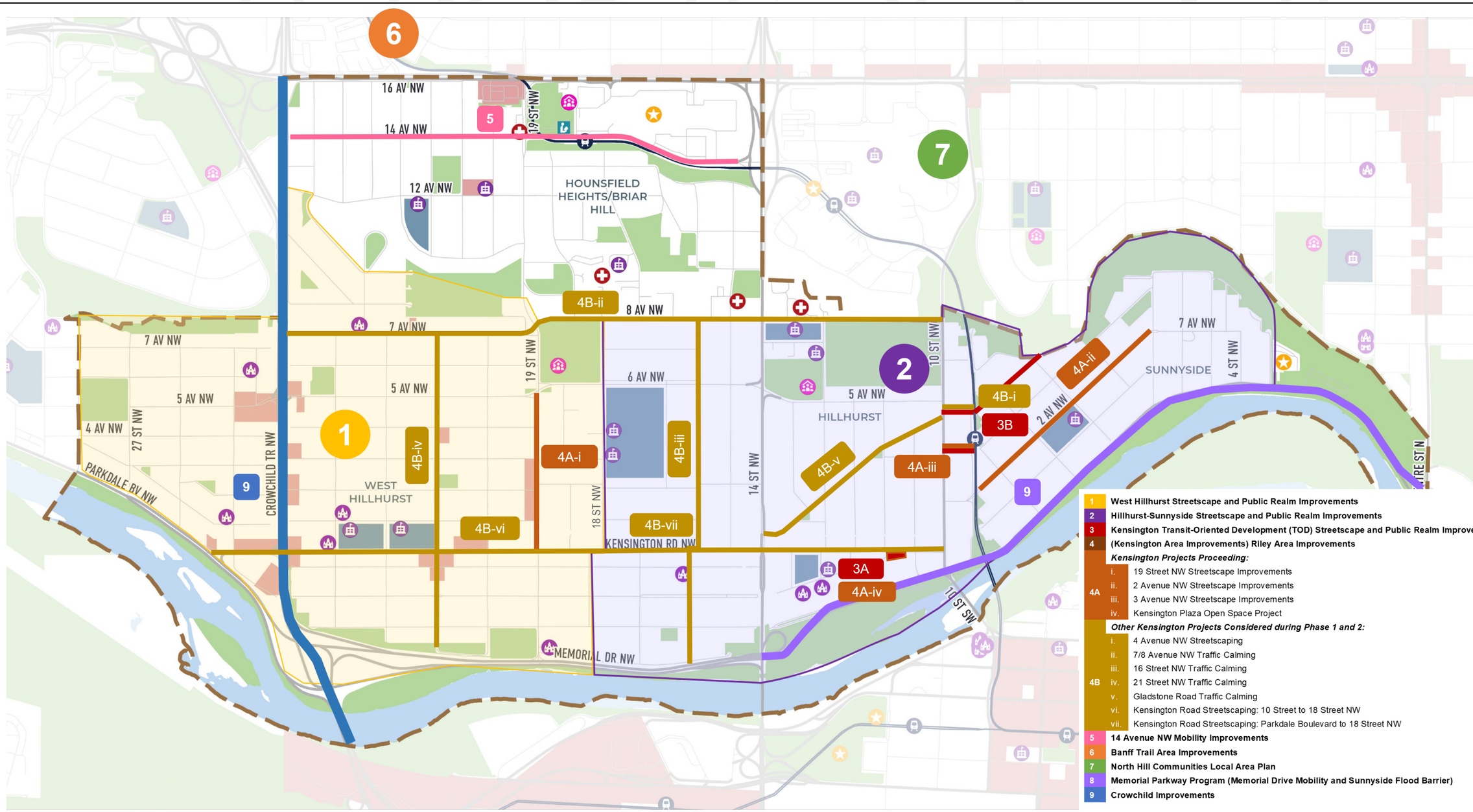
3.0 BACKGROUND POLICES, PROGRAMS AND PROJECTS

Various planning studies have been conducted in the study area. A comprehensive review of these studies and other relevant documents was conducted to ensure that the plans and policies align and that efforts are not duplicated or wasted. **Table 3-1** lists the documents and projects reviewed. For the applicable projects, **Figure 3-1** illustrates each location. Some documents refer to the entire project area and are not shown on the figure.

Table 3-1: Summary of Reviewed Policies, Programs and Projects

	Project Name		Est. Timeline	Riley Communities Impacted	Status
Established Area Growth and Change Strategy					
1	West Hillhurst Streetscape and Public Realm Improvements		2021-2023	West Hillhurst	Phase 1 – Identifying Opportunities engagement completed (April 2021)
2	Hillhurst-Sunnyside Streetscape and Public Realm Improvements		2021-2023	Hillhurst Sunnyside	Phase 1 – Project Prioritization engagement completed (June 2021)
3	Kensington Transit-Oriented Development (TOD) Streetscape and Public Realm Improvements		2021-2023	C. Hillhurst (Kensington Plaza) D. Sunnyside (3/4 Avenue NW)	Initial engage survey launched. No public results from survey.
4	(Kensington Area Improvements) Riley Area Improvements		2021-2023	West Hillhurst Hounsfield Heights/ Briar Hill Hillhurst Sunnyside	SEE BELOW
	Riley Area Improvement Projects Proceeding:				
4A	i.	19 Street NW Streetscape Improvements	2022-2024	Hillhurst West Hillhurst Sunnyside	Phase 3 engagement completed. Design and construction anticipated for Spring 2023-Fall 2024
	ii.	2 Avenue NW Streetscape Improvements			
	iii.	Grasshopper Hill Off-Leash Park			
	v.	Kensington Plaza Open Space Project			
	Other Kensington Projects Considered during Phase 1 and 2:				
4B	i.	4 Avenue NW Streetscaping	2021	West Hillhurst Hounsfield Heights/ Briar Hill Hillhurst Sunnyside	Phase 2 – Proposed Improvement engagement completed (Aug/Sept 2021). Project identified, but not shortlisted.
	ii.	7/8 Avenue NW Traffic Calming	2021		
	iii.	16 Street NW Traffic Calming	2021		
	iv.	21 Street NW Traffic Calming	2021		
	v.	Gladstone Road Traffic Calming	2021		
	vi.	Kensington Road Streetscaping: 10 Street to 18 Street NW	2021		
	vii.	Kensington Road Streetscaping: Parkdale Boulevard to 18 Street NW	2021		

	Project Name	Est. Timeline	Riley Communities Impacted	Status
5	14 Avenue NW Mobility Improvements	2021	Hounsfield Heights/ Briar Hill	Deferred in 2022
6	Banff Trail Area Improvements	2018-2022	Hounsfield Heights/ Briar Hill (north limits)	Construction primarily completed October 2022
7	North Hill Communities Local Area Plan	2021	None (includes communities to the NE of the project area)	Completed
8	Memorial Parkway Program (Memorial Drive Mobility and Sunnyside Flood Barrier)	2022-2023	Hillhurst Sunnyside	Phase 2 completed (WWHR2 Dec 2022). Next step is developing concepts for potential public realm improvements. Sunnyside Flood Barrier construction planned for 2023.
9	Crowchild Improvements	2017-2027+	West Hillhurst, Hounsfield Heights/ Briar Hill	Short-term upgrades completed. Medium term construction for 2027 and beyond.
	Zoning By-law 1P2007	2007	All	NA



1 West Hillhurst Streetscape and Public Realm Improvements
2 Hillhurst-Sunnyside Streetscape and Public Realm Improvements
3 Kensington Transit-Oriented Development (TOD) Streetscape and Public Realm Improvements
4 (Kensington Area Improvements) Riley Area Improvements

Kensington Projects Proceeding:

4A
- i. 19 Street NW Streetscape Improvements
- ii. 2 Avenue NW Streetscape Improvements
- iii. 3 Avenue NW Streetscape Improvements
- iv. Kensington Plaza Open Space Project

Other Kensington Projects Considered during Phase 1 and 2:

4B
- i. 4 Avenue NW Streetscaping
- ii. 7/8 Avenue NW Traffic Calming
- iii. 16 Street NW Traffic Calming
- iv. 21 Street NW Traffic Calming
- v. Gladstone Road Traffic Calming
- vi. Kensington Road Streetscaping: 10 Street to 18 Street NW
- vii. Kensington Road Streetscaping: Parkdale Boulevard to 18 Street NW

5 14 Avenue NW Mobility Improvements
6 Banff Trail Area Improvements
7 North Hill Communities Local Area Plan
8 Memorial Parkway Program (Memorial Drive Mobility and Sunnyside Flood Barrier)
9 Crowchild Improvements

URBAN SYSTEMS

0 100 200 300
Meters

Coordinate System:
NAD 1983 3TM 114

Scale: 1:13,000
(When plotted at 11"x17")

Legend

- Attraction
- Community Centre
- Library
- Health Clinic/Care Centre
- School
- Place of Worship
- LRT Station
- LRT
- Commercial
- Park
- School
- Study Area

Project #: 1057.0189.01
Author: SDF

Revision: A
Date: 2022 / 11 / 14

Calgary

Riley Communities Mobility Study

FIGURE 3-1

Additional Project Areas

3.1 ESTABLISHED AREAS GROWTH AND CHANGE STRATEGY (ONGOING)

The Established Area Growth and Change Strategy (EAGCS) outlines how the City can support established communities experiencing growth and change due to redevelopment. The Established Area includes approximately 180 communities and encompasses almost 80 percent of the city's population. The Riley Communities are included in the EAGCS area.

The EAGCS invests in places and spaces in established communities, to meet the unique needs of each community. Some examples of investments are:

- Improving traffic and pedestrian safety.
- Updating existing and building new parks and playgrounds.
- Creating urban plazas.

Public space improvement projects funded through the Strategy generally fall within one of the three following categories:

- **Streetscape improvements** such as traffic calming, new sidewalks, and pathways and intersection improvements.
- **Parks and open space improvements** such as playgrounds, picnic tables, benches, and field improvements.
- **Partnership projects** with Calgary Neighbourhoods and Business Improvement Associations. This can include improvements and upgrades such as plazas, community gardens, some playgrounds, and public art.

Several projects have been identified within the Riley Communities for Phase 1 public space improvements. Phase 1 project funding was approved in 2020. **Figure 3-2** illustrates the EAGCS area and the projects currently underway. Projects #2, #10 and #11 are within the Riley Communities area and are summarized in the subsequent subsections of this review.

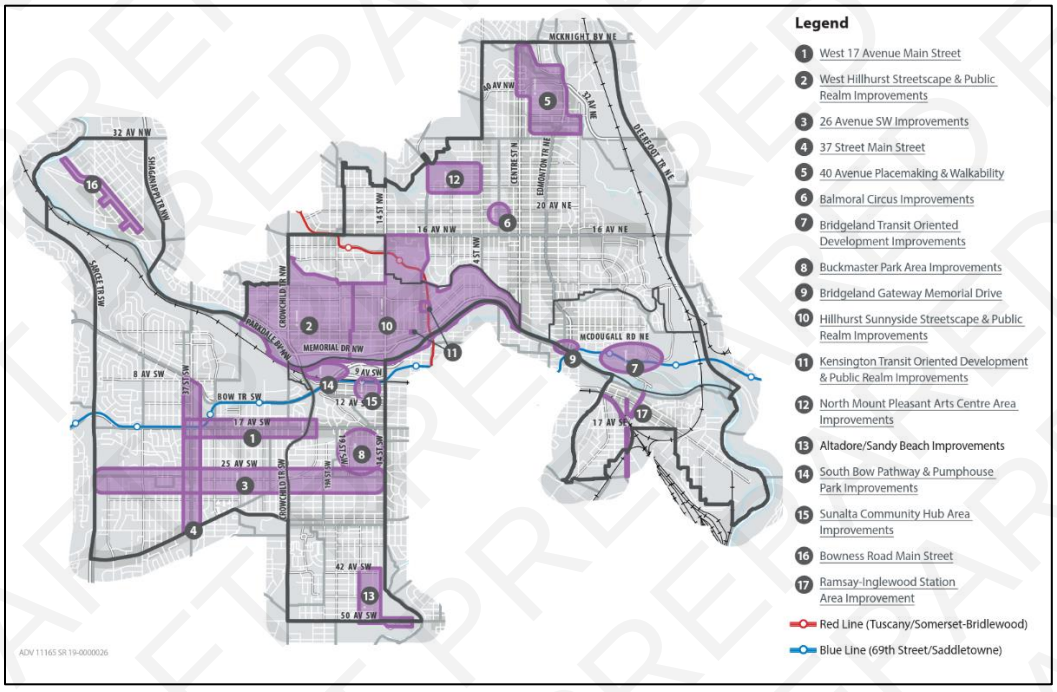


Figure 3-2: EAGCS Phase 1 Projects

3.2 EAGCS PROJECT #2: WEST HILLHURST STREETSCAPE AND PUBLIC REALM IMPROVEMENTS

The purpose of this project is to make a series of community-level improvements within West Hillhurst. The initial engagement to identify opportunities began in Spring 2021.

The initial engagement allowed the public to provide feedback on the following categories:

- Walking
- Traffic
- Biking and wheeling
- Park space
- Gathering place
- Business access

Comments related to walking received the highest number of responses followed by traffic, and biking and wheeling. **Figure 3-3** illustrates the locations of engagement responses by theme. Several key themes for concerns included safety, potential conflicts between travel modes, and network gaps.

Figure 3-3: Clusters of Responses by Theme

Specific comments relating to mobility included support for more wheeling lanes with improved protection from vehicular traffic (i.e. paint is insufficient), improved sight lines at crosswalks, more traffic calming measures, narrow sidewalks, lighting concerns, and improved traffic controls.

The feedback and location of these concerns will be an important data source for the Riley Communities study existing conditions assessment. No project activity has been noted since the initial phase of engagement in April 2021.

3.3 EAGCS PROJECT #10: HILLHURST-SUNNYSIDE STREETSCAPE AND PUBLIC REALM IMPROVEMENTS

Eleven potential improvement projects were identified by the City and the Hillhurst-Sunnyside Community Association (HSCA). Due to insufficient funding to implement all projects, the purpose of the initial engagement in Spring 2021 was to prioritize these improvement projects. Of the 11 potential projects provided, the mobility-related improvement projects ranked 6th, 8th, 9th, 10th, and 11th. The resulting project list in order of priority is as follows (*blue text indicates a mobility-related project*):

1. Urban Tree Planting
2. Riley Park Restaurant and Outdoor Patio
3. Hillhurst Sunnyside Urban Mural Project
4. Riley Park Year-Round Programming
5. Hillhurst Sunnyside Community Association Building Programming
6. Hillhurst/Sunnyside Street Calming Initiatives
7. Community Garden Improvements
8. Sidewalk and Ramp Accessibility Improvements
9. 14 Street NW Upgrades
10. Gladstone Road NW Upgrade to a Living Street
11. 12 Street NW Upgrade to Complete Street Standards

The specifics of the mobility-related projects will be considered in the development of the Riley Communities Study and are summarized here:

Hillhurst/Sunnyside Street Calming Initiatives (Item #6) would include:

- Low-cost and high value street calming to high priority locations in Hillhurst-Sunnyside. Street calming methods may include but are not limited to: angled parking, road closures (fencing), vertical pylons, road paint, temporary curb extensions, traffic circles, etc.

Sidewalk and Ramp Accessibility Improvements (Item #8) would include:

- Sidewalk and ramp accessibility and repairs – making the existing public realm more user friendly for all people.
- Focusing on alignments connecting pedestrians to transit, the hospital, schools, and Kensington Road (which has recently been upgraded for accessibility standards).
- Evaluating sidewalks and ramps with slipping, tripping, or falling hazards that do not meet accessible standards for improvements.

14 Street NW Upgrades (Item #9) would include:

- The addition of a devoted left turn light in southbound direction onto 6 Avenue NW.
- Upgrading several bus stops to have shelters and provide an unimpeded sidewalk.
- Upgrading sidewalks adjacent to civic owned properties to better match improved sidewalks of newer private developments.
- Providing low cost and high impact decorative improvements to the chain link fence at the SW corner of Kensington Road.
- Further discussions in the next stage of engagement to prioritize improvements.

Gladstone Road NW Upgrade to a Living Street (Item #10) would include:

- Changing Gladstone Road to one-way street for vehicular traffic to reduce shortcut traffic.
- Integrating planting with shared roadway for vehicles, wheelers, and pedestrians.
- Changing the layout of parking spots to encourage slower speed of travel.

- Adding additional park amenities such as swing benches and picnic tables for West Gladstone Park and East Gladstone Park.

12 Street NW Upgrade to Complete Street Standards (Item #11) would include:

- Closing the south access lane of HSCA parking lot and expanding the plaza space up to the roadway, creating a welcoming entrance.
- Widening sidewalks and adding amenities such as seating and bike racks at strategic locations.
- General aesthetic improvements on west edge of Riley Park.
- Repairing the existing traffic calming fence at Kensington Road NW.

The next stage of this project is to refine design of the short-listed projects. Phase 3 will involve presenting the final project designs to the community. No project activity has been noted since the initial phase of engagement in June 2021.

3.4 EAGCS PROJECT #11: KENSINGTON TRANSIT-ORIENTED DEVELOPMENT STREETSCAPE AND PUBLIC REALM IMPROVEMENTS

The purpose of this project is to help support future Transit-Oriented Development (TOD) near Sunnyside Station. The initial engagement in the Spring of 2021 identified opportunities and potential improvements. So far, the project has focused on two main areas:

1. **Kensington Plaza** *(source: https://engage.calgary.ca/kensingtonarea/kensingtonTOD)*

In 2021 the City tested out different uses within the Plaza. Some of the trial events included temporary activities and programming while others were temporary examples of more permanent installations. A redesign of the space is scheduled for 2022.

2. **3/4 Avenue NW improvements** *(Source: https://engage.calgary.ca/kensingtonarea/kensingtonTOD)*

   The City is looking at different options along 3 Avenue and 4 Avenue NW to improve the connection between Sunnyside Station and the communities to the west. These options include:

   - Improved sidewalks;
   - More street trees and plantings;
   - Additional public seating; and
   - Bikeway connection (on 4 Avenue NW)

A What We Heard report summarizing the results of the engagement activities was not available. The next steps for the project include refining the final proposed designs and gathering input from the community on these designs. No progression in project activity has been noted on the project website.

3.5 (KENSINGTON AREA IMPROVEMENTS) RILEY AREA IMPROVEMENTS

This project was recently renamed to Riley Area Improvements, and has involved examining potential improvements to streetscape, traffic calming and/or public space in the areas of West Hillhurst, Hounsfield Heights, Briar Hill and Hillhurst Sunnyside. The City has conducted three rounds of engagement between the spring of 2021 and the spring of 2022 to understand priority projects and preferred designs. The first round gathered input from citizens regarding key areas of focus. From this, sixteen projects were brought forward in Phase 2 to seek input on prioritization, knowing that not all

projects could be funded. Phase 3 narrowed the list down to seven projects where participants were presented with concept designs and asked to provide feedback.

Within Phase 3, four locations were identified for mobility-related improvements:

- 19 Street NW Streetscape Improvements
- 2 Avenue NW Streetscape Improvements
- 3 Avenue NW Streetscape Improvements
- Kensington Plaza

The following subsections summarize the proposed designs and provide a brief overview of the Phase 3 engagement. A summary of the mobility projects that were not carried forward to Phase 3 are summarized in **Section 3.5.5**.

3.5.1 19 STREET NW STREETSCAPE IMPROVEMENTS

The proposed concept applies to 19 Street NW between 5/6 Avenue NW and Kensington Road. The objective is to encourage slower vehicle speeds and to provide a corridor that is appropriate for all ages and abilities.

The key changes to the corridor include:

- On-street wheeling lanes located between the sidewalk and parking lane on both sides of the street.
- A buffer between parked vehicles and the wheeling lane to reduce the risk of someone wheeling coming into conflict with an opening vehicle door and for snow storage.
- Narrower vehicle travel lanes to encourage slower vehicle speeds and to provide space for the wheeling lanes.
- Raised islands at intersections to visually narrow the road and reduce the crossing distances for pedestrians.
- Road widening on the east side of the street to incorporate these enhancements.

Figure 3-4 illustrates the proposed cross-section.

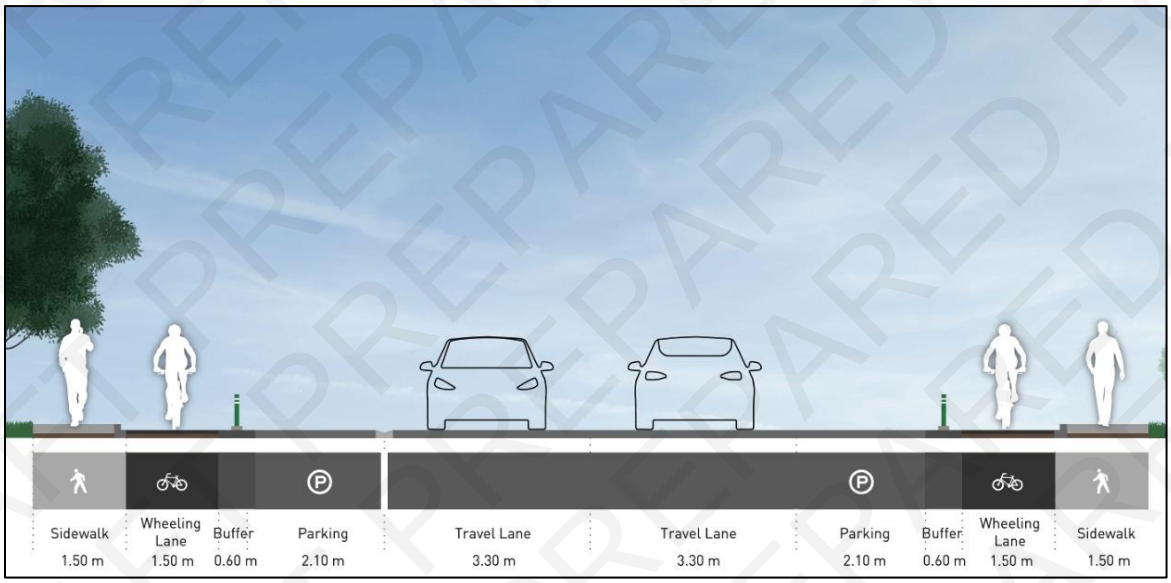


Figure 3-4: 19 Street NW Proposed Cross-Section

Participants in the third round of engagement were generally supportive of the proposed improvement. Some stakeholders expressed a desire for more public realm improvements such as increased seating, wider sidewalks and more trees and planters. There was also a desire for more continuity in wheeling lanes. Participants indicated wheeling lanes should be marked through intersections, not disrupted by bus stops. Further, participants were concerned that the design did not adequately address the pedestrian experience on 19 Street.

Additional comments in opposition of the project related to the cost of implementation, suggestions that other bicycle routes were superior/sufficient, and that narrowing of driving lanes and parking loss were bad for storefront businesses.

3.5.2 2 AVENUE NW STREETSCAPE IMPROVEMENTS

The proposed concept applies to 2 Street NW between 9A Street NW and 5A Street NW. The objectives of the changes are to discourage short-cutting and encourage slower vehicle speeds by physically and visually narrowing the corridor. The design is intended to be appropriate for all ages and abilities.

The key changes to the corridor include:

- On-street wheeling lanes located between the sidewalk and parking lane on both sides of the street.
- A buffer between parked vehicles and the wheeling lane to reduce the risk of a person wheeling coming into conflict with an opening vehicle door and for snow storage.
- Narrower vehicle travel lanes to encourage slower vehicle speeds and to provide space for the wheeling lanes.
- Raised islands at intersections to visually narrow the road and reduce the crossing distances for pedestrians.
- Minor road widening and shifts to the curb will be needed to preserve the existing sidewalk width.

Figure 3-5 illustrates the proposed cross-section.

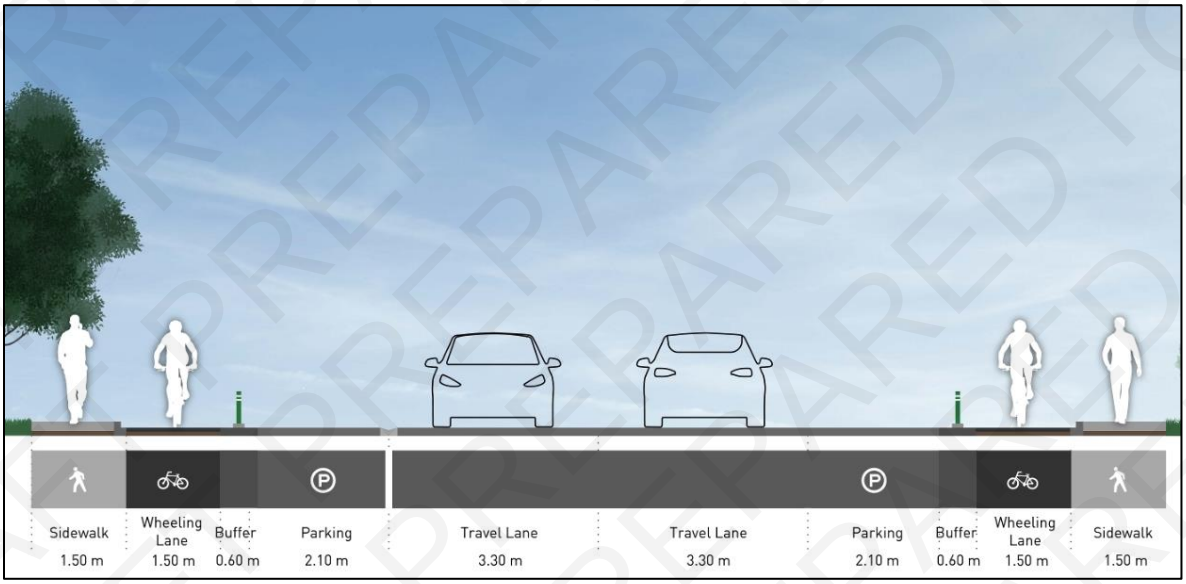


Figure 3-5: 2 Avenue NW Proposed Cross-Section

Participants in the third round of engagement were generally supportive of the proposed changes and often provided suggestions for additional improvements along with their support. A few respondents suggested 7 Avenue NW (2 Avenue transitions into 7 Avenue at its east end) be included in the project scope because it would better connect to the bike network, enhance safety for families traveling in the area and mitigate spillover traffic. The importance of a protected, permanent bike lane along 2 Avenue NW including enhanced protection through intersections was expressed by participants.

3.5.3 3 AVENUE NW STREETSCAPING

The proposed concept applies to 3 Avenue NW between 10 Street NW and 9A Street NW. The objective of the changes is to improve the pedestrian environment by improving the existing sidewalks and installing corner curb extensions to reduce crossing distances.

Figure 3-6 illustrates the proposed cross-section.

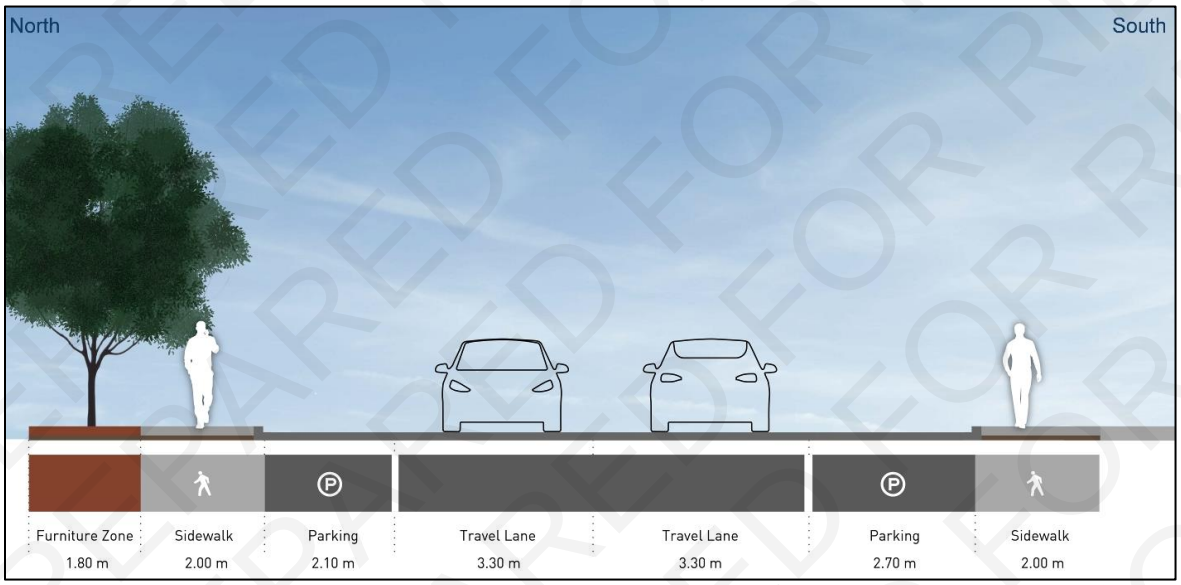


Figure 3-6: 3 Avenue NW Proposed Cross-Section

Participants in the third round of engagement were generally in support of the changes and agreed that pedestrian and LRT access improvements are needed in the area. Some stakeholders indicated more was required with suggestions for raised crosswalks, widened sidewalks, corner mirrors and enhanced landscaping. Some participants were concerned about the impact to traffic flow and that the curb extensions may create an obstacle for cyclists and vehicles. Concerns were also expressed over parking removal and changes not being a good use of public funds.

3.5.4 KENSINGTON PLAZA OPEN SPACE PROJECT

The proposed concept applies to Kensington Plaza located south of Kensington Road between Kensington Crescent and 10A Street NW. The goals of this area are to:

- Create a safe and comfortable space for people to gather.
- Support the needs of local businesses.
- Bring forward features prioritized through the phase 2 public engagement process, such as enhanced shade and seating areas, and improved sidewalks.

A key goal of this design is enhancing Kensington Plaza as a destination, gathering point and flexible-use community space in the neighbourhood's vibrant business district.

The key changes to the plaza include:

- Dedicated space for scooter/bicycle parking.
- Additional benches/seating areas.
- More trees.
- Waste and recycling receptacles.
- Community art areas.

Figure 3-7 illustrates the proposed redesign.

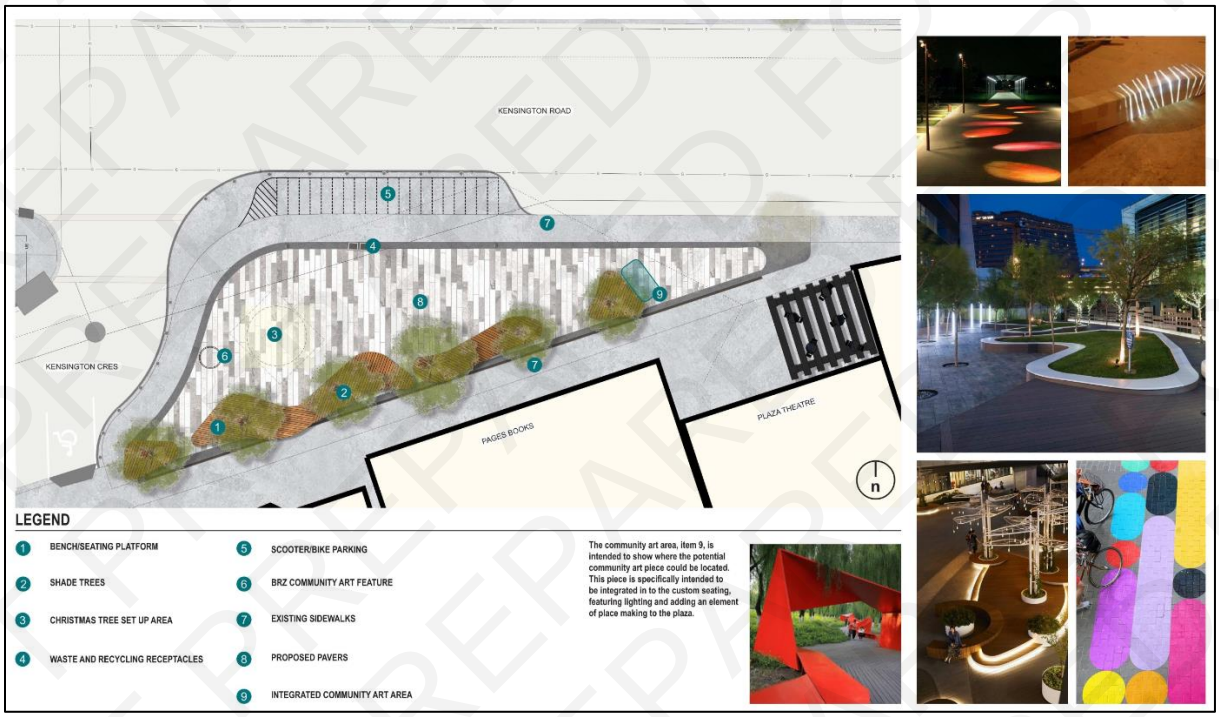


Figure 3-7: Kensington Plaza Redesign

Participants in the third round of engagement were generally supportive of the investment. Suggestions were provided for added seating, programming features, bike parking, greenery, and landscaping to increase the gathering and recreational potential of the space. Supportive participants also suggested extending the pedestrian-focused benefits into Kensington Crescent.

Opposition included cost of implementation, the potential for social disorder with added seating and/or areas for people to hide, and opinions that the proposed changes did not align with the character of Kensington.

3.5.5 OTHER KENSINGTON PROJECTS CONSIDERED

Although these projects did not progress to concept design refinement, the remaining mobility-related projects in Phase 2 of the engagement process were also examined to ensure alignment with previous work completed. Below is a summary of each, and some of the feedback received during Phase 2 engagement. Concept options for each were also presented online during the Phase 2 engagement.

4 Avenue NW Streetscaping

Fourth Avenue between 9A and 10 Street NW serves as one of the main connections between Sunnyside Station and the Kensington commercial district. The goals for the design of this corridor was to:

- Create a more welcoming entrance to the Kensington commercial district for people arriving by LRT or from Sunnyside.
- Enhance the experience of pedestrians.
- Support the needs of local businesses.

Observations regarding the streetscape identified the following as critical issues for consideration:

- Active modes are not properly prioritized on this corridor;
- There is a lack of dedicated space for pedestrians and cyclists; and
- Traffic calming interventions would assist in mitigating cut through traffic and vehicle/cyclists conflicts.

Two road cross-section options were presented during the engagement:

- **Option A** – widen sidewalks, introduce a defined furnishing zone on both sides of the street, provide protected wheeling lanes on both sides of the street, reduce the width of vehicle travel lanes.
- **Option B** – widen sidewalks, add flex-zone with trees/planters/parking, provide protected two-way wheeling lane, reduce width of vehicle travel lanes.

Both treatment options received favourable feedback with Option B ranking higher as it was seen to better meet the streetscape goals. In general, stakeholders felt the streetscape lacked a sense of place and that the proposed treatments would improve the public realm. Option B was noted to be a superior solution for separating modes of travel and prioritizing active modes though a few respondents questioned if it would consume too much street width. Critical comments for both options frequently cited that the street functioned well already and there was no need for investment at this corridor. These comments were often correlated to opposition to the permanent installation of wheeling lanes.

7/8 Avenue NW Traffic Calming

Recognizing that sections of the 7/8 Avenue corridor were scheduled for pavement rehabilitation in 2022, the City heard concerns from residents regarding speeding and shortcutting along this corridor. It is currently an east-west connection as part of the wheeling network, and it also connects to north-south routes.

The goals for the design included:

- Reduce vehicle speeds and traffic volumes.
- Improve pedestrian safety.
- Enhance cycling and wheeling.

Specific proposed traffic calming measures are illustrated in **Figure 3-8**.

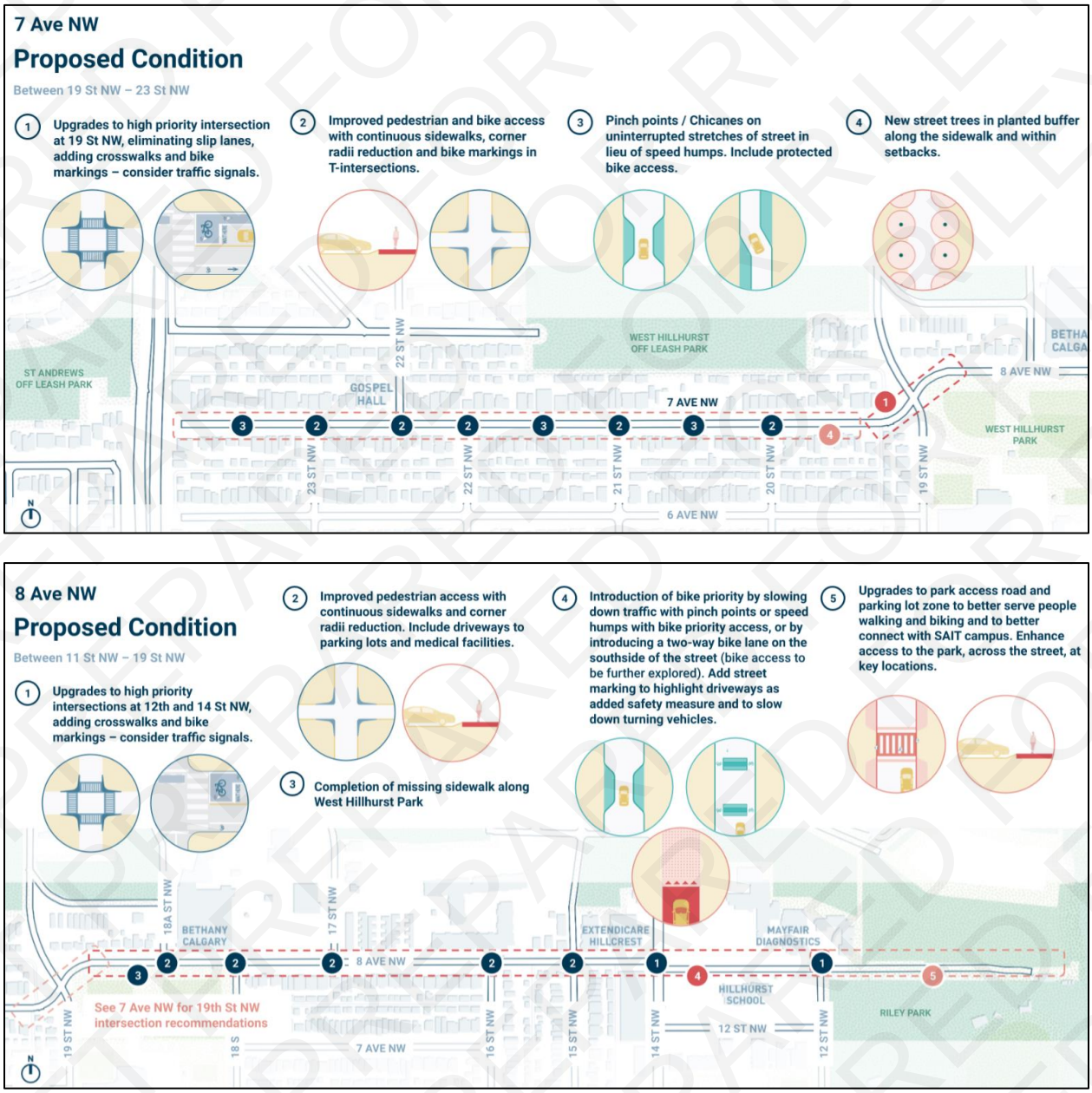


Figure 3-8: 7/8 Avenue NW Traffic Calming Concepts

In general, stakeholders recognized the need for traffic calming measures implemented along 7 Avenue and 8 Avenue NW. The point at 7 Avenue and 19 Street was consistently recognized as an important intersection where there were observed conflicts between modes. Participants offered suggestions regarding the most critical traffic calming interventions and where they felt those

treatments would be most effective. Most participants ranked their enthusiasm as high for changes along this corridor and provided a highly supportive ranking for improvements to 7 and 8 Avenue NW.

The top three themes that emerged from the comments provided by stakeholders on the project engage portal were:

- Traffic calming and speed reduction.
- Prioritize active modes and pedestrian crossings.
- Safety concerns.

16 Street NW Traffic Calming

16 Street provides a connection from Kensington Road to 8 Avenue NW, and further north. Traffic calming on this street was considered from 6 Avenue NW to Kensington Road.

Goals for 16 Street NW corridor design included:

- Reducing vehicle speeds and traffic volumes.
- Improving pedestrian safety.
- Enhancing cycling and wheeling.

Specific proposed traffic calming measures are illustrated in **Figure 3-9**.

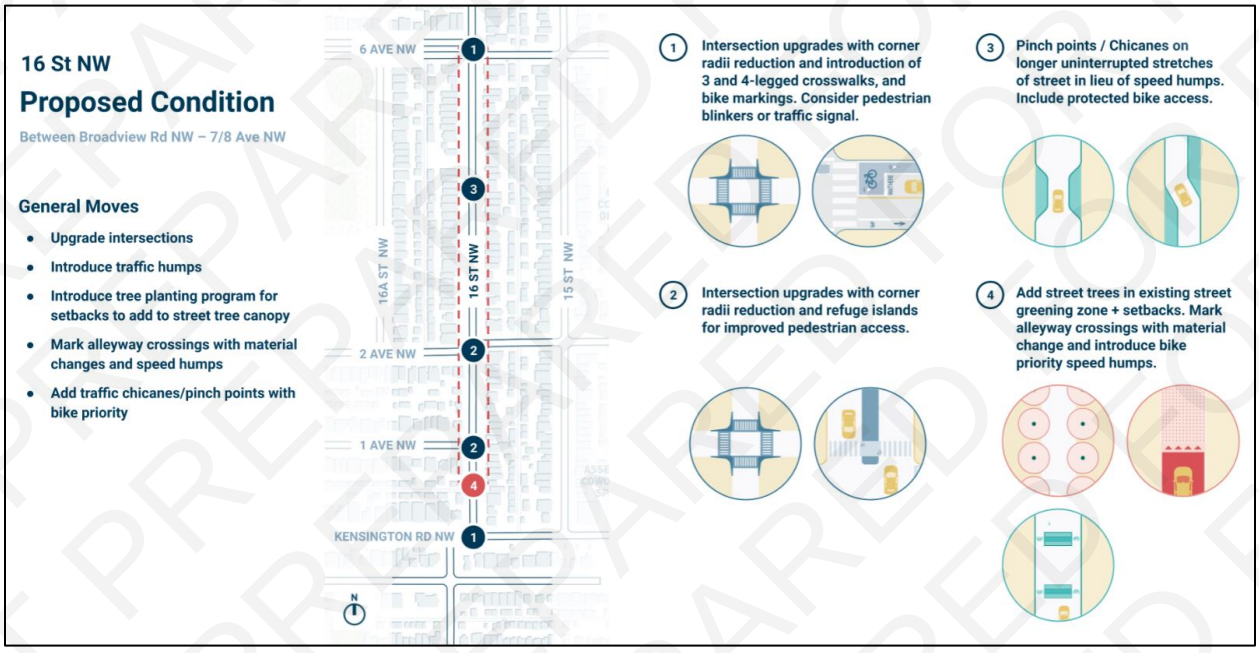


Figure 3-9: 16 Street NW Traffic Calming Concepts

In general, stakeholders provided explicit support for the proposed treatment at Kensington Road and 16 Street NW which included a pedestrian blinker. Enhancements to the tree canopy and an improved streetscape for pedestrians and cyclists were noted as priorities by many stakeholders. Participants observed cut through traffic from motorists who avoided the congestion point at Kensington Road and 14 Street NW and suggested traffic diversion treatments in addition to the proposed traffic calming options. Some stakeholders raised concerns regarding the potential narrowing of 16 Street NW and on-street parking removal.

21 Street NW Traffic Calming

21 Street provides an important connection from the Bow River Pathway, via the pathway bridge over memorial, to 16 Avenue. Traffic calming was considered on this street from Memorial Drive to 7 Avenue NW.

The goals for the design included:

- Reduce vehicle speeds and traffic volumes.
- Improve pedestrian safety.
- Enhance cycling and wheeling.

Specific proposed traffic calming measures are illustrated in **Figure 3-10**.

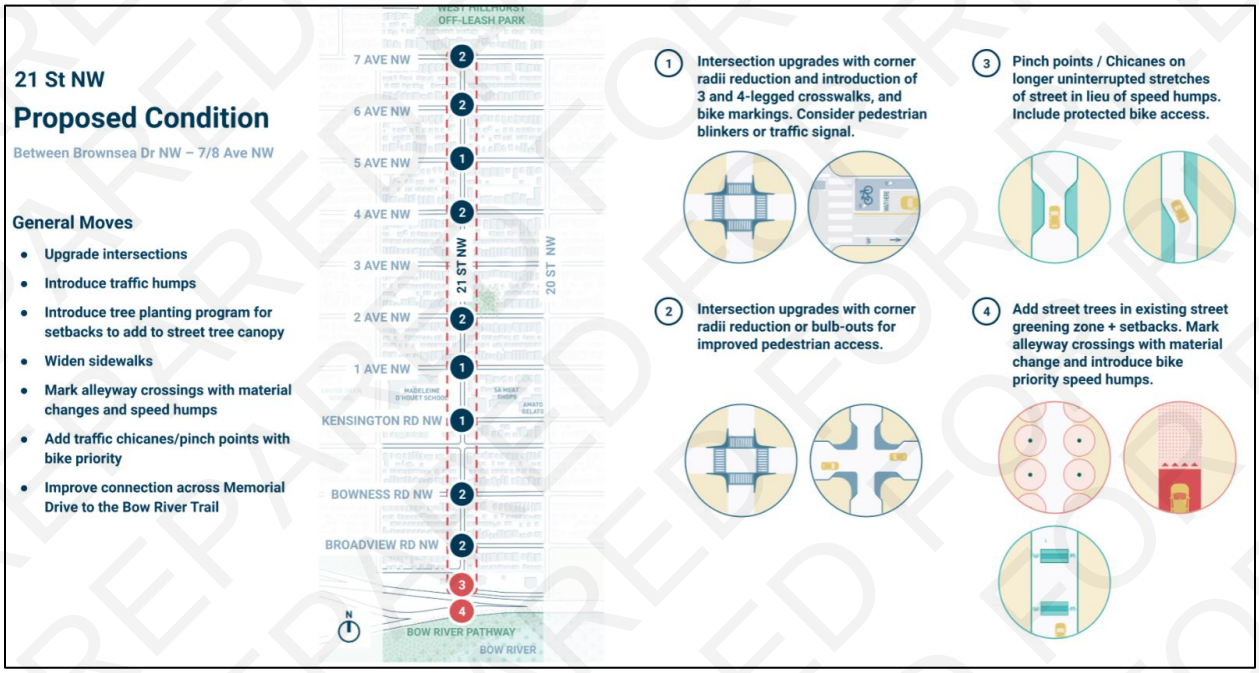


Figure 3-10: 21 Street Traffic Calming Concepts

In general, stakeholders were enthusiastic about both improving this corridor, as well as the traffic calming treatments proposed. Many stakeholders indicated they used 21 Street NW as a walking or cycling route, and that traffic calming measures were required to slow vehicular traffic on the street and ensure that drivers use 19 Street NW as a commuter route.

Gladstone Road Traffic Calming

Gladstone Road provides an excellent walking connection. Traffic calming would help to enhance the pedestrian experience along this street. Goals for Gladstone Road corridor design include:

- Reduction of vehicle speeds and traffic volumes.
- Improved pedestrian safety.

Specific proposed traffic calming measures are illustrated in **Figure 3-11**.

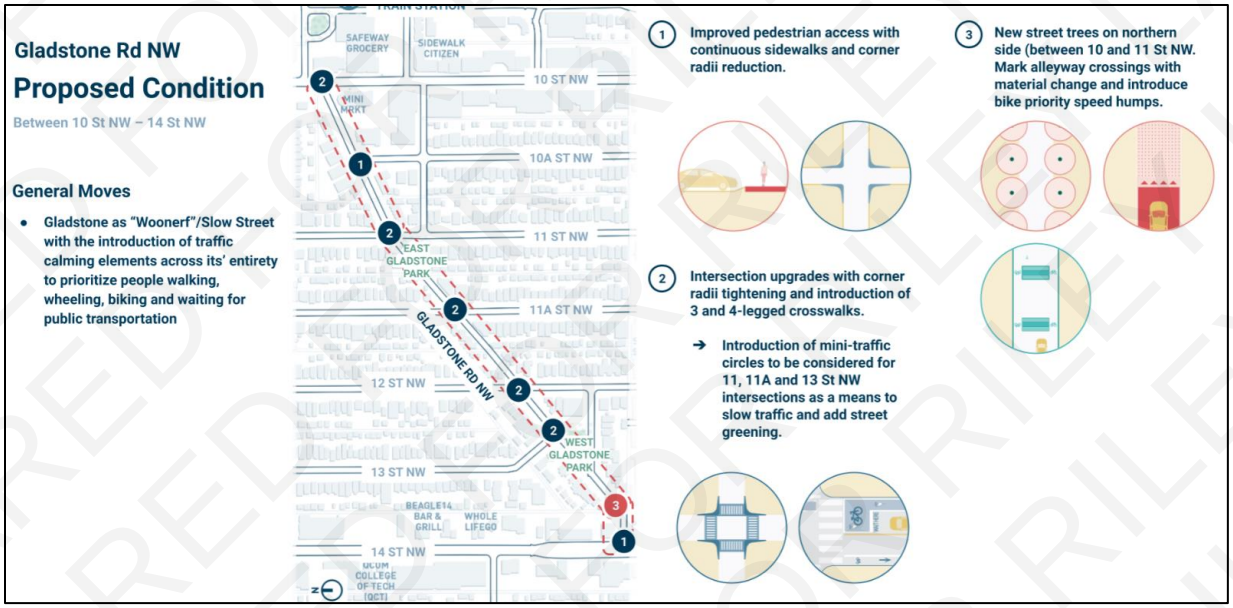


Figure 3-11: Gladstone Road NW Traffic Calming Concepts

In general, the most frequently cited issues for Gladstone Road were pedestrian safety, accommodations for other active modes and vehicle speed reductions. Enhanced sidewalks and designated wheeling lanes were generally favoured by participants as treatment options. Stakeholders were supportive of measures that would reduce cut-through traffic and car speeds. A few participants questioned if traffic circles were appropriate for Gladstone Road given the narrow street and potential disruption to cyclists.

Kensington Road Streetscaping: 10 Street to 18 Street NW

Improvements to this corridor were considered because it was scheduled to be repaved in 2023. However, repaving of this section of Kensington Road was shifted to the summer of 2022 and the suggested improvements identified through this engagement were not implemented. The proposed improvements included two options. One of these options (Option A) provided different cross-sections for the summer and winter conditions.

Option A (Temporary):

Summer Condition – replace existing parking spaces with wide street-level, buffered wheeling lanes on both sides of the roadway, provision for a wide furnishing zone between the wheeling lanes and sidewalk, reduced width of vehicle travel lanes.

Winter Condition – Replace wheeling lanes with bus loading/parking on one side of the roadway, and a parking lane on the other side.

Option B (Permanent):

Year-round Condition - replace existing parking spaces with raised, wheeling lanes on both sides of the roadway, provision for a wide furnishing zone between the wheeling lanes and sidewalk, reduce width of vehicle travel lanes.

In general, stakeholders acknowledged that Kensington Road was an important project particularly due to the high commercial and retail presence between 10 Street and 14 Street NW. The three most frequently cited observation themes of the current roadway were:

- Streetscape lacks appeal west of 14 Street NW;
- Active mode and pedestrian realm improvements are needed (e.g. sidewalk upgrades, bike racks and street furniture) along Kensington Road; and
- The street does [not] contain enough room for all modes; sidewalks need improvement and widening, nearby streets are more appropriate for designated bike routes given the necessary movement of vehicles and parking on Kensington Road between 14 and 10 Street NW.

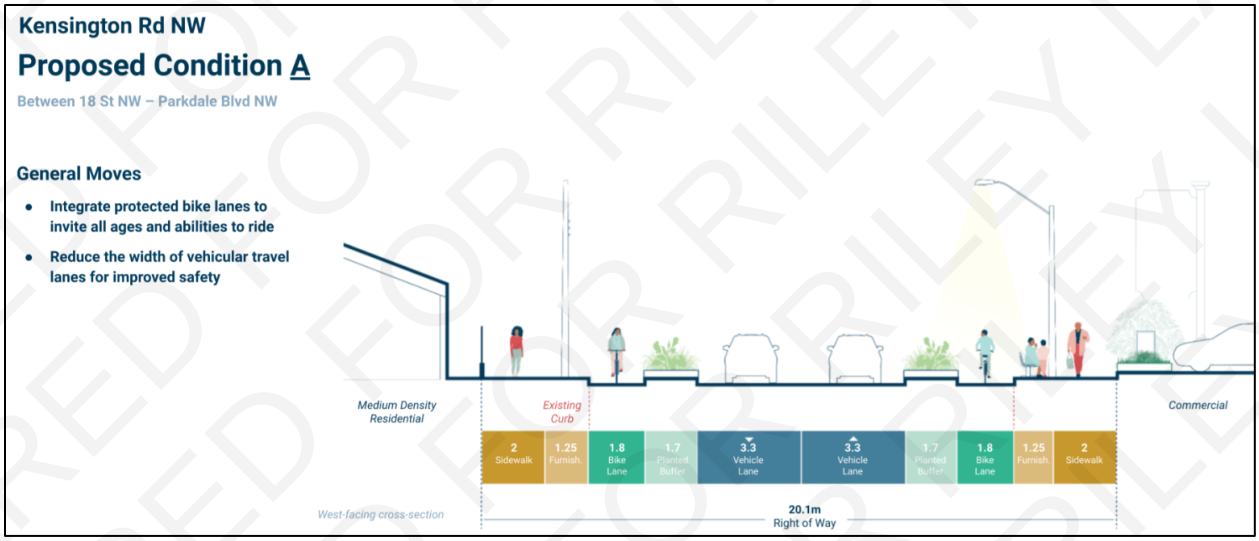
Stakeholders provided commentary that seasonal changes to street conditions and bike infrastructure could confuse users. Participants expressed that biking was a year-round mode of transport and that bike route planning should consider this along with consistent snow removal to allow for winter active transportation. Reduced width for vehicular travel, in both options, raised concerns that traffic flow and vehicular business access could be negatively impacted. Both options received favourable comments for their potential to enhance the public realm and streetscape esthetic.

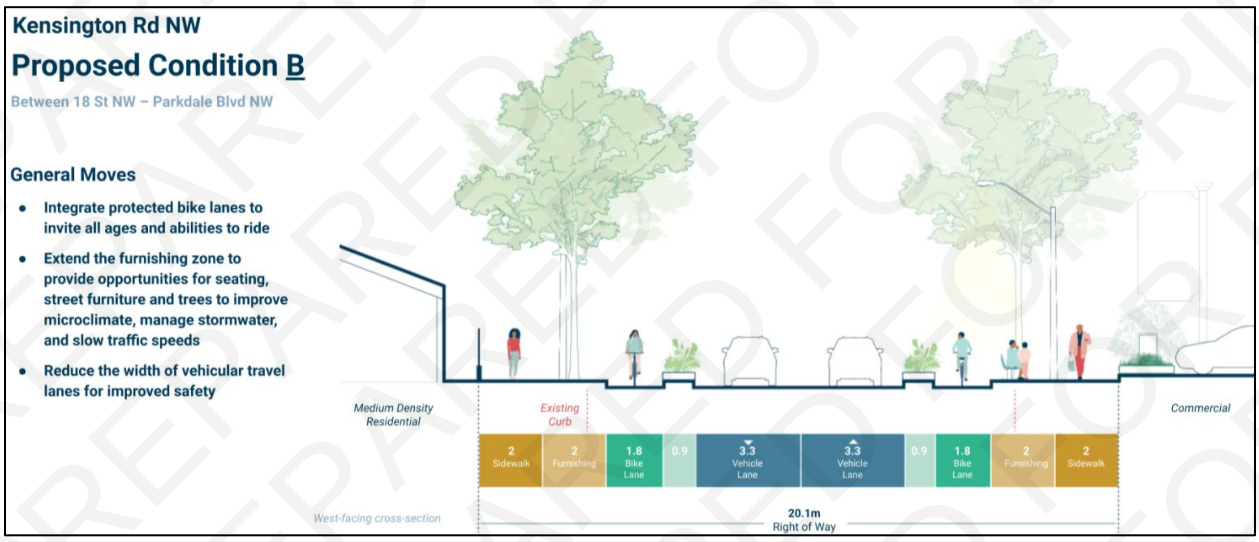
Kensington Road Streetscaping: Parkdale Boulevard to 18 Street NW

The existing road cross-section includes furnishing zones and sidewalks on both sides of the road, and four vehicular travel lanes. The public was presented with three potential options for new road cross-sections for this segment of Kensington Road.

- **Option A** – replace outer vehicular travel lanes with wheeling lanes protected by planted buffer zones. Widen sidewalks, reduce furnishing zones and vehicle travel lane widths.
- **Option B** – Same as option A but with wider furnishing zones and narrower planted buffer zones.
- **Option C** – Planted median with street trees, protected wheeling lane on one side with a shared lane on the other (adjacent to commercial land uses) that would accommodate bicycles and slow moving local vehicular traffic.

Illustrations of the proposed cross-sections are provided in **Figure 3-12**.





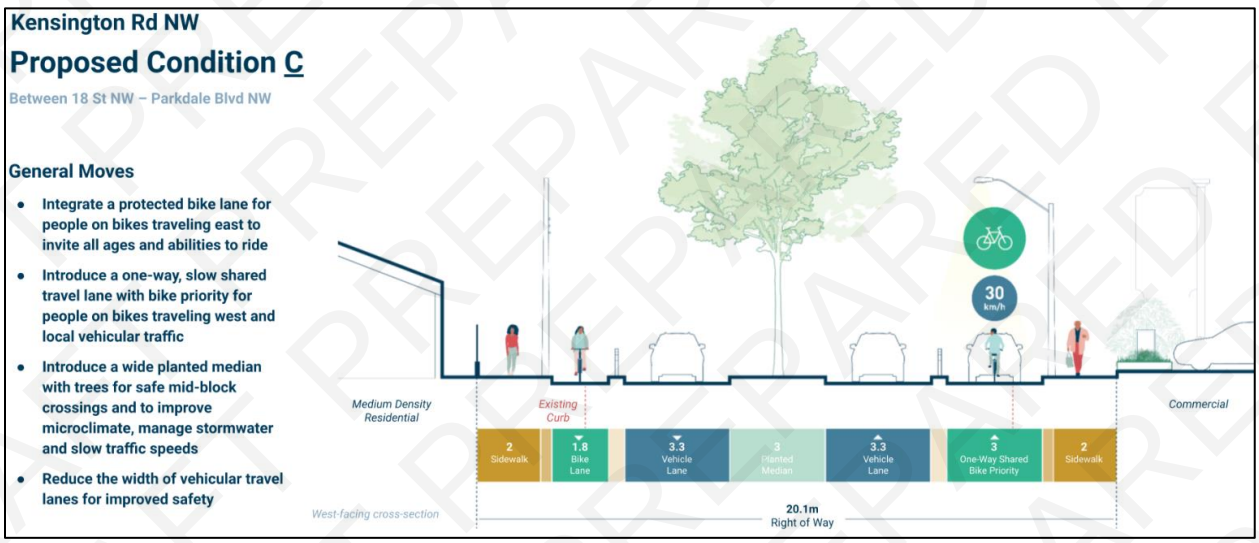


Figure 3-12: Kensington Road between 18 St and Parkdale Blvd Cross-Section Options

3.6 14 AVENUE NW MOBILITY IMPROVEMENTS

The section of 14 Avenue NW between 24 Street and 14 Street NW was scheduled for road rehabilitation in 2022. At the east end, the 14 Avenue bridge over 14 Street NW has also been identified as a high priority location for major bridge rehabilitation. Timeline for the bridge rehabilitation has not been confirmed and funding was to be explored in the 2023-2026 budget cycle.

The City took the above infrastructure project as an opportunity to look further into how to improve mobility and accessibility for all travel modes along the corridor. These projects provided an opportunity to address concerns the City has heard in the past from the community and explore ideas to enhance existing infrastructure along and across 14 Avenue NW. including:

- Replacing the existing on-street shared vehicle and wheeling lane with on-street painted wheeling lanes from 24 Street to 19 Street;
- Constructing a traffic circle at 20 Street to make it easier to exit Lions Park strip mall eastbound for people who drive;
- Installing elephant crossings on 19 Street so people who wheel do not have to dismount (elephant crossings are the white markings painted on each side of a pedestrian crossing that allow people who wheel to ride through the intersection rather than dismount);
- Providing transition ramps from the on-street painted wheeling lane to the widened multi-use pathway west of the 19 Street intersection;
- Providing wheelchair ramps and extending the 3.0-meter multi-use pathway to the ramps at the southeast corner of the 19 Street intersection to provide a more direct connection;
- Improving walking and wheeling facilities by adding a 3.0-meter multi-use pathway around the transit space behind Lions Park LRT station; and
- Improving segments of the existing multi-use pathway including the constrained section under the pedestrian bridge.

The proposed improvements are illustrated in **Figure 3-13**.

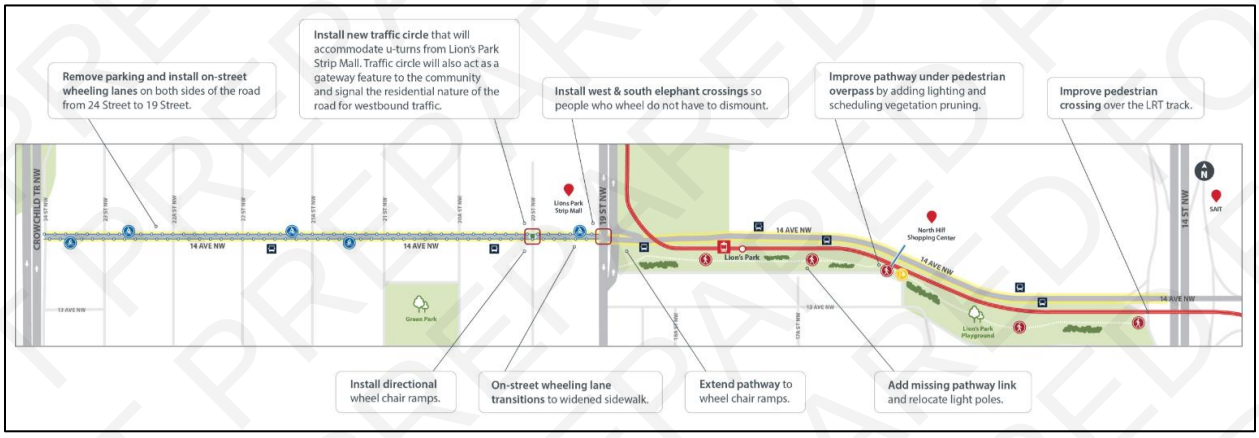


Figure 3-13: 14 Avenue NW Proposed Improvements

The public engagement took place during June 2021. The following themes came out of questions regarding the removal of parking between 24 Street and 20 Street:

- There is a perception that parking utilization is low and because most homes do not front onto this residential road, the removal of parking will result in minimal impacts.

- When the Lions Park Strip Mall is busy the businesses and their customers may no longer find convenient parking if it is removed.
- There is a perception that free (non-permitted) parking is needed in the community and if removed, will result in more vehicles parked along the nearby residential streets.
- There is a perception that 14 Avenue is not wide enough for two vehicle travel lanes with parking on either side; therefore, by removing parking, visibility will be enhanced for people who wheel and drive.
- There is a perception that homeowners along 14 Avenue will not be able to park close to their front and side entrances which impacts access.

The following perceptions were shared by participants regarding the traffic circle at 14 Avenue and 20 Street:

- 14 Avenue will be safer because:
    - It will slow vehicle speeds.
    - It will allow for vehicles exiting the Lions Park Strip Mall to turn around safely.
    - It will encourage less illegal vehicle turns.
- 14 Avenue will be less safe because:
    - It will increase traffic community to do a legal turn around.
    - Many people who drive are not familiar or do not know how to use a traffic circle.
    - Perception that people who walk and wheel will not know how to use a traffic circle.

When asked about other possible improvements to the Lions Park Pathway, participants most frequently commented on the following themes:

- Install more lighting.
- Construct wider pathways.
- Increase visibility within the Lions Park by reducing and trimming the landscaping.
- Narrowing of the pathway under the pedestrian overpass is dangerous.
- Provision for signage and pavement markings along the pathway to provide direction and to communicate that it is a shared pathway (for people who walk and wheel).

Additional general mobility improvements comments included the following:

- Concern about the removal of the 14 Avenue eastbound left turn lane to 19 Street northbound.
- Potential for higher traffic volumes on 12 Avenue because of the perception it may be quicker to turn on 19 Street northbound from 12 Avenue instead of 14 Avenue.
- Wheeling lanes are not needed because of a perception there is low traffic volumes on 14 Avenue between 24 and 20 Street.
- Perception mobility improvements are good for the community and protected wheeling lanes would make it even safer for people who wheel.

3.7 BANFF TRAIL AREA IMPROVEMENTS PROJECT

The Foothills Hospital/Stadium/Banff Trail Transit-Oriented Development (TOD) area is anticipated to see an increase in population density over the next 10-20 years. To accommodate this growth, the following improvements were completed as part of this project:

- 16 Avenue N: Lane widening from Crowchild Trail NW to 20A Street NW
- Constructing a westbound 16 Avenue NW off-ramp to northbound Crowchild Trail NW
- Intersection Improvements at Crowchild Trail and 24 Avenue NW
- 24 Avenue NW corridor (Crowchild Trail NW to 14 Street NW) improvements

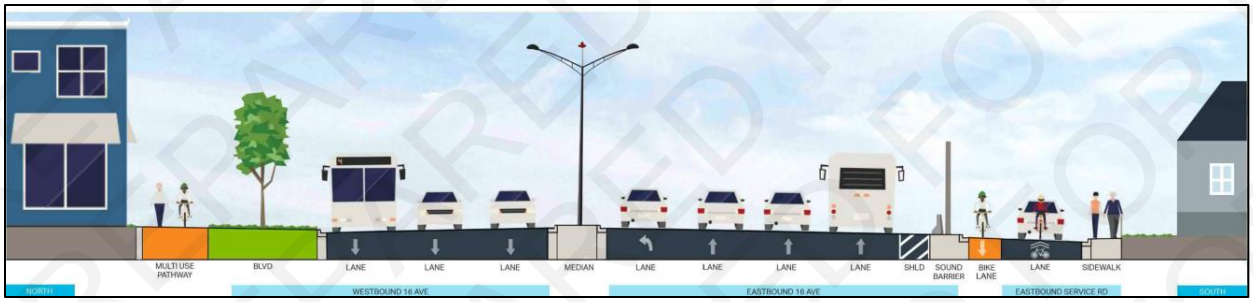
The majority of the Banff Trail Improvements project is now completed.

The project improvements that connect to the Riley Communities study area include the improvements along 16 Avenue NW which include the following:

- Adding one eastbound lane along 16 Avenue NW (from Crowchild Trail to 20A Street NW)
- Adding a pedestrian ramp to the pedestrian bridge east of Banff Trail NW on the north side of 16 Avenue NW, painting the handrails, and replacing / relocating the existing staircase.
- Relocating a westbound Calgary Transit bus stop on 16 Avenue NW from east of the Banff Trail pedestrian bridge to west of Banff Trail NW.
- Re-aligning the Banff Trail & 16 Avenue NW intersection to the west
- Improvements to accommodate a continuous multi-use pathway from 19th Street NW to Banff Trail NW (on the north side of 16 Avenue N.W.) to link to the new pathway from Banff Trail to Crowchild Trail.
- Replacement of the noise wall adjacent to the Briar Hill Community (south side of 16 Avenue NW, Crowchild Trail to 20A Street NW).
- Inclusion of a contra-flow bike lane on 16 Avenue Residential Road (south of the noise wall).
- Adding new Calgary Transit bus stops (in both directions) on the east side of Crowchild Trail on 16 Avenue N.W.

Figure 3-14 illustrates the new cross-section.

Figure 3-14: Banff Trail Area Improvements Project - 16 Avenue NW Improvements



3.8 NORTH HILL COMMUNITIES LOCAL AREA PLAN (2021)

The North Hill Communities (NHC) LAP includes four communities that are adjacent to the study area communities: Capitol Hill, Southern Alberta Institute of Technology (SAIT), Rosedale, and Crescent Heights. Maintaining existing connections and creating more robust connections for all roadway users between these communities will be important in the development of the Riley Communities Mobility Study. Given that SAIT is a significant trip generator within these neighbourhoods, improving connections to it through the Riley Communities will be crucial.

As shown in **Figure 3-15**, the NHC LAP identifies 14 Street and 10 Street as "Recommended Enhanced Pedestrian Corridors". These are two important livable streets that run through the Riley Mobility study area.

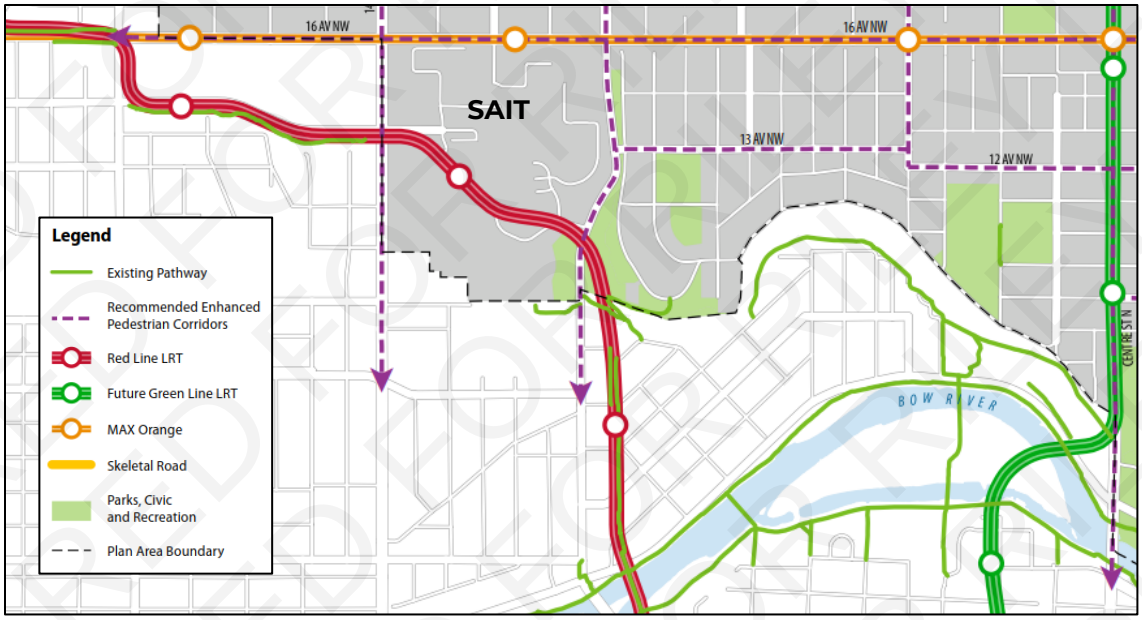


Figure 3-15: North Hill Communities LAP Pedestrian Corridors

Figure 3-16 illustrates the main wheeling connections between the NHC and the Riley Communities identified in the NHC LAP. As shown, these connections include 10 Street, and an existing pathway route that stems from both 10 Street and Crescent Road, converging at the existing bikeway on 7 Street. Further, a "recommended route per 5A network" is identified at the main entrance to the SAIT campus from 14 Avenue.

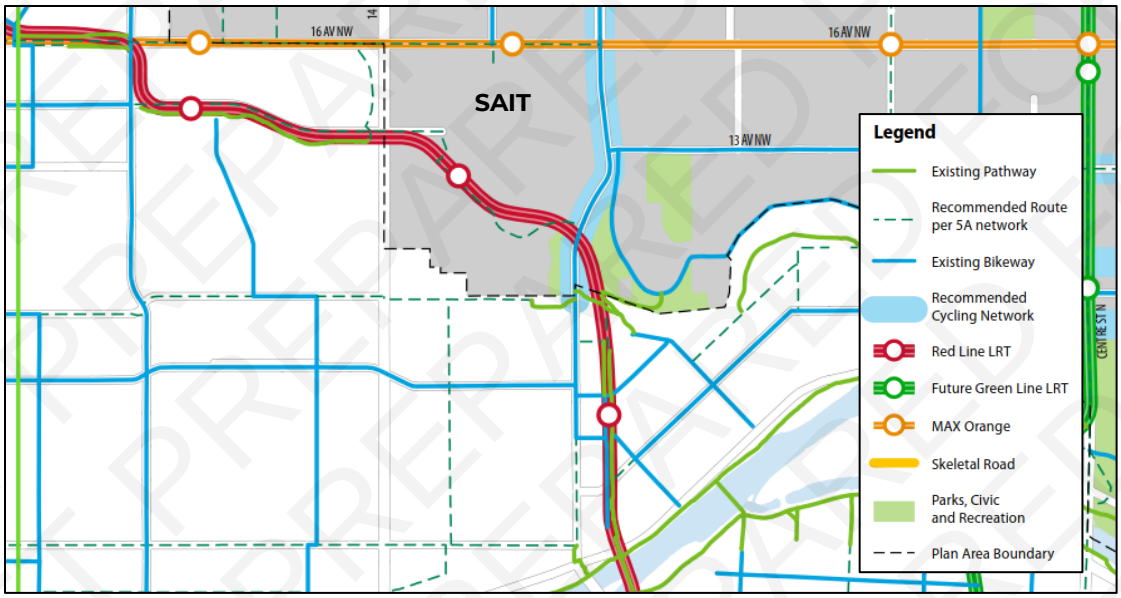


Figure 3-16: North Hill Communities LAP Cycling Network

16 Avenue is identified in the LAP as an "Urban Main Street". The plan envisions this Main Street accommodating a greater diversity of uses and higher levels of pedestrian activity to support primary transit investments in the area. The plan identifies SAIT as a "Community Activity Centre" but does not highlight its interface with the surrounding communities outside the North Hill boundary.

3.9 OTHER AREA PROJECTS

3.9.1 MEMORIAL PARKWAY PROGRAM

The city is investing in improvements along Memorial Drive and the north side of the Bow River to increase flood resiliency and create new public spaces for commemoration and place making. The reimagined Memorial Drive will also provide opportunities to improve mobility options. The Memorial Parkway program encompasses the entire corridor along Memorial Drive between Centre Street and 14 Street NW (ie. adjacent green space, walking and cycling corridor, Memorial Trees and the Sunnyside Flood Barrier). **Figure 3-17** illustrates the project location and extent.

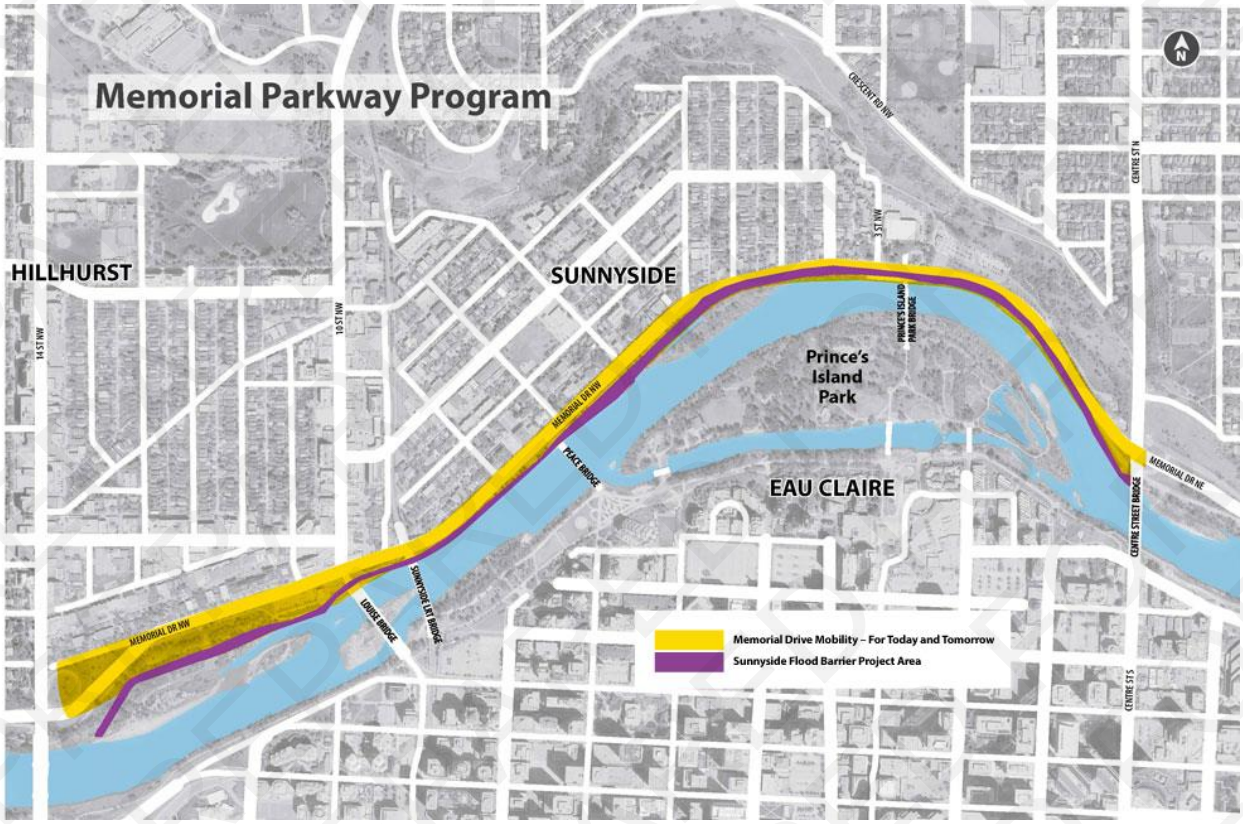


Figure 3-17: Memorial Parkway Program Project Area

Phase 1 engagement occurred in June 2022 and asked the public for feedback on the updated mission and principles of the program. Approximately 60 percent of participants indicated that the proposed mission and principles reflected how they would like to experience the space. Through the initial feedback, numerous suggestions on what to do with the space were provided. Some comments include improving access and adapting the space to provide more enjoyment. There were conflicting comments on traffic along the corridor, with some wanting to reduce traffic and others not wanting to impact traffic.

The second engagement phase occurred recently in October 2022, and requested feedback on special place locations, Memorial Trees re-use, and mobility opportunities, and provided precedent imageries for materials to be used along the Sunnyside Flood Barrier. The What We Heard Report is anticipated in December 2022. Enabling works on the flood barrier will occur Winter and Spring 2023 while the design of the barrier continues.

3.9.1.1 SUNNYSIDE FLOOD BARRIER PROJECT

Sunnyside is in a vulnerable flood location and the City has been exploring different options for a flood barrier to prevent another flood like the one experienced in 2013. The final recommendation for Council is to move forward with design and construction of a 1 in 100-year flood barrier for the community. This option was chosen for the following reasons:

- Reduces 2013 level flood risk, which will be further reduced by current and future upstream reservoirs on the Bow River.
- Less disruptive to the community look and feel.
- Increases the ability to protect vulnerable populations.
- Meets the provincial and federal flood standard.
- Provides building blocks for future climate resiliency.

The potential for groundwater seepage from the river under the barrier was also investigated. It was determined that a seepage trench would be required to mitigate these groundwater impacts.

Figure 3-18 illustrates the 1 in 100-year option profiles along the Sunnyside riverbank. The project is planned to move into construction in spring 2023 and be completed in 2025.

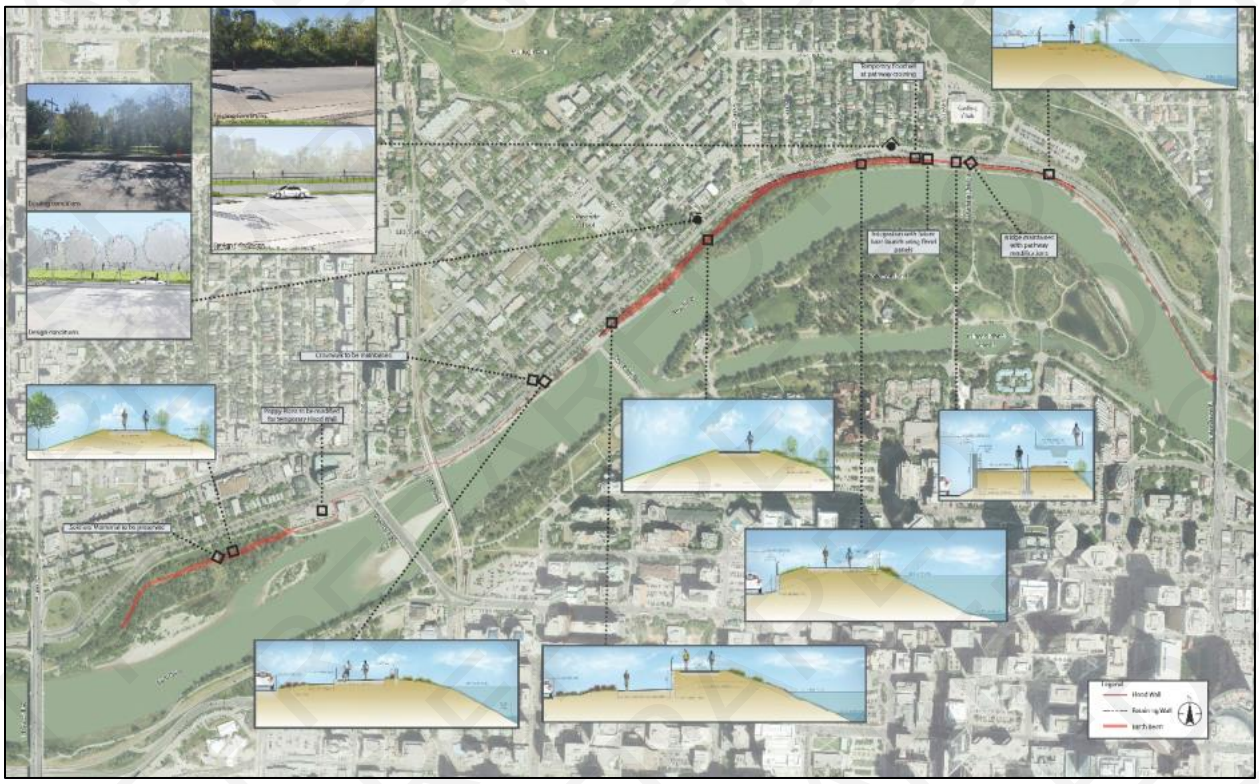


Figure 3-18: Sunnyside 1 in 100 Year Flood Barrier Profiles

3.10 CROWCHILD TRAIL IMPROVEMENTS

Short- Medium- and long-term changes and upgrades to Crowchild Trail have been developed to address the anticipated population growth along Crowchild Trail.

Short-term Recommendations

The short-term upgrades included improvements to the Bow River Bridge, Kensington Road/Crowchild Trail NW intersection, Parkdale Boulevard/Kensington Road NW intersection, and 16 Avenue/Crowchild Trail NW intersection. These improvements have been completed.

Medium- and Long-term Recommendations

The medium- to long-term plans are recommended to be implemented beyond 2027. The recommendations are currently unfunded but will be brought to Council as candidate projects for the Investing in Mobility Capital Plan. The specific medium and long-term recommendations within the Riley Mobility Study area include the following improvements:

- New pedestrian overpass across Crowchild Trail at 2 Avenue NW.
- Land bridge-style overpass across Crowchild Trail at 5 Avenue NW.
- Enhanced, accessible pedestrian overpass across Crowchild Trail at 9 Avenue NW.
- Enhanced, accessible pedestrian overpass across Crowchild Trail at 12 Avenue NW.
- Enhanced, accessible pedestrian overpass under the Bow River Bridge.
- New crossing from Bow River Pathway across Memorial Drive at Parkdale Boulevard tying the Bow River Pathway to continuous north-south pathways on west side of Crowchild Trail (note this was completed as part of the short-term improvements).
- New east-west wheeling lanes on 5 Avenue NW connecting bordering communities to the University of Calgary and other destinations.
- Enhancements along Kensington Road extending the Main Street feel continuously across Crowchild Trail to Parkdale Boulevard.

3.11 ZONING BYLAW, LAND USE AND RIGHT-OF-WAY REVIEW

Calgary's Land Use Bylaw 1P2007 (Part 3, Division 1: Roads Rights-of-Way, Section 53, Table 1) identifies the required setback and the basic right-of-way (ROW) for new/re-development on several roads within the study area. **Table 3-2** summarizes these requirements. Note that not all study roads have specified setbacks and basic ROWs.

Table 3-2: Setback and Basic R.O.W. for Study Area Roads

ON CORRIDOR	From	To	Basic R.O.W. (m)	Required R.O.W.	Required Setbacks (m)	(Side)
10 Street W.	24 Avenue N.	Gladstone Road	20.117	30.481	5.182	Both
14 Street W.	Roselawn Crescent N.	38 Avenue S.	20.117	30.481	5.182	Both
16 Avenue N.	13 Street W.	4 Street E.	20.117	40.539	5.182	North

These setbacks and ROWs will be considered in the development of potential roadway improvements along these corridors.

4.0 TRANSPORTATION NETWORK

4.1 PEDESTRIAN NETWORK

The existing pedestrian network within the study area is well established with over 100 kilometres of sidewalks and almost 4 kilometres of paved pathways. Sidewalks are located on both sides of almost all roadways. The exceptions are various short segments dispersed throughout the study area (Ex. South side of 8 Avenue NW from 19 Street NW to 18 Street NW). For most of these segments, sidewalk is located on at least one side of the roadway. Very few locations exist where sidewalks are not on either side of the road (Ex. Brownsea Drive NW south of Broadview Road NW).

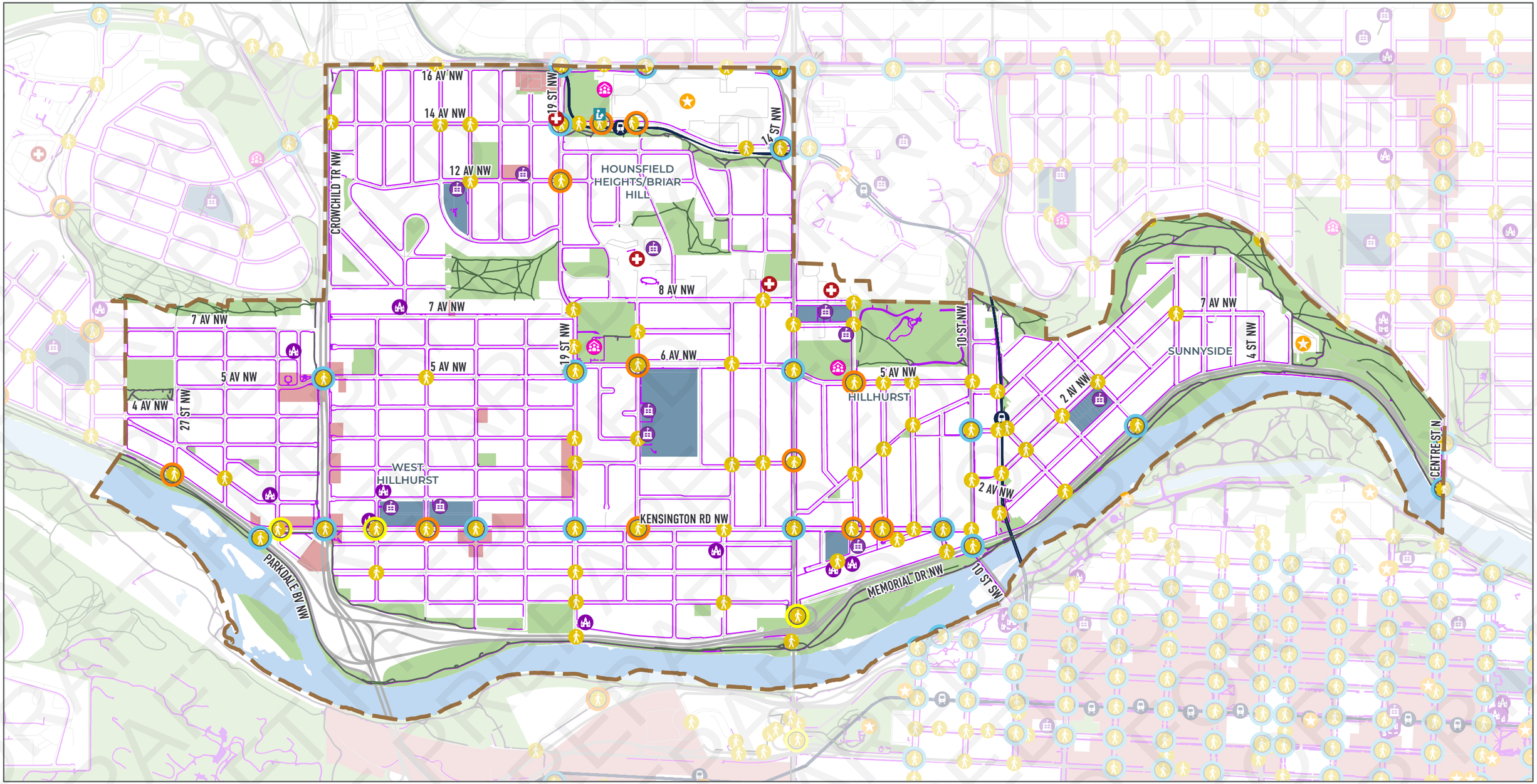
The sidewalk network is supported by several clusters of pathways, most located throughout parks and green spaces (ex. Riley Park, Grasshopper Hill, Lion's Park, and Helicopter Park) and adjacent to major roadways (ex. Memorial Drive and Crowchild Trail). There are also some pathways along the eastern and northern perimeters of the community of Sunnyside.

Crosswalks are also located throughout the network. Most are located on higher volume roadways such as Kensington Road, 14 Street, 5 Avenue/6 Avenue, Gladstone Road, 10 Street, 19 Street, 14 Avenue and 2 Avenue. Crosswalks also tend to be clustered near the two C-Train stations within the study area, facilitating pedestrian movement. In addition to painted crosswalks, there are three locations that provide an extra level of safety for pedestrians with Rectangular Rapid Flashing Beacons.

Because of the extensive sidewalk network, there are no major connectivity gaps to highlight. However, there are a few barriers in the study area that limit pedestrian comfort, safety, and convenience. These barriers include the steep grades along the escarpment, and limited crossings along the busier roadways such as Memorial Drive, Crowchild Trail, and 14 Street.

Most street corners have sidewalk ramps to accommodate wheelchairs, strollers, and other assistive devices. However, most corners do not meet current standards that specify one ramp for each direction of travel. Most street corners in the study area have one ramp angled toward the centre of the intersection that is intended for traveling in either direction from the corner. There are some exceptions in areas that have recently been upgraded/repaved. Further, most sidewalks in the study area are 1.5m monowalks, with no space between the edge of the sidewalk and the curb.

Error! Reference source not found. illustrates the existing pedestrian network, including the sidewalks, pathways, and crosswalks.



URBAN SYSTEMS

Project #: 1057.0189.01
Author: SDF

Revision: A
Date: 2023 / 4 / 27

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Meters

Coordinate System:
NAD 1983 3TM 114

Scale: 1:13,000
(When plotted at 11"x17")

The accuracy & completeness of information shown on this drawing is not guaranteed. It will be the responsibility of the user of the information shown on this drawing to locate & establish the precise location of all existing information whether shown or not.

Legend

- Crosswalk with Pedestrian RRFB
- Crosswalk with Pedestrian Overhead Flasher
- Crosswalk with Signal
- Crosswalk
- Trail / Pathway
- Sidewalk
- Attraction
- Community Centre
- Library
- Health Clinic/Care Centre
- School
- Place of Worship
- LRT Station
- LRT
- School
- Park
- Commercial
- Study Area

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FIGURE 4-1

Existing Pedestrian Network

4.2 WHEELING NETWORK

Within the study area, the existing wheeling network consists of paved pathways, wheeling lanes, signed routes and shared lanes. These facilities are defined on the City's Parks Pathways and Bikeways Map as follows:

- **Wheeling Lane -** An on-street travel lane designated for the use of bicycles, scooters and other wheeled, active transportation devices. Identified by a painted line, bicycle and diamond shaped pavement markings and signs.
- **Signed Routes and Shared Lanes -** On-street bicycle routes where bicycles and cars share the roadway. Signed route are usually on low-volume residential roadways and identified by blue and white way-finding signs. Shared lanes are signed with yellow Share the Road signs and have pavement markings to indicate recommended location for wheeling and to assist with wayfinding.
- **Local and Regional Pathways** – Are multi-use amenities. Regional pathways are part of a city-wide linear network that facilitates non-motorized movements for recreation and transportation purposes. They are typically asphalt and located off-street. A local pathway provides secondary routes within communities, linking residential areas to facilities such as neighbourhood parks, schools, and other local community destinations. For the purposes of this study, local and regional pathways have been grouped under the same category.

Within the study area, there are approximately 2.3 centreline kilometres of wheeling lanes, 13.8 km of signed routes, 2.3 km of shared lanes and 22.3 kms of trails.

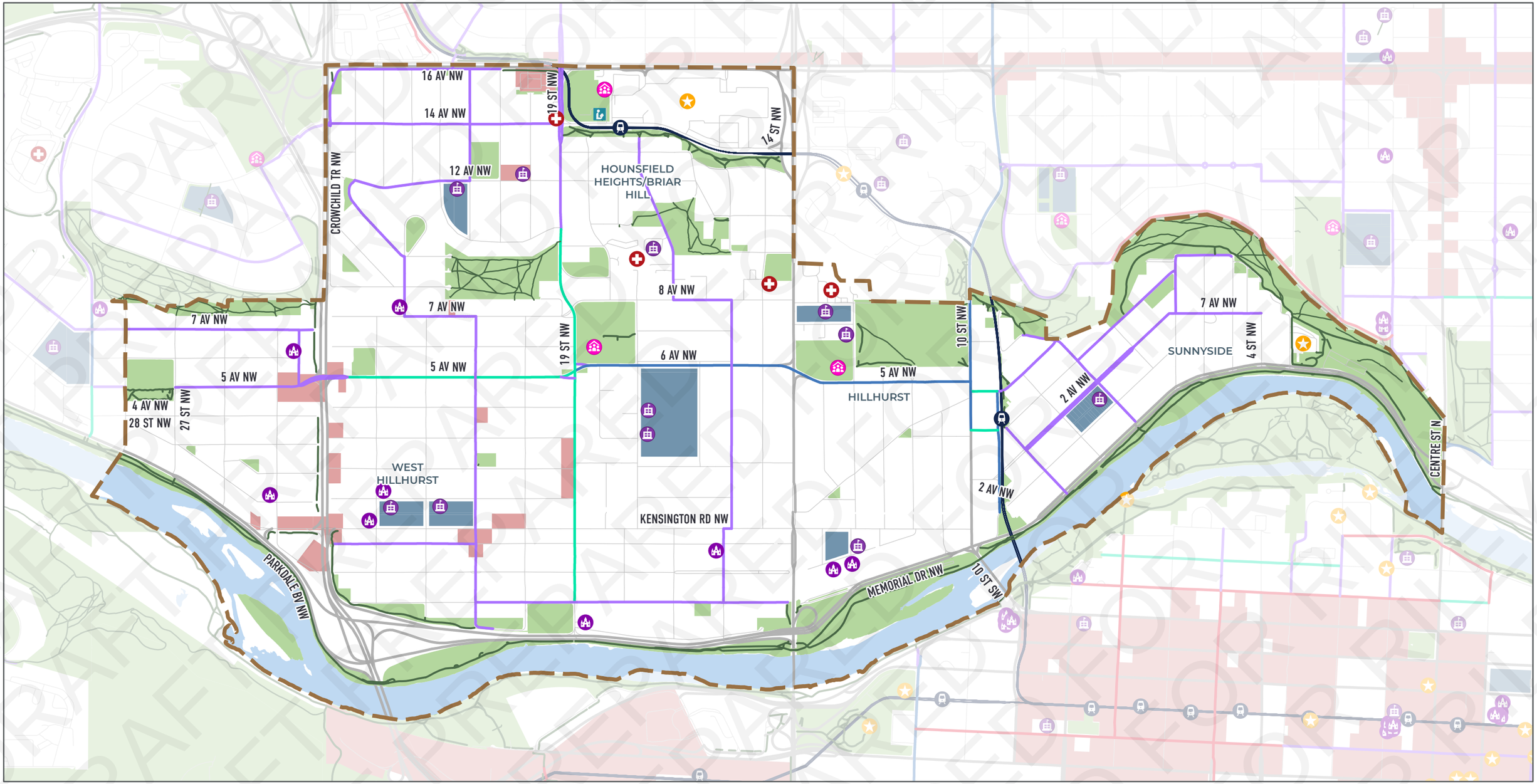
A significant portion of the study area's wheeling network consists of local and regional pathways. These facilities are considered 5A facilities. This means that people of all ages and all abilities can feel safe and comfortable, year-round while wheeling on these facilities (Always Available for All Ages and Abilities). The City developed a 5A network in 2020 with the goal of implementing 5A facilities on all roads identified on the network by 2050. For more information on how the 5A network was developed, refer to **Section 4.2.1**.

The dedicated facilities, that are generally more comfortable for people wheeling (although not considered "5A"), within the study area include wheeling lanes on 6 Avenue/5 Avenue from 19 Street NW to 10 Street NW, on 10 Street NW from 16 Avenue NW to 3 Avenue NW. Further, there is a northbound contraflow lane (a wheeling lane where people on bicycles or other wheeling devices are permitted to travel in the opposite direction of traffic flow) on 9A Street NW between 4 Avenue NW and Memorial Drive.

There are many shared routes within the study area including 14 Avenue, 21 Street NW, 19 Street NW, Juniper Road NW, 5 Avenue NW, Broadview Road NW, 10 Street NW, etc. While most of these routes are on low volume, low speed roadways and are comfortable for many people wheeling, some routes, such as 10 Street NW and 19 Street NW, experience higher traffic volumes and are not comfortable for most people. Only one set of wheeling traffic control signals are provided in the study network. These are located at the intersection of 5 Avenue NW and Crowchild Trail.

While the dedicated bicycle network is minimal, the shared routes provide supporting connections facilitating good wheeling movement throughout the study area. It should be reiterated that most of these connections are not suitable for many wishing to wheel.

Figure 4-2 illustrates the existing wheeling network, including the wheeling lanes, pathways, and shared routes. Figure 4-3 illustrates the existing wheeling network with the 5A network overlayed to show



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Legend

- Trail / Pathway
- Wheeling Lane
- Cycle Track
- Shared Lane
- Signed Bikeway
- Attraction
- Community Centre
- Library
- Health Clinic/Care Centre
- School
- Place of Worship
- LRT Station
- LRT
- School
- Park
- Commercial
- Study Area

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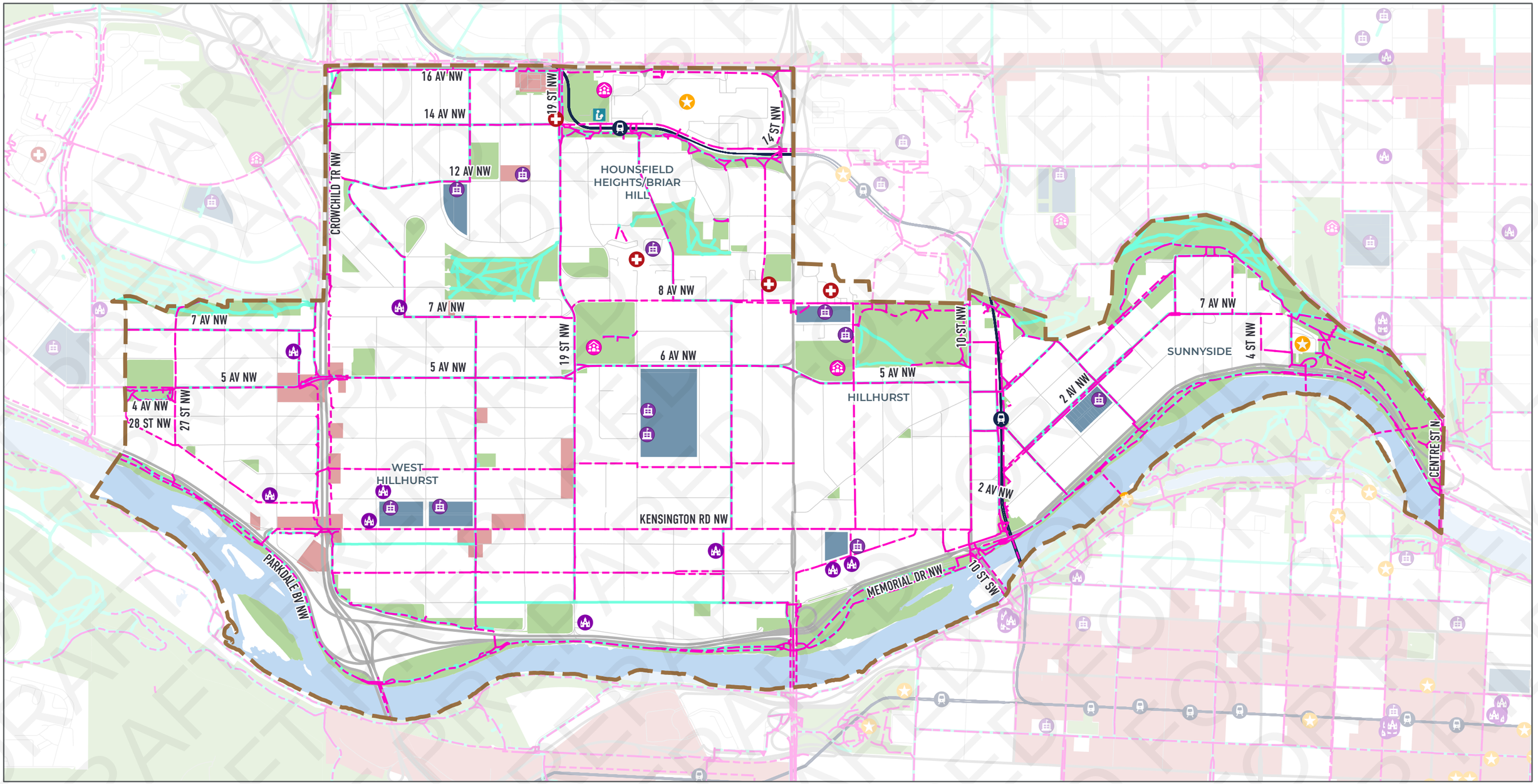
FIGURE 4-2

Existing Wheeling Network



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Project #: 1057.0189.01
Author: SDF

Revision: A
Date: 2023 / 5 / 2

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Legend

- Existing Wheeling Network
- 5A Network*
- Attraction
- Community Centre
- Library
- Health Clinic/Care Centre
- Place of Worship
- LRT Station
- School
- LRT
- Park
- Commercial
- Study Area

*5A refers to the "Always Available for All Ages and Abilities" pathway and bikeway network that is accessible by people of all physical abilities. (Some existing routes require upgrades to be considered 5A facilities)

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FIGURE 4-3
Existing Wheeling Network with 5A Network

4.2.1 LEVEL OF TRAFFIC STRESS (LTS)

Level of Traffic Stress (LTS) is a measure used to determine how stressful it is for someone wheeling to travel on the roadway. The City of Calgary completed a LTS analysis on the road network in 2020 to help identify their 5A network. A variety of methods have been developed for measuring LTS that include different factors and different LTS scales (ex. LTS 1-5 or LTS 1-4). There is not yet a standardized method for measuring LTS.

The City of Calgary used a method based off a method developed by Northeastern University. This method uses an LTS scale of 1-4 and describes them as follows:

- LTS 1: Strong separation from all except low speed, low volume traffic. Simple crossings. Suitable for children.
- LTS 2: Except in low speed / low volume traffic situations, people wheeling have their own place to ride that keeps them from having to interact with traffic except at formal crossings. Physical separation from higher speed and multilane traffic. Crossings that are easy for an adult to negotiate. A level of traffic stress that most adults can tolerate, particularly those sometimes classified as "interested but concerned."
- LTS 3: Involves interaction with moderate speed or multilane traffic, or close proximity to higher speed traffic. A level of traffic stress acceptable to those classified as "enthused and confident."
- LTS 4: Involves interaction with higher speed traffic or close proximity to high-speed traffic. A level of stress acceptable only to those classified as "strong and fearless."

This method uses the following criteria to determine the LTS for each road segment:

- Number of through lanes on the road,
- Effective ADT (effective ADT = ADT for two-way roads and 1.5xADT for one-way roads),
- Prevailing speed (i.e. posted speed limit).

A matrix is used with these criteria to assign each road segment an LTS. Separate matrices are used for roads without bicycle/wheeling facilities, roads with bicycle/wheeling lanes not adjacent to parking lanes and roads with bicycle/wheeling lanes alongside parking lanes. **Figure 4-4** illustrates the LTS matrix for roads without bicycle facilities.

Number of lanes	Effective ADT*	Prevailing Speed						
		≤ 20 mph	25 mph	30 mph	35 mph	40 mph	45 mph	50+mph
Unlaned 2-way street (no centerline)	0-750	LTS 1	LTS 1	LTS 2	LTS 2	LTS 3	LTS 3	LTS 3
	751-1500	LTS 1	LTS 1	LTS 2	LTS 3	LTS 3	LTS 3	LTS 4
	1501-3000	LTS 2	LTS 2	LTS 2	LTS 3	LTS 4	LTS 4	LTS 4
	3000+	LTS 2	LTS 3	LTS 3	LTS 3	LTS 4	LTS 4	LTS 4
1 thru lane per direction (1-way, 1-lane street or 2-way street with centerline)	0-750	LTS 1	LTS 1	LTS 2	LTS 2	LTS 3	LTS 3	LTS 3
	751-1500	LTS 2	LTS 2	LTS 2	LTS 3	LTS 3	LTS 3	LTS 4
	1501-3000	LTS 2	LTS 3	LTS 3	LTS 3	LTS 4	LTS 4	LTS 4
	3000+	LTS 3	LTS 3	LTS 3	LTS 3	LTS 4	LTS 4	LTS 4
2 thru lanes per direction	0-8000	LTS 3	LTS 3	LTS 3	LTS 3	LTS 4	LTS 4	LTS 4
	8001+	LTS 3	LTS 3	LTS 4	LTS 4	LTS 4	LTS 4	LTS 4
3+ thru lanes per direction	any ADT	LTS 3	LTS 3	LTS 4	LTS 4	LTS 4	LTS 4	LTS 4

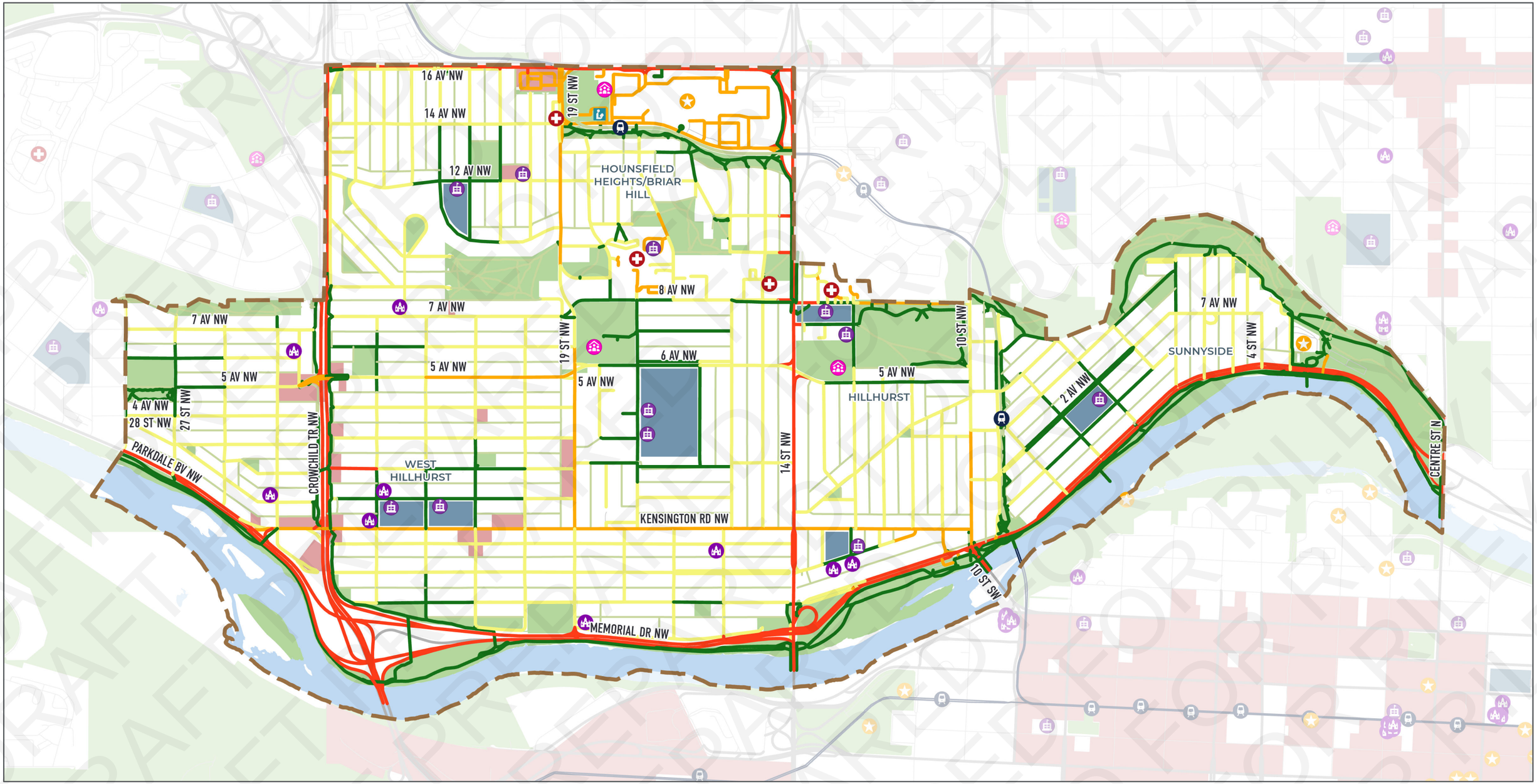
* Effective ADT = ADT for two-way roads; Effective ADT = 1.5*ADT for one-way roads

Figure 4-4: LTS for Road Segments without Bicycle/Wheeling Facilities

To better understand whether the City's model used Northeastern University's method directly, the GIS data from the model was reviewed. It was determined that several other criteria could have been considered in the development of the LTS ratings including:

- Surface Type
- Existing Bicycle Facility Type
- Existing Bicycle Facility Width
- Minimum and Maximum Slope
- Average Slope
- Snow Removal Priority Level
- Lighting (lights within 20m of facility)
- Network Gap

Figure 4-5 illustrates the City's final LTS for the road segments within the study area. By overlaying the LTS network on the 5A network, it was determined that approximately 48% of the 5A network consists of LTS 1 routes.



URBAN SYSTEMS

0 100 200 300
Meters

Coordinate System:
NAD 1983 3TM 114

Scale: 1:13,000
(When plotted at 11"x17")

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Project #: 1057.0189.01
Author: SDF

Revision: A
Date: 2022 / 9 / 12

Legend

Level of Traffic Stress
- 1
- 2
- 3
- 4
- Unknown

- Attraction
- Community Centre
- Library
- Health Clinic/Care Centre
- School
- Place of Worship

- LRT Station
- LRT
- Park
- Commercial
- School
- Study Area

Calgary

Riley Communities Mobility Study

FIGURE XX

Level of Traffic Stress

4.3 TRANSIT NETWORK

The existing transit network consists of 16 regular bus routes, two bus rapid transit (BRT) routes, six school routes and an LRT line. **Table 4-1** summarizes these routes and their frequencies. **Figure 4-7** illustrates the transit network within the study area. **Figure 4-6** provides a screenshot of bus routes from Calgary Transit's webpage to help illustrate the number of buses servicing each route.

Table 4-1: Study Area Transit Route Frequencies

Route No.	Route Name	Frequency (Minutes)							Route Category
		AM Peak	Mid Day	PM Peak	Evening	Saturday		Sunday	
						Day	Evening	All Day	
1	Bowness / Forest Lawn	20	20	20	26	25	25	25	Regular
4	Huntington	20	20	20	24/32	37	37	37	Regular
5	North Haven	20	20	20	31	37	37	37	Regular
9	Dalhousie Station / Chinook Station	10/20	20	10/20	20/30	31	31	31	Regular
19	16 Ave N	30	30	30	27	45/30	45	45/30/45	Regular
20	Heritage Station / Northmount Dr N	20	20	20	30	21	30	30/21/30	Regular
31	Dalhousie Station / Lions Park Station	25	25	14/25	30	30	30/40	30/40	Regular
40	Crowfoot Station / North Hill	35	35	35	35	35	35	35	Regular
65	Market Mall / Downtown West	21	40	21	40	45	45	45	Regular
89	Lions Park – North Pointe	42	-	42	-	-	-	-	Regular
90	Bridgeland / University of Calgary	32	32	32	32	32	32	32	Regular
91	Foothills Medical Centre	21	21	21	21	21	21	21	Regular
104	Sunnyside / University of Calgary	32	32	32	32	32	32	32	Regular
105	Dalhousie Station / Lions Park Station	30	30	30	30	40	40	40	Regular
201	Red Line Tuscany / Somerset-Bridlewood	6	15	6	15	15	15	15	LRT
303	MAX Orange Brentwood / Saddletowne	11/25	25	13/25	25/30	30	30	30	Max
305	BRT Bowness / City Centre	30	-	30	-	-	-	-	BRT
404	North Hill	60	60	60	60	60	60	60	Regular
414	14 St W	60	60	60	-	60	-	60	Regular

The regular bus routes provide good connectivity throughout the study area with main north-south routes on Crowchild Trail, 14 Street and 10 Street and main east-west routes on Kensington Road / 2 Avenue, 5 Avenue / 6 Avenue, 16 Avenue and 16 Avenue. It is noted that no regular routes are provided on 19 Street NW, one of the major north-south connections through the study area. As such, 19 Street is identified as a gap in the transit network.

The purpose of BRT is to provide a faster, more reliable service compared to regular bus service through measures such as less frequent stops, more frequent service, and signal priority. The two BRT routes through the project area provide east-west connections – one on Kensington Road and the other on 16 Avenue. The BRT route on 16 Avenue NW is a MAX route. Calgary's MAX lines include station amenities such as heated shelters and real-times schedules, the traffic signals along the lines are equipped with signal priority to allow queue jumping, and the routes provide more frequent service and more direct connections to major destinations. The BRT route (Route 305) is designed for commuter trips and operates only on weekdays during AM and PM peak times, with three buses offered during each peak time with 30 minute headways. There are two LRT stations within the study area, Lions Park (in Hounsfield Heights/Briar Hill) and Sunnyside (in Sunnyside). Eight bus routes provide service to Lions Park Station and three bus routes provide service to Sunnyside Station. The remaining regular bus routes within the study area link to other LRT stations.

Bus stop amenities within the area consist of any combination of benches, shelters, garbage bins, and concrete waiting areas.

All Calgary Transit buses, and LRT vehicles are equipped with ramps or are ground-level accessible to make it easier for transit users with mobility issues to board. These vehicles also have priority seating areas reserved for the same users. The study area's sidewalk network provides good connections to all bus stops. However, it is noted that at some locations that are designated for future bus stops, proper crossing facilities are lacking. Refer to **Section 6.1** for further details.

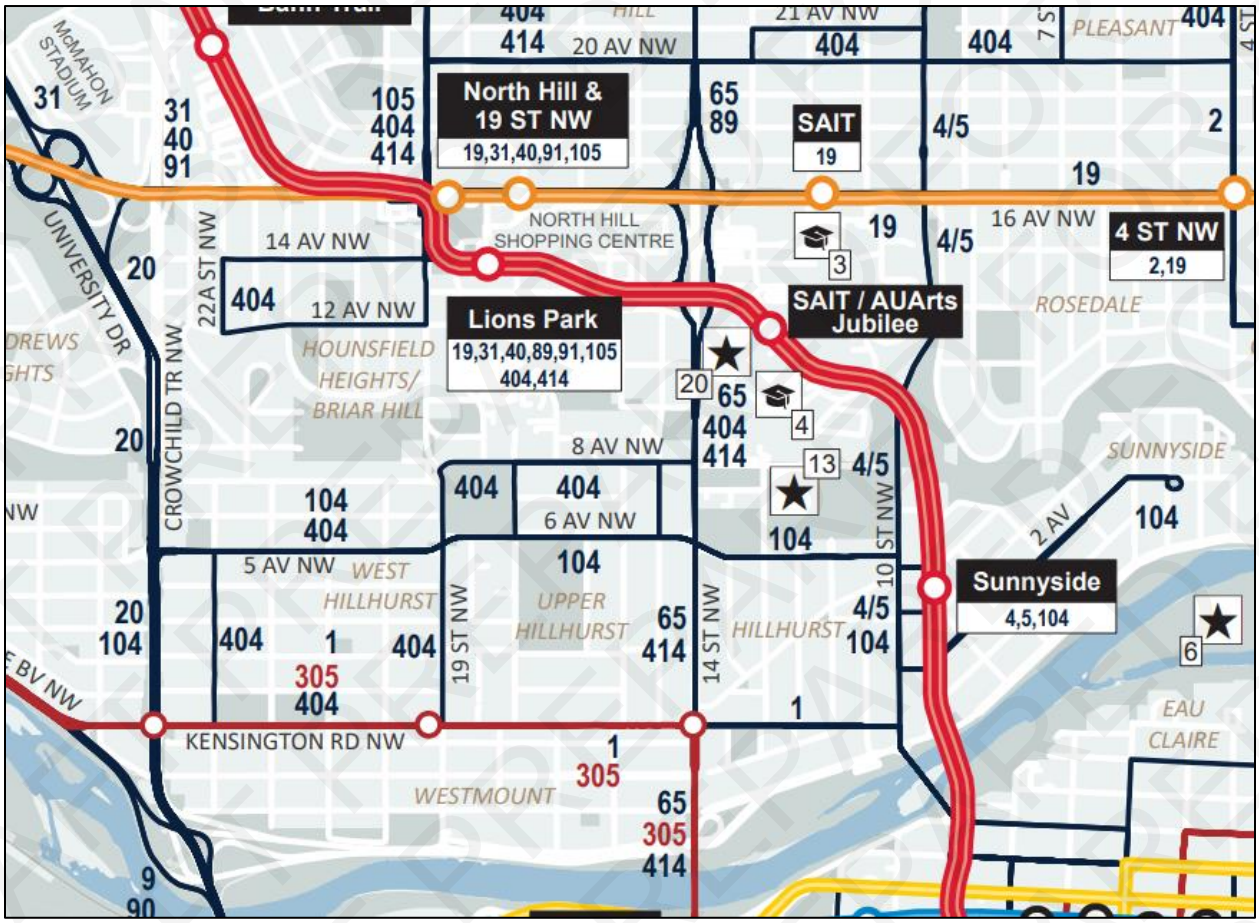
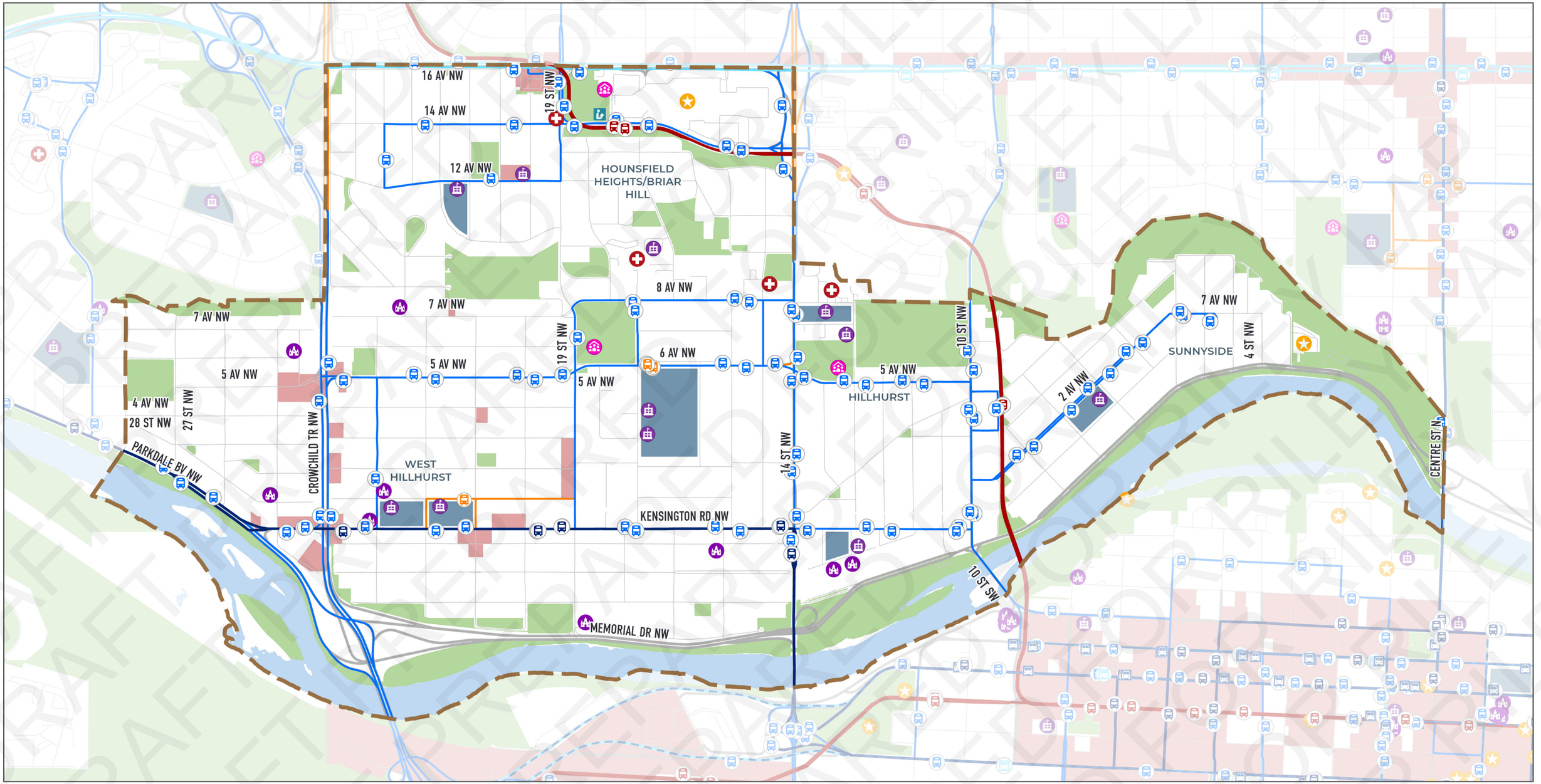


Figure 4-6: Transit Routes and Stops ***(Source: Calgary Transit)***



URBAN SYSTEMS

0 100 200 300
Meters

N

Coordinate System:
NAD 1983 3TM 114

Scale: 1:13,000
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Author: SDF

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Date: 2022 / 9 / 12

Legend

Transit Stop
- LRT
- BRT
- Regular
- School
- Express
- Max

Transit Route
- LRT
- BRT
- Regular
- School
- Express
- Max

- Attraction
- Community Centre
- Library
- Health Clinic/Care Centre
- School
- Place of Worship

- School
- Park
- Commercial
- Study Area

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FIGURE XX

Existing Transit Network

4.4 ROAD NETWORK

4.4.1 ROAD CLASSIFICATIONS AND GOODS MOVEMENT

The study area road network is comprised of a variety of roadway types. This variety supports efficient and comfortable movement for all travel types (walking, wheeling, transit, personal vehicles). It consists of mostly collector and residential roadways that facilitate lower traffic volumes and slower moving vehicles which support more comfortable environments for individuals walking or wheeling. Roadways of note include:

- Skeletal roads that facilitate high traffic volumes and high traffic speeds, and walking or wheeling is not permitted (e.g., Crowchild Trail).
- Arterial streets that place lower priority on walking and wheeling and higher priority on transit and motor vehicles (e.g., 14 Street, from north of the study area to 5 Avenue NW/6 Avenue NW).
- Urban Boulevards, the backbone of higher-density corridors and activity centres, place the highest priority on accommodating walking, wheeling and transit, while still accommodating high volumes of vehicular traffic (e.g., 14 Street NW south of to 5 Avenue/6 Avenue NW, and 16 Avenue NW)
- Neighbourhood Boulevards, similar to Urban Boulevards but on a smaller scale, are destinations for the local communities surrounding them and prioritize walking and wheeling (e.g., Kensington Road and 10 Street, from Memorial Dr to 5 Avenue NW).

Routes designated for goods movement (commercial vehicles/trucks) include, Crowchild Trail NW, Memorial Drive NW/Parkdale Boulevard NW, Kensington Road NW, 14 Street NW, and 10 Street NW. 16 Avenue NW is the single Dangerous Goods Route in the study area.

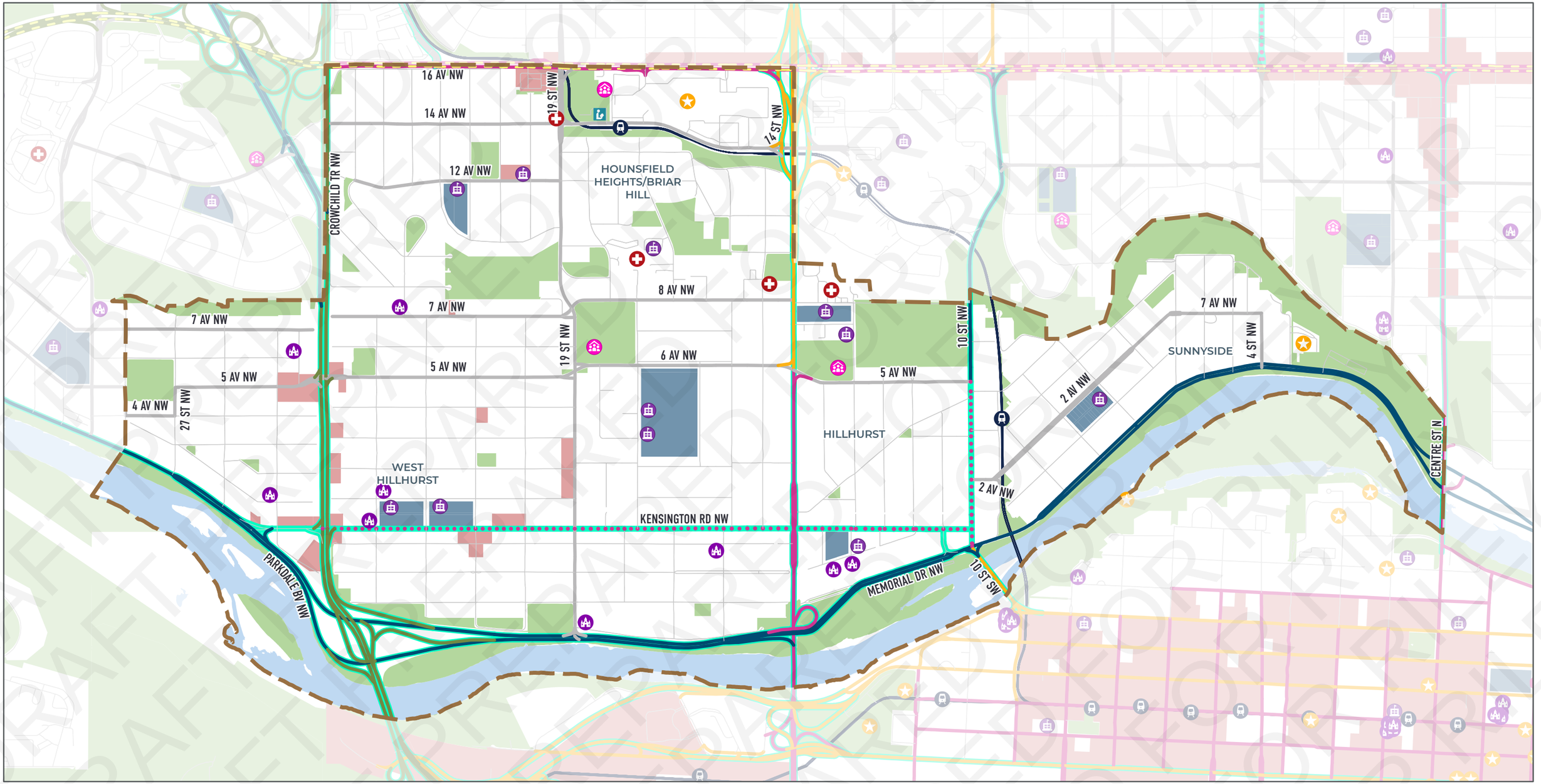
The road classifications, and goods movement network within the Riley Communities are illustrated in Error! Reference source not found.**Figure 4-8.**

Average Daily Traffic (ADT) volumes (data collected from 2012-2019, and in 2022) for roadways in the study area were obtained and compared to their assigned road classification's capacity. It was determined that, for the most part, the existing traffic volumes are consistent with the assigned road classifications. The exceptions are highlighted in **Figure 4-9**. The roads with ADTs greater than the volume guidelines of their assigned road classification include:

- 16 Avenue NW
- 19 Street NW from 8 Avenue NW to 16 Avenue NW
- 19 Street NW from 2 Avenue NW to 3 Avenue NW
- Various sections of 5 Avenue NW/6 Avenue NW
- Most of Memorial Drive
- Parkdale Boulevard
- 14 Avenue NW
- 3 Avenue NW from 10 Street NW to 9a Street NW

The roads with ADTs less than the volume guidelines of their assigned road classification include:

- Kensington Road from 22 Street NW to 10 Street NW
- Kensington Road from Crowchild Trail to Parkdale Boulevard
- 10 Street NW from the north end of Riley Park to 5 Avenue NW
- 2 Avenue NW east of 6 Street NW



URBAN SYSTEMS

0 100 200 300
Meters

Coordinate System:
NAD 1983 3TM 114

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Legend

- Skeletal Road
- Arterial Street
- Urban Boulevard
- Neighbourhood Boulevard
- Parkway
- Collector
- Residential Street
- Dangerous Goods Route
- Truck Route
- Attraction
- Community Centre
- Library
- Health Clinic/Care Centre
- School
- Place of Worship
- LRT Station
- LRT
- School
- Park
- Commercial
- Study Area

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Author: SDF

Revision: A
Date: 2023 / 4 / 28

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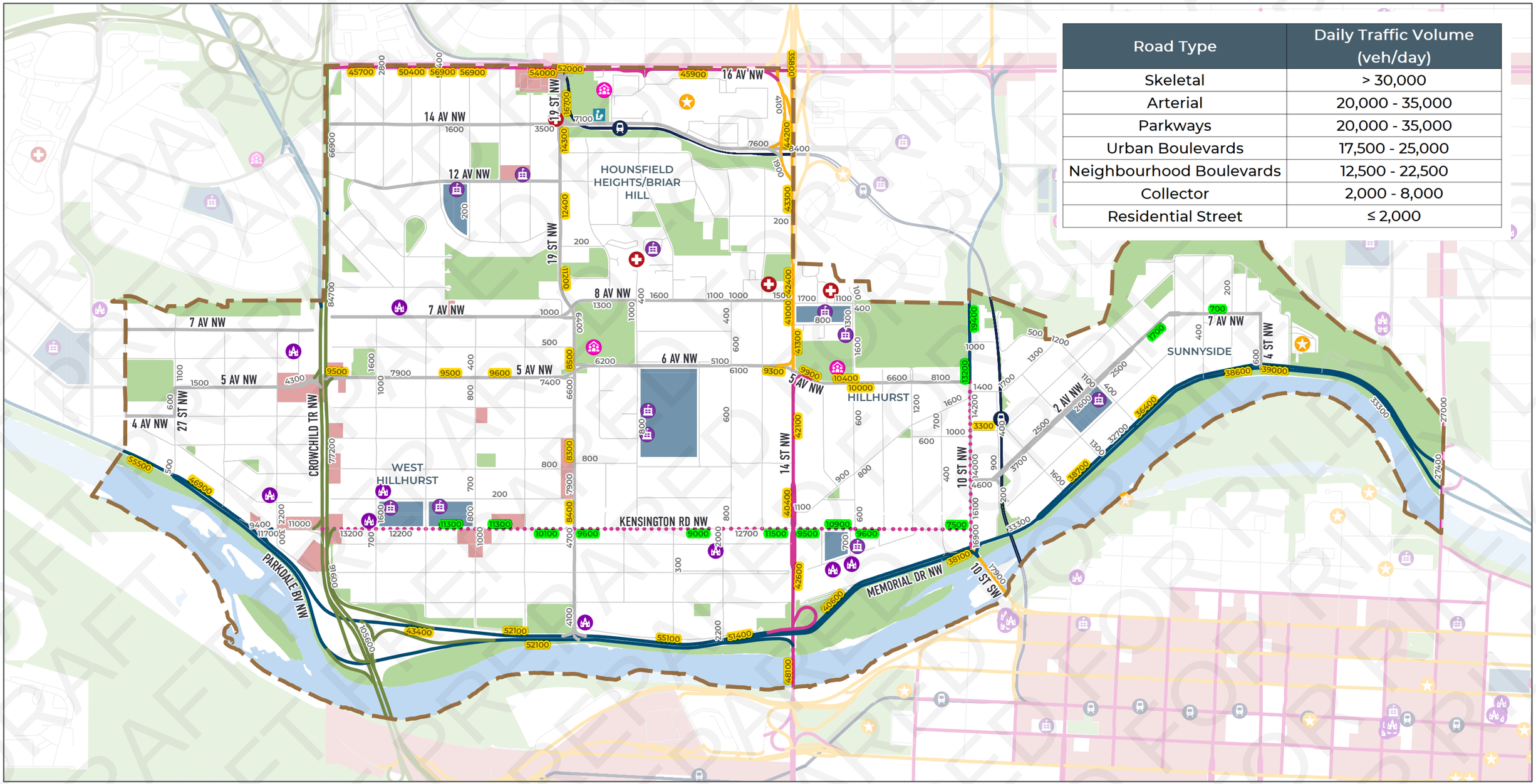
FIGURE 4-8
Road Network Classification and Goods Movement

Road Type	Daily Traffic Volume (veh/day)
Skeletal	> 30,000
Arterial	20,000 - 35,000
Parkways	20,000 - 35,000
Urban Boulevards	17,500 - 25,000
Neighbourhood Boulevards	12,500 - 22,500
Collector	2,000 - 8,000
Residential Street	≤ 2,000



URBAN SYSTEMS

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Legend

- Skeletal Road
- Arterial Street
- Urban Boulevard
- Neighbourhood Boulevard
- Parkway
- Collector
- Residential Street
- Attraction
- Community Centre
- Library
- Health Clinic/Care Centre
- School
- Place of Worship
- LRT Station
- LRT
- Park
- Commercial
- Study Area
- #### Road ADT > Classification
- #### Road ADT < Classification

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FIGURE 4-9

Average Daily Traffic Volumes

4.4.2 SPEED LIMITS AND TRAFFIC CONTROL

Posted speed limits within the study area vary between 70 km/h, on Crowchild Trail and Memorial Drive, and 40 km/h on all residential roads. It is noted that this 40 km/h speed limit on residential roads came into effect on May 31, 2021. Prior to this, the speed limit on residential roads was 50 km/h. Scattered throughout the community are playground zones which restrict vehicle speeds to 30 km/h, between 7:30 a.m. and 9:00 p.m., seven (7) days a week, year-round.

Traffic controls in the study area consists of 21 full traffic signals, two (2) half traffic signals, 11 pedestrian overhead flashers, three (3) pedestrian rectangular rapid flashing beacons (RRFB), and many non-signalized intersections (i.e. stop or yield controlled). There is also one bicycle signal at the intersection of Crowchild Trail NW and 5 Avenue NW for the eastbound/westbound direction.

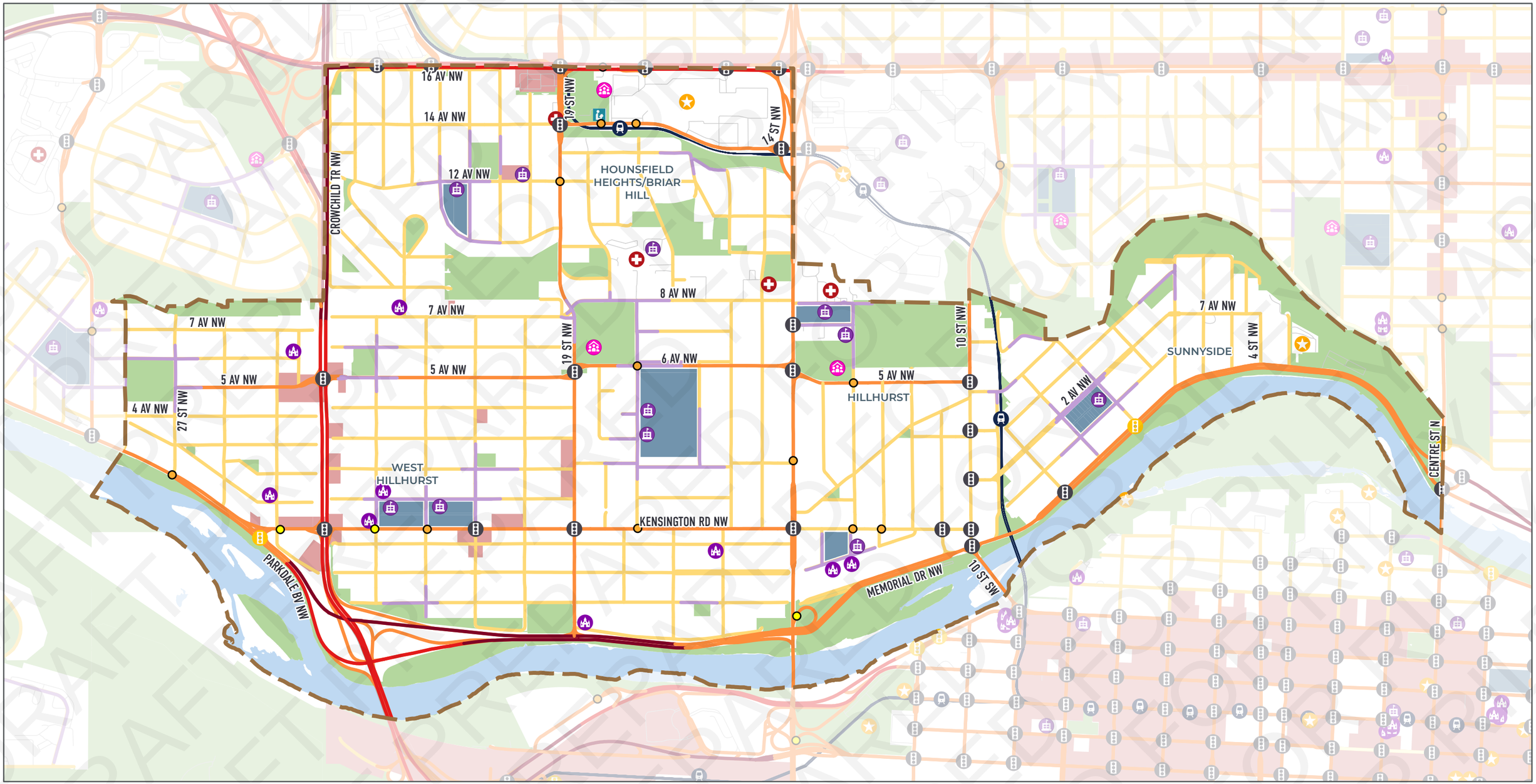
Traffic signals are limited to the collectors, urban and neighbourhood boulevards, arterials, and skeletal roads. The half signals, pedestrian overhead flashers and RRFBs improve the connectivity for people walking and wheeling and are generally located along main walking and wheeling corridors or near attractions such as schools and parks.

Figure 4-10 illustrates the posted speed limits and traffic control on the study network.

Observed 85th percentile vehicular speed data from the City of Calgary was compiled to understand if speeding is an issue in the study area, and if so, where. The data was filtered to exclude data collected during the COVID-19 pandemic (2020-2021). The 85th percentile speeds were compared to the posted speed limits.

Figure 4-11 illustrates this comparison: wherever the 85% speeds were over 5 km/h greater than the posted speed limit, the data point is circled in purple. As shown, roads with multiple purple circles are Kensington Road, Memorial Drive/Parkdale Boulevard, 16 Avenue NW, and 5 Avenue NW.

Figure 4-12 illustrates the comparison of 85th percentile speed limits taken when playground zone restrictions were in effect to the posted speed limit during this time. Again, the data points where the 85th percentile speeds were over 5 km/h greater than the posted speed limit; the data point is circled in purple. As shown, most playground zones in the study area have at least one street circled in purple.



URBAN SYSTEMS

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Meters

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(When plotted at 11"x17")

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Revision: A
Date: 2023 / 5 / 2

Legend

- Pedestrian Overhead Flasher
- Pedestrian RRFB
- Fire signal
- Half Traffic Signal
- Traffic Signal
- School / Playground Zone
- 30 km / h
- 40 km / h
- 50 km / h
- 60 km / h
- 70 km / h
- Attraction
- Community Centre
- Library
- Health Clinic/Care Centre
- School
- Place of Worship
- LRT Station
- LRT
- School
- Park
- Commercial
- Study Area

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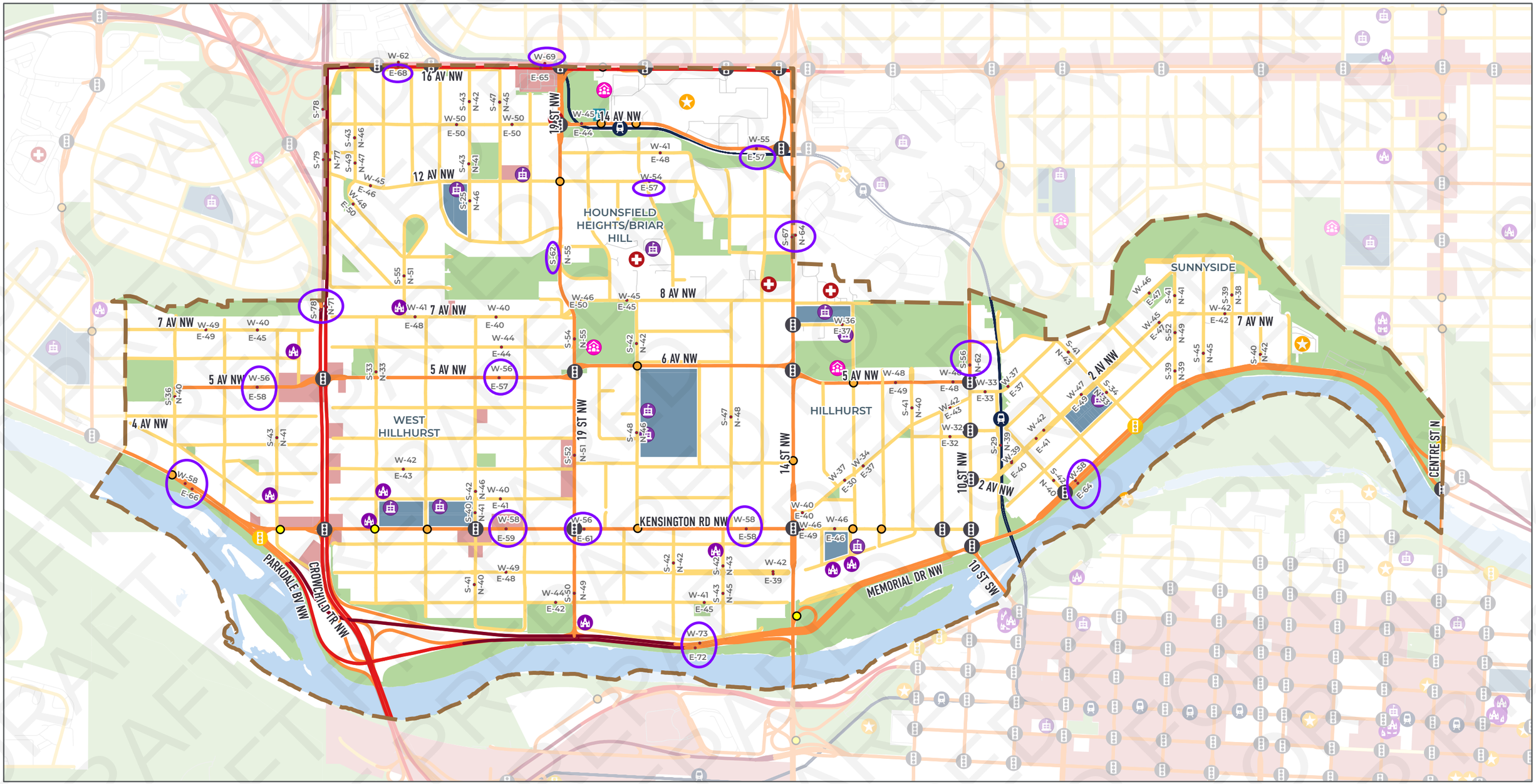
FIGURE 4-10
Posted Speed Limit and Traffic Control



URBAN SYSTEMS

0 100 200 300
Meters

N

Coordinate System:
NAD 1983 3TM 114

Scale: 1:13,000
(When plotted at 11"x17")

Project #: 1057.0189.01
Author: SDF

Revision: A
Date: 2023 / 5 / 2

Legend

- Pedestrian Overhead Flasher
- Pedestrian RRFB
- Fire signal
- Half Traffic Signal
- Traffic Signal

- 30 km / h
- 40 km / h*
- 50 km / h
- 60 km / h
- 70 km / h

- Attraction
- Community Centre
- Library
- Health Clinic/Care Centre
- School
- Place of Worship
- LRT Station

- LRT
- School
- Park
- Commercial
- Study Area
- X-## / X-## Direction of Travel - 85th Percentile Speed (km/h)

*Prior to May 31, 2021, the posted speed limit was 50km/h

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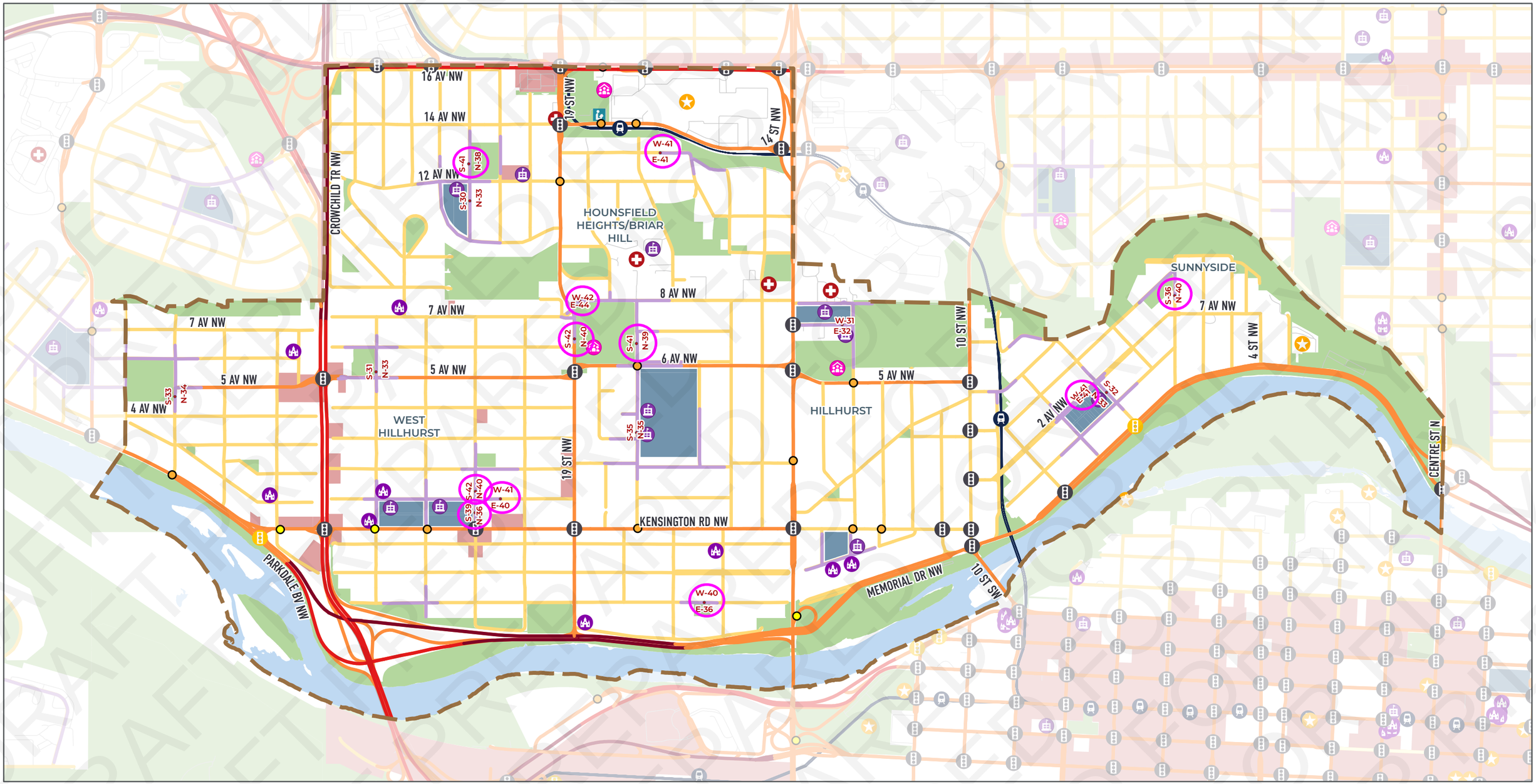
FIGURE 4-11
Posted Speed Limit & 85th Percentile Speed



URBAN SYSTEMS

0 100 200 300
Meters

N

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NAD 1983 3TM 114

Scale: 1:13,000
(When plotted at 11"x17")

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Author: SDF

Revision: A
Date: 2023 / 4 / 27

Legend

- Pedestrian Overhead Flasher
- Pedestrian RRFB
- Fire signal
- Half Traffic Signal
- Traffic Signal
- Playground Zone
- 30 km / h
- 40 km / h
- 50 km / h
- 60 km / h
- 70 km / h
- Attraction
- Community Centre
- Library
- Health Clinic/Care Centre
- Place of Worship
- LRT Station
- School
- LRT
- School
- Commercial
- Park

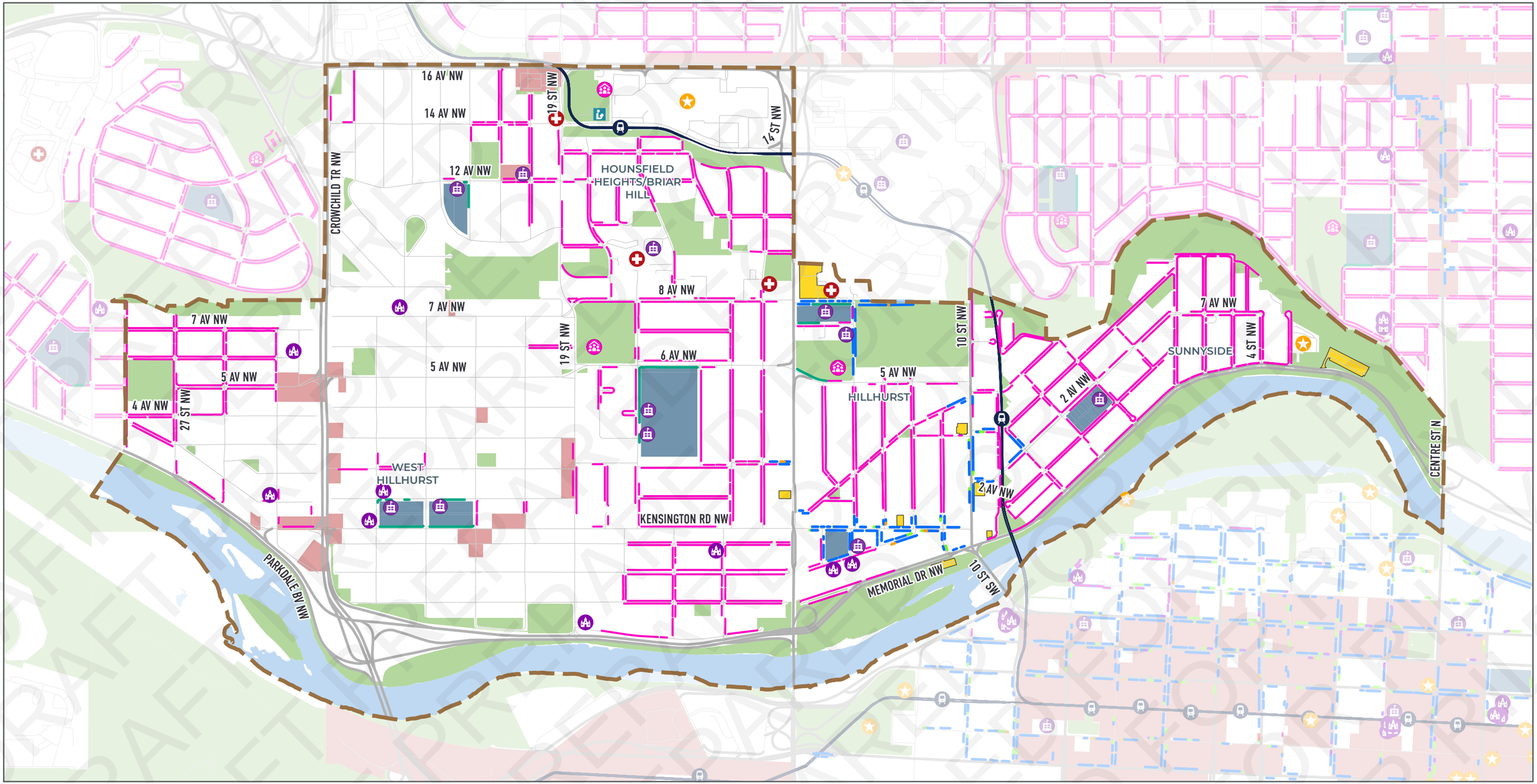
Calgary

Riley Communities Mobility Study

FIGURE 4-12
Posted Speed Limit & 85th Percentile Speed In Playground Zones

4.4.3 PARKING

Parking is permitted on all residential roadways within the study area. However, some of these roadways have parking restrictions for those not living on/near the street to ensure those living nearby have on-street parking within a short walk of their residence. Further, there are some parking restrictions and/or payment zones for the commercial areas including sections along 10 Street NW, 2 Avenue NW, Gladstone Road NW, 9 Street NW, 12 Street NW, 8 Avenue NW, and Kensington Road including some of its side streets between 14 Street NW and 10 Street NW. Additionally, there are several public parking lots, most of which are located in Hillhurst to support the higher density commercial land uses. **Figure 4-13** illustrates the parking permissions and restrictions in the study area.



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Legend

- School Parking Zones
- Time Restricted Public Parking Zone
- Access Calgary Loading Zone
- Handicapped Zone
- Loading Zone
- Paid Parking Zone
- Taxi Zone
- Valet Parking Zone
- Motorcycle Zone
- Parking Lots
- Attraction
- Community Centre
- Library
- Health Clinic/Care Centre
- School
- Place of Worship
- LRT Station
- LRT
- School
- Park
- Commercial
- Study Area

Calgary

Riley Communities Mobility Study

FIGURE 4-13

Parking

5.0 TRAFFIC CALMING MEASURES

Existing traffic calming measures in the Riley Communities include curb bulbs, bicycle lanes, reduce posted speed limits, partial and full closures, and centre medians. The measures are located throughout all communities with the most measures in the Hillhurst and Sunnyside communities.

A high-level review of vehicles speeds was completed along corridors where traffic calming measures were in place. This review excluded areas with closures in place. Speed data was not available to compare vehicle travel speeds prior to the implementation of the traffic calming measures. The following is a summary of the review by location (note that this review consists of data from before the 40km/h speed reduction was put in place):

- **2 Avenue NW (between 6 Street and 9 Street)**
  - Traffic Calming Measure: Centre medians.
  - Reported speeds: The 85th percentile speed varies between 39 km/h to 49 km/h. Higher speeds around the playground zone.
- **5/6 Avenue NW**
  - **10 Street to 14 Street**
    - Traffic calming measures: posted speed at 40 km/h, painted bicycle lanes, and curb bulbs.
    - Reported speeds: The 85th percentile speed is just below 50 km/h.
  - **14 Street to 19 Street**
    - Traffic calming measure: Painted bicycle lanes.
    - No speed data available.
  - **19 Street to Crowchild Trail**
    - Traffic Calming Measures: Curb bulbs, posted speed 50 km/h.
    - Reported speeds: The 85th percentile speed is 56 km/h to 57 km/h.
  - **West of Crowchild Trail**
    - no traffic calming measures, posted speed 50 km/h.
    - Reported speeds: The 85th percentile speed is 56 km/h to 58 km/h.
- **10 Street NW, north of 5 Avenue**
  - Traffic calming measure: Painted bicycle lane, posted speed 50km/h.
  - Reported speeds: The 85th percentile speed varies between 56 km/h to 62 km/h,
- **19 Street NW (between Kensington Road and 5 Avenue)**
  - Traffic calming measures: curb bulbs and sharrows, posted speed 50km/h.
  - Reported speeds: The 85th percentile speed varies between 51 km/h to 52 km/h. Speed increases north of this segment from 55 km/h to 60 km/h.

These traffic calming measures may not be as effective on collector roadways due to no vertical deflection measures being used and the need to accommodate larger vehicles at intersections (vehicle with large turning radii).

Additional traffic calming measures around playground zones and on the streets leading to playground zones would be beneficial. Several connecting residential streets should also be considered for traffic calming measures. While these corridors do not exceed the previously posted 50 km/h speed limit, there may be some violators of the new limit (40km/h) since the 50km/h speed limit conditions had 85th percentile speeds over 45 km/h and 50 km/h in various locations. These corridors include 14 Avenue NW (west of 19 Street), 12 Avenue NW, Bowness Road NW, and 16 Street NW.

6.0 SAFETY REVIEW

6.1 PLANNING LEVEL SAFETY REVIEW

A planning level safety review of the corridors and intersections within the study area was completed using the City's historic traffic and collision data from 2016 – 2021. This data helped to gain an understanding of the types of exposures and interactions that are most associated with collisions within the study area. A field visit was also completed to observe the road user behaviour, identify related contributing factors, and record site conditions that could warrant repairs or improvements. For the detailed report, refer to **Appendix A**.

6.1.1 OVERALL COLLISION TRENDS

The data showed a consistent trend of approximately 1,000 collisions per year from 2016 to 2019 with an average of 5.4% of collisions resulting in an injury or fatality. Collision frequencies declined in 2020 and 2021, likely due to the impacts from the COVID-19 pandemic on travel patterns. During this period, the data showed a slight increase in injury/fatal collisions (6.3%). Injury and fatal collisions represented 5.5% and 0.1% of all collisions, respectively.

Most collisions (80%) occurred at intersections (20% occurred at midblock), most collisions (65.6%) occurred under dry conditions, and most collisions (80%) occurred during clear environmental conditions. A total of 51 collisions involved people walking and 38 involved people cycling. The collisions involving people walking and bicycling represented a significant proportion of all injury and fatal collisions: 18% of all injury collisions and 40% of all fatal collisions involved people walking, 3% of all injury collisions and 0% of all fatal collisions involved people bicycling.

Locations with multiple collisions involving people walking and/or bicycling included the following:

- Kensington Road NW and 14 Street NW
- 6 Avenue NW and 19 Street
- Parkdale Avenue NW and 27 Street NW
- 19 Street NW and 7 Avenue NW
- 19 Street NW and 12 Avenue NW
- 19 Street NW and Kensington Road NW
- 14 Street, north of Kensington Road NW (midblock)

6.1.2 GEOSPATIAL ANALYSIS

The geospatial analysis provided several heat maps that helped to identify collision hotspots. The following provides a summary of the conclusions that can be drawn from these heat maps.

Five corridors experienced the highest collision frequency:

1. Crowchild Trail NW from Kensington Road NW to 5 Avenue NW;
2. Kensington Road NW from 14 Street NW to 10 Street NW;
3. 10 Street NW from Kensington Road NW to 5 Avenue NW/4 Avenue NW;
4. 14 Street NW from 5 Avenue NW to 8 Avenue NW; and
5. 19 Street NW from 16 Avenue 14 Avenue NW.

These locations coincide with the locations of the injury and fatal collisions recorded within the study area. It should be noted that these corridors are all high-volume roadways compared with the other

roads in the study area. Thus, the number of collisions cannot be the only factor when prioritizing countermeasures.

Three areas with a higher number of collisions involving pedestrians were identified:

1. 10 Street NW between 5 Avenue NW and Kensington Road NW. This roadway is a highly commercial area with high pedestrian demand;
2. Kensington Road between 14 Street NW and 10 Street NW. This is also a commercial area with high pedestrian demand; and
3. On 16 Avenue NW and 14 Avenue NW, near 19 Street NW. This area is near Lions Park LRT Station and North Hill Mall, which also results in high pedestrian traffic.

Three corridors with a higher number of collisions involving cyclists were identified:

1. Kensington Road NW from 16 Street NW to 12 Street NW;
2. 14 Street NW between from Kensington Road NW to Gladstone Road NW; and
3. 10 Street NW between 5 Avenue NW and 3 Avenue NW.

Of the above three corridors with a higher number of collisions involving cyclists, only 10 Street NW has on-street cycling facilities. No bicycle facilities are provided on the other two corridors.

6.1.3 NETWORK SCREENING

Network screening was completed to identify and rank higher collision risk locations where a reduction in collision frequency with remedial actions could be achieved. This process can help to determined where mitigation measures will be the most effective. The Method of Moments was used for the Network Screening process. This method considered collision types (fatal, injury, property damage only) to rank locations.

The following intersections were identified as the top ten signalized intersections for potential improvements (listed in order of most potential for improvement to least):

1. Crowchild Trail NW and Kensington Road NW
2. Crowchild Trail NW and 5 Avenue NW
3. Memorial Drive NW and 10 Street NW
4. 14 Avenue NW and 14 Street NW (west intersection)
5. Kensington Road NW and 14 Street NW
6. Kensington Road NW and 10 Street NW
7. 16 Avenue NW and 19 Street NW
8. 14 Street NW and 6 Avenue NW
9. Kensington Road NW and 19 Street NW
10. 16 Avenue NW and 17 Street NW

The following intersections were identified as the top ten unsignalized intersections for potential improvements (listed in order of most potential for improvement to least):

1. Memorial Drive NW and 5 Street NW
2. 8 Avenue NW and 14 Street NW
3. Crowchild Trail NW and 2 Avenue NW
4. Memorial Drive NW and 5A Street NW
5. Memorial Drive NW and 19 Street NW
6. Kensington Road NW and 11 Street NW
7. 13 Avenue NW and 16A Street NW

8. Gladstone Road NW and 14 Street NW
9. Kensington Road NW and 13 Street NW
10. Memorial Drive NW and 10A Street NW

Out of these intersections, 11 are along the corridors identified as hotspots in the geospatial analysis, six intersections are along Kensington Road and five are along Memorial Drive.

6.1.4 ISSUES AND RECOMMENDATIONS

A desktop review and field investigation of the study area were conducted to help understand existing issues and potential countermeasures. While the top 20 identified locations for improvements were investigated during the analysis, other safety risks throughout the study area were also examined.

The following provides a summary of the issues and countermeasures identified. These will be further considered during Phase 2 of the Mobility Plan. For more detailed information and specific examples, refer to **Appendix A.**

Key Safety Issues

- Wide roads that were built before the current guidelines were established (greatly exceeding the minimum roadway width specified in the Design Guidelines for Subdivision Servicing – 2020).
    - Countermeasures: implement design features that narrow the width of the road such as curb extensions, chicanes, raised median islands and cycling facilities.
- Wide accesses/intersections, especially where minor roads intersect with higher order roadways.
    - Countermeasures: curb extensions, provision of stop bars and centrelines.
- Obstructed sightlines at several study area intersections.
    - Countermeasures: trim, relocate or remove vegetation or obstructions within the sight triangles, provide curb extensions.
- Large corner radii at intersections (creating high right-turn speeds).
    - Countermeasures: Where curb radius exceeds minimum requirements, curb radius should be reduced through pavement markings or truck aprons.
- Large right-turn channel Radii and width (results in higher turn speeds).
    - Countermeasures: Reduce widths of right-turn channels by conversion to smart channels. The conversion causes right-turning drivers to be more perpendicular with the intersection roadway and pedestrian crosswalks, slowing motorists and improving the visibility of pedestrians to motorists.
- Skewed intersections (result in restricted visibility).
    - Countermeasures: A historical collision review along the Gladstone corridor did not conclude that the skew of the intersections is causing safety issues. However, the City should regularly trim vegetation along the corridor to ensure clear sight lines are maintained.
- Conflicts at unsignalized controlled [pedestrian] crossings on wide roadways with high operating speeds (result in lower compliance of motorists with the control system – such as pedestrian crossing signs - exposing pedestrians to conflicts).
    - Countermeasures: providing controlled [pedestrian] crossings at stop-controlled intersections along with traffic calming measures that improve compliance of motorists (ex. Curb extensions).
- Lack of crosswalk visibility (faded crossings at intersections and minimal crosswalk markings).

    - Countermeasures: repaint crosswalk markings and consider ladder type crossings at locations with high pedestrian demand, and locations near schools and community centres.
- Lack of pedestrian connections at future bus zones.
    - Countermeasures: review potential pedestrian desire lines at future bus zones and ensure they are accommodated with designated crossing facilities. Provide sidewalks or concrete pads to ensure an appropriate waiting place for transit users.
- Several tripping hazards on sidewalks within study area.
    - Countermeasures: mark, grind, or ramp the height differential, resurface the pavement, or remove tripping hazard.
- Discontinuous cycling facilities.
    - Countermeasures: extend the facility to connect to existing facilities, provide appropriate signage to indicate the facilities are ending, and/or place sharrow markings in the centre of the traffic lane to reinforce cyclist right-of-way and encourage cyclists to “take the lane”.
- Faded, obstructed or missing cyclist markings (along roadway and near intersections).
    - Countermeasures: regularly review conditions of pavement markings for wheeling facilities and reapply paint when needed. Add delineated bicycle facilities at potential conflict areas with dashed cyclist green pavement markings through intersections and in right-turn channels.
- Obstructed wheeling facilities (ex. transit bench in wheeling path).
    - Countermeasures: relocate obstructions where they do not encroach on the bicycle path.
- Misaligned wheeling lanes (ex. Westbound wheeling lanes at 14 Street and 6 Avenue NW).
    - Add pavement markings through the intersection outlining the path for cyclists.
- Missing tactile plates at curb ramps.
    - Countermeasures: add tactile plates at all curb ramps
- Missing pedestrian countdown timers.
    - Countermeasures: add pedestrian countdown timers at 14 Avenue NW and 19 Street NW.
- Curb ramps do not align with crosswalk markings.
    - Countermeasures: Relocate curb ramps to better align with centre of the crosswalk, or modify width of crosswalk to better align with curb ramp.
- Obstructed sidewalks (resulting in less than 1.5m of clear space).
    - Countermeasures: remove or relocate obstructions that are located in the pedestrian clear zone.
- Too many signs (information overload).
    - Countermeasures: remove and/or spread signs to provide motorists with more time to read and comprehend the information on the signs.

Location Specific Issues

As part of the full planning level safety review, field investigations were completed at ten intersections within the study area. The selection of locations for detailed field investigations considered the following factors:

- Location received a high ranking in the network screening analysis.
- Location had a higher number of collisions involving pedestrians and cyclists.
- Geographical distribution of sites across the study area.

The full report (**Appendix A**) provides safety issues, potential countermeasures and impacts of the countermeasures at each intersection. Note that some of these intersections have been reviewed in more detail through the video-based conflict analysis which is summarized in **Section 6.2**. For these intersections, only new information, not highlighted in the video-based conflict analysis, is provided.

The following is a summary of the recommended countermeasures from the Planning-level Safety Review for the ten intersections examined during the field investigations.

11. **Crowchild Trail NW and Kensington Road NW** (it is noted that this intersection will be updated as part of the medium and long-term improvements for Crowchild Trail. These recommendations should be considered when revisiting the project during these stages):
    - Reduce width of right turn channels or consider elimination of the right-turn channels.
        - If right-turn channels are removed, provide crossride on south leg.
    - Consider converting right-turn channel on southbound approach to a smart channel.
    - Extend median on north leg to be closer to the crosswalk.
    - Consider median nose extensions on the northbound and southbound approaches (as a temporary measure, the City could install rubber bumps as a centreline hardening measure).
    - Relocate transit bench so that it does not impede on the bicycling facility (southwest corner).
    - Explore expansion of the wheeling network so that wheeling facilities aren't disconnected.
    - Install "Cyclists Dismount" signage on the southwest corner.
    - Remove empty pole mount at northwest corner of north sidewalk.
    - Trim vegetation to provide clear view of speed limit sign (west of intersection).
    - Add ladder markings in crosswalks.
12. **14 Avenue NW and 14 Street NW (also reviewed in Section 6.2):**
    - Add transit vehicle pre-emption on southbound traffic signal.
    - Remove one westbound though lane to maintain the cross-section of adjacent roadway segments.
    - Add roadway edge pavement marking for eastbound right-turn channel.
    - Relocate crosswalk obstructions – "Look both ways for train" signs and railings – at the eastbound right-turn channel (south side) to ensure crosswalks are visible to motorists.
    - Realign crosswalk on the southeast and northeast corners to align with curb ramps.
    - Install "Cyclists dismount" signage on the southwest corner.
13. **10 Street NW and Memorial Drive NW:**
    - Modify signals between Memorial Drive and Kensington Road to improve progression between intersections and reduce weaving maneuvers.
    - Reduce curb radius on SW corner.
    - Modify westbound right-turn channel from two lanes to one lane or consider providing a dedicated signal phase for the movement.
    - Convert northbound right-turn channel to a smart channel or reduce existing lane width.
    - Explore expansion of the wheeling network on 10 Street to connect with existing facilities north of 3 Avenue.
    - Provide a curb ramp for the north and west crosswalks.
    - Add ladder markings in all crosswalks.
    - Add yellow tactile plates at corners that do not have them.
14. **14 Street NW and Kensington Road NW:**
    - Implement leading pedestrian intervals on eastbound and westbound approaches.

- Reduce curb radius of northwest, northeast, and southwest corners with pavement markings or truck aprons.
- Extend median closer to crosswalk at north and south legs (temporary measure – install rubber bumps as a centreline hardening measure).
- Remove private property accesses close to intersections.
- Explore expansion of wheeling network along Kensington Road.
- Re-paint stop bar at eastbound approach.
- Assess lighting conditions and consider improvements.
- Provide separate curb ramps for each crosswalk.
- Add ladder markings in crosswalks.
- Add yellow tactile plates at corners that do not have them.

15. **16 Avenue NW and 19 Street NW:**
    - Reduce width of northbound right-turn channel.
    - Consider eliminating right-turn channels.
    - Relocate eastbound stop bar closer to the crosswalk. Could also extend median into crosswalk (temporary measure – install rubber bumps as a centreline hardening measure).
    - Extend red pavement further east, to the end of the bus bay (eastbound curb lane, east leg).
    - Assess lighting conditions and consider improvements.
    - Relocate push buttons closer to crosswalks.
    - Add yellow tactile plates at corners that do not have them.
16. **19 Street NW and Kensington Road NW:**
    - Provide better clarity on lane drop for the southbound movement – there are two through lanes at the approach and only one, wide, receiving lane.
    - Review streetlight power source/light bulbs (streetlights were not illuminated during site visit).
    - Relocate bus stop closer to intersection to prevent midblock crossings.
    - Remove fencing that obstructs sightlines of the southbound motorists looking east (left).
17. **19 Street NW and 12 Avenue NW:**
    - Review streetlight power source/light bulbs (streetlights were not illuminated during site visit).
    - On 19 Street, implement on-street wheeling lanes.
    - Provide curb extensions on northwest and southwest corners.
    - Trim vegetation to improve sightlines for eastbound motorists looking north.
    - Add separate curb ramps for each crosswalk.
    - Add yellow tactile plates at corners that do not have them.
18. **14 Street NW and 8 Avenue NW:**
    - Implement curb extensions at intersection.
    - To reduce the road width of 8 Avenue, implement road diet.
    - Add yellow tactile plates on all corners that do not have them.
    - Provide pavement markings and stop bars on the eastbound and westbound approaches.
    - Conduct a detailed safety review of the intersection
        - Potential countermeasures that could be determined form the review:
            - Convert east and west legs to right-in right-out accesses.
            - Make 8 Avenue west of 14 Street one-way westbound
            - Make 8 Avenue east of 14 Street one-way eastbound
19. **11 Street NW/Kensington Crescent NW and Kensington Road NW:**

- Provide curb extension at the southeast corner for pedestrians crossing east-west on the south leg.
- Provide a crosswalk with ladder markings on the south leg (south crosswalk).
- Reduce the curb radius at the northeast corner.
- Add ladder markings in the crosswalk on the west leg.
- Provide RRFB on the west crosswalk.
- Provide curb extensions on Kensington Road at the west crosswalk.

20. **19 Street NW and 7 Avenue NW/8 Avenue NW (also reviewed in Section 6.2):**
    - Consider implementing wheeling facilities on 19 Street.
        - In the southbound direction from 12 Avenue NW to 5 Avenue NW.
        - In the northbound direction from 8 Avenue NW to 6 Avenue NW.
    - Add crosswalks with ladder style pavement markings on the west, east and south legs.
    - Install overhead flashing pedestrian signal or install RRFB on south leg.
    - Provide curb extensions on east leg.
    - Assess and consider improving lighting conditions for the south crosswalk.
    - Trim vegetation on the southeast side of the intersection and relocate street light pole to improve visibility of pedestrians to motorists.

6.2 VIDEO BASED CONFLICT ANALYSIS SUMMARY

Five intersections were selected from the study area to conduct more detailed safety analysis. These intersections were chosen based on collision data, observations from site visits and overall potential for improvement.

Conflict analysis data, vehicular speed data, and traffic volume data were collected at the following intersections:

- 18 Street and 6 Avenue NW
- 14 Street and 6 Avenue NW/5 Avenue NW
- 14 Street and 14 Avenue NW
- 19 Street and 6 Avenue NW/5 Avenue NW
- 19 Street and 14 Avenue NW

All data was collected for 72 hours. **Figure 6-1** illustrates the locations of these study intersections.

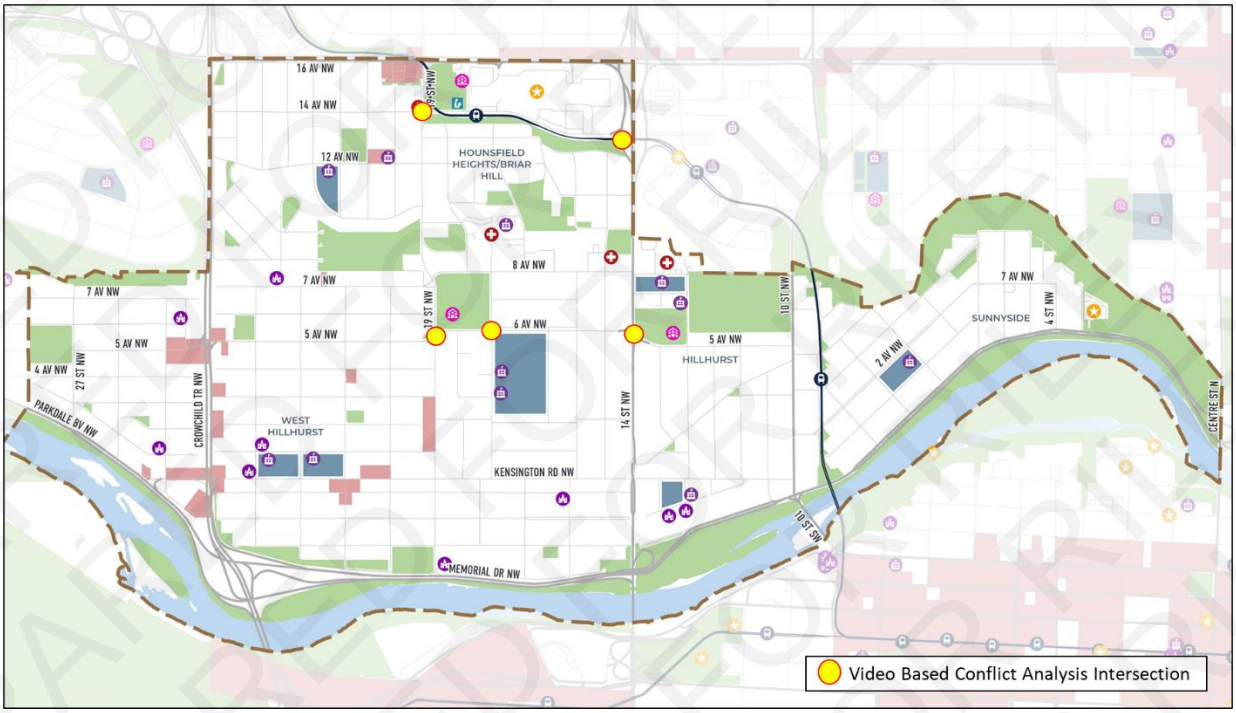


Figure 6-1: Video Based Conflict Analysis Intersections

Table 6-1 and **Table 6-2** provide a summary of the conflict analysis data for the five intersections. The subsections following the tables provide summaries of the safety assessments conducted using this data for each intersection. Full reports are provided in **Appendix B**.

Table 6-1: Summary of Frequency of Conflicts at Study Intersections

Conflict Type		18 St and 6 Ave NW		19 St and 6 Ave NW		14 St and 14 Ave NW		19 St and 14 Ave NW		14 St and 6 Ave NW	
		Frequency	Location	Frequency	Location	Frequency	Location	Frequency	Location	Frequency	Location
Conflicts with VRUs	Highest Frequency of conflicts at crosswalks	65	east crosswalk	117	west crosswalk	7	west crosswalk	107	south crosswalk	44	south crosswalk
	Highest Frequency of conflicts with VRUs per conflict type	59	though movements	129	right turns	5	through movements	126	right turns	24	through movements
	Highest Frequency of conflicts between right-turning vehicles and VRUs	13	north crosswalk SBRT	108	SBRT west crosswalk	2	SBRT west crosswalk	42	NBRT east crosswalk	4	NBRT east crosswalk
	Highest Frequency of conflicts between left turning vehicles and VRUs	5	north crosswalk EBLT	15	SBLT east crosswalk	0	-	65	WBLT south crosswalk	18	WBLT south crosswalk
	Highest Frequency of conflicts between through vehicles and VRUs	35	east crosswalk EBT	4	SBT south crosswalk	4	WBT west crosswalk	11	SBT north crosswalk	22	SBT south crosswalk
Vehicle-Vehicle Conflicts	Highest Frequency of conflicts with left turning traffic	51	NBLT with SBT	268	EBLT with WBT	19	WBLT with EBT	357	SBLT with NBT	225	NBLT with SBT[2]
	Highest Frequency of angle conflicts	96	SBT with EBT	10	SBT with EBT[1]	31	SBT with WBT	5	SBT with WBT	8	NBT with WBT
	Highest Frequency of conflicts with right turning traffic	43	NBRT with EBT	77	SBRT with WBT	4	SBRT with WBT	26	EBRT with SBT	50	WBRT with NBT[3]

[1]Potential false positives

[2]SBLT with NBT had a similar frequency

[3]SBRT were not captured

Table 6-2: Summary of Conflict Speeds at Study Intersections

Conflict Type		18 St and 6 Ave NW		19 St and 6 Ave NW		14 St and 14 Ave NW		19 St and 14 Ave NW		14 St and 6 Ave NW	
		Speed (km/h)	Location	Speed (km/h)	Location	Speed (km/h)	Location	Speed (km/h)	Location	Speed (km/h)	Location
Conflicts with VRUs	Highest vehicle speed for the conflicts between right turning traffic and VRUs	23.82	WBRT north crosswalk	23.18	NBRT east crosswalk	29.31	SBRT west crosswalk[1]	19.83	NBRT east crosswalk[2]	25.08	NBRT east crosswalk
	Highest vehicle speed for the conflicts between left turning traffic and VRUs	43.04	NBLT west crosswalk	22.46	EBLT north crosswalk	0	-	26.45	SBLT east crosswalk	25.65	WBLT south crosswalk
Vehicle-Vehicle Conflicts	Highest 85th percentile speed per movement for the left turn conflicts (left turn speed)	42.42	NBLT with SBT	26.2	WBLT with EBT	21.07	WBLT with EBT	25.48	SBLT with NBT	27.61	EBLT with NBT
	Highest 85th percentile speed per movement for the angle conflicts	41.08	NBT with EBT (EB)	48.79	NBT with EBT (NB)	23.22	SBT with EBT	48.77	NBT with WBT (NB)	56.65	NBT with WBT (NB)
	Highest 85th percentile speed per movement for the right turn conflicts (right turn speed)	38.11	NBRT with EBT	22.95	NBRT with EBT	30.31	SBRT with WBT (WB)	21.26	NBRT with EBT	24.64	EBRT with SBT

[1]Only one conflict occurred

[2]WB right turn channel not assessed

6.2.1 18 STREET NW AND 6 AVENUE NW

The intersection of 6 Avenue NW and 18 Street NW is unsignalized with stop control on the north and south legs. There is a pedestrian crossover on the east leg of the intersection which provides a designated crossing facility for pedestrians. The intersection provides access to low-density residential homes, and two schools on the southeast corner of the intersection, and a park and community centre on the northwest corner. The intersection is in a playground zone meaning the posted speed limit between 7:30am and 9:00pm is 30 km/h. Outside of these times, the speed limit is 50km/h.

6 Avenue NW is a two-lane collector road with painted wheeling lanes. 18 Street NW is a two-lane residential road (one serving each direction) and has on-street parking. Sidewalks are provided on both sides of each roadway, except on the west side of 18 Street NW, north of 6 Avenue NW.

The peak morning hourly traffic occurred between 8:00 am and 9:00 am. The peak afternoon hourly volume was recorded between 3:15 pm and 4:15 pm. This aligns closely with bell times at Queen Elizabeth High School. **Figure 6-2** summarizes the peak hourly volumes of the intersection.

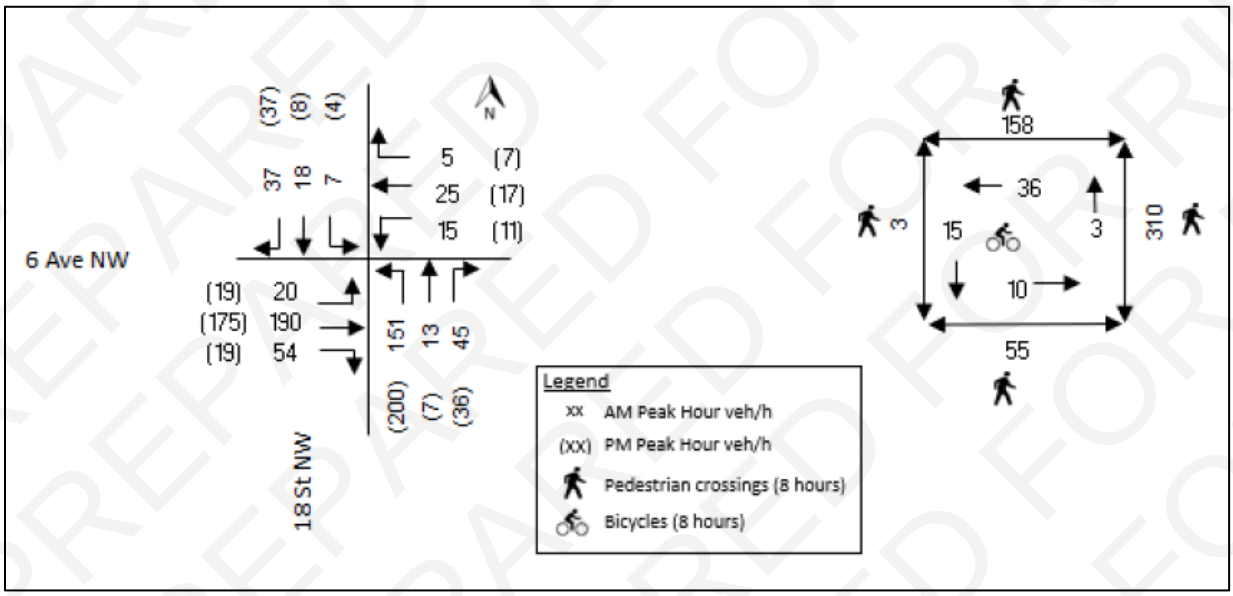


Figure 6-2: 18 Street and 6 Avenue NW Existing Traffic Volumes

The safety issues identified at the intersection include:

- Pedestrians crossing outside of crosswalks (especially on the west leg of the intersection).
- Right-turn (northbound) conflicts with vulnerable road users – vehicles not yielding to pedestrians when making a right turn. Potentially due to constrained sight distances caused by vegetation located on the private property on the southwest corner.
- Most northbound/southbound vehicles did not come to a complete stop.
- Sidewalk at northeast corner of the intersection does not align with north crosswalk.
- High right-turn speeds, especially at the eastbound and westbound approaches, due to the large effective radii (because of the parking lane and the adjacent parallel road).
- Left-turn conflicts with vulnerable road users – vehicles making left-turns while pedestrians are crossing.
- Low lighting levels on the northeast corner of the intersection.

The recommendations to potentially mitigate these concerns were outlined along with a suggested priority level. A higher priority level represents a higher conflict and/or liability risk and that the recommendation should be prioritized by the City. The following was suggested:

- Add crosswalk ladder markings to improve pedestrian visibility (lower priority).
- Realign curb cuts on the southwest and northwest corners of the intersection (lower priority).
- Consider installing a signalized intersection to better establish right-of-way (higher priority).
- Add curb extensions on the southwest and northwest corners to reduce the right-turn radius and thus reduce vehicle turning speeds (lower priority).
- Assess lighting conditions at the intersection to determine if improvements should be made (higher priority).

6.2.2 14 STREET NW AND 6 AVENUE NW/5 AVENUE NW

The intersection of 14 Street NW and 6 Avenue NW is signalized with pedestrian crosswalks on all 4 legs. 14 Street NW is a north-south 4-lane arterial road with a painted median. 6 Avenue is a local collector road with a dedicated, painted bicycle lane.

The posted speed limit through the intersection is 50 kilometres per hour (km/h). Adjacent land uses consist primarily of mixed-use residential developments with retail on the ground floor. Additionally, Hillhurst Sunnyside Park is located on the northeast corner.

The peak hours at this intersection occurred from 7:30 a.m. to 8:30 a.m. (morning peak hour), and from 4:30 p.m. to 5:30 p.m. (afternoon peak hour). This aligns with typical peak hours for an urban environment, with vehicle demand along 14 Street significantly higher compared to 6 Avenue. Most of the pedestrian volume was recorded on the south leg of the intersection. The intersection peak hour average volumes are summarized in **Figure 6-3**. Note that given the intersection geometry and the camera angle, the traffic volume and conflicts involving southbound right turn motorists could not be captured.

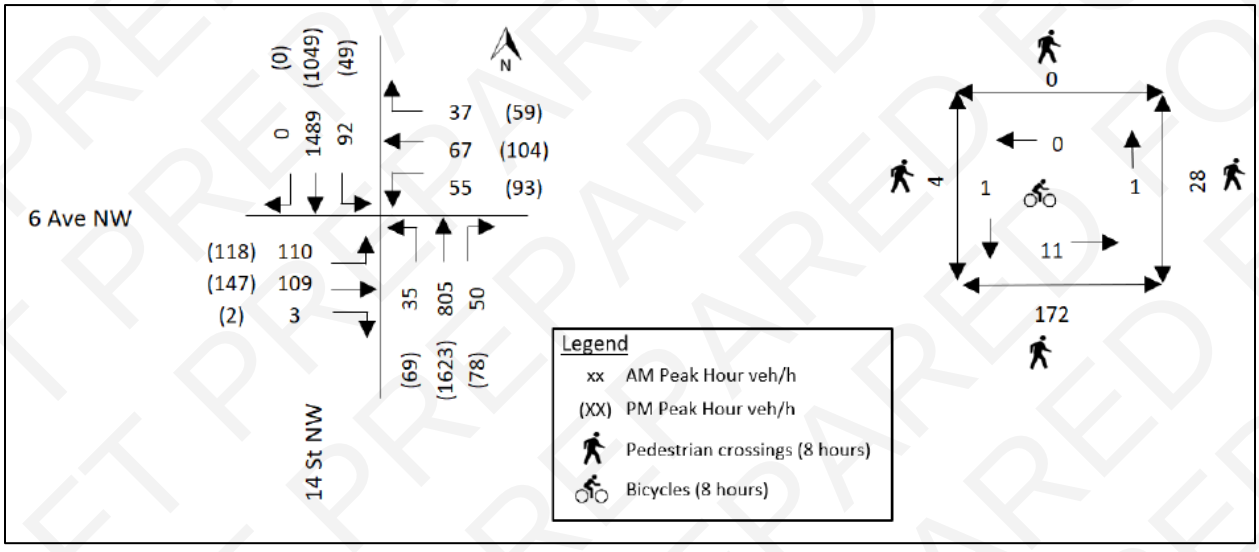


Figure 6-3: 14 Street NW and 6 Avenue NW/5 Avenue NW Existing Traffic Volumes

The safety issues identified at the intersection include:

- Westbound left-turn conflicts with vulnerable road users (all on the south crosswalk) due to the skewed configuration of the intersection.
- High frequency of conflicts with southbound through movements and VRUs on the south crosswalk.
- Lack of pedestrian visibility.
- High frequency of left-turn conflicts with through movements for northbound and southbound left-turning motorists.
- High frequency of westbound right-turn conflicts with northbound through movements.
- High right-turn speeds at right-turn channels (Northbound right turn).

The recommendations to potentially mitigate these concerns were outlined along with a suggested priority level. A higher priority level represents a higher conflict and/or liability risk and that the recommendation should be prioritized by the City. The following was suggested:

- Extend the bicycle lane pavement markings through the intersection to increase bicyclist visibility (higher priority).
- Paint ladder type crosswalks to increase pedestrian visibility (lower priority).
- Consider implementing and/or extending northbound and southbound protected left-turn phases (lower priority).
- Provide "smart channels" on the northwest and southeast corners to cause right-turning drivers to be more perpendicular with the intersection roadway and pedestrian crosswalks (lower priority).

6.2.3 14 STREET AND 14 AVENUE NW

The intersection of 14 Street NW and 14 Avenue NW is a signalized ramp terminal intersection. Pedestrian crosswalks are provided on the north, south, and west legs of the intersection. 14 Street NW is a north-south, one-way road with two southbound lanes. 14 Avenue NW is an east-west roadway with four lanes. Right turn channels are provided on both the northwest and southwest corners of the intersection.

There is an at-grade railway crossing for the CTrain (Red Line) immediately south of the intersection, with flashing lights and gates on the vehicular approaches. The posted speed limit through the intersection is 50 km/h. Adjacent land uses consist of North Hill Shopping Centre in the northwest corner, low-density residential in the southwest corner, and SAIT and Jubilee Auditorium to the east. A multi-use trail runs south of the rail corridor and connects to the south leg of 14 Street NW.

The peak morning and afternoon hourly traffic occurred at this intersection between 7:30 a.m. and 8:30 a.m. and 5:15 pm and 6:15 pm, respectively. The intersection peak hour average volumes are summarized in **Figure 6-4**. The pedestrian crossing volumes were relatively low and were only observed for the west crosswalk.

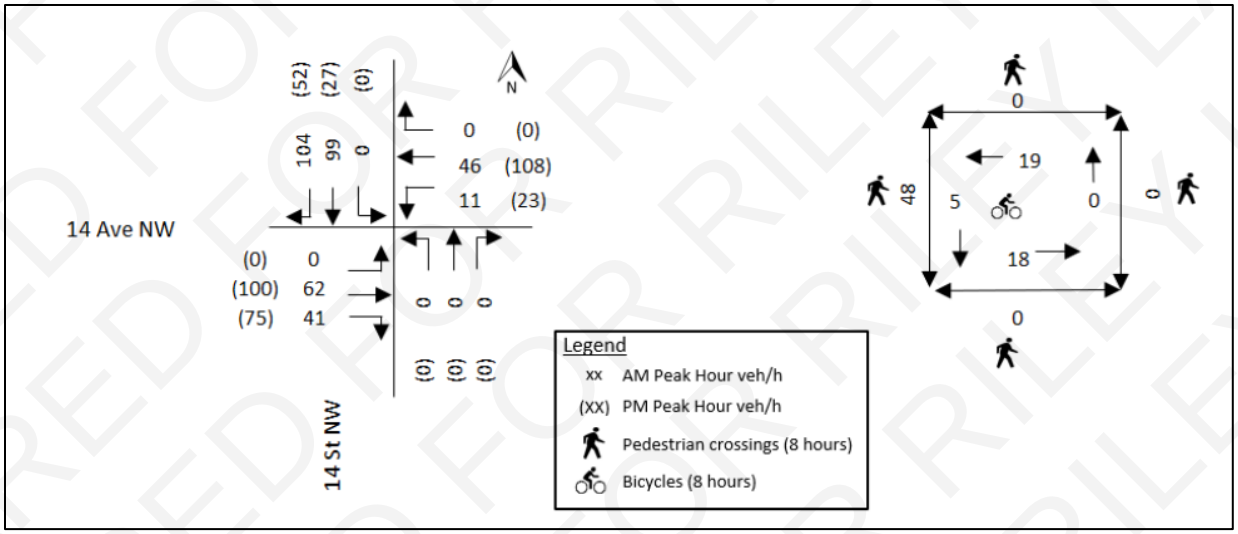


Figure 6-4: 14 Street NW and 14 Avenue NW (west intersection) Existing Traffic Volumes

The safety issues identified at the intersection include:

- Vulnerable road users disobeying pedestrian signals – only one instance recorded.
- Conflicts with vulnerable road users and right-turning traffic – only two instances recorded.
- High frequency angle conflicts between southbound through and westbound through movements (involving southbound motorist entering intersection late into the intergreen period before the subsequent east/west phase).
- Low lighting levels at all corners of the intersection.
- Lack of pedestrian accessibility at the southeast corner of the intersection.

The recommendations to potentially mitigate these concerns were outlined along with a suggested priority level. A higher priority level represents a higher conflict and/or liability risk and that the recommendation should be prioritized by the City. The following was suggested:

- Provide a "smart channel" for right-turning traffic at the northwest corner of the intersection (lower priority).
- Assess lighting conditions at the intersection (higher priority).
- Assess the curb cuts and sidewalks widths to determine if facilities are wide enough to accommodate people with mobility devices (higher priority).
- Install accessible pedestrian signals (APS) (higher priority).

6.2.4 19 STREET NW AND 6 AVENUE NW/5 AVENUE NW

The intersection of 5 and 6 Avenue NW and 19 Street NW is a four-leg signalized intersection with a skewed configuration. Right-turn channels are provided on both the eastbound and westbound approaches. 6 Avenue NW and 5 Avenue NW are two-lane collector roads that run east-west. 19 Street NW is a collector road that runs north-south.

The posted speed limit through the intersection is 50 kilometres/hour (km/h). Adjacent land uses consist of residential on all corners, except on the northeast corner where there is a community centre. On-street wheeling lanes are provided on 6 Avenue NW. On the west leg, the wheeling lanes are discontinued approximately 25 metres (m) west of 19 Street NW. Shared cycling facilities designated with sharrows are provided on 19 Street NW. Sidewalks are provided on each leg of the intersection.

The peak morning hourly traffic for the intersection of 5 & 6 Avenue NW and 19 Street NW intersection occurred between 8:15 a.m. to 9:15 a.m. The peak afternoon hourly volume was recorded between 4:15 p.m. to 5:15 p.m. **Figure 6-5** summarizes the peak hourly volumes of the intersection.

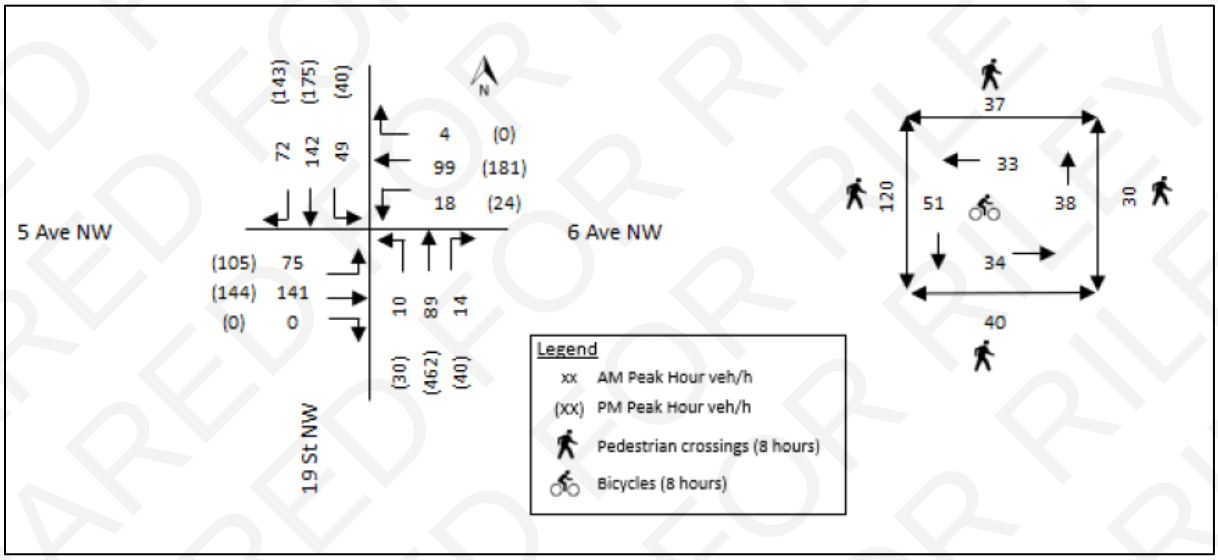


Figure 6-5: 19 Street NW and 6 Avenue NW/5 Avenue NW Existing Traffic Volumes

The safety issues identified at the intersection include:

- High frequency of southbound right-turn conflicts with vulnerable road users on the west crosswalk. Contributing factor is the limited visibility between motorists and pedestrians caused by vegetation, intersection skew and significant stop bar setback.
- Limited pedestrian visibility due to minimal crosswalk pavement markings that were also faded.
- High frequency of opposing left-turn conflicts identified primarily between westbound through traffic and eastbound left-turns. These conflicts occurred during the permissive eastbound left-turn phase.
- Substantial number of cyclists did not dismount to use the crosswalks (specific crosswalks not specified).

The recommendations to potentially mitigate these concerns were outlined along with a suggested priority level. A higher priority level represents a higher conflict and/or liability risk and that the recommendation should be prioritized by the City. The following was suggested:

- Paint ladder type crosswalks to increase visibility of pedestrians for motorists (lower priority).
- Install NO RIGHT TURN ON RED signs on the northbound and southbound approaches (higher priority).
- Consider a Leading Pedestrian Interval (LPI) at the intersection (higher priority).
- Review collision data at intersection to determine if there is a pattern of eastbound left-turn with westbound through collisions (lower priority).
- Extend the bicycle lane pavement markings through the intersection to increase visibility of bicyclists to motorists (higher priority).
- Assess the installation of bicycle facilities and consider marking the bicycle lanes through the intersection (lower priority).

6.2.5 19 STREET NW AND 14 AVENUE NW

The intersection of 19 Street NW and 14 Avenue NW is four-leg signalized intersection. In vicinity of the intersection, 19 Street NW runs north-south, and 14 Avenue NW runs east-west. The posted speed limit through the intersection is 50 kilometres/hour (km/h). Both 14 Avenue NW and 19 Street NW are collector roads.

There are sidewalks on both sides of 19 Street NW and on the west leg of 14 Avenue NW. On the east leg, a sidewalk is present on the north side and the south sidewalk transitions into a multi-use trail approximately 50 metres (m) east of 19 Street NW. A multi-use trail also connects to the south leg of the intersection. There is an at-grade railway crossing for the C-Train (Red Line) approximately 60 m east of 19 Street NW, with flashing lights and gates on the vehicular approaches.

The peak morning hourly traffic for the intersection of 19 Street NW and 14 Avenue NW occurred between 8:45 a.m. to 9:45 a.m. The peak afternoon hourly volume was recorded between 4:30 p.m. to 5:30 p.m. **Figure 6-6** summarizes the peak hourly volumes of the intersection. Note that given the intersection configuration and the camera orientation, the westbound right turning volumes could not be counted.

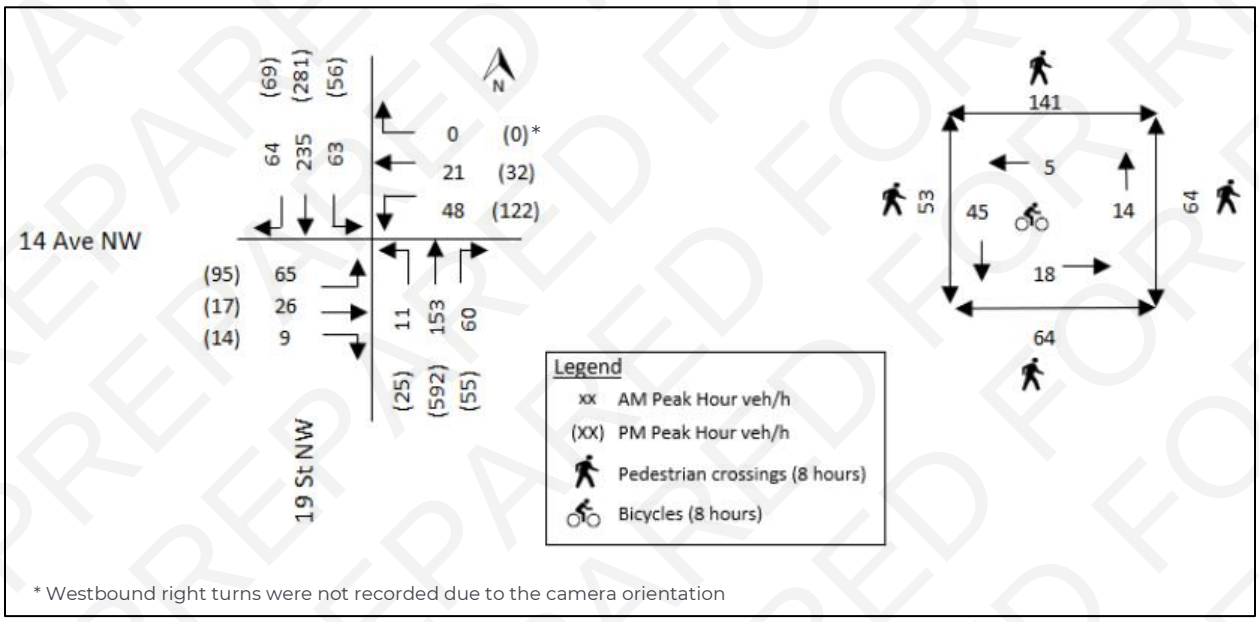


Figure 6-6: 19 Street NW and 14 Avenue NW Existing Traffic Volumes

The safety issues identified at the intersection include:

- High right turning speed for northbound right turning (and likely westbound right turning) motorists due to larger corner radius on the southeast corner (and northeast corner).
- High frequency of northbound right-turn conflicts with pedestrians on the east crosswalk.
- High frequency of southbound left-turn motorists and northbound through motorists during permissive left-turn phase. Also, the southbound left-turns were identified to have the highest left-turn speeds.
- Substantial number of cyclists did not dismount to use the crosswalks (specific crosswalks not specified).
- Pedestrian signals do not have timers to advise pedestrians how much time they have remaining to cross.

- Low lighting levels at the northeast and southeast corners of the intersection.

The recommendations to potentially mitigate these concerns were outlined along with a suggested priority level. A higher priority level represents a higher conflict and/or liability risk and that the recommendation should be prioritized by the City. The following was suggested:

- Consider reducing the corner radius on the southeast corner to less than 12.0m or installing a curb extension on the southeast corner (higher priority).
- Provide a "smart channel" on the northeast corner (higher priority).
- Consider a Leading Pedestrian Interval (LPI) at the intersection (higher priority).
- Review collision history to determine if there is a pattern of southbound left-turns with northbound through collisions. If so, implement southbound protected-only left-turn phases (lower priority).
- Install a left-turn calming measure on the east leg (ex. Median nose extension). This would result in slower turning speeds and better visibility of VRUs for motorists (lower priority).
- Assess the installation of bicycle facilities and consider marking the wheeling lanes through the intersection (lower priority).
- Assess the lighting conditions at the intersection (higher priority).

7.0 PUBLIC FEEDBACK SUMMARY

7.1.1 ENGAGEMENT EVENTS

Several engagement events have been held to gather feedback on existing concerns of residents and visitor of the Riley Communities and to gather feedback on potential improvements. The following engagement tactics were used as part of the Mobility Study for the Riley Communities Local Area Plan project:

- Two CA sessions (November 2022)
- One walking tour (November 2022)
- Riley Communities Open House in January (2023)
- Creation of a project email address – this email was used for the LAP and mobility-related feedback was collected for the Mobility Study.

The main themes from these events are summarized in the following subsection.

Further, past events from the Kensington Area Improvements projects gathered feedback from residents on similar topics. This input was also reviewed and included in the summary of what we heard themes in the following subsection.

7.1.2 WHAT WE HEARD THEMES

From the feedback gathered for the LAP project, the mobility-related key themes included the following:

- Desire for more traffic calming due to speeding, especially around schools
- Desire for wider sidewalks
- Concerns about lack of parking (especially in Hillhurst and Sunnyside)
- Concern about increased traffic due to new development
- Concerns about existing cycling facilities not being up to par in the area (specifically 5 Avenue NW/6 Avenue NW)

- 14 Street is uncomfortable for walking and cycling despite its Urban Boulevard classification

From the previous engagement conducted for the projects in the Riley Communities in the past, the following key themes were noted:

- Support for traffic calming.
- Hesitation for implementation of traffic circles (mostly due to potential disruption to cyclists and vehicles).
- Desire for reduced cut through traffic.
- Desire for a reduction in vehicle speeds.
- Desire for improved conditions for active modes.
- Desire for more seating and landscaping.
- Desire for improvements to be permanent and year-round (as opposed to seasonal).
- Desire for continuous active modes connections.
- Concerns over impact of improvements to traffic flow and parking
- Individuals questioning whether improvements are a good use of public funds.

It was noted that the engagement reporting provided on the City's website regarding the Riley Communities Improvement Projects did not quantify which projects received the most support.

Further, some spot-improvement requests were received. Some examples of these included:

- The crossing time provided to pedestrians at the signal crossing 14 Street at 7 Avenue is insufficient.
- Temporary patio sidewalk bypass on 9 Street NW at Vendome needs surface repair.
- At Sunnyside LRT station replace LRT gates with accessible design.

These requests were forwarded to the appropriate City departments for review.

8.0 NEXT STEPS

This background summary report has compiled studies, plans, policies and data for the Riley Communities area to provide the project team with a full understanding of the study area's existing conditions and planned improvements. This information will be used to inform the next steps of the project including the recommended network improvements and prioritization process.

The suggested network improvements may be determined based on:

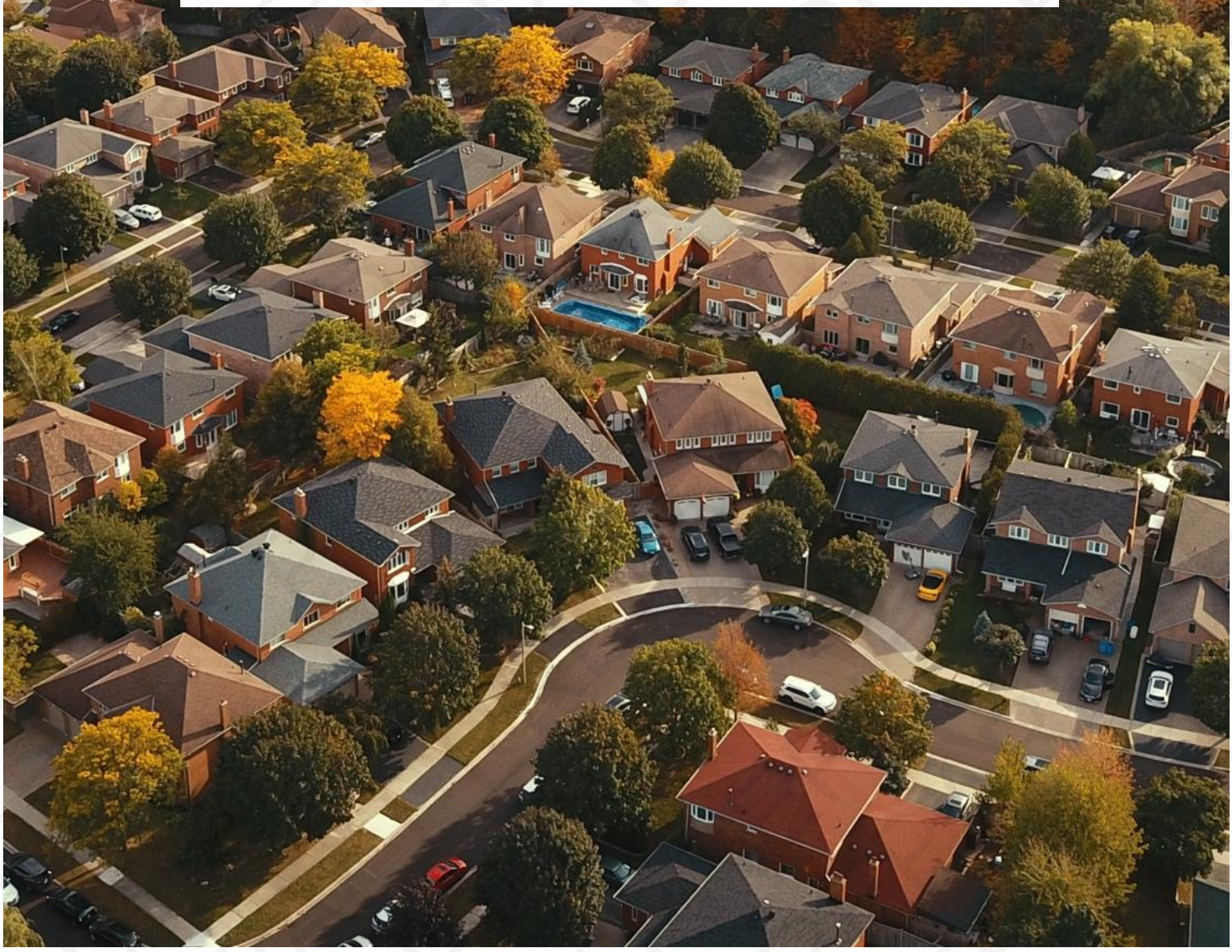
- Existing corridors that have additional capacity and could be modified to be more in line with City standards and guidelines.
- Identified efficiencies through already planned network improvements.
- Poor traffic operations.
- Gaps in the pedestrian and/or wheeling network.
- Collision hotspots.
- High vehicle-VRU and/or vehicle-vehicle conflict locations.
- Areas where speeding was identified as a potential issue through historical data, video-based conflict analysis or public engagement.
- Community priorities identified through engagement events.

Once the list of network improvements is established, projects will be assessed through a multiple accounts evaluation help with prioritizing the improvements. The criteria and considerations used in this evaluation will be confirmed through discussion with City staff and may be based on factors such as cost, community support, impact to vehicle traffic, connectivity to key destinations, safety, and/or comfort and accessibility of people walking and wheeling, among others.

APPENDIX A:

RILEY COMMUNITIES MOBILITY STUDY AND IMPROVEMENTS PLAN

TRAFFIC SAFETY DRAFT REPORT



RILEY COMMUNITIES MOBILITY STUDY AND IMPROVEMENTS PLAN

TRAFFIC SAFETY DRAFT REPORT

May 2023

TRUE NORTH SAFETY GROUP

RILEY COMMUNITIES MOBILITY STUDY AND IMPROVEMENTS PLAN – TRAFFIC SAFETY DRAFT REPORT

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May 2023

Version	Date	Comments
e01	September 19, 2022	Issued for review
e02	May 3, 2023	Final report

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1.0 INTRODUCTION

The City of Calgary retained the Urban Systems Team ('Urban Systems') to conduct the Riley Communities Mobility Study and Improvements Plan. True North Safety Group ('TNS') was retained to conduct a planning-level safety review of the intersections and roadways that are included within the study area. The purpose of the review was to identify safety issues and potential countermeasures to mitigate risks of collisions. In support of the City's Safer Mobility Plan, an emphasis has been placed on safety issues and conflicts involving vulnerable road users (e.g., pedestrians and cyclists).

TNS analyzed historic traffic and collision data from the past six years (2016-2021) to gain an understanding of the types of exposures and interactions that are most associated with collisions within the study area. Subsequently, our team conducted a field visit to the study area on August 24 and 25, 2022. The purpose of the field visit was to observe road user behavior, identify related contributing factors, and record site conditions that could warrant repairs or improvements.

This report is intended to summarize the findings of the road user safety review by providing an overview of the study area context, present findings of the collision review and field investigations, and present a list of safety issues and countermeasures.

1.1 Study Area

Riley Community is comprised of several smaller communities including Sunnyside, Hillhurst, West Hillhurst and Hounsfield Heights/Briar Hill. The area is roughly bounded by 16 Avenue NW and McHugh Bluff to the north, Memorial Drive NW and Parkdale Boulevard to the south, Centre Street N and 14 Street NW, and 28 Street NW and Crowchild Trail NW to the west. **Figure 1** shows a map of the study area boundary.

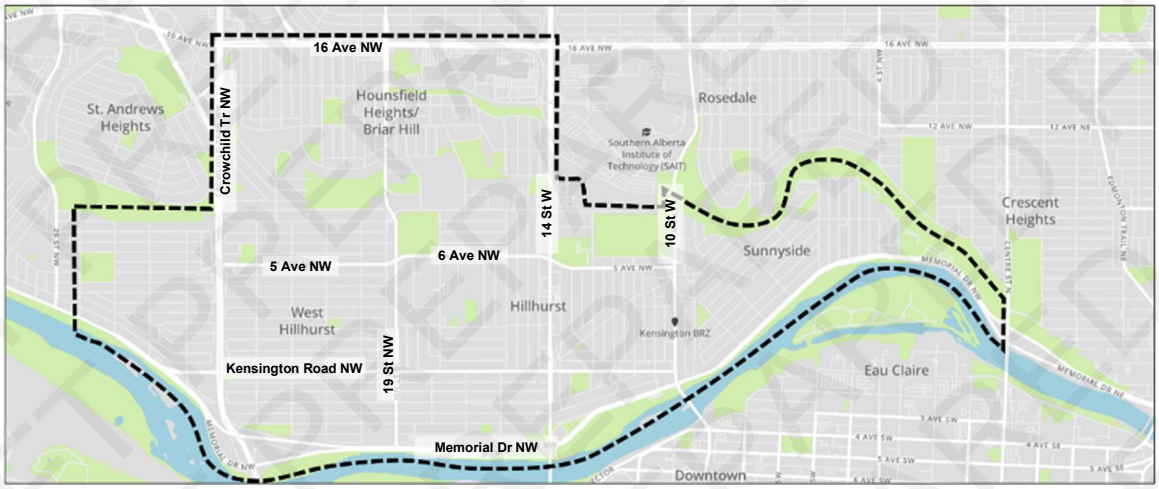


Image Source: data.calgary.ca

Figure 1: Study Area Map.

Based on the City's Land Use Districts map, the study area is primarily Residential – Low Density and Residential – Medium Density, with some Commercial Corridors to the east (i.e., 14 Street NW, 10 Street NW, and Kensington Road NW). In general, most residential developments in the low-density residential areas do not have driveways in the front yard – these residences rely on on-street parking and generally have garage access through back alleyways.

Traffic Volumes

The available Average Annual Weekday Traffic (AAWT) for roadways in the study area is shown in **Figure 2**. AAWT volumes are measured in vehicles per day (veh/day) and represent two-way volumes. The traffic data was collected in 2012 to 2022 and excluded data collected during COVID years.

Figure 2: Study Area Traffic Volumes (2012-2022).

Figure 2 shows that there are four major roadways within the study area, making a quadrilateral shape, which provide the main corridors for traffic movement, with collector roads branching off to provide access to residential streets.

Schools

There are a total of 11 schools within the study area, consisting of 3 early childcare services (ECS), 4 elementary schools, 3 junior high/high schools, 1 youth services centre. Schools serve as generators and destinations for vulnerable road users, especially school-aged children. There may also be students that walk or bike to school, which increases the number of pedestrians and cyclists on the road network surrounding schools. Pick-up/drop-off activity and traffic demand near schools significantly increases around bell times, which further increases the exposure to conflicts.

Figure 3 shows the locations of schools by type (e.g., elementary, junior high, senior high, etc.) within the study area.

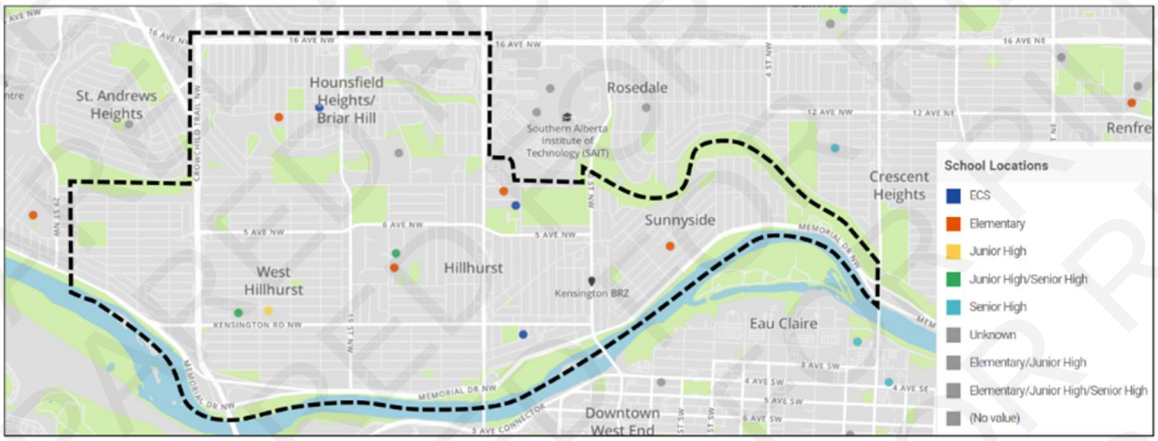


Image Source: data.calgary.ca

Figure 3: School Locations.

Transit

Riley Community is relatively well served by transit through a mix of surface transit routes and a light rail transit (LRT) route. The LRT (Red Line) has two stations within the study area (Sunnyside Station and Lions Park Station) and generally operates with headways between 5 to 15 minutes on weekdays. For surface transit, there is the MAX bus (Orange Line) which runs along 16 Avenue NW within the extent of the study area. There is a stop at North Hill (east of 16 Avenue NW and 17 Street NW). There are also 12 regular surface transit routes and 2 school routes that operate within the study area. A map of the transit routes is shown in **Figure 4**.

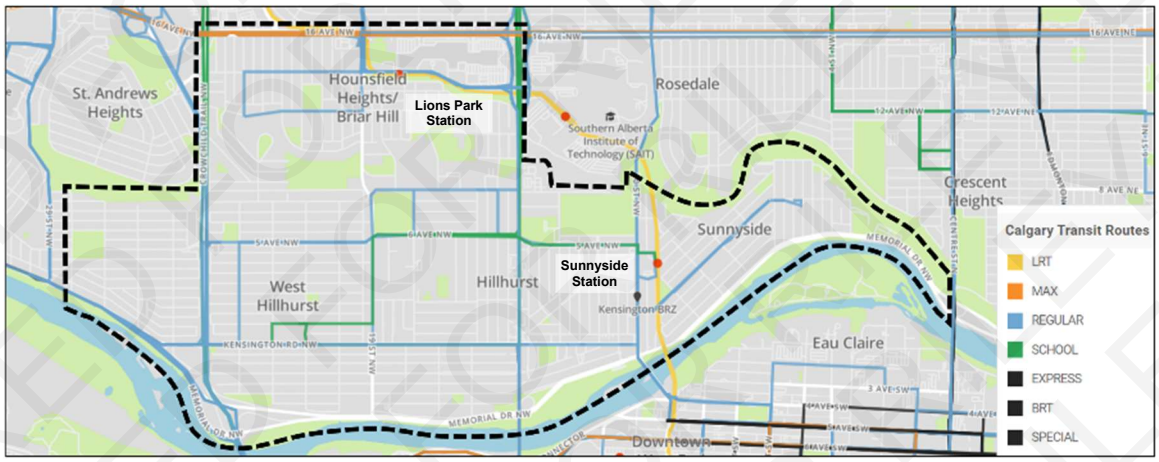


Image Source: data.calgary.ca

Figure 4: Transit Routes.

Cycling Facilities

There are several cycling facilities within the study area, ranging from off-street multi-use pathways to on-street bikeways. A brief description of each facility type is summarized below:

- Multi-use Path: an off-street facility reserved for cyclists and pedestrians. The Bow River Pathway is located south of Memorial Drive NW/Parkdale Boulevard and extends through the limits of the study area.
- Bicycle Lane: a designated cycling facility that is separated through pavement markings. There are bicycle lanes along parts of 5 Avenue/6 Avenue NW and 10 Street NW.
- Shared Lane: facilities where bicycles mix with general traffic. Sharrow markings are provided to remind motorists and cyclists that the road is to be shared between road users. There are shared lanes along parts of 5 Avenue NW and 19 Street NW.
- Neighbourhood Greenway: a cycling facility along roads with low vehicle volumes and speed limits. There may be physical measures implemented to reduce vehicle traffic and speeds on these roads. There are pavement markings that are used as wayfinding for cyclists and indicate the presence of cyclists to motorists.
- On-Street Bikeway: a cycling facility along quiet or residential roads that is only designated by signage.

Figure 5 shows the location and type of on-street bikeways present in the study area.

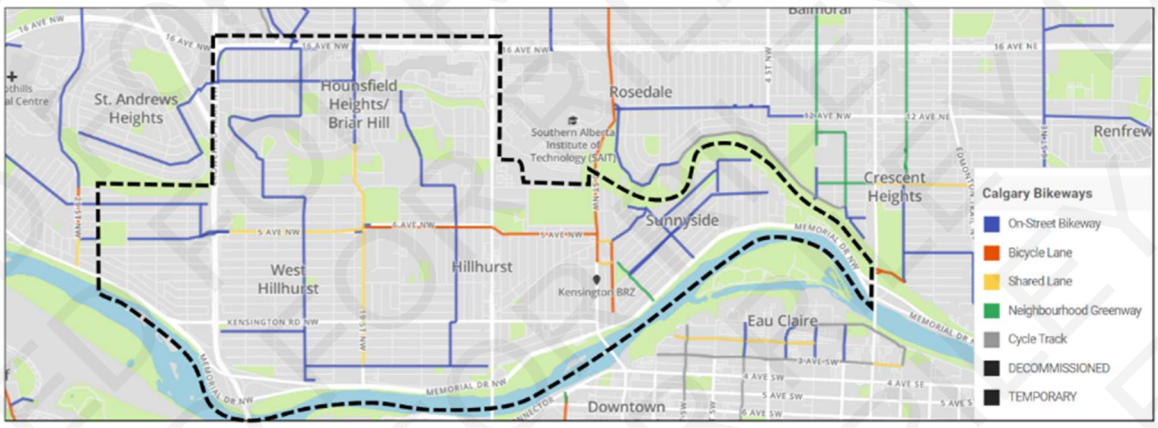


Figure 5: Cycling Facilities.

2.0 COLLISION REVIEW

Collision data for the study area intersections and road segments were obtained from the City. The City provided collision data for a six-year period between January 1, 2016, through December 31, 2021. A range of collision assessments were conducted using the City data, including:

- Descriptive analysis: assessment to understand the potential contributing factors to collisions that involve vulnerable road users (VRUs) and vehicles.
- Spatial analysis of collision data: geospatial analysis to determine the level of correlation between site specific characteristics and the collisions that involve VRUs and vehicles.
- Network screening: ranking of higher collision risk locations that is used to prioritize sites for the field investigation.

2.1 Overall Collision Trends

This section provides a descriptive analysis of the attributes in the collision databases we received from the City. The collision data included a limited number of attributes, including location (i.e., address and coordinates), date and time, severity, road surface condition, environmental condition and whether pedestrians or cyclists were involved. All the collisions were geocoded using ArcGIS and the associated intersection/ road segment was assigned to each collision. For VRU collisions, the direction of travel and impact type was extracted from the collision. Injury and fatal collisions represented 5.5% and 0.1% of all collisions respectively. **Figure 6** presents the frequency of all the collisions within the study area, by severity.

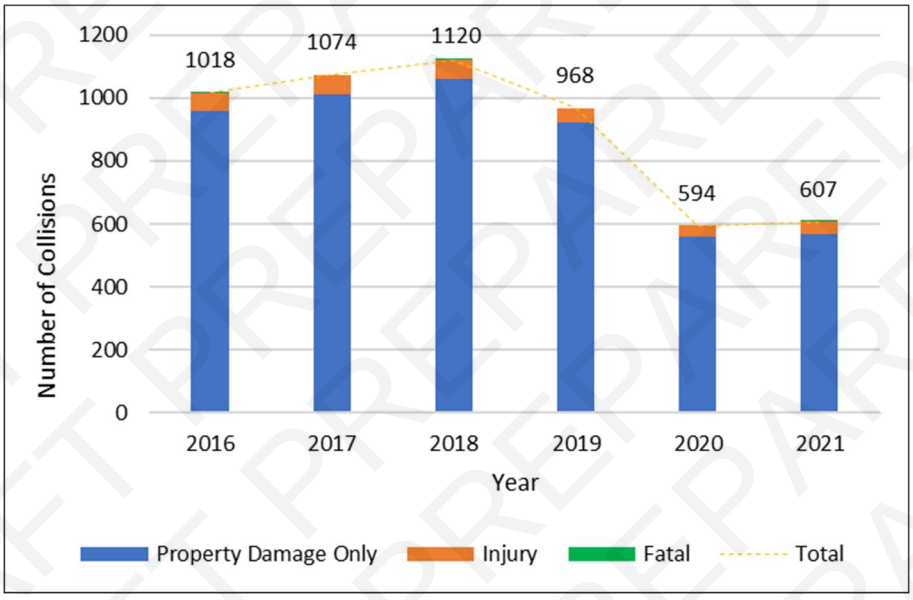


Figure 6: Collision Frequency by Severity (2016-2021).

Based on **Figure 6**, the following conclusions can be drawn:

- There is a consistent trend of approximately 1,000 collisions per year from 2016 to 2019 with an average of 5.4% of collisions resulting in an injury or fatality; and
- Collision frequencies significantly declined in 2020 and 2021, which is likely due to the impacts of the COVID-19 pandemic on travel patterns. During this period, there was an average of 6.3% of collisions that resulted in an injury or fatality.

Figure 7 shows that most collisions occurred at intersections as opposed to midblock locations.

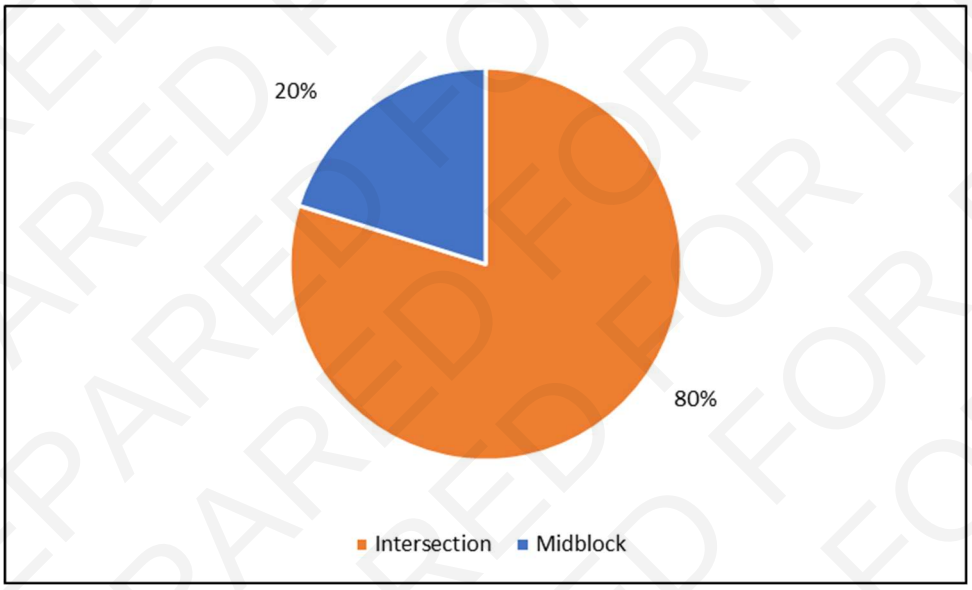


Figure 7: Collisions by Location (2016-2021).

Figure 8 shows the collisions by road surface condition.

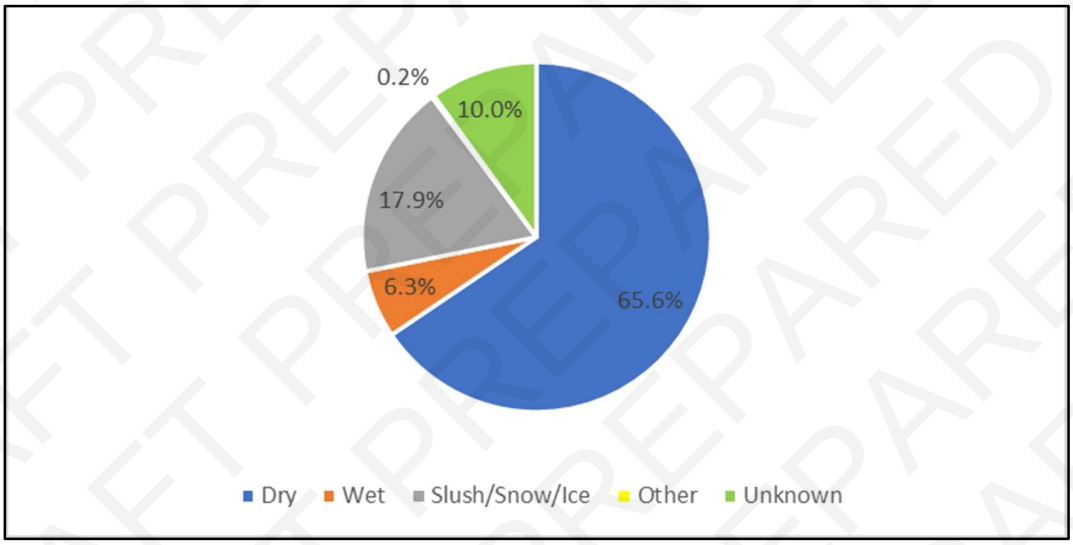


Figure 8: Collisions by Road Surface Condition (2016-2021).

Figure 8 shows that approximately 25% of all the collisions occurring on slush/snow/ice or wet conditions and 66% occurred on dry road surface conditions.

Figure 9 shows the collisions by environmental condition.

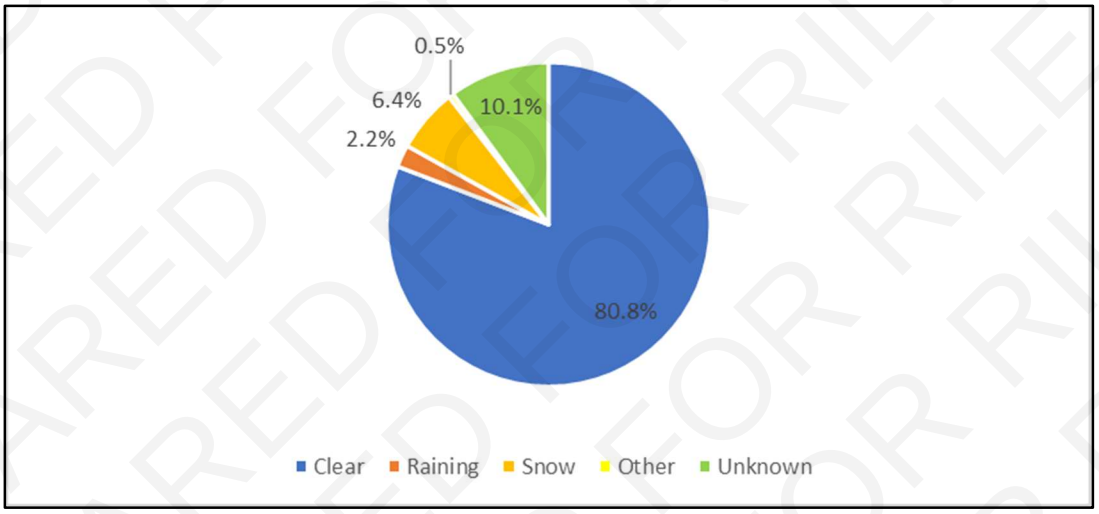


Figure 9 Collisions by Environmental Condition (2016-2021).

Figure 9 shows that over 80% of the collisions occur under clear environmental conditions, and less than 10% occur under rain and snow conditions.

2.2 Vulnerable Road User Collisions

During the study period, a total of 51 collisions involving pedestrians and 38 collisions involving people cycling occurred within the study area. These VRU collisions were reported at 41 of the intersections and 20 road segments.

Figure 10 shows that 71% of all VRU collisions were reported at intersections.

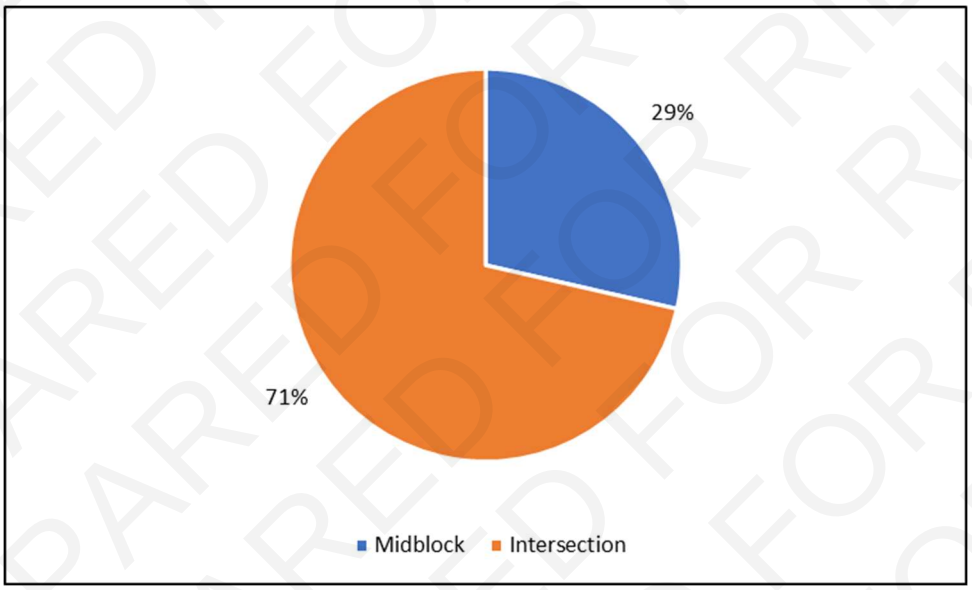


Figure 10: Pedestrian and Bicycle Collisions by Location (2016-2021).

Figure 11 shows the yearly distribution of collisions involving VRUs.

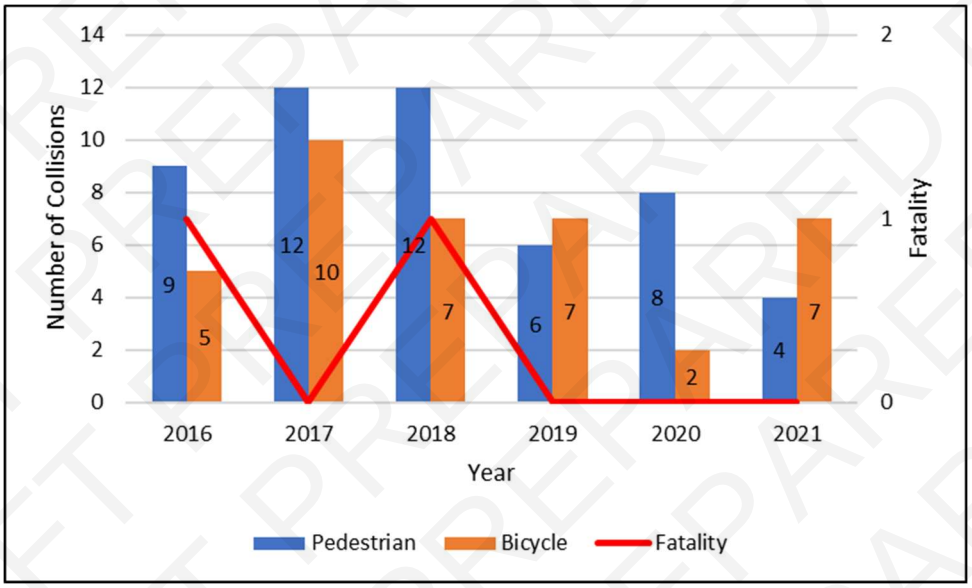


Figure 11: Pedestrian and Bicycle Collision Frequency (2016-2021).

Figure 11 shows a relatively high number of pedestrian and bicycle collisions within the study area, with the highest total of 22 in 2017 and the lowest total of 10 and 11 in 2020 and 2021, respectively. VRUs represented a significant proportion of all injury and fatal collisions:

- Pedestrians: 18% of all injury collisions and 40% of all fatal collisions
- Cyclists: 3% of all injury collisions and 0% of all fatal collisions

The sites where multiple VRU collisions were recorded are summarized in **Table 1**.

Table 1: Sites with multiple VRU collisions.

Sites	Pedestrian Collisions	Cyclist Collisions	Total
Kensington RD NW & 14 ST NW Intersection	6	2	8
6 AV NW & 19 ST Intersection	4	1	5
Parkdale AV NW & 27 ST NW Intersection	0	3	3
19 ST NW & 7 AV NW Intersection	0	3	3
19 ST NW & 12 AV NW Intersection	2	1	3
19 ST NW & Kensington RD NW Intersection	1	2	3
14 ST NW, North of Kensington RD NW Midblock	1	2	3

A detailed summary of the collisions involving VRUs is provided in **Appendix A**.

2.3 Geospatial Analysis

A geospatial analysis was conducted to visually determine the distribution of the vehicle-vehicle and VRU collisions within the study area. **Figure 12** shows the heatmap of all the collisions within the study area during the study period.

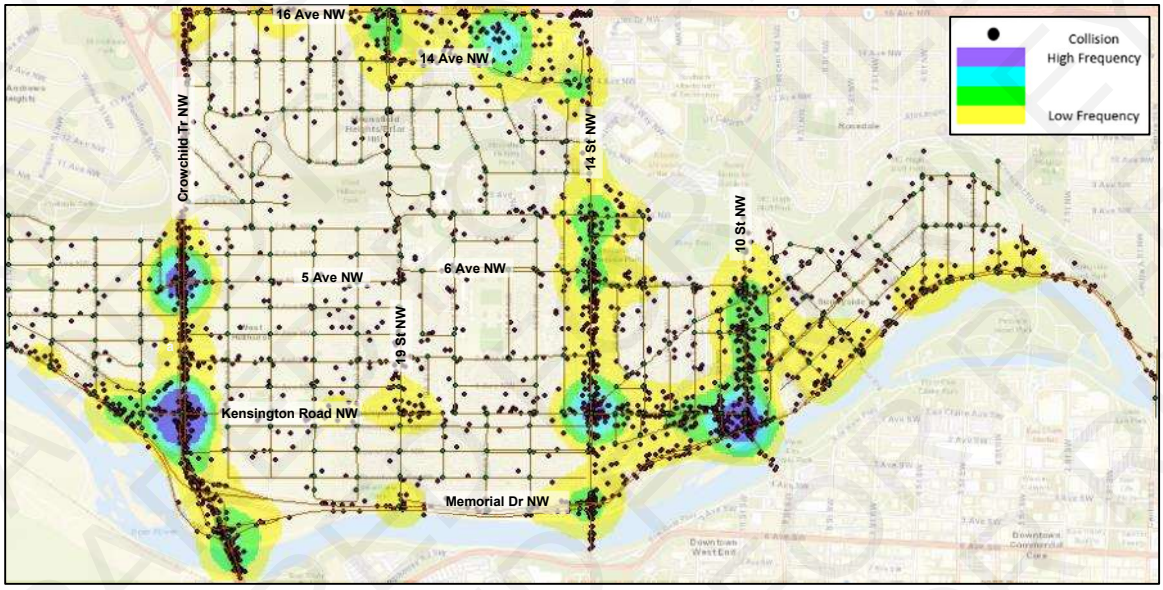


Figure 12: Heatmap of all collisions within the study area (2016-2021).

Figure 12 shows that the five corridors that experienced the highest collision frequency are the following:

- Crowchild Trail NW from Kensington Road NW to 5 Avenue NW;
- Kensington Road NW from 14 Street NW to 10 Street NW;
- 10 Street NW from Kensington Road NW to 5 Avenue NW/4 Avenue NW;
- 14 Street NW from 5 Avenue NW to 8 Avenue NW; and
- 19 Street NW from 16 Avenue 14 Avenue NW.

While these corridors represent locations where the highest number of collisions occur, they also represent the five corridors that experience the highest vehicular volumes within the study area. Higher vehicle volumes result in a higher exposure to conflicts and thereby collision frequency. During the peak travel periods, these roadways were observed to be congested which can further increase potential for conflicts between road users but often results in lower severity collisions.

To identify collisions that result in higher injury or fatality risk, locations of collisions involving VRUs were examined. **Figure 13** shows the heatmap of fatal/injury collisions within the study area. The map identifies similar hotspots as the all the collisions heatmap (**Figure 12**).

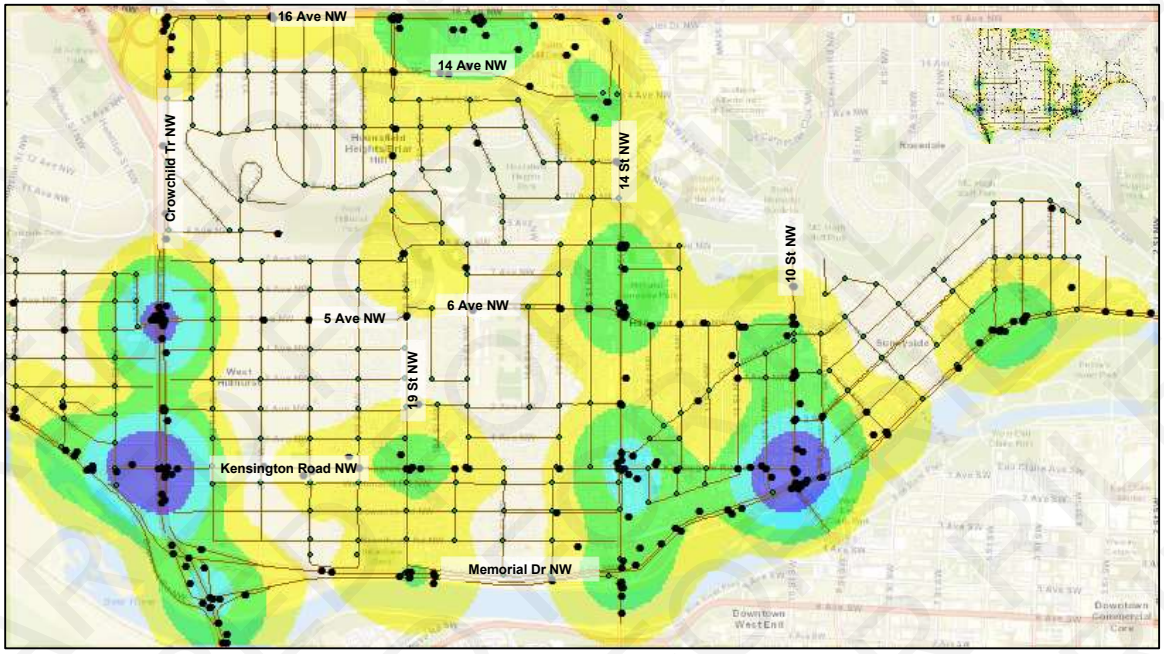


Figure 13: Heatmap of Fatal/Injury Collisions within the Study Area (2016-2021).

Figure 14 shows the heatmap of pedestrian collisions within the study area.

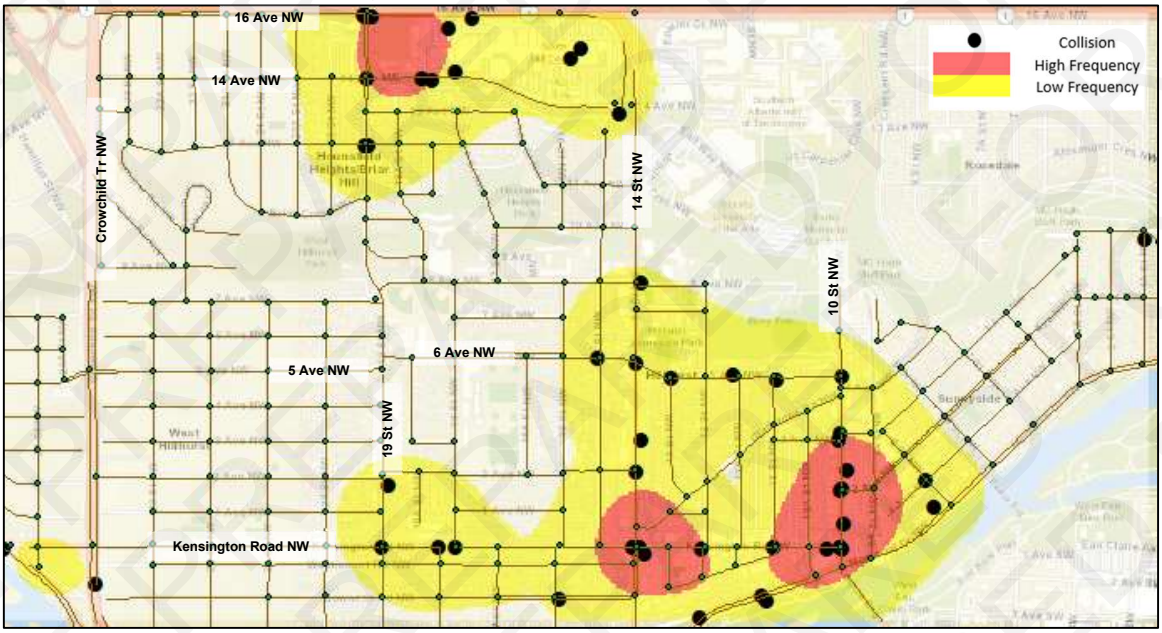


Figure 14: Heatmap of Pedestrian Collisions within the Study Area (2016-2021).

Figure 14 shows that there are three areas where a higher number of collisions involving pedestrians were experienced. The three areas are the following:

- 10 Street NW between 5 Avenue NW and Kensington Road NW. This roadway is a highly commercial area with high pedestrian demand;
- Kensington Road between 14 Street NW and 10 Street NW. This is also a commercial area with high pedestrian demand; and
- On 16 Avenue NW and 14 Avenue NW, near 19 Street NW. This area is near Lions Park LRT Station and North Hill Mall, which also results in high pedestrian traffic.

Figure 15 shows the heatmap of cyclist collisions within the study area.

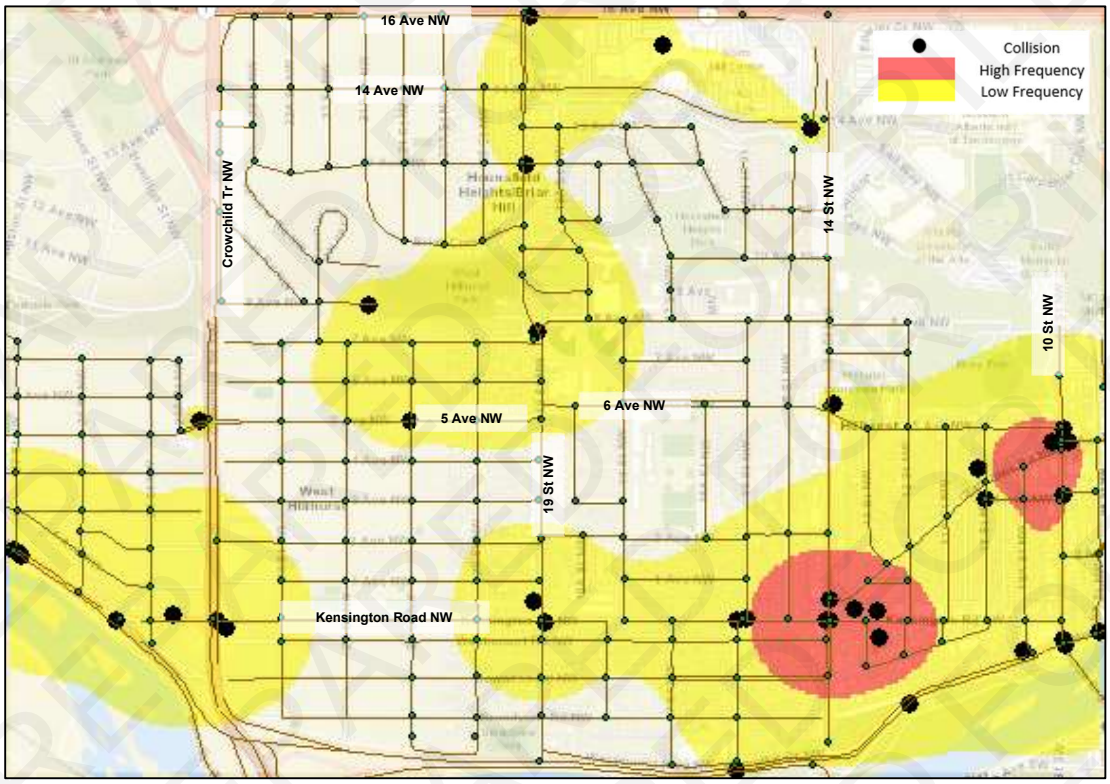


Figure 15: Heatmap of Cyclist Collisions within the Study Area (2016-2021).

Figure 15 shows that there are three corridors where a higher number of collisions involving cyclists were experienced. The three corridors are as follows:

- Kensington Road NW from 16 Street NW to 12 Street NW;
- 14 Street NW between from Kensington Road NW to Gladstone Road NW; and
- 10 Street NW between 5 Avenue NW and 3 Avenue NW.

Of the above streets, only 10 Street NW has on-street cycling facilities. No bicycle facilities are provided on the other two corridors.

2.4 Network Screening

Due to the large number of sites and collision recorded within a study area, a network screening process is typically used to identify and rank higher collision risk sites where a reduction in collision frequency with remedial actions could be achieved. Based on the available traffic and collision data, the network screening method used for the study area was the Method of Moments. In this methodology, the safety performance of intersections with different control systems are compared with their peers in that reference population or group.

The Method of Moments is a relatively simple methodology for estimating potential for safety improvement. This method does not require exposure parameters such as traffic volumes, and therefore was used for intersections with incomplete traffic volume information. However, unlike other methods which do not require exposure parameters (e.g., frequency method), this method is able to partially account for the Regression-to-the-Mean phenomenon.

A detailed description of the methodology along with the rankings of all sites is provided in **Appendix B**.

The top 10 ranked locations within each traffic control type (e.g., signalized and stop-controlled intersections) are summarized in **Table 2** and **Table 3**.

Table 2: Top 10 Method of Moment Ranking for Signalized Intersections.

Intersection	Traffic Control	Collision Frequency				Adjusted	PI	Rank
		Fatal	Injury	PDO	EPDO Total			
CROWCHILD TR NW @ KENSINGTON RD NW	Signal	0	20	376	572	568.99	479.53	1
5 AV NW @ CROWCHILD TR NW	Signal	0	22	260	475	473.15	383.69	2
10 ST NW @ MEMORIAL DR NW	Signal	0	15	160	307	305.61	216.14	3
14 AV NW @ 14 ST NW (WEST INT)	Signal	1	5	79	302	300.90	211.43	4
14 ST NW @ KENSINGTON RD NW	Signal	0	8	182	260	259.33	169.86	5
10 ST NW @ KENSINGTON RD NW	Signal	0	9	98	186	185.57	96.10	6
16 AV NW @ 19 ST NW	Signal	0	7	79	148	147.21	57.75	7
14 ST NW @ 6 AV NW	Signal	0	6	78	137	136.48	47.02	8
19 ST NW @ KENSINGTON RD NW	Signal	0	7	34	103	102.48	13.01	9
16 AV NW @ 17 ST NW	Signal	0	8	23	101	101.28	11.82	10

Table 3: Top 10 Method of Moment Ranking for Stop-controlled Intersections.

Intersection	Traffic Control	Collision Frequency				Adjusted	PI	Rank
		Fatal	Injury	PDO	EPDO Total			
5 ST NW @ MEMORIAL DR NW	Stop_controlled	1	5	23	246	241.94	229.22	1
8 AV NW @ 14 ST NW	Stop_controlled	0	7	80	149	146.10	133.37	2
2 AV NW @ CROWCHILD TR NW	Stop_controlled	0	5	52	101	99.37	86.65	3
MEMORIAL DR NW @ 5A ST NW	Stop_controlled	0	6	39	98	96.22	83.50	4
19 ST NW @ MEMORIAL DR NW	Stop_controlled	0	5	38	87	85.62	72.90	5
11 ST NW @ KENSINGTON RD NW	Stop_controlled	0	2	62	82	80.34	67.62	6
13 AV NW @ 16A ST NW	Stop_controlled	0	1	63	73	71.71	58.98	7
14 ST NW @ GLADSTONE RD NW	Stop_controlled	0	3	43	72	71.30	58.58	8
13 ST NW @ KENSINGTON RD NW	Stop_controlled	0	3	36	65	64.43	51.70	9
MEMORIAL DR NW @ 10A ST NW	Stop_controlled	0	0	62	62	61.11	48.38	10

3.0 FIELD INVESTIGATIONS

TNS staff conducted field investigations of the study area on August 24 and 25, 2022. The purpose of the field investigations was to observe and document existing safety operations, road user behavior, and field conditions, and to identify contributing factors to historic collisions. Field investigations were scheduled to allow the project team to observe operating conditions throughout the day; the field investigations were conducted during peak, off-peak, and nighttime periods.

The field investigations consisted of drive-throughs on major roadways in the area to observe traffic flow, traffic control, operating speeds, and interactions with road users. The drive-throughs were recorded with a dashcam to allow the project team to review operating conditions. There were also location-specific investigations to observe sightlines, pavement markings, and interactions between road users. These locations were identified through the findings of the collision review in Section 2.0.

Given the scope of the study, field investigations were not meant to provide a comprehensive examination of all intersections/segments in the study area, but rather to identify key issues that exist within the study area. The observations made during the field investigation informed the safety issues and recommendations that are presented in **Section 4.0**.

4.0 ISSUES AND RECOMMENDATIONS

This section provides a summary of the issues identified from the desktop review and field investigations, priority level of the potential issue, and associated countermeasures that could be implemented to mitigate the issues. **Section 4.1** provides an overview of the key safety issues that were observed across the study area and **Section 4.2** summarizes identified safety issues and countermeasures for specific locations that were identified based on the collision review.

4.1 Key Safety Issues

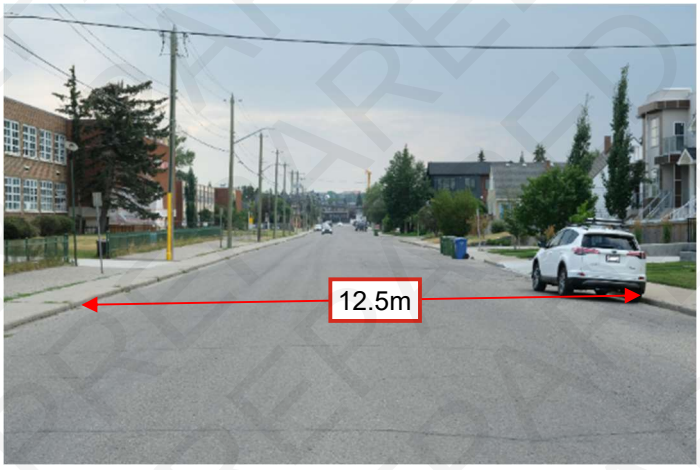
The key safety issues are divided into five categories which are summarized below:

- Roadway Geometry: involves the design of physical features such as road widths, sightlines, and intersection corner radii;
- Pedestrian Facilities: considerations that impact the movement of pedestrians including crosswalk visibility, control type, and tripping hazards;
- Cycling Facilities: considerations that impact the movement of people on bicycles including bicycle facility continuity and condition;
- Accessibility: provision of physical features that can assist persons with limited mobility, vision loss, and other disabilities waling across the study area; and
- Other: issues that do not apply to the above categories.

Each key issue is summarized with a description, photos from example locations, priority level, and potential countermeasures that could be applied to mitigate the issue. Lower priority level represents countermeasures that would improve road user safety but does not address a safety issue with a significant conflict and/or liability risk. Higher priority items address a safety issue with a high conflict and/or liability risk that should be prioritized by the City.

It should be noted that the potential safety issues consist of examples that were observed throughout the study area during field observations. The locations and images shown are used to illustrate the safety issue and are not an exhaustive list of all locations where the safety issue applies within the study area.

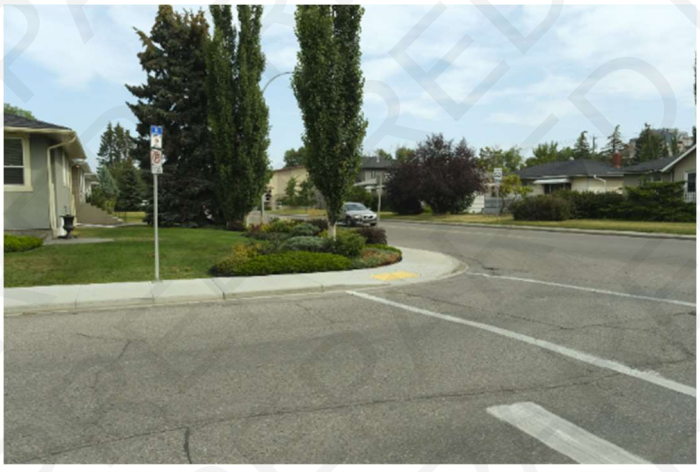
4.1.1 Roadway Geometry

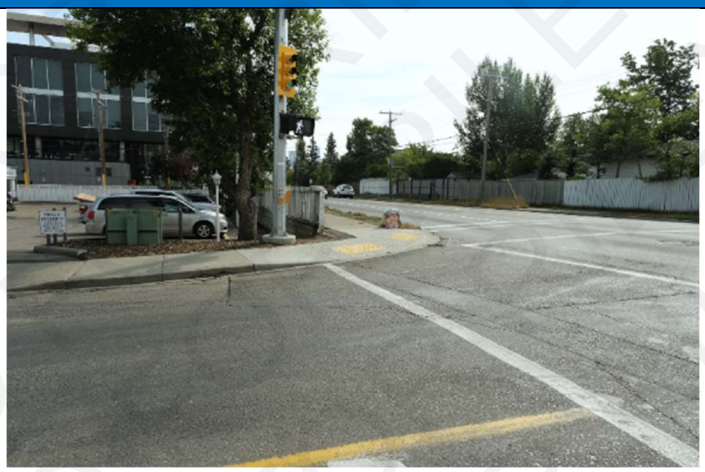
Wide Roadways	
Description	It was observed that road widths on some residential streets were significantly wider than what was specified in the *Design Guidelines for Subdivision Servicing* (2020) document. It should be noted that these roads were constructed prior to the 2020 guidelines were established and use older standards. These residential streets generally consist of a parking lane and a travel lane per direction (four lanes in total) and often do not have a centre median. The curb-to-curb width was measured to be more than 12.5 metres (m) and up to 16 m on some streets. There is generally low traffic demand since they are primarily used by residents that live on the street. The wide right-of-way and excess capacity may lead to motorists travelling at high speeds on these roads increasing the risk of collisions.
Priority Level	Lower
Example Location(s)	 *Bowness Road (west of 17 Street NW)*  *18 Street NW (6 Avenue NW to Kensington Road NW)*

Wide Roadways	
Countermeasures	The City should conduct a scan of residential roads where widths significantly exceed the minimums outlined in the *Design Guidelines for Subdivision Servicing* (2020) document. To reduce the pavement widths on wide residential streets and reclaim space for other uses, several design features that narrow the width of the road should be considered: ▸ Curb extensions/neckdown/chokers: horizontal intrusion of the curb into the roadway resulting in narrower sections of roadways. ▸ Chicanes: visually narrows the roadway at key locations, reduces pedestrian crossing distance (may impact a limited number of parking spaces). ▸ Raised median island: visually narrows the roadway, provides a refuge for crossing pedestrians, and provides space for landscaping. ▸ Cycling facilities: provide cycle lanes on key residential roads, reinforcing cyclist right of way and encouraging cyclist demand. Note that some traffic calming measures can be implemented through pavement markings and flexible bollards to allow for quicker and more cost-effective implementation.

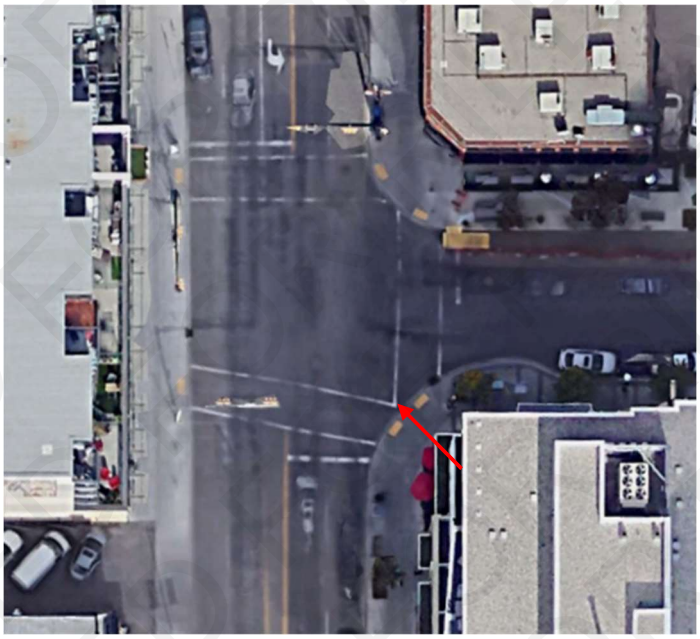
Wide Accesses	
Description	Wide intersection widths were observed at many locations, primarily where wide minor streets intersect with a higher order roadway. These wide accesses allow motorists to turn at higher speeds and visually widens the roadway, which can further encourage high operating speeds. The side street approach may not have a stop bar or centerline, which can also increase the effective turn radius and result in inconsistent vehicle turn paths. From a pedestrian perspective, these wide road accesses result in a longer crossing distance and increase the exposure to conflicts with motorists.
Priority Level	Lower
Example Location(s)	 *8 Avenue at 14 Street*  *2 Avenue at Crowchild Trail*

Wide Accesses	
Countermeasures	To reduce access widths, curb extensions could be implemented. Curb extensions visually narrow the roadway, reduce pedestrian crossing distance, and accommodate existing on-street parking. Stop bars and centerlines should also be added to provide guidance of intended turning paths for motorists and to provide visual cues of the approaching intersection.

Obstructed Sightlines	
Description	Sight triangle requirements at intersections are intended to provide departing drivers with sufficient visibility of oncoming traffic to determine if there are safe gaps in traffic for the motorist to cross the intersection. The sight triangle must be clear of visual obstructions so that the motorists can see each other clearly within that triangle. It was observed that departure sight distances were obstructed at several intersections within the study area. Obstructions can consist of vegetation and street furniture (e.g., transit stops, fences, etc.).
Priority Level	Higher
Example Location(s)	 *18 Street at 6 Avenue (northbound approach, looking west)*  *19 Street at 12 Avenue (eastbound approach, looking north)*

Obstructed Sightlines	
	 *19 Street NW at Kensington Road NW (southbound approach, looking east)*
Countermeasures	To provide sufficient departure sightlines, it is recommended that vegetation or obstructions within the sight triangles be trimmed or relocated/removed. In some cases, the installation of curb extensions along with the relocation of the stop bars can address the sight line issues.

Large Intersection Corner Radii	
Description	Many intersections within the study area have large curb radii. This creates opportunities for motorists to make right-turns at high speeds, exposing pedestrians to increased collision severity. This issue can be compounded by large lane widths, which can further increase the effective radius by allowing turning motorists to initiate their turn away from the curb.
Priority Level	Lower
Example Location(s)	  *10 Street at Kensington Road*

Large Intersection Corner Radii	
	 *10 Street at 2 Avenue (SE corner)*
Countermeasures	The City should identify locations within the study area where the curb radius exceeds the minimum requirements in the *Design Guidelines for Subdivision Servicing* (2020) document. Curb radius could be reduced through pavement markings or truck aprons, which constrain curb radius for general vehicles while accommodating turn movements for heavy vehicles.

Large Right-turn Channel Radii	
Description	The right-turn channels at various intersections were observed to have a width of more than 6.5 m at the crosswalks. The wide right turn lanes results in higher turn speeds for vehicles and exposes vulnerable road users crossing the ramps to conflicts with high-speed vehicles.
Priority Level	Lower
Example Location(s)	 *14 Street at 5 Avenue/6 Avenue (northbound approach)*  *19 Street at 16 Avenue (northbound approach)*

Large Right-turn Channel Radii	
Countermeasures	Reducing the width of right-turn channels by conversion to smart channels would require motorists to slow down and improve pedestrian visibility. The provision of smart channels aligns right-turning drivers to be more perpendicular with the intersecting roadway and pedestrian crosswalks. Motorists are also required to navigate the channel at lower speeds. It is possible to implement smart channels through pavement markings or truck aprons, which still accommodate turning movements of larger vehicles.

Skewed Intersections	
Description	Several skewed intersections are present within the study area, especially along Gladstone Road NW which run diagonally between 14 Street NW and 10 Street NW. Skewed intersections generally increase the collision risk primarily due to the restricted visibility.
Priority Level	Lower
Example Location(s)	 *Gladstone Road NW/11 Street NW (eastbound approach)*

Skewed Intersections	
Countermeasures	Based on the collision review, collisions along Gladstone Road NW are not over-represented. The low collision frequency on Gladstone Road NW is likely due to road environment (narrow roadways with buildings close to the street) that leads to low operating speeds. Although the collision history does not warrant major geometric changes along Gladstone Road NW, the following recommendations could be applied to skewed intersections: ▸ Maintain clear intersection sight lines by reducing obstructions such as vegetation and street furniture on intersection corners; ▸ Increase crosswalk and pedestrian conspicuity by providing ladder type crosswalks; and ▸ Where possible, explore opportunities to realign the intersection legs to reduce the skew. This would reduce the speed of turning motorists by constraining turn radii and reduce pedestrian crossing distances.

4.1.2 Pedestrian Facilities

Conflicts at Controlled Crossings	
Description	At some unsignalized intersections, controlled crossings are provided to protect and give the right of way to pedestrians attempting to cross major road. In some cases, these controlled crossings are installed on wide roadways with high operating speeds. In general, higher operating speeds result in lower compliance of motorists with the control systems and expose pedestrians to conflicts with motorists. The City uses the TAC Pedestrian Crossing Control Guide to support decisions about crosswalk treatments to ensure consistent city-wide application at locations without significant collision risk. Industry guidelines (including the TAC guide) currently do not consider conflict risk as part of the current decision-making process. There are some jurisdictions that are working to incorporate these considerations to provide more proactive data sources as part of the decision-making process.
Priority Level	Higher
Example Location(s)	 *19 Street NW at 7 Avenue/8 Avenue NW*
Countermeasures	Installing controlled crossings at stop-controlled intersections should be implemented along with traffic calming measures that effectively narrow roadways and improve compliance of motorists with the control treatments such as curb extensions. Note that the City has implemented curb extensions at multiple unsignalized locations along the 5 Avenue NW corridor.

Crosswalk Visibility	
Description	Many intersections had faded crosswalk markings which can reduce motorist awareness of pedestrian presence. In addition, most crosswalks were delineated by two horizontal lines and did not have ladder markings.
Priority Level	Lower
Example Location(s)	 *Crowchild Tr at Kensington Rd*  *19 Street NW at 5 Avenue/6 Avenue NW*
Countermeasures	It is recommended that the City repaint faded crosswalk markings and consider the implementation of ladder type crosswalks at locations with high pedestrian demand and those near schools and community centres.

Future Bus Zones	
Description	Signage indicating "*Future Bus Zones*" was identified at various locations within the study area. It is assumed that these signs indicate that a future transit stop will be implemented at these locations. It was also observed that these locations did not always have designated pedestrian crossing facilities to accommodate potential desire lines, which may encourage pedestrians to cross at uncontrolled midblock locations. Some locations did not have existing sidewalks, which should be installed before the transit stop is operational to ensure accessibility for all transit users. Sidewalk widths should be reviewed to ensure that associated street furniture (e.g., benches, shelters, waste receptacles, etc.) do not obstruct the sidewalk.
Priority Level	Higher

Future Bus Zones	
Example Location(s)	 *19 Street NW at 12 Avenue NW*  *18 Street NW at 6 Avenue NW*
Countermeasures	To promote accessibility and safe access for transit passengers, the City should review locations of future bus zones to ensure that potential pedestrian desire lines are accommodated with designated crossing facilities. Sidewalks should be added where they do not already exist, and existing sidewalk widths should be reviewed to determine if any street furniture will obstruct the walkway zone. If so, the City should install concrete pads to provide more space and ensure that unobstructed paths of travel are provided.

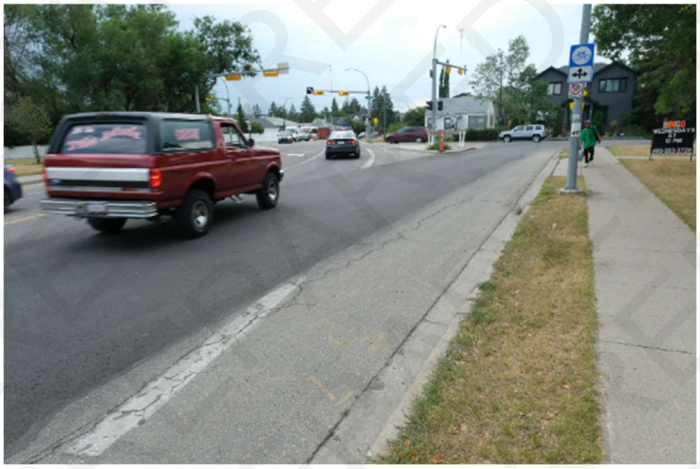
Tripping Hazards	
Description	Several tripping hazards that exceed the ASTM F1637[1] were observed on crosswalks and sidewalks.
Priority Level	Higher
Example Location(s)	 *6 Avenue NW (west of 18 Street NW)*  *14 Street NW at 5 Avenue / 6 Avenue NW (southwest corner)*
Countermeasures	The City should mark, grind, or ramp the height differential or resurface the pavement.

[1] ASTM F1637: Standard Practice for Safe Walking Surfaces.

4.1.3 Cycling Facilities

Discontinuous Bicycle Facilities	
Description	Designated bicycle facilities promote active transportation and reduces exposure to conflicts between cyclists and motorists. It was observed that there were discontinuities in cycling infrastructure that leave cyclists in general vehicle lanes with little guidance on how to safely mix and proceed with general traffic. This may also deter people from choosing bicycles as a mode of transportation since they feel less comfortable riding in mixed traffic.
Priority Level	Higher
Example Location(s)	 *Cyclists riding in mixed traffic after the on-street bicycle lane ends (5 Avenue west of 19 Street NW)*  *Cyclists riding through pedestrian crosswalk after departing the multi-use trail (Crowchild Tr at Kensington Rd)*

Discontinuous Bicycle Facilities	
Countermeasures	It is recommended that the City examine bicycle facility types in areas where on-street bicycle lanes or multi-use paths terminate. At these areas, the following measures could be implemented: ▸ Extend the designated facility to provide connectivity to other designated cycling facilities. An example of where this can be implemented is on 19 Street NW between Briar Crescent NW and 5 Avenue NW. ▸ If it is not possible to extend the designated cycling facilities, signage indicating the end of the facility should be visible. ▸ The City could also consider placing sharrow markings in the centre of the traffic lane to reinforce cyclist right-of-way and encourage cyclists to “take the lane.”

Faded or Missing Cyclist Markings	
Description	Existing pavement markings indicating designated cycling facilities were observed to be faded or obstructed. This reduces motorist visibility of cycling facilities and the presence of cyclists. There were also key conflict areas (e.g., right-turn channels) where general traffic crosses over a cycling facility that did not have cyclist green pavement markings reminding motorists of the designated cycling facility.
Priority Level	Lower
Example Location(s)	 *Crowchild Trail NW at 5 Avenue NW*  *19 Street NW at 5 Avenue/6 Avenue NW* *Crowchild Trail NW at 5 Avenue NW*
Countermeasures	The City should regularly review the condition of pavement markings for cycling facilities and reapply paint when needed.

Faded or Missing Cyclist Markings	
	The City should also add delineated the bicycle facilities at potential conflict areas with dashed cyclist green pavement markings through intersections and in right-turn channels to alert motorists that they are crossing designated cycling facilities.

Obstructed Cycling Facilities	
Description	The off-street cycling path west of Crowchild Trail NW at Kensington Road was observed to be partially blocked by a transit bench. This obstruction can result in potential cyclist collisions, especially in dark conditions where the bench may not be visible.
Priority Level	Higher
Example Location(s)	 *Crowchild Tr at Kensington Rd*
Countermeasures	The City should relocate the bench to a different location where it does not encroach on the cycle path.

Misaligned Cycling Lanes	
Description	The westbound cycle lanes at 14 Street NW and 6 Avenue NW are not aligned through the intersection. The cycle lane on the east side of the intersection is shifted away from the curb to accommodate the eastbound right-turn lane. This may cause confusion for cyclists on the intended path through the intersection.
Priority Level	Lower
Example Location(s)	 *Photo taken from the cycle lane on the west side of the intersection shows the offset in the cycling lane on either side of the intersection (14 Street NW at 6 Avenue NW, looking eastbound)*
Countermeasures	To mitigate this issue, it is recommended that there be continuity lines added through the intersection. This will also highlight the presence of a bicycle lane through the intersection for motorists.

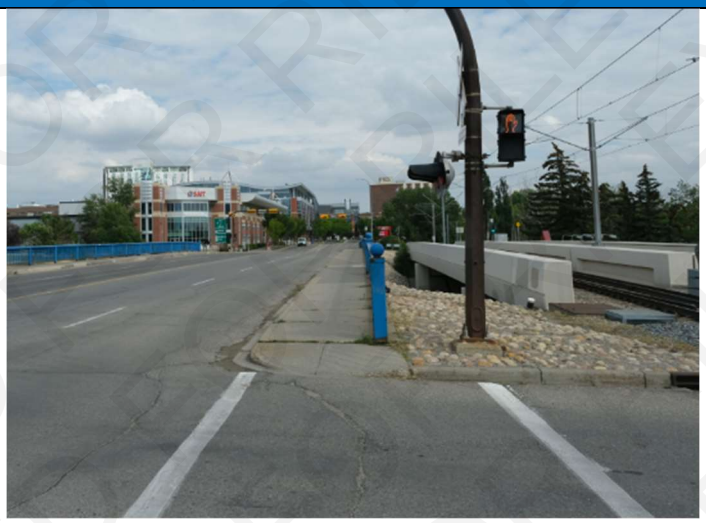
4.1.4 Accessibility

Missing Tactile Plates	
Description	While curb ramps at most intersections are denoted through a different texture of pavement, the texture in pavement may not adequately identify crossing locations for visually impaired pedestrians. Some locations were identified to have a tactile plate on one side of the crosswalk, but not the other side. This inconsistency may cause confusion for pedestrians.
Priority Level	Higher
Example Location(s)	 *10 Street NW at 3 Avenue NW*  *10 Street NW at Memorial Drive NW*
Countermeasures	The addition of tactile plates can help visually impaired pedestrians better identify locations of curb ramps. The yellow colour provides visual contrast with the surrounding pavement and the textured

Missing Tactile Plates	
	bumps can be more easily identified compared to grooves in pavement.

Missing Pedestrian Countdown Timers	
Description	Pedestrian countdown signals provide an indication of how much time is left in the pedestrian phase before it terminates and allow pedestrians to determine if they have enough time to safely cross the intersection. Pedestrian countdown timers were provided at all signalized intersections except for the intersection of 19 Street NW at 14 Avenue NW.
Priority Level	Higher
Example Location(s)	 *19 Street NW at 14 Avenue NW*
Countermeasures	It is recommended to add pedestrian countdown timers at this intersection.

Curb Ramp Alignment	
Description	Many intersections had curb ramps that did not fully align with crosswalk markings. Misaligned curb ramps present challenges for pedestrians that rely on mobility devices and may also be tripping hazards for pedestrians on the edge of the crosswalk.
Priority Level	Lower
Example Location(s)	 *19 Street NW at 12 Avenue NW*  *10 Street NW at Memorial Drive NW*

Curb Ramp Alignment	
	 *14 Street NW at 14 Avenue NW*
Countermeasures	It is recommended that curb ramps be relocated to better align with the center of the crosswalk. In some cases, the catch basin locations may limit the curb ramp location. In these instances, a review of the crosswalk width should be conducted to determine if the crosswalk limits can be narrowed to better align with the curb ramp.

Obstructed Sidewalks	
Description	Obstructions were identified at various locations that resulted in there being less than 1.5 m of clear space on the sidewalks. This can present accessibility challenges for pedestrians with mobility devices.
Priority Level	Lower
Example Location(s)	 *Crowchild Trail NW at 5 Avenue NW*  *14 Street* NW at 5 Avenue/6 Ave NW

Obstructed Sidewalks	
	 *10 Street NW at 5 Avenue NW*
Countermeasures	The City should remove and/or relocate obstructions that are located in the pedestrian clear zone.

4.1.5 Other

Memorial Drive Lane Reversal	
Description	Within the vicinity of the intersection, Memorial Drive has a lane reversal between 9 Street NW and Westmount Boulevard NW during the PM peak period (3:30 to 6:30 PM) where three westbound lanes are provided in the westbound direction. Compared to other roads with lane reversals in the City, the additional westbound lane is provided on the other side of the median separating Memorial Drive which could confuse motorists that are not familiar with traffic operations. To accommodate the transition at the west limits of the lane reversal, the median lane in the permanent westbound direction terminates to allow motorists on the other side of the median to merge. The City installed lane reversal overhead signs, roadside signs, dynamic LED signs, and flashing gate arms to alert motorists of the intended lane directions and transition areas. Based on a review of the collision records, there were a total of 22 collisions that occurred on the segment where the lane reversals are in effect. Most collisions were related to motorists colliding with the lane reversal arms, with some indications that the glare from the sunset may inhibit westbound motorists' view of the arms. Other collisions occurred related to motorists colliding at the limits of the lane reversal where traffic lanes may be terminating to accommodate the lane reversal. Of the total collisions, only two resulted in injury, one of which involved a pedestrian that was crossing at a midblock location.
Priority Level	Lower
Example Location(s)	 *Memorial Drive NW west of 10 Street NW, looking east*
Countermeasures	Improvements along Memorial Drive are outside of the scope of this study. However, there is an opportunity to further explore the potential countermeasures as part of the future Memorial Drive

Memorial Drive Lane Reversal	
	Mobility Study. Some potential countermeasures that could be further explored include: ▸ Provide signage warning of the westbound lane closure near Westmount Boulevard NW in advance of the lane reversal gates. There is currently a lane closure sign on the north curb of Memorial Drive located approximately 50 m upstream of the first gate. The Manual of Uniform Traffic Control Devices for Canada (MUTCDC) recommends these signs to be located 100 m upstream of the lane closure to provide sufficient time and space for motorists to change lanes; ▸ The existing lane closure sign near Westmount Boulevard NW is located on the curb, which could be obstructed by on-street parking. The City could install additional signs on the median to improve motorist visibility and awareness. LED signs could also be installed to only display during lane reversal times; ▸ The existing lane closure tab signs near Westmount Boulevard indicate "during lane reversal". Motorists unfamiliar with the area may not know when lane closure are in effect. The tab could be changed to specify the days and times that the lane closure apply; ▸ Explore the installation of reflective backboards on the lane reversal overhead signs to improve visibility of backlit signs. This was noted to be a potential issue in the westbound direction; and ▸ Explore the permanent closure of the westbound median lane near Westmount Boulevard NW. This lane is already closed during the PM peak period, where there are presumably the highest westbound vehicle volumes. This would be dependent on the westbound traffic operations during off-peak and shoulder periods.

Information Overload	
Description	At some locations, multiple signs are installed on the same post or within a short distance. Driver confusion may result from the presence of too many signs within a short segment, cause haphazard lane changes and result in rear-end/sideswipe collisions.
Priority Level	Lower

Information Overload	
Example Location(s)	 *18 Street NW at 6 Avenue NW*
Countermeasures	The City should remove and/or spread signs to provide drivers more time to read and comprehend the higher primacy information.

4.2 Location Specific Issues

This section provides a summary of the issues and countermeasures that were identified at 10 locations within the study area. The selection of the locations where detailed field investigations was to be conducted considered the following factors:

- Ranked high as part of the network screening analysis;
- Higher number of collisions involving VRUs; or
- Geographical distribution of sites across the study area.

The locations that were selected for detailed field investigations are the following:

- Crowchild Trail NW at Kensington Road NW;
- 14 Avenue NW at 14 Street NW;
- 10 Street NW at Memorial Drive NW;
- 14 Street NW at Kensington Road NW;
- 16 Avenue NW at 19 Street NW;
- 19 Street NW at Kensington Road NW;
- 19 Street NW at 12 Avenue NW;
- 14 Street NW at 8 Avenue NW;
- 11 Street NW/Kensington Crescent NW at Kensington Road NW; and
- 19 Street NW at 7 Avenue NW/8 Avenue NW.

The findings for each location are presented in a table that summarizes the safety issue, location, priority level, countermeasure, and impacts of implementation (either positive or negative). Lower priority level represents countermeasures that would improve road user safety but does not address a safety issue with a significant conflict and/or liability risk. Higher priority items address a safety issue with a high conflict and/or liability risk that should be prioritized by the City.

4.2.1 Crowchild Trail NW at Kensington Road NW

It should be noted that this intersection will be updated as part of the medium and long-term improvements for Crowchild Trail. These recommendations are to be considered when revisiting the medium and long-term improvements once those stages are funded.

Issue	Location	Countermeasure	Priority Level	Impact
Wide right-turn channels. The right-turn channel lanes were measured to be more than 6 m. Note that the right-turn channels on the eastbound and northbound approaches were recently converted to smart channels.	NB, SB, and EB approach	Reduce the width of each right-turn channel with pavement markings or truck aprons and consider converting the right-turn channel installed on the southbound approach to a smart channel. The City should also consider eliminating the right-turn channels at the intersection.	Lower	+ Reduced channel width and turning speed + Improved geometry - Converting a right-turn channel to a smart channel require significant investments
Median does not extend to crosswalk	North leg	Extend median closer to the crosswalk. The City should also consider median nose extensions on the northbound and southbound approaches to reduce. As a temporary measure, the City could consider installing rubber speed bumps as a centreline hardening measure.	Lower	+ Reduced eastbound left-turn radius and turn speeds - Heavy vehicles may turn into adjacent traffic lanes to accommodate movement - Median extension may involve relocation of catch basin

Issue	Location	Countermeasure	Priority Level	Impact
Obstructed off-street bicycle facility by a bench at the transit stop	Southwest corner	Relocate transit bench	Higher	+ Reduced obstructions on cycling facilities
Discontinued cycling facility at the intersection	EB and WB approach	Explore expansion of cyclist network. Should the right turn channels be removed, a crossride on the south leg could be implemented.	Higher	+ Increased connectivity to the Bow River Pathway + Reduce the risk of collisions with motorists - Requires significant geometric changes
Cyclists riding through the right-turn channel	EB approach	Install signage "*Cyclists dismount*" signage on the southwest corner	Lower	+ Provides guidance of intended crossing maneuver for cyclists
Tripping hazard caused by the presence of pole mount	NW corner, north sidewalk	Remove empty pole mount	Lower	+ Reduced obstructions on the sidewalk
Obstructed speed limit sign	West of intersection	Trim vegetation to provide clear view of speed limit sign	Lower	+ Improved visibility of traffic control devices
Crosswalk visibility	All approaches	Add ladder markings in crosswalks	Lower	+ Improved visibility of crosswalks and pedestrians

4.2.2 14 Avenue NW at 14 Street NW

It should be noted that this location was also analyzed as part of the video conflict analysis. The issues and recommendations below represent issues that were not identified as part of the previous analysis.

Issue	Location	Countermeasure	Priority Level	Impact
Southbound traffic signal is not connected to LRT gate arms. It was observed that green signals were displayed to southbound through motorists when the gate arms were lowered.	South leg	Add transit vehicle pre-emption	Higher	+ Reduced confusion for motorists of intended operations - Requires coordination between transit and traffic signals
Excess roadway capacity. Within the vicinity of the intersection, 14 Avenue NW widens to a two to three-lane approach. This can lead to excess capacity and higher vehicle operating speeds.	WB approach	Remove a lane in the westbound direction to maintain the cross section of adjacent roadway segments. Traffic operations analysis should be conducted prior to implementing lane reductions.	Lower	+ May reduce vehicle operating speeds + Reduced pedestrian crossing distance - Reduction of westbound traffic capacity
Missing edge pavement markings	EB right-turn channel	Add a roadway edge pavement marking	Lower	+ Improved visibility of intended path for right-turning motorists
Obstructed crosswalk	EB right-turn channel (south side)	Reconfigure "*Look both ways for train*" signs and railings to not obstruct crosswalks	Lower	+ Increased pedestrian accessibility
Curb ramp alignment The curb ramps do not fully align with crosswalk markings.	SE and NE corners	Realign crosswalk	Lower	+ Increased pedestrian accessibility

Issue	Location	Countermeasure	Priority Level	Impact
Cyclists riding through the right-turn channels	EB approach	Install signage "*Cyclists dismount*" signage on the southwest corner	Lower	+ Provides guidance of intended crossing maneuver for cyclists - Compliance with such signs is generally low

4.2.3 10 Street NW at Memorial Drive NW

It should be noted that improvements along Memorial Drive are outside of the scope of this study. These recommendations can help inform the future Memorial Drive Mobility Study.

Issue	Location	Countermeasure	Priority Level	Impact
Dual right-turn channel The right-turn channel was measured to be approximately 6 m wide. This increases pedestrian crossing distance and can result in higher vehicle turn speeds. In addition, the fact that it is a two-lane right-turn channel could result pedestrian visibility being obstructed if there is another vehicle in the adjacent lane.	EB approach	Remove one lane in the right-turn channel. Should the dual right-turn channel be maintained, the City should consider providing a dedicated signal phase for eastbound right turning traffic.	Higher	+ Reduced exposure to sideswipe conflicts and reduced turn speeds + Improved visibility of conflicting southbound vehicles + Reduced pedestrian crossing distance + Reduced risk of motorists turning into oncoming traffic when 10 Street NW is operating with three northbound lanes - Reduced eastbound right-turn capacity during non-restricted times
Wide right-turn channel The right-turn channel was measured to be approximately 6 m wide. This increases pedestrian crossing distance and can result in higher vehicle turn speeds.	NB approach	Convert to smart channel configuration or reduce reducing the existing lane width with pavement markings.	Lower	+ Reduced channel width and turning speed + Improved geometry and visibility of conflicting eastbound traffic

Issue	Location	Countermeasure	Priority Level	Impact
Weaving maneuvers associated with proximity to Kensington Road NW	SB approach	Review signal timing plans at both intersections to improve progression between the two intersections	Lower	+ Reduced queue spillback from Memorial Drive NW - May have limited opportunities to adjust signal timings given minimum split times and cycle lengths
Large curb radius	SW corner	Reduce curb radius (pavement markings or truck aprons)	Lower	+ Reduced vehicle turn speeds
Crosswalk visibility	All approaches	Add ladder markings in crosswalks	Lower	+ Improved visibility of crosswalks and pedestrians
Missing tactile plates	NW, SW, SE corners	Add yellow tactile plates	Higher	+ Warns visually impaired pedestrians about potential hazards

4.2.4 14 Street NW at Kensington Road NW

Issue	Location	Countermeasure	Priority Level	Impact
Right-turn conflicts with pedestrians	EB and WB approaches	Implement leading pedestrian intervals	Higher	+ Increased pedestrian visibility and right-of-way
Large curb radius	NW, NE, SW corners	Reduce curb radius with pavement markings or truck aprons	Lower	+ Reduced vehicle turn speeds
Median does not extend to crosswalk	North and south legs	Extend median closer to the crosswalk. As a temporary measure, the City should consider installing rubber bumps as a median.	Lower	+ Reduced eastbound and westbound left-turn radius and turn speeds - Heavy vehicles may turn into adjacent traffic lanes to accommodate movement
Private access located within 5 m of intersection	North leg, NB curb lane	Remove accesses close to intersections	Lower	+ Reduced conflict points for all road users - Requires coordination with private property owner
Cyclists riding on sidewalks and crosswalks Historic cyclist collisions at this intersection	EB and WB approach	Explore expansion of cyclist network along Kensington Road NW	Higher	+ Increased connectivity along Kensington Road NW + Reduce the risk of collisions with motorists - Requires geometric changes
Missing stop bar	EB approach	Repaint stop bar	Lower	+ Provides intended stopping location for motorists
Missing streetlight can result in reduced pedestrian level lighting	NW corner	Assess lighting conditions and consider improving lighting conditions	Higher	+ Improved pedestrian visibility in dark conditions

Issue	Location	Countermeasure	Priority Level	Impact
Curb ramp alignment The curb ramps do not fully align with crosswalk markings.	NW and NE corners	Add separate curb ramps for each crosswalk	Lower	+ Increased pedestrian accessibility
Crosswalk visibility	All approaches	Add ladder markings in crosswalks	Lower	+ Improved visibility of crosswalks and pedestrians
Missing tactile plates	NW and NE corners	Add yellow tactile plates	Higher	+ Warns visually impaired pedestrians about potential hazards

4.2.5 16 Avenue NW at 19 Street NW

Issue	Location	Countermeasure	Priority Level	Impact
Wide right-turn channel	NB approach	Reduce the width of the right-turn channel with pavement The City should also consider eliminating the right-turn channels at the intersection.	Lower	+ Reduced channel width and turning speed + Improved geometry
Stop bar located 4.5 m away from the crosswalk	EB approach	Relocate stop bar and centre median closer to the crosswalk. As a temporary measure, the City should consider installing rubber bumps as a median.	Lower	+ Improved stop bar compliance
Discontinuous “Transit only” red pavement	EB curb lane, east leg	Extend the red pavement further east to the end of the bus bay	Lower	+ Increased visibility of reserved lane for northbound right-turning motorists
Missing streetlight can result in reduced pedestrian level lighting	SE corner	Assess lighting conditions and consider improving lighting conditions	Higher	+ Improved pedestrian visibility in dark conditions
Pedestrian pushbutton located approximately 7 m from crosswalk	NW corner	Relocate pushbutton closer to the crosswalks	Higher	+ Improved pedestrian accessibility
Missing tactile plates	NE corner	Add yellow tactile plates	Higher	+ Warns visually impaired pedestrians about potential hazards

4.2.6 19 Street NW at Kensington Road NW

Issue	Location	Countermeasure	Priority Level	Impact
Unclear lane designation Although shared right-turn/through and left-turn/through lanes are provided, there is only receiving lane. Note that there is a lane drop sign installed south of the intersection.	SB direction, south leg	Review the lane designation at the intersection.	Lower	+ Reduced driver confusion of intended operations
Streetlights were not illuminated	All corners	Review streetlight power source and bulbs	Higher	+ Improved pedestrian level lighting conditions
Bus stop located far from intersection, which promotes midblock crossing	EB direction, west leg	Relocate bus stop closer to the intersection	Lower	+ Improved transit accessibility + May reduce pedestrian midblock crossing
Obstructed sightline	NE corner	Remove fencing that obstructs the sightline for SB motorists looking left	Higher	+ Improved sightlines - Requires coordination with private property owner

4.2.7 19 Street NW at 12 Avenue NW

Issue	Location	Countermeasure	Priority Level	Impact
Streetlights were not illuminated	SE corner	Review streetlight power source and bulbs	Higher	+ Improved pedestrian level lighting conditions
Cyclists riding on sidewalks	NB and SB approaches	Implement on-street bicycle lanes	Lower	+ Improved cyclist visibility
Wide intersection access	EB approach	Implement curb extensions on the northwest and southwest corners	Lower	+ Reduced intersection width + Reduced pedestrian crossing distance
Constrained sight distance	EB approach, looking north	Trim vegetation	Higher	+ Improved departure sightlines - Requires coordination with private property owner
Curb ramp alignment	SW and SE corners	Add separate curb ramps for each crosswalk	Lower	+ Increased pedestrian accessibility
Missing tactile plates	NE, SW, and SE corners	Add yellow tactile plates	Higher	+ Warns visually impaired pedestrians about potential hazards

4.2.8 14 Street NW at 8 Avenue NW

Issue	Location	Countermeasure	Priority Level	Impact
Constrained sight distance, offset intersection, and the significant grade of 14 Street NW expose motorists attempting to turn onto 14 Street NW from the minor street to frequent conflicts with motorists travelling at high speeds.	EB and WB approaches	The City should conduct a detailed safety review of this intersection and the surrounding area to determine how the collision risk could be minimized. Potential remedial measures include: ▸ Converting the east and leg to right-in-right-out configuration. ▸ Making 8 Ave west of 14 Street NW one-way westbound. ▸ Making 8 Ave east of 14 Street NW one-way eastbound.	Higher	+ Reduced conflicts between turning drivers - Potential traffic infiltration associated with rerouted vehicle trips
Wide road width	WB approach	Implement curb extensions at intersection	Lower	+ Reduced intersection width + Reduced pedestrian crossing distance
		Road diet		+ Reduced roadway width and vehicle speeds
Missing tactile plates	NE, SW, and SE corners	Add yellow tactile plates	Higher	+ Warns visually impaired pedestrians about potential hazards
Missing crosswalk markings and stop bars	EB and WB approaches	Pavement markings	Lower	+ Increased crosswalk visibility

4.2.9 11 Street NW/Kensington Crescent NW at Kensington Road NW

Issue	Location	Countermeasure	Priority Level	Impact
Wide intersection access	South leg	Curb extension (from SE corner)	Lower	+ Reduced vehicle turn speeds + Reduced pedestrian crossing distance
Large curb radius	NE corner	Reduce curb radius	Lower	+ Reduced vehicle turning speeds
Crosswalk visibility Given the dense and busy road environment (i.e., advertisement signs, proximity of buildings, on-street parking, etc.), the controlled crossing is not visible	West leg	Add ladder markings in crosswalks	Higher	+ Improved visibility of crosswalks and pedestrians
		Implementation of Rectangular Rapid Flash Beacons (RRFB)		
		Curb extension		+ Reduced pedestrian crossing distance + Improved visibility of crosswalk
Missing crosswalk markings	South leg	Add crosswalk with ladder style pavement markings	Lower	+ Improved visibility of crosswalks and pedestrians

4.2.10 19 Street NW at 7 Avenue NW/8 Avenue NW

Issue	Location	Countermeasure	Priority Level	Impact
Shared bicycle facilities on a steep and curved roadway, which creates important speed differentials and increase the risk of conflicts	SB approach	Consider implementing bicycle facilities at the following locations: ▸ SB direction from 12 Avenue NW to 5 Avenue NW. ▸ NB direction from 8 Avenue NW to 6 Avenue NW.	Higher	+ Increased visibility and separation for cyclists

Issue	Location	Countermeasure	Priority Level	Impact
Crosswalk visibility and compliance to the controlled crossing	West, east, and south legs	Add crosswalk with ladder style pavement markings	Higher	+ Increased pedestrian visibility
	South leg	Add overhead flashing pedestrian signal or Implementation of RRFB		+ Increased pedestrian visibility, especially in dark conditions
Wide intersection access	East leg	Curb extension	Lower	+ Reduced radius of NE corner + Reduced pedestrian crossing distance
Missing streetlight can result in reduced pedestrian level lighting	South crosswalk	Assess lighting conditions and consider improving lighting conditions	Higher	+ Improved pedestrian visibility in dark conditions
Sidewalk obstructed by vegetation and a streetlight	South of the intersection, east side	Trim vegetation and relocate light pole	Lower	+ Increased pedestrian accessibility

5.0 SUMMARY

TNS was retained by Urban Systems to conduct a planning-level safety review of key intersections and roadways within the Riley Community. The Riley Community is composed of smaller communities in the northwest region of Calgary, including Sunnyside, Hillhurst, West Hillhurst and Hounsfield Heights/Briar Hill.

As part of the safety review scope, TNS conducted a desktop review of historic collision trends to identify locations where collision hotspots exist. In support of the City's Safer Mobility Plan, an emphasis was placed on collisions involving vulnerable road users. To identify higher risk sites, collision locations were plotted geographically and examined to determine areas where higher collision frequencies exist. A network screening exercise was also conducted to rank intersections with the highest potential for safety improvement based on control type (e.g., signalized and stop-controlled).

TNS conducted field investigations to better identify and diagnose safety issues that exist within the study area. This consisted of drive-throughs of major roadways and location specific investigations at 10 key intersections that were informed from the desktop collision review. The purpose of the field investigations was to observe and document existing safety operations, road user behavior, and field conditions, and to identify contributing factors to historic collisions.

Based on findings of the desktop review and field investigations, TNS identified key safety issues that were observed across the study area. The key issues were divided into specific categories consisting of roadway geometry, pedestrian facilities, cycling facilities, accessibility, and other issues. Countermeasures were proposed to mitigate the observed key issues. In addition, the project team identified location-specific issues and recommendations for the 10 key intersections.

Appendix A

Vulnerable Road User Collision Summary

Intersections

KENSINGTON RD NW & 14 ST NW

- 8 collisions (i.e. 6 involving pedestrian and 2 involving cyclist) were recorded:
    - 4 collisions involved a westbound vehicle:
        - 2 of them making a right-turn to the north, 1 hitting a ped and the other one hitting scooter rider,
        - 1 of them making a left-turn to the south, hitting pedestrian and stating sun was bin her eye,
        - 1 was stationery at WB lights waiting to turn left to the south, while past the stop line and crosswalk on green yield. Light turned red and vehicle reversed slowly hitting pedestrian with rear of vehicle
    - 2 collisions involved an eastbound vehicle, both making a right-turn to the south, both hitting a bike. In one case the bike riding NB against the flow of traffic on the sidewalk and entered the intersection at flash "don't walk sign" and under dark condition.
    - 2 collisions involved a northbound vehicle, both going ahead near intersection following rules, both hitting a ped ran out into road under dark condition. In one case traffic was slow in the other lane, and the other case ped was chasing his stolen car.

16 AV NW & 19 ST NW

- 5 collisions (i.e. 4 involving pedestrian and 1 involving cyclist) were recorded:
    - 2 collisions involved a southbound vehicle, 1 making left turn to the east condition and 1 making right turn to the west, both failed to yield to pedestrian crossing the sidewalk and hit them, both occurred under dark condition.
    - 1 collision involved an eastbound vehicle, making right turn to the south and hitting pedestrian crossing EW.
    - 1 collision involved a westbound vehicle, making left turn to the south and hitting pedestrian crossing EW.
    - 1 collision involved a northbound vehicle approaching intersection in Ln # 1 obeying rules, hitting a cyclist travelling in Ln #2 who cut across the path of the vehicle. Collision occurred under dark condition

Parkdale AV NW & 27 ST NW

- 3 collisions recorded, all involving cyclist, all involved an eastbound vehicle traveling straight on Parkdale Blvd, and failing to yield right of way to cyclist crossing at pedestrian flashing light.

19 ST NW & 7 AV NW

- 3 collisions (i.e. all involving cyclist) were recorded:
    - 1 collision involved both vehicle and cyclist traveling southbound on 19 St under dark condition, vehicle making left turn to 7 Ave and hitting cyclist.
    - 1 collision involved an eastbound vehicle on 7 AV making right turn to the south onto 19 St and hitting cyclist who was already south coming down the hill (Vehicle didn't see the bike).
    - 1 collision involved serious injury between car & cyclist under dark condition (no details provided)

19 ST NW & 12 AV NW

- 3 collisions (i.e. 2 involving pedestrian and 1 involving cyclist) were recorded:
    - 1 collision involved a northbound vehicle, traveling straight and hitting a ped crossing EB under dark condition.
    - 1 collision involved a westbound vehicle making right turn to north, and hitting a cyclist traveling southbound on 19 ST NW sidewalk on the wrong side (east side).
    - 1 collision involved a vehicle making a left turn and hitting a ped due to glare from the sun .

19 ST NW & Kensington RD NW

- 3 collisions (i.e. 1 involving pedestrian and 2 involving cyclist) were recorded:
    - 1 collision involved a vehicle making a westbound turn onto Kensington Rd and hitting a ped walking NB on the crosswalk under dark condition.
    - 1 collision involved an eastbound vehicle, making a left turn to the north onto 19 ST and hitting a cyclist heading to west.
    - 1 collision involved a vehicle making a right turn and hitting a cyclist riding on crosswalk with 'walk' signal on (no direction provided).

Midblocks

14 ST NW, north of Kensington RD NW

- 3 collisions (i.e. 1 involving pedestrian and 2 involving cyclist) were recorded:
    - 1 collision involved a vehicle exiting the west facing parking lot of Petro Canada and hitting a wheelchair ped walking NB on the sidewalk.
    - 1 collision involved a northbound vehicle, making a right turn into the Petro Canada parking lot and hitting a bicycle riding NB on the sidewalk.
    - 1 collision involved a northbound vehicle veered into and hit a northbound cyclist riding just north of Kensington Rd alongside/outside of solid white lane.

Appendix B

Network Screening Methodology and Results

Method of Moment – Theoretical Basis

The Method of Moments is a relatively simple methodology for estimating potential for safety improvement. This method does not require exposure parameters such as traffic volumes, and therefore was used for intersections with incomplete traffic volume information. However, unlike other methods which do not require exposure parameters (e.g. frequency method), this method is able to partially account for the Regression-to-the-Mean phenomenon.

The Method of Moments is described in the HSM as one of the techniques to conduct network screening. In this methodology, safety performance of individual entities (an intersection) in a group is compared with its peers in that reference population or group. As a result, the average annual observed collision frequency for the reference population is first calculated using the following equation:

$$\overline{X}_r = \frac{\sum_{i=1}^{n_r} X_i}{n_r} \quad \text{Eq. 1}$$

Where,

$\overline{X}_r$ denotes average collision frequency for reference population r;

X_i represents observed collision frequency at location i;

n_r is the number of locations per reference population;

The variance of observed collisions for the reference population is calculated using the following equation:

$$\mathrm{var}(X_r) = \frac{\sum_{i=1}^{n_r}(X_i - \overline{X}_r)^2}{n_r - 1} \quad \text{Eq. 2}$$

Where,

$\mathrm{var}(X_r)$ denotes the variance of collisions for the reference population.

Using the variance and average collision frequency for the reference population, the adjusted observed collision frequency for each location is calculated by the following equation:

$$X_{i,(adj)} = X_i + \frac{\overline{X}_r}{\mathrm{var}(X_r)} \times (\overline{X}_r - X_i) \quad \text{Eq. 3}$$

Where,

$X_{i,(adj)}$ denotes the adjusted observed number of collisions per year for location i.

To calculate the potential for improvement at each location, the average collision frequency for the reference population is subtracted from the adjusted observed average collision frequency for the location as shown by the following equation:

$$PI_i = X_{i,(adj)} - \overline{X}_r \quad \text{Eq. 4}$$

Where,

PI_i represents potential for improvement for location i.

All entities in a reference population are ranked based on $\mathbf{PI_i}$ from the highest to the lowest. The locations with larger potential for improvement will be ranked higher, showing more potential for improvement.

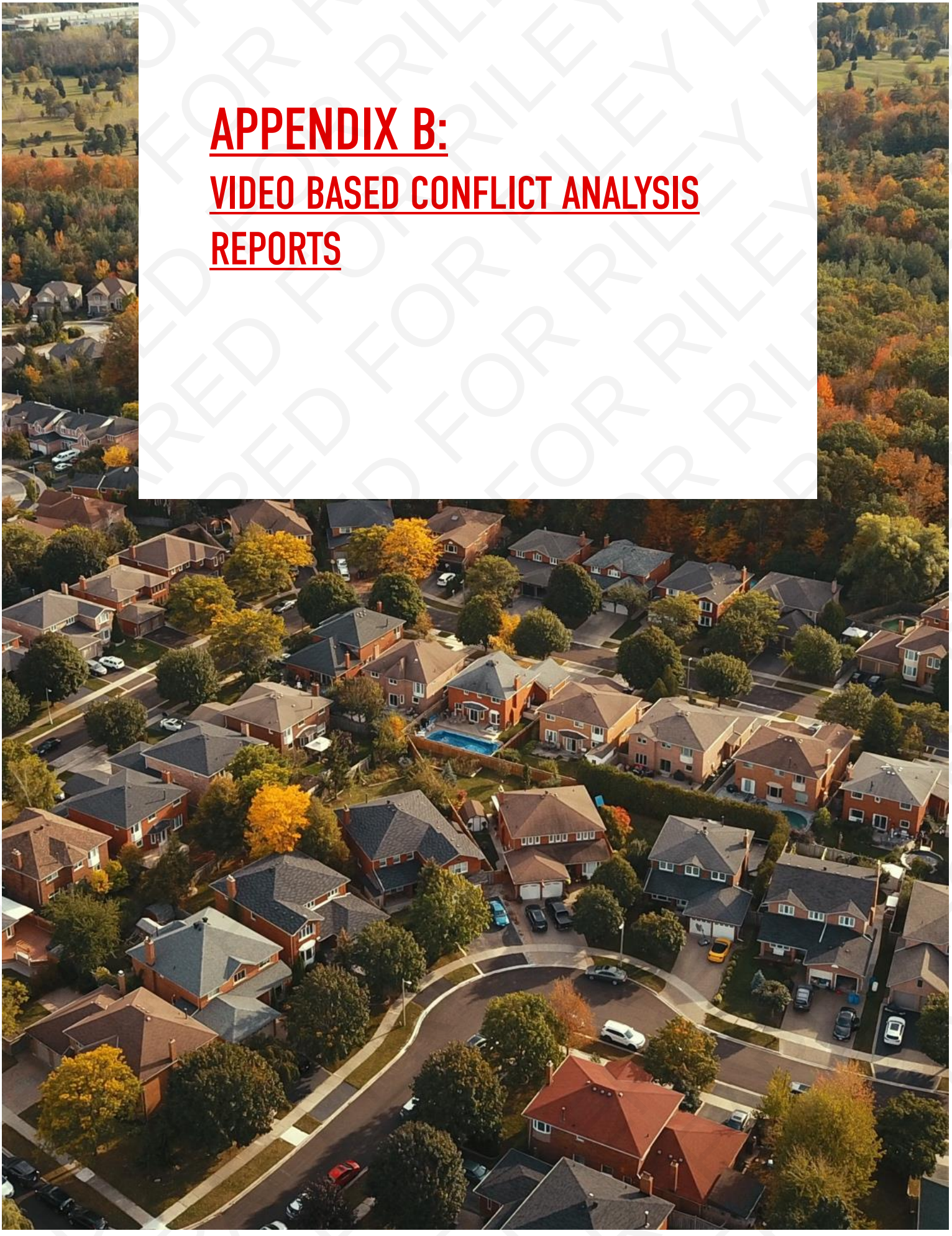
Results

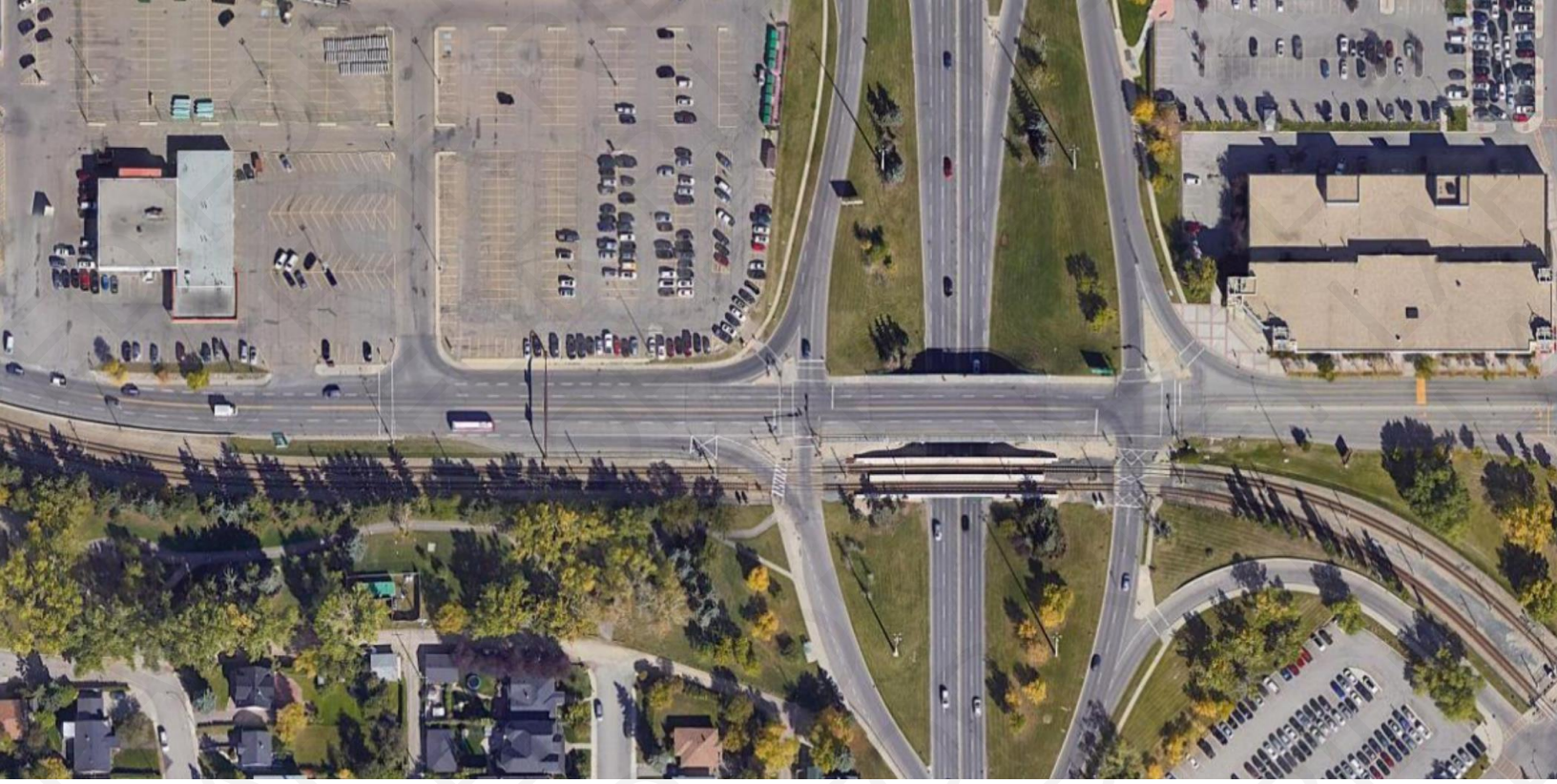
Intersection	Traffic Control	Collision Frequency				Adjusted	PI	Rank
		Fatal	Injury	PDO	EPDO Total			
CROWCHILD TR NW @ KENSINGTON RD NW	Signal	0	20	376	572	568.99	479.53	1
5 AV NW @ CROWCHILD TR NW	Signal	0	22	260	475	473.15	383.69	2
10 ST NW @ MEMORIAL DR NW	Signal	0	15	160	307	305.61	216.14	3
14 AV NW @ 14 ST NW (WEST INT)	Signal	1	5	79	302	300.90	211.43	4
14 ST NW @ KENSINGTON RD NW	Signal	0	8	182	260	259.33	169.86	5
10 ST NW @ KENSINGTON RD NW	Signal	0	9	98	186	185.57	96.10	6
16 AV NW @ 19 ST NW	Signal	0	7	79	148	147.21	57.75	7
14 ST NW @ 6 AV NW	Signal	0	6	78	137	136.48	47.02	8
19 ST NW @ KENSINGTON RD NW	Signal	0	7	34	103	102.48	13.01	9
16 AV NW @ 17 ST NW	Signal	0	8	23	101	101.28	11.82	10
KENSINGTON RD NW @ 10A ST NW	Signal	0	3	68	97	97.33	7.87	11
2 AV NW @ 10 ST NW	Signal	0	2	71	91	90.58	1.12	12
14 ST NW @ RAMP TO WB MEMORIAL DR NW	MPS	0	4	51	90	90.17	0.71	13
9 ST NW @ MEMORIAL DR NW	Signal	0	4	43	82	82.22	-7.25	14
14 AV NW @ 19 ST NW	Signal	0	1	61	71	70.91	-18.56	15
10 ST NW @ 3 AV NW	Signal	0	2	51	71	70.70	-18.76	16
10 ST NW @ 5 AV NW (SOUTH INT)	Signal	0	3	40	69	69.50	-19.96	17
2 AV NW @ 14 ST NW	Signal	0	2	38	58	57.78	-31.69	18
27 ST NW @ PARKDALE BV NW	Signal	0	3	28	57	57.57	-31.89	19
16 AV NW @ BANFF TR NW	Signal	0	2	31	51	50.82	-38.64	20
25 ST NW @ KENSINGTON RD NW	Signal	0	2	30	50	49.83	-39.64	21
7 AV NW @ 14 ST NW	Signal	0	1	34	44	44.07	-45.40	22
18 ST NW @ KENSINGTON RD NW	Signal	0	3	11	40	40.67	-48.79	23
KENSINGTON RD NW @ 11A ST NW	Signal	0	0	36	36	36.32	-53.14	24
21 ST NW @ KENSINGTON RD NW	Signal	0	2	14	34	33.92	-55.54	25
5 AV NW @ 12 ST NW	Signal	0	1	22	32	32.14	-57.33	26
12 ST NW @ KENSINGTON RD NW	Signal	0	1	21	31	31.14	-58.32	27
19 ST NW @ 12 AV NW	Signal	0	2	9	29	28.95	-60.51	28
5 AV NW @ 19 ST NW	Signal	0	1	13	23	23.19	-66.27	29
16 AV NW @ 14 ST NW WEST INTERSECTION	Signal	0	1	13	23	23.19	-66.27	30
MEMORIAL DR NW @ 7 ST NW	Signal	0	1	11	21	21.20	-68.26	31
NORTH HILL WEST DRIVEWAY NW @ 16 AV NW	Signal	0	1	9	19	19.22	-70.25	32
6 AV NW @ 18 ST NW	Signal	0	1	8	18	18.22	-71.24	33
KENSINGTON RD NW @ 22 ST NW	Signal	0	1	5	15	15.24	-74.22	34
23 ST NW @ KENSINGTON RD NW	Signal	0	0	11	11	11.47	-77.99	35
16 AV NW @ 14 ST NW	Signal	0	0	10	10	10.48	-78.99	36
22 ST NW @ 16 AV NW	Signal	0	0	7	7	7.49	-81.97	37
14 AV NW @ 14 ST NW	Signal	0	0	4	4	4.51	-84.95	38
CENTRE ST S @ CENTRE ST N	Signal	0	0	3	3	3.52	-85.95	39
ENT TO MOTEL VILLAGE NW @ 16 AV NW	Signal	0	0	3	3	3.52	-85.95	40
SAMIS RD NE @ CENTRE ST N	Signal	0	0	3	3	3.52	-85.95	41
CENTRE ST S @ MEMORIAL DR NE	Signal	0	0	2	2	2.52	-86.94	42
10 ST SW @ 9 ST SW	Signal	0	0	2	2	2.52	-86.94	43

Intersection	Traffic Control	Collision Frequency				Adjusted	PI	Rank
		Fatal	Injury	PDO	EPDO Total			
5 ST NW @ MEMORIAL DR NW	Stop_controlled	1	5	23	246	241.94	229.22	1
8 AV NW @ 14 ST NW	Stop_controlled	0	7	80	149	146.10	133.37	2
2 AV NW @ CROWCHILD TR NW	Stop_controlled	0	5	52	101	99.37	86.65	3
MEMORIAL DR NW @ 5A ST NW	Stop_controlled	0	6	39	98	96.22	83.50	4
19 ST NW @ MEMORIAL DR NW	Stop_controlled	0	5	38	87	85.62	72.90	5
11 ST NW @ KENSINGTON RD NW	Stop_controlled	0	2	62	82	80.34	67.62	6
13 AV NW @ 16A ST NW	Stop_controlled	0	1	63	73	71.71	58.98	7
14 ST NW @ GLADSTONE RD NW	Stop_controlled	0	3	43	72	71.30	58.58	8
13 ST NW @ KENSINGTON RD NW	Stop_controlled	0	3	36	65	64.43	51.70	9
MEMORIAL DR NW @ 10A ST NW	Stop_controlled	0	0	62	62	61.11	48.38	10
3 AV NW @ 10 ST NW	Stop_controlled	0	2	30	50	48.92	36.20	11
19 ST NW @ 7 AV NW	Stop_controlled	0	4	9	48	47.53	34.81	12
3 ST NW @ MEMORIAL DR NW	Stop_controlled	0	1	31	41	40.29	27.56	13
20 ST NW @ KENSINGTON RD NW	Stop_controlled	0	2	21	41	40.08	27.36	14
26 ST NW @ PARKDALE BV NW	Stop_controlled	0	3	11	40	39.88	27.16	15
16 AV NW @ 21A ST NW	Stop_controlled	0	2	19	39	38.12	25.39	16
8 ST NW @ MEMORIAL DR NW	Stop_controlled	0	0	38	38	37.54	24.82	17
14 ST NW @ 11 AV NW	Stop_controlled	0	2	16	36	35.17	22.45	18
24 ST NW @ 9 AV NW	Stop_controlled	0	2	14	34	33.21	20.49	19
16 ST NW @ MEMORIAL DR NW	Stop_controlled	0	1	22	32	31.45	18.72	20
10 ST NW @ 5 AV NW (NORTH INT)	Stop_controlled	0	1	22	32	31.45	18.72	21
5 AV NW @ 11 ST NW	Stop_controlled	0	2	11	31	30.26	17.54	22
14 ST NW @ BOWNESS RD NW	Stop_controlled	0	1	20	30	29.48	16.76	23
6 AV NW @ 15 ST NW	Stop_controlled	0	2	10	30	29.28	16.56	24
14 ST NW @ 10 AV NW	Stop_controlled	0	0	28	28	27.72	15.00	25
5 AV NW @ 13 ST NW	Stop_controlled	0	1	18	28	27.52	14.80	26
CROWCHILD TR NW @ UNIVERSITY DR NW	Stop_controlled	0	1	17	27	26.54	13.81	27
3 AV NW @ 9A ST NW	Stop_controlled	0	0	26	26	25.76	13.04	28
10 ST NW @ GLADSTONE RD NW	Stop_controlled	0	0	26	26	25.76	13.04	29
16 ST NW @ 6 AV NW	Stop_controlled	0	2	6	26	25.35	12.63	30
2 AV NW @ 9A ST NW	Stop_controlled	0	1	14	24	23.59	10.87	31
10 ST NW @ 4 AV NW	Stop_controlled	0	1	14	24	23.59	10.87	32
16 AV NW @ 20A ST NW	Stop_controlled	0	1	14	24	23.59	10.87	33
4 ST NW @ MEMORIAL DR NW	Stop_controlled	0	0	23	23	22.81	10.09	34
MEMORIAL DR NW @ 9A ST NW	Stop_controlled	0	1	13	23	22.61	9.89	35
2 AV NW @ 19 ST NW	Stop_controlled	0	1	12	22	21.63	8.91	36
BRIAR CR NW @ 19 ST NW	Stop_controlled	0	1	11	21	20.65	7.92	37
16 AV NW @ CROWCHILD TR NW	Stop_controlled	0	1	11	21	20.65	7.92	38
16 ST NW @ KENSINGTON RD NW	Stop_controlled	0	1	10	20	19.67	6.94	39
23 ST NW @ 16 AV NW	Stop_controlled	0	0	19	19	18.89	6.16	40
BROWNSEA DR NW @ 21 ST NW	Stop_controlled	0	1	9	19	18.68	5.96	41
14 AV NW @ 24 ST NW	Stop_controlled	0	1	9	19	18.68	5.96	42
CROWCHILD TR NW @ 14 AV NW	Stop_controlled	0	1	9	19	18.68	5.96	43
2 AV NW @ 8 ST NW	Stop_controlled	0	0	18	18	17.90	5.18	44
12 ST NW @ 8 AV NW	Stop_controlled	0	0	18	18	17.90	5.18	45
GLADSTONE RD NW @ 11A ST NW	Stop_controlled	0	1	8	18	17.70	4.98	46
1 AV NW @ 9 ST NW	Stop_controlled	0	1	8	18	17.70	4.98	47
2 AV NW @ 9 ST NW	Stop_controlled	0	0	16	16	15.94	3.22	48
16 AV NW @ 16 ST NW	Stop_controlled	0	1	6	16	15.74	3.01	49
16 ST NW @ 8 AV NW	Stop_controlled	0	0	15	15	14.96	2.23	50

APPENDIX B:

VIDEO BASED CONFLICT ANALYSIS REPORTS





VIDEO CONFLICT ANALYSIS

Location: **14 Street NW and 14 Avenue NW Intersection, Calgary, Alberta**

May 2023

TRUE NORTH SAFETY GROUP

VIDEO CONFLICT ANALYSIS

Location: **14 Street NW and 14 Avenue Intersection NW, Calgary, Alberta**

Project Team:
Stefan Tsang, B.A.Sc., P.Eng.
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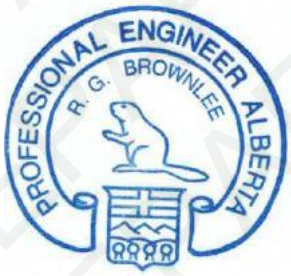

Russell Brownlee, B.Sc., M.A. Sc., RSP1, P. Eng.

Alexandre Nolet, M.Eng., RSP_1, P.Eng.

May 2023

1.0 INTRODUCTION

1.1 Background

The City of Calgary ('the City') retained the Urban Systems Team ('Urban Systems') to conduct the Riley Communities Mobility Study and Improvements Plan. True North Safety Group ('TNS') and Transoft Solutions ('Transoft') were retained to undertake video conflict analysis at five intersections across the City. As part of this study, Transoft collected conflict analysis data, vehicular speed data, and traffic volumes at each intersection. TNS analyzed the outputs and included the key road safety review findings in individual reports.

The following is a summary of the safety assessment conducted for the intersection of 14 Street NW and 14 Avenue NW.

1.2 Study Area

The intersection of 14 Street NW and 14 Avenue NW is a signalized ramp terminal intersection. Pedestrian crosswalks are provided on the north, south, and west legs of the intersection. 14 Street NW is a one-way roadway that runs north-south with two southbound lanes. 14 Avenue NW is an east-west roadway with four lanes. Right turn channels are provided on both the northwest and southwest corners of the intersection.

There is an at-grade railway crossing for the CTrain (Red Line) immediately south of the intersection, with flashing lights and gates on the vehicular approaches. The posted speed limit through the intersection is 50 kilometres per hour (km/h). Adjacent land uses consist of North Hill Shopping Centre in the northwest corner, low-density residential in the southwest corner, and the Southern Alberta Institute of Technology (SAIT) and Jubilee Auditorium to the east. A multi-use trail runs south of the rail corridor and connects to the south leg of 14 Street NW.

Figure 1 provides an image of the lane configuration. **Figure 2** provides an aerial image of the intersection.

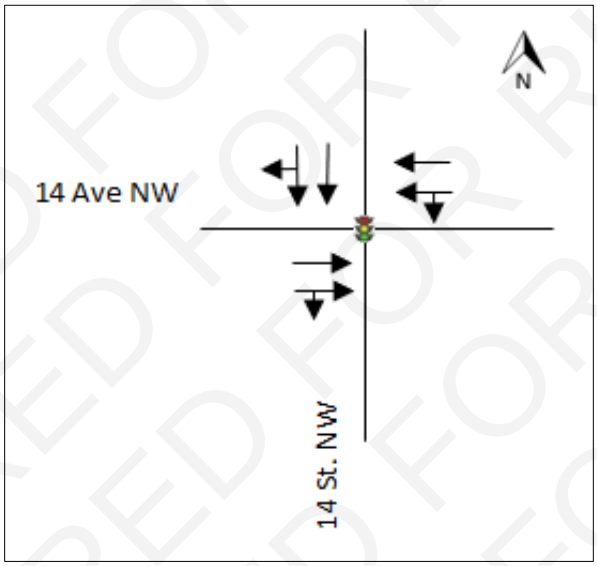

Figure 1: Lane Configuration of 14th Street NW and 14 Avenue NW Intersection

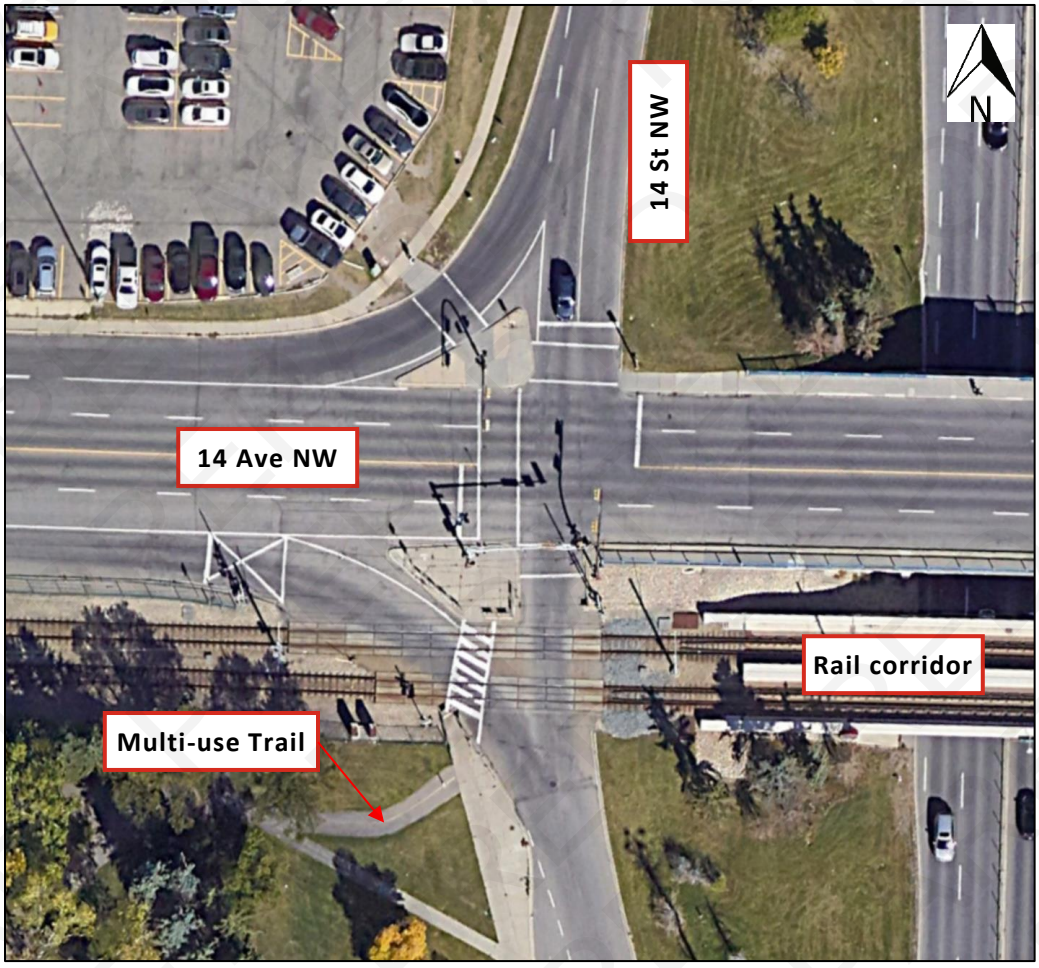

Figure 2: 14th Street NW and 14 Avenue NW Intersection

1.3 Video Data Collection

One camera was installed on the northwest corner of the intersection to capture all traffic movements. The view of the camera is shown in **Figure 3**. Data was collected for 72 consecutive hours over a three-day period (June 23 to 26, 2022).

Figure 3: Camera View of the Intersection from the northwest corner

2.0 VIDEO ANALYTIC OUTPUT

The results of the video analytic assessment related to traffic volumes, speeds, and conflicts for the subject intersection are provided below.

2.1 Volumes

The peak morning and afternoon hourly traffic occurred at this intersection from 7:30 a.m. to 8:30 a.m. and 5:15 pm to 6:15 pm respectively. The intersection peak hour volumes collected on Thursday, June 23, 2022, are summarized in **Figure 4**. The pedestrian crossing volumes were relatively low and were only observed for the west crosswalk.

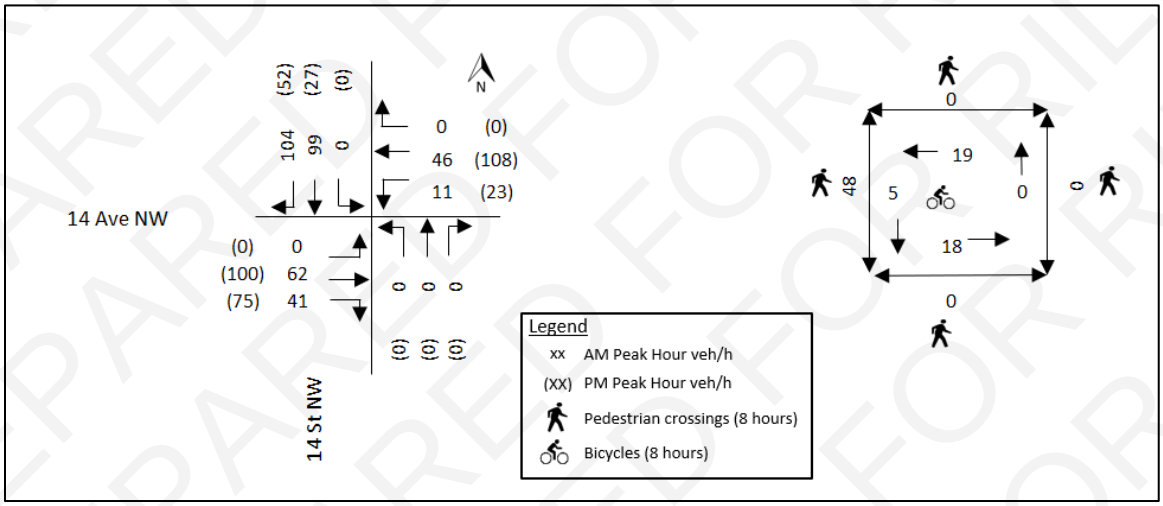

Figure 4: Intersection Peak Hour Volumes on Thursday, June 23, 2022

2.2 Conflicts

2.2.1 Conflict Analysis Methodology

Traffic conflicts can be grouped in two main types: time-proximity conflicts and evasive action conflicts. Traffic conflicts based on an evasive action consist of an event involving two or more road users, in which the action of one user causes the other user to brake or swerve. Time-proximity conflicts consist of determining how close in time or space the involved road users are to colliding. The time-proximity conflict measures include Post Encroachment Time (PET) and Time to Collision (TTC).

PET is defined as the time between the first road user leaving the common spatial zone (i.e., where two road users could potentially collide) and the second road user arriving to the common spatial zone. TTC describes the time until a collision that would have happened if two conflicting road users were to continue their paths and speeds. The lower the PET and/or TTC, the smaller the temporal and/or spatial proximity between the road users and the lower the available reaction time would be.

Transoft's video conflict algorithm captures all safety-related events with a PET/TTC of less than ten seconds. The information about each safety-related event (e.g., speed of the road users, PET or TTC values, vehicle that arrived first at the conflict location, date, and time) is recorded in a disaggregated database. In general, video footage for each safety-related event with a PET/TTC of less than two seconds is also provided.

The safety-related events identified by Transoft's algorithm are not differentiated as to whether the safety-related event was the result of normal operations or of hazardous road user behaviors that could have resulted in a collision. Therefore, further analysis was required to identify which safety-related events involved hazardous road user behaviors (actual conflicts).

The approach used to differentiate the actual conflicts varied based on the nature of the conflicts and the available data. **Table 1** summarizes the approach used to identify which safety-related events involved hazardous road user behaviors for the key conflict types.

Table 1: Approach to Identify Conflicts

Conflict Type	Approach
Conflicts with vulnerable road users (VRUs) Right-turning, left-turning, or through vehicle in conflict with a vulnerable road user.	• Determining which safety-related events involved a hazardous behavior by the motorist and/or pedestrian can only be accomplished by reviewing individual video footage. • Each video footage for safety-related events of 2 seconds or less are reviewed and the safety-related events that required an evasive action are flagged. • In addition to providing the total number of safety-related events of 2 seconds or less, a description of the safety-related events that required an evasive action is provided.
Opposing Left Turn Vehicle making a left turn in front of a vehicle approaching from the opposing direction.	• The conflict frequency of the safety-related events where the first vehicle to arrive at the conflict point was the left turning motorist is provided. • The frequency of opposing left turn safety-related events where the left turning vehicle arrived second at the conflict point is not considered as part of the analysis.
Angle Vehicles travelling at an angle to each other.	• An angle conflict type occurring at a controlled intersection implies that one vehicle disobeyed the traffic control system. Therefore, all recorded angle safety-related events are considered conflicts.
Right turn Vehicle making a right turn in front of a perpendicular through vehicle.	• The conflict frequency of the safety-related events where the first vehicle to arrive at the conflict point was the right turning motorist is provided. • The frequency of right turning safety-related events where the right turning vehicle arrived second at the conflict point is not considered as part of this analysis.

Conflicts are also sorted into risk levels. The conflict risk level speed thresholds are based on the Wramborg biomechanical survivability thresholds[1]. These risk levels are shown in **Table 2.**

[1] Jurewicz, Chris, Air Sobhani, Jeremy Woolley, Jeff Dutschke and Bruce Corben. 2016. "Exploration of Vehicle Impact Speed-Injury Severity Relationships for Application in Safer Road Design." Transportation Research Procedia, Volume 14: 4247-4256.

Table 2: Conflict Risk Levels Based on Vehicular and Pedestrian Speeds

Risk Level	Vehicle-Pedestrian Conflicts	Vehicle-Vehicle Conflicts
Low	< 15 km/h	< 35 km/h
Medium	> 15 km/h	> 35 km/h
High	> 35 km/h	> 50 km/h
Critical	> 50 km/h	> 70 km/h

The results for the conflict analysis are provided below. In **Appendix A**, a list of the less than 2 seconds conflicts with the hyperlink to the associated video footage for each key conflict type is provided.

2.2.2 Conflicts with Vulnerable Road Users

Table 3 and **Table 4** summarize the number of conflicts recorded at each crosswalk.

Table 3: Frequency of Conflicts at Each Crosswalk with PET of Less than 2.0 Seconds

Risk Level	North Crosswalk	South Crosswalk	East Crosswalk	West Crosswalk
Low	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Medium	0 (0%)	0 (0%)	0 (0%)	1 (50%)
High	0 (0%)	0 (0%)	0 (0%)	1 (50%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	0	0	0	2

Table 4: Frequency of Conflicts at each Crosswalk with PET of 2.0 to 4.0 Seconds

Risk Level	North Crosswalk	South Crosswalk	East Crosswalk	West Crosswalk
Low	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Medium	0 (0%)	0 (0%)	0 (0%)	2 (40%)
High	0 (0%)	0 (0%)	0 (0%)	2 (40%)
Critical	0 (0%)	0 (0%)	0 (0%)	1 (20%)
Total	0	0	0	5

A relatively low number of conflicts between vehicles and VRUs was recorded. All conflicts occurred on the west crosswalk at the intersection or on the channelized southbound right-turn lane. **Table 5** and **Table 6** summarize the number of conflicts per VRU conflict types.

Table 5: Frequency of Conflicts with PET of Less than 2.0 Seconds per VRU Conflict Types

Risk Level	Right Turn	Left Turn	Through
Low	0 (0%)	0 (0%)	0 (0%)
Medium	1 (100%)	0 (0%)	0 (0%)
High	0 (0%)	0 (0%)	1 (100%)
Critical	0 (0%)	0 (0%)	0 (0%)
Total	1	0	1

Table 6: Frequency of Conflicts with PET of 2.0 to 4.0 Seconds per VRU Conflict Types

Risk Level	Right Turn	Left Turn	Through
Low	0 (0%)	0 (0%)	0 (0%)
Medium	1 (100%)	0 (0%)	1 (25%)
High	0 (0%)	0 (0%)	2 (50%)
Critical	0 (0%)	0 (0%)	1 (25%)
Total	1	0	4

Right Turn with Vulnerable Road Users

Table 7 and **Table 8** summarize the number of conflicts recorded between right turning traffic and VRUs.

Table 7: Frequency of Conflicts Between Right Turning Vehicles and VRUs with PET of Less than 2.0 Seconds

Risk Level	North Crosswalk		South Crosswalk		East Crosswalk		West Crosswalk	
	WBRT	SBRT	EBRT	NBRT	NBRT	WBRT	SBRT	EBRT
Low	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Medium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (100%)	0 (0%)
High	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	0	0	0	0	0	0	1	0

Table 8: Frequency of Conflicts between Right Turning Vehicles and VRUs with PET of 2.0 to 4.0 Seconds

Risk Level	North Crosswalk		South Crosswalk		East Crosswalk		West Crosswalk	
	WBRT	SBRT	EBRT	NBRT	NBRT	WBRT	SBRT	EBRT
Low	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Medium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (100%)	0 (0%)
High	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	0	0	0	0	0	0	1	0

Two right turn conflicts involving a VRU occurred on the west crosswalk with a southbound right turning motorist.

Left Turn with Vulnerable Road Users

At this intersection, there were no conflicts observed between left turning vehicles and VRUs. This is likely since the only left-turn movement that crosses a pedestrian crosswalk is the westbound left-turn movement, and both movements have relatively low volumes (23 left-turns during the peak hour, and no pedestrians).

Through with Vulnerable Road Users

Table 9 and **Table 10** summarize the number of conflicts recorded between through traffic and VRUs.

Table 9: Frequency of Conflicts between Through Vehicles and VRUs with PET of Less than 2.0 Seconds

Risk Level	North Crosswalk		South Crosswalk		East Crosswalk		West Crosswalk	
	NBT	SBT	NBT	SBT	EBT	WBT	EBT	WBT
Low	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Medium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
High	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (100%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	0	0	0	0	0	0	0	1

The pedestrian conflict in **Table 9** involved a pedestrian crossing in the west crosswalk without the right of way. The pedestrian waited for the oncoming westbound motorist to pass the crosswalk before running northbound.

Table 10: Frequency of Conflicts between Through Vehicles and VRUs with PET of 2.0 to 4.0 Seconds

Risk Level	North Crosswalk		South Crosswalk		East Crosswalk		West Crosswalk	
	NBT	SBT	NBT	SBT	EBT	WBT	EBT	WBT
Low	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Medium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (33%)
High	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (67%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (100%)	0 (0%)
Total	0	0	0	0	0	0	1	3

2.2.3 Other Conflict Types

Table 11 and **Table 12** summarize the number of conflicts for the most common vehicular conflict types.

Table 11: Frequency of Vehicular Conflict Types with PET of Less than 2.0 Seconds

Risk Level	Right Turn Conflicts	Left Turn with Opposing Through Conflicts	Angle Type Conflicts
Low	1 (100%)	2 (67%)	4 (100%)
Medium	0 (0%)	1 (33%)	0 (0%)
High	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)
Total	1	3	4

Table 12: Frequency of Vehicular Types with PET of 2.0 to 4.0 Seconds

Risk Level	Right Turn Conflicts	Left Turn with Opposing Through Conflicts	Angle Type Conflicts
Low	1 (25%)	3 (19%)	29 (91%)
Medium	3 (75%)	11 (69%)	3 (9%)
High	0 (0%)	2 (13%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)
Total	4	16	32

The most frequent conflict type was angle conflicts, followed by left turn with opposing through conflicts.

Left Turn Conflicts

Table 13 and **Table 14** summarize the number of conflicts recorded for left turning traffic conflict types.

Table 13: Frequency of Conflicts with Left Turning Traffic with PET of Less than 2.0 Seconds

Risk Level	NBLT with SBT	SBLT with NBT	EBLT with WBT	WBLT with EBT
Low	0 (0%)	0 (0%)	0 (0%)	2 (67%)
Medium	0 (0%)	0 (0%)	0 (0%)	1 (33%)
High	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	0	0	0	3

Table 14: Frequency of Conflicts with Left Turning Traffic with PET of 2.0 to 4.0 Seconds

Risk Level	NBLT with SBT	SBLT with NBT	EBLT with WBT	WBLT with EBT
Low	0 (0%)	0 (0%)	0 (0%)	3 (19%)
Medium	0 (0%)	0 (0%)	0 (0%)	11 (69%)
High	0 (0%)	0 (0%)	0 (0%)	2 (13%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	0	0	0	16

All conflicts shown involve the westbound left-turn movement, since that is the only left-turn that has a conflicting through movement.

Angle Conflicts

Table 15 and **Table 16** summarize the number of angle conflicts recorded.

Table 15: Frequency of Angle Conflicts with PET of Less than 2.0 Seconds

Risk Level	NBT with EBT	NBT with WBT	SBT with EBT	SBT with WBT
Low	0 (0%)	0 (0%)	1 (100%)	3 (100%)
Medium	0 (0%)	0 (0%)	0 (0%)	0 (0%)
High	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	0	0	1	3

Table 16: Frequency of Angle Conflicts with PET of 2.0 to 4.0 Seconds

Risk Level	NBT with EBT	NBT with WBT	SBT with EBT	SBT with WBT
Low	0 (0%)	1 (100%)	3 (100%)	25 (89%)
Medium	0 (0%)	0 (0%)	0 (0%)	3 (11%)
High	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	0	1	3	28

The majority of angle conflicts involve a southbound through or left-turn motorist that entered the intersection late into the intergreen period before the subsequent east/west phase. One conflict involved a transit bus that stopped in the middle of the intersection when the LRT gate arms were lowered.

Right Turn Conflicts

Table 17 and **Table 18** summarize the number of conflicts recorded for right turning traffic conflict types.

Table 17: Frequency of Conflicts with Right Turning Traffic with PET of Less than 2.0 Seconds

Risk Level	NBRT with EBT	SBRT with WBT	EBRT with SBT	WBRT with NBT
Low	0 (0%)	1 (100%)	0 (0%)	0 (0%)
Medium	0 (0%)	0 (0%)	0 (0%)	0 (0%)
High	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	0	1	0	0

Table 18: Frequency of Conflicts with Right Turning Traffic with PET of 2.0 to 4.0 Seconds

Risk Level	NBRT with EBT	SBRT with WBT	EBRT with SBT	WBRT with NBT
Low	0 (0%)	0 (0%)	1 (100%)	0 (0%)
Medium	0 (0%)	3 (100%)	0 (0%)	0 (0%)
High	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	0	3	1	0

Most recorded vehicular right turn conflicts occurred between southbound right turning and westbound through motorists.

2.3 Speeds

2.3.1 Conflicts with Vulnerable Road Users

Right Turn with Vulnerable Road Users

A comparison of the 85th percentile speed per movement for the conflicts with right turning traffic and VRUs is summarized in **Table 19**.

Table 19: Speed in Kilometers Per Hour per Movement for the Conflicts between Right Turning Traffic and VRUs

Conflict Type	Right Turn Movement	Pedestrian
NBRT vs VRU (East Crosswalk)	-	-
SBRT vs VRU (West Crosswalk)	29.31	10.80
EBRT vs VRU (South Crosswalk)	-	-
WBRT vs VRU (North Crosswalk)	-	-

The only right-turn conflict with a VRU occurred in the southbound right turn channel. The turning motorist was travelling at a speed of approximately 30 km/h. The radius of the southbound right turn channel was measured to be approximately 23 m, which allows motorists to navigate the curve at high speeds.

2.3.2 Other Conflict Types

Left Turn Conflicts

A comparison of the 85th percentile speed per movement for the left turn conflict types is summarized in **Table 20**.

Table 20: 85th percentile Speed per Movement for the Left Turn Conflicts

Conflict Type	Left turn Movement	Through Movement
NBLT with SBT	-	-
SBLT with NBT	-	-
EBLT with WBT	-	-
WBLT with EBT	21.07	47.16

Angle

A comparison of the 85th percentile speed per movement for the angle conflict types is summarized in **Table 21**.

Table 21: 85th Percentile Speed per Movement for the Angle Conflicts

Conflict Type	Through N/S	Through E/W
NBT with EBT	-	-
NBT with WBT	11.28	45.78
SBT with EBT	21.49	48.36
SBT with WBT	23.22	49.24

Right Turn Conflicts

A comparison of the 85th percentile speed per movement for the right turn conflict types is summarized in **Table 22**.

Table 22: 85th percentile Speed per Movement for the Right Turn Conflicts

Conflict Type	Right turn movement	Through movement
NBRT with EBT	-	-
SBRT with WBT	30.31	39.09
EBRT with SBT	26.15	20.09
WBRT with NBT	-	-

3.0 POTENTIAL CONTRIBUTING FACTORS AND REMEDIAL MEASURES

The identification of potential contributing factors was based on a review of video clips and the above video analytic outputs. These potential contributing factors are summarized in **Table 23**. The potential remedial measures to address the identified safety issues are summarized in **Table 24**.

For each identified remedial measure, the implementation timeline and priority level is specified. The categories used are the following:

Timeline:

- Short-term actions include relatively inexpensive measures that could be implemented in the short-term without major physical changes to the layout of the intersection.
- Medium/long-term recommendations are more costly, which require long-term planning, design, and property.

Priority Level:

- Lower priority: remedial measure that would improve safety but that does not address a safety issue with a significant conflict and/or liability risk.
- Higher priority: remedial measure that addresses a safety issue with a high conflict and/or liability risk and that should be prioritized by the City.

It should be noted that due to relatively low number of conflicts recorded at the intersection, it can be difficult to identify safety issues and trends. It is recommended that a collision review be conducted to gain a better understanding of historic safety performance at the intersection. In addition, no field investigations were conducted as part of this video conflict analysis. The City should confirm the feasibility of the recommended remedial measures before implementing them.

Table 23: Identified Safety Issues

Safety Issues	Conflict Example
VRUs disobeying pedestrian signals Conflicts between pedestrians and opposing through movements involved the pedestrian running across the crosswalk without the right of way. The pedestrian was observed crossing without the WALK display.	 *Video ID: 63648115*
VRUs in conflicts with right turning traffic Conflicts between right turning motorists and pedestrians involved motorists making right turn movements and conflicting with pedestrians. In the screenshot, the pedestrian crosses the road outside of the crosswalk and into the path of the right turning vehicle. The pedestrian then went back onto the sidewalk and crossed in the crosswalk. Conflicts with pedestrians in the southbound right-turn channel can occur when motorists are not anticipating pedestrians in the crosswalk, and where high turn speeds reduce the perception-reaction time.	 Video ID: 63793483

Safety Issues	Conflict Example
Low lighting levels[2] Low lighting levels appear to be present on all corners of the intersection which reduces the visibility of VRUs under dark conditions. There are no light poles installed to illuminate the crosswalks.	
Pedestrian accessibility[3] The curb cut on the southeast corner of the intersection may not be wide enough for a mobility device. In addition, a portion of the sidewalk width is obstructed by the pedestrian fencing.	

[2] Note that no formal lighting assessment was conducted as part of this safety review. The comments about the lighting levels are based on a cursory review of the conflict videos and Google Streetview images.

[3] Note that no in-field measurements were collected as part of this safety review. The comments about curb cut and sidewalk width are based on a review of Google Streetview images.

Table 24: Potential Remedial Measures

Safety Issues	Potential Remedial Measures	Effectiveness	Timeline	Priority Level
VRUs in conflicts with right turning traffic	**Provide "Smart Channels"** on the northwest. The provision of Smart Channels align right-turning drivers to be more perpendicular with the intersecting roadway and pedestrian crosswalks. Motorists are also required to navigate the channel at lower speeds. It is possible to implement Smart Channels through pavement markings or truck aprons, which still accommodate turning movements of larger vehicles.	CMF of 0.558 for all collisions[4].	Medium-term	Lower
Low lighting levels	**Assess the lighting conditions** at the intersection to determine if improvements should be installed.	No specific CMF for assessing the lighting conditions at the intersection.	Short-term	Higher
Pedestrian accessibility	**Assess the curb cuts and sidewalk widths** to determine if pedestrian facilities are sufficient to accommodate pedestrians with mobility devices.	No CMF available for this treatment.	Medium-term	Higher

[4] Safety Impacts of a Modified Right Turn Lane Design at Intersections, Schattler and Hanson, 2016.

Safety Issues	Potential Remedial Measures	Effectiveness	Timeline	Priority Level
	Install accessible pedestrian signals (APS) Installing APS with an audible chirp synchronized with visual signals. It provides additional auditory cues for the visually impaired.	No CMF available for this treatment.	Short/Medium Term	Higher

APPENDIX A

Conflicts with a PET/TTC of 2 seconds or less

Conflicts with VRUs

Safety Indicator Value(seconds)	Date	Time	Evasive Action Conflicts	URL
1.6	2022-06-23	16:03:09	No	https://results.trafxsafe.com/indicators/63648115
1.94	2022-06-24	17:31:42	Yes	https://results.trafxsafe.com/indicators/63793483

Opposing Left Turn

Safety Indicator Value(seconds)	Date	Time	Evasive Action Conflicts	URL
1.6	2022-06-24	10:10:10	Yes	https://results.trafxsafe.com/indicators/63654216
1.84	2022-06-24	16:44:22	Yes	https://results.trafxsafe.com/indicators/63793219
1.97	2022-06-24	15:30:43	Yes	https://results.trafxsafe.com/indicators/63793520

Angle

Safety Indicator Value(seconds)	Date	Time	Evasive Action Conflicts	URL
1.74	2022-06-22	15:37:11	Yes	https://results.trafxsafe.com/indicators/63671770
1.74	2022-06-22	18:43:58	Yes	https://results.trafxsafe.com/indicators/63648296
1.8	2022-06-25	13:06:32	Yes	https://results.trafxsafe.com/indicators/63648069
1.97	2022-06-23	8:15:52	Yes	https://results.trafxsafe.com/indicators/63659625

Right Turn

Safety Indicator Value(seconds)	Date	Time	Evasive Action Conflicts	URL
1.7	2022-06-23	7:48:43	Yes	https://results.trafxsafe.com/indicators/63648134

VIDEO CONFLICT ANALYSIS

Location: **18 Street NW and 6 Avenue NW Intersection, Calgary, Alberta**

May 2023

TRUE NORTH SAFETY GROUP

VIDEO CONFLICT ANALYSIS

Location: **18 Street NW and 6 Avenue NW Intersection, Calgary, Alberta**

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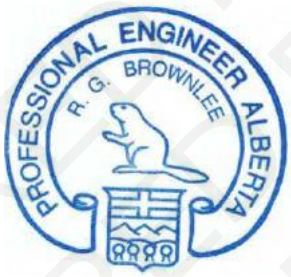
Alexandre Nolet, M.Eng., RSP_1, P.Eng.



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Alexandre Nolet, M.Eng., RSP_1, P.Eng.

May 2023

1.0 INTRODUCTION

1.1 Background

The City of Calgary ('the City') retained the Urban Systems Team ('Urban Systems') to conduct the Riley Communities Mobility Study and Improvements Plan. True North Safety Group ('TNS') and Transoft Solutions ('Transoft') were retained to undertake video conflict analysis at five intersections across the City. As part of this study, Transoft collected conflict analysis data, vehicular speed data, and traffic volumes at each intersection. TNS analyzed the outputs and included the key road safety review findings in individual reports.

The following is a summary of the safety assessment conducted for the intersection of 18 Street NW and 6 Avenue NW.

1.2 Study Area

The intersection of 6 Avenue NW and 18 Street NW is unsignalized with stop control on the north and south legs. There is a pedestrian crossover on the east leg of the intersection which provides a designated crossing facility for pedestrians. Land use in the vicinity of the intersection is predominantly low-density residential and institutional, with two public schools on the southeast corner of the intersection, and a community centre on the northwest corner. The posted speed limit through the intersection is 30 kilometres/hour (km/h).

6 Avenue NW is a two-lane collector road with painted bicycle lanes. 18 Street NW is a two-lane residential road (one serving each direction) and has on-the street parking permitted. Sidewalks are provided on both sides of each roadway, except along the west side of 18 Street NW north of 6 Avenue NW.

Figure 1 provides an image of the lane configuration. **Figure 2** provides an aerial image of the intersection.

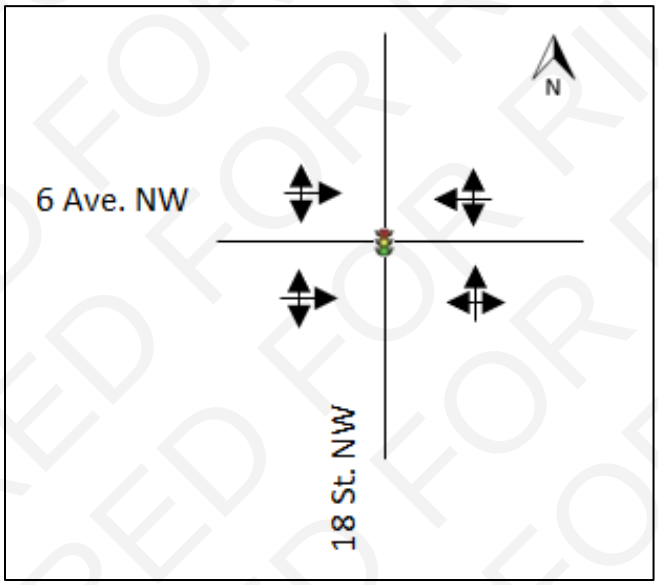


Figure 1: Lane Configuration of 18 Street NW and 6 Avenue NW Intersection

Figure 2: 18 Street NW and 6 Avenue NW Intersection

1.3 Video Data Collection

A video camera was installed on the northwest corner of the intersection and was facing south. All traffic movements and the crosswalk were captured. The data of interest was collected for 72 consecutive hours over a three-day period (June 23 to 26, 2022). **Figure 3** shows the field of view of the camera.

Figure 3: Camera View at the Intersection (Looking South)

2.0 VIDEO ANALYTIC OUTPUT

The results of the video analytic assessment related to traffic volumes, speeds, and conflicts for the subject intersection are provided below.

2.1 Volumes

The peak morning hourly traffic for the intersection of 18 Street NW and 6 Avenue NW intersection occurred between 8:00 am to 9:00 am. The peak afternoon hourly volume was recorded between 3:15 pm to 4:15 pm. This aligns closely with bell times at Queen Elizabeth High School. **Figure 4** summarizes the intersection peak hour volumes collected on Thursday, June 23, 2022.

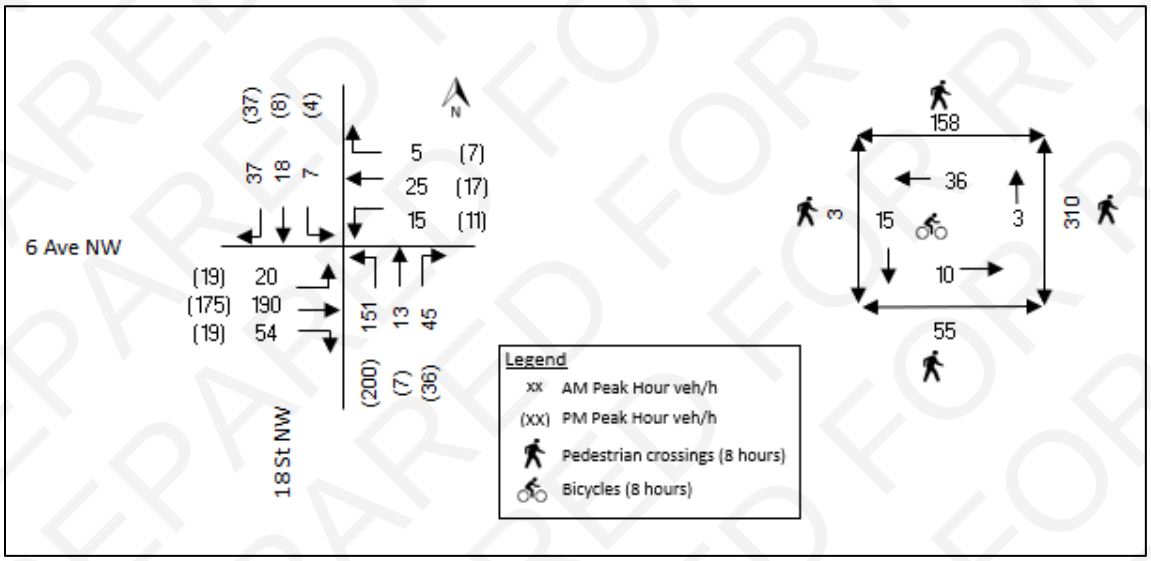


Figure 4: Intersection peak hour volumes on Thursday, June 23, 2022

2.2 Conflicts

2.2.1 Conflict Analysis Methodology

Traffic conflicts can be grouped in two main types: time-proximity conflicts and evasive action conflicts. Traffic conflicts based on an evasive action consist of an event involving two or more road users, in which the action of one user causes the other user to brake or swerve. Time-proximity conflicts consist of determining how close in time or space the involved road users are to colliding. The time-proximity conflict measures include Post Encroachment Time (PET) and Time to Collision (TTC).

PET is defined as the time between the first road user leaving the common spatial zone (i.e., where two road users could potentially collide) and the second road user arriving to the common spatial zone. TTC describes the time until a collision that would have happened if two conflicting road users were to continue their paths and speeds. The lower the PET and/or TTC, the smaller the temporal and/or spatial proximity between the road users and the lower the available reaction time would be.

Transoft's video conflict algorithm captures all safety-related events with a PET/TTC of less than ten seconds. The information about each safety-related event (e.g., speed of the road users, PET or TTC values, vehicle that arrived first at the conflict location, date, and time) is recorded in a disaggregated database. In general, video footage for each safety-related event with a PET/TTC of less than two seconds is also provided.

The safety-related events identified by Transoft's algorithm are not differentiated as to whether the safety-related event was the result of normal operations or of hazardous road user behaviors that could have resulted in a collision. Therefore, further analysis was required to identify which safety-related events involved hazardous road user behaviors (actual conflicts).

The approach used to differentiate the actual conflicts varied based on the nature of the conflicts and the available data. **Table 1** summarizes the approach used to identify which safety-related events involved hazardous road user behaviors for the key conflict types.

Table 1: Approach to Identify Conflicts

Conflict Type	Approach
Conflicts with vulnerable road users (VRUs) Right-turning, left-turning, or through vehicle in conflict with a vulnerable road user.	• Determining which safety-related events involved a hazardous behavior by the motorist and/or pedestrian can only be accomplished by reviewing individual video footage. • Each video footage for safety-related events of 2 seconds or less are reviewed and the safety-related events that required an evasive action are flagged. • In addition to providing the total number of safety-related events of 2 seconds or less, a description of the safety-related events that required an evasive action is provided.
Opposing Left Turn Vehicle making a left turn in front of a vehicle approaching from the opposing direction.	• The conflict frequency of the safety-related events where the first vehicle to arrive at the conflict point was the left turning motorist is provided. • The frequency of opposing left turn safety-related events where the left turning vehicle arrived second at the conflict point is not considered as part of the analysis.
Angle Vehicles travelling at an angle to each other.	• An angle conflict type occurring at a controlled intersection implies that one vehicle disobeyed the traffic control system. Therefore, all recorded angle safety-related events are considered conflicts.
Right turn Vehicle making a right turn in front of a perpendicular through vehicle.	• The conflict frequency of the safety-related events where the first vehicle to arrive at the conflict point was the right turning motorist is provided. • The frequency of right turning safety-related events where the right turning vehicle arrived second at the conflict point is not considered as part of this analysis.

Conflicts are also sorted into risk levels. The conflict risk level speed thresholds are based on the Wramborg biomechanical survivability thresholds[1]. These risk levels are shown in **Table 2.**

[1] Jurewicz, Chris, Air Sobhani, Jeremy Woolley, Jeff Dutschke and Bruce Corben. 2016. "Exploration of Vehicle Impact Speed-Injury Severity Relationships for Application in Safer Road Design." Transportation Research Procedia, Volume 14: 4247-4256.

Table 2: Conflict Risk Levels Based on Vehicular and Pedestrian Speeds

Risk Level	Vehicle-Pedestrian Conflicts	Vehicle-Vehicle Conflicts
Low	< 15 km/h	< 35 km/h
Medium	> 15 km/h	> 35 km/h
High	> 35 km/h	> 50 km/h
Critical	> 50 km/h	> 70 km/h

The results for the conflict analysis are provided below. A list of conflicts less than 2 seconds is presented along with the hyperlink to the associated video footage for each key conflict type is provided in **Appendix A**.

2.2.2 Conflicts with Vulnerable Road Users

Table 3 and **Table 4** summarize the number of conflicts recorded at each crosswalk. It should be noted that there is no west crosswalk; those conflict volumes involve a pedestrian crossing at an undesignated location.

Table 3: Frequency of Conflicts at Each Crosswalk with PET of Less than 2.0 seconds

Risk Level	North Crosswalk	South Crosswalk	East Crosswalk	West Crosswalk
Low	2 (67%)	3 (100%)	0 (0%)	0 (0%)
Medium	1 (33%)	0 (0%)	6 (86%)	0 (0%)
High	0 (0%)	0 (0%)	1 (14%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	3	3	7	0

Table 4: Frequency of Conflicts at Each Crosswalk with PET of 2.0 to 4.0 seconds

Risk Level	North Crosswalk	South Crosswalk	East Crosswalk	West Crosswalk
Low	13 (59%)	5 (63%)	7 (12%)	0 (0%)
Medium	9 (41%)	3 (38%)	36 (62%)	0 (0%)
High	0 (0%)	0 (0%)	15 (26%)	1 (50%)
Critical	0 (0%)	0 (0%)	0 (0%)	1 (50%)
Total	22	8	58	2

The highest frequency of VRU conflicts and pedestrian volumes were recorded on the east crosswalk. **Table 5** and **Table 6** summarize the number of conflicts per VRU conflict types.

Table 5: Frequency of Conflicts with PET of less than 2.0 seconds per VRU Conflict Types

Risk Level	Right Turn	Left Turn	Through
Low	4 (80%)	0 (0%)	1 (17%)
Medium	1 (20%)	2 (100%)	4 (67%)
High	0 (0%)	0 (0%)	1 (17%)
Critical	0 (0%)	0 (0%)	0 (0%)
Total	5	2	6

Table 6: Frequency of Conflicts with PET of 2.0 to 4.0 seconds per VRU Conflict Types

Risk Level	Right Turn	Left Turn	Through
Low	18 (62%)	2 (25%)	5 (9%)
Medium	11 (38%)	5 (63%)	32 (60%)
High	0 (0%)	0 (0%)	16 (30%)
Critical	0 (0%)	1 (13%)	0 (0%)
Total	29	8	53

Conflicts between VRUs and through movements were noted to have the highest frequency, followed by conflicts between VRUs and right turning motorists.

Right Turn with Vulnerable Road Users

Table 7 and **Table 8** summarize the number of conflicts recorded between right turning traffic and VRUs.

Table 7: Frequency of Conflicts Between Right-turning Vehicles and VRUs with PET of less than 2.0 seconds

Risk Level	North Crosswalk		South Crosswalk		East Crosswalk		West Crosswalk	
	WBRT	SBRT	EBRT	NBRT	NBRT	WBRT	SBRT	EBRT
Low	0 (0%)	2 (100%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Medium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1(100%)	0 (0%)	0 (0%)	0 (0%)
High	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	0	2	0	2	1	0	0	0

Table 8: Frequency of Conflicts Between Right-turning Vehicles and VRUs with PET of 2.0 to 4.0 seconds

Risk Level	North Crosswalk		South Crosswalk		East Crosswalk		West Crosswalk	
	WBRT	SBRT	EBRT	NBRT	NBRT	WBRT	SBRT	EBRT
Low	1 (50%)	1 (91%)	2 (67%)	2 (100%)	1 (13%)	2 (67%)	0 (0%)	0 (0%)
Medium	1 (50%)	1 (9%)	1 (33%)	0 (0%)	7 (88%)	1 (33%)	0 (0%)	0 (0%)
High	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	2	11	3	2	8	3	0	0

The highest frequency of conflicts between VRUs and right turning motorists was recorded on the north crosswalk with southbound right turning motorists, followed by the east crosswalk with northbound right turning motorists.

Left Turn with Vulnerable Road Users

Table 9 and **Table 10** summarize the number of conflicts recorded between left turning traffic and VRUs.

Table 9: Frequency of conflicts between left turning vehicles and VRUs with PET of less than 2.0 seconds

Risk Level	North Crosswalk		South Crosswalk		East Crosswalk		West Crosswalk	
	EBLT	SBLT	WBLT	NBLT	SBLT	WBLT	NBLT	EBLT
Low	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Medium	1(100%)	0 (0%)	0 (0%)	0 (0%)	1(100%)	0 (0%)	0 (0%)	0 (0%)
High	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	1	0	0	0	1	0	0	0

Table 10: Frequency of conflicts between left turning vehicles and VRUs with PET of 2.0 to 4.0 seconds

Risk Level	North Crosswalk		South Crosswalk		East Crosswalk		West Crosswalk	
	EBLT	SBLT	WBLT	NBLT	SBLT	WBLT	NBLT	EBLT
Low	0 (0%)	1(100%)	0 (0%)	0 (0%)	0 (0%)	1(100%)	0 (0%)	0 (0%)
Medium	4 (100%)	0 (0%)	0 (0%)	0 (0%)	1 (100%)	0 (0%)	0 (0%)	0 (0%)
High	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1(100%)	0 (0%)
Total	4	1	0	0	1	1	1	0

The highest frequency of conflicts between VRUs and left turning motorists was recorded on the north crosswalk with eastbound left turning motorists.

Through with Vulnerable Road Users

Table 11 and **Table 12** summarize the number of conflicts recorded between through traffic and VRUs.

Table 11: Frequency of conflicts between through vehicles and VRUs with PET of less than 2.0 seconds.

Risk Level	North Crosswalk		South Crosswalk		East Crosswalk		West Crosswalk	
	NBT	SBT	NBT	SBT	EBT	WBT	EBT	WBT
Low	0 (0%)	0 (0%)	1(100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Medium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (10%)	2(67%)	0 (0%)	0 (0%)
High	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1(33%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	0	0	1	0	2	3	0	0

Table 12: Frequency of conflicts between through vehicles and VRUs with PET of 2.0 to 4.0 seconds.

Risk Level	North Crosswalk		South Crosswalk		East Crosswalk		West Crosswalk	
	NBT	SBT	NBT	SBT	EBT	WBT	EBT	WBT
Low	0 (0%)	1(100%)	1 (50%)	0 (0%)	1 (3%)	2 (17%)	0 (0%)	0 (0%)
Medium	3 (100%)	0 (0%)	1 (50%)	1 (100%)	21 (64%)	6 (50%)	0 (0%)	0 (0%)
High	0 (0%)	0 (0%)	0 (0%)	0 (0%)	11 (33%)	4 (33%)	1 (100%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	3	1	2	1	33	12	1	0

The highest frequency of conflicts between VRUs and through travelling motorists was recorded on the east crosswalk with eastbound and westbound through motorists, with a vast majority of conflicts occurring on the east crosswalk where the controlled pedestrian crossing was located. Due to the camera location, it was not possible to identify if the conflicts occurred when the pedestrian signal was activated.

2.2.3 Other Conflict Types

Table 13 and **Table 14** summarize the number of conflicts for the most common vehicular conflict types.

Table 13: Frequency of vehicular conflict types with PET of less than 2.0 seconds

Risk Level	Right Turn Conflicts	Left Turn with Opposing Through Conflicts	Angle Type Conflicts
Low	4 (80%)	6 (100%)	21 (60%)
Medium	1 (20%)	0 (0%)	11 (31%)
High	0 (0%)	0 (0%)	3 (9%)
Critical	0 (0%)	0 (0%)	0 (0%)
Total	5	6	35

Table 14: Frequency of vehicular types with PET of 2.0 to 4.0 seconds

Risk Level	Right Turn Conflicts	Left Turn with Opposing Through Conflicts	Angle Type Conflicts
Low	33 (67%)	32 (44%)	110 (59%)
Medium	11 (22%)	37 (51%)	69 (37%)
High	5 (10%)	4 (5%)	8 (4%)
Critical	0 (0%)	0 (0%)	0 (0%)
Total	49	73	187

Angle type conflicts were the most common vehicle-vehicle conflict type, which is not unusual at minor stop-controlled intersections.

Left Turn Conflicts

Table 15 and **Table 16** summarize the number of conflicts recorded for left turning traffic conflict types.

Table 15: Frequency of conflicts with left turning traffic with PET of less than 2.0 seconds.

Risk Level	NBLT with SBT	SBLT with NBT	EBLT with WBT	WBLT with EBT
Low	2 (100%)	0 (0%)	4 (100%)	0 (0%)
Medium	0 (0%)	0 (0%)	0 (0%)	0 (0%)
High	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	2	0	4	0

Table 15: Frequency of conflicts with left turning traffic with PET of 2.0 to 4.0 seconds.

Risk Level	NBLT with SBT	SBLT with NBT	EBLT with WBT	WBLT with EBT
Low	19 (37%)	3 (100%)	5 (50%)	5 (56%)
Medium	30 (59%)	0 (0%)	4 (40%)	3 (33%)
High	2 (4%)	0 (0%)	1 (10%)	1 (11%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	51	3	10	9

Most left turn conflicts (67%) occurred between northbound left turning and southbound through travelling motorists.

Angle Conflicts

Table 17 and **Table 18** summarize the number of angle conflicts recorded.

Table 17: Frequency of angle conflicts with PET of less than 2.0 seconds

Risk Level	NBT with EBT	NBT with WBT	SBT with EBT	SBT with WBT
Low	7 (54%)	5 (83%)	5 (71%)	4 (44%)
Medium	4 (31%)	1 (17%)	2 (29%)	4 (44%)
High	2 (15%)	0 (0%)	0 (0%)	1 (11%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	13	6	7	9

Table 18: Frequency of angle conflicts with PET of 2.0 to 4.0 seconds

Risk Level	NBT with EBT	NBT with WBT	SBT with EBT	SBT with WBT
Low	36 (58%)	15 (83%)	46 (52%)	13 (72%)
Medium	22 (35%)	3 (17%)	39 (44%)	5 (28%)
High	4 (6%)	0 (0%)	4 (4%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	62	18	89	18

Most (77%) of the recorded angle conflicts involved an eastbound through motorist. Upon review of the conflict videos, it was observed that most of these conflicts occurred when the northbound/southbound vehicles entered the intersection after yielding to the eastbound/westbound vehicle that had the right of way. It was also observed that most drivers did not come to a complete stop before entering the intersection.

Right Turn Conflicts

Table 19 and **Table 20** summarize the number of conflicts recorded for right turning traffic conflict types.

Table 19: Frequency of conflicts with right turning traffic with PET of less than 2.0 seconds.

Risk Level	NBRT with EBT	SBRT with WBT	EBRT with SBT	WBRT with NBT
Low	2 (67%)	0 (0%)	2 (100%)	0 (0%)
Medium	1 (33%)	0 (0%)	0 (0%)	0 (0%)
High	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	3	0	2	0

Table 20: Frequency of conflicts with right turning traffic with PET of 2.0 to 4.0 seconds.

Risk Level	NBRT with EBT	SBRT with WBT	EBRT with SBT	WBRT with NBT
Low	24 (60%)	2 (100%)	6 (100%)	1 (100%)
Medium	11 (28%)	0 (0%)	0 (0%)	0 (0%)
High	5 (13%)	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	40	2	6	1

Most (80%) of the recorded vehicular right turn conflicts occurred between northbound right turning and eastbound through motorists. Upon a desktop review of departure sightlines at the northbound stop bar, it appears that the sight distance may be constrained by vegetation located on private property on the southwest corner.

2.3 Speeds

2.3.1 Conflicts with Vulnerable Road Users

Right Turn with Vulnerable Road Users

A comparison of the 85th percentile speed per movement for the conflicts with right turning traffic and VRUs is summarized in **Table 21**.

Table 21: Speed in kilometers per hour per movement for the conflicts between right turning traffic and VRUs.

Conflict Type	Right Turn Movement	Pedestrian
NBRT vs VRU (East Crosswalk)	15.43	6.88
SBRT vs VRU (West Crosswalk)	9.71	9.88
EBRT vs VRU (South Crosswalk)	18.83	9.19
WBRT vs VRU (North Crosswalk)	23.82	6.01

The highest right turning speed was recorded on the westbound approach. In both westbound and eastbound approaches, motorists do not turn right adjacent to the curb, which results in a larger effective right turn radius.

Left Turn with Vulnerable Road Users

A comparison of the 85th percentile speed per movement for the conflicts with left turning traffic and VRUs is summarized in **Table 22.**

Table 22: Speed in kilometers per hour per movement for the conflicts between left turning traffic and VRUs.

Conflict Type	Left Turn Movement	Pedestrian
NBLT vs VRU (West Crosswalk)	43.04	6.51
SBLT vs VRU (East Crosswalk)	13.78	6.74
EBLT vs VRU (North Crosswalk)	25.42	6.29
WBLT vs VRU (South Crosswalk)	19.64	7.51

High left turn speeds exceeding 40 km/h were recorded on the northbound approach.

2.3.2 Other Conflict Types

Left Turn Conflicts

A comparison of the 85th percentile speed per movement for the left turn conflict types is summarized in **Table 23**

Table 23: 85th percentile speed per movement for the left turn conflicts.

Conflict Type	Left turn Movement	Through Movement
NBLT with SBT	42.42	19.76
SBLT with NBT	18.11	17.33
EBLT with WBT	24.15	36.58
WBLT with EBT	26.27	41.21

High left turn speeds exceeding 40 km/h were recorded on the northbound approach.

Angle Conflicts

A comparison of the 85th percentile speed per movement for the angle conflict types is summarized in **Table 24.**

Table 24: 85th percentile speed per movement for the angle conflicts.

Conflict Type	Through N/S	Through E/W
NBT with EBT	17.92	41.08
NBT with WBT	17.73	37.61
SBT with EBT	18.64	40.48
SBT with WBT	18.10	37.82

Right Turn Conflicts

A comparison of the 85th percentile speed per movement for the right turn conflict types is summarized in **Table 25**.

Table 25: 85th percentile speed per movement for the right turn conflicts.

Conflict Type	Right turn movement	Through movement
NBRT with EBT	38.11	41.28
SBRT with WBT	14.70	36.42
EBRT with SBT	25.81	19.09
WBRT with NBT	23.04	17.01

High right turn speeds of approximately 40 km/h were recorded on the northbound approach.

3.0 POTENTIAL CONTRIBUTING FACTORS AND REMEDIAL MEASURES

The identification of potential contributing factors was based on a review of video clips and the above video analytic outputs. These potential contributing factors and proposed remedial measures are summarized in **Table 26** and **Table 27**.

For each identified remedial measure, the implementation timeline and priority level is specified. The categories used are the following:

Timeline:

- Short-term actions include relatively inexpensive measures that could be implemented in the short-term without major physical changes to the layout of the intersection.
- Medium/long-term recommendations are more costly, which require long-term planning, design, and property.

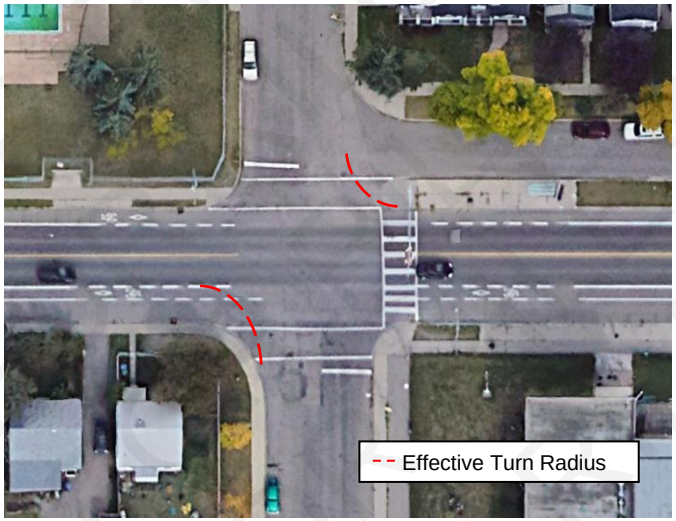
Priority Level:

- Lower priority: remedial measure that would improve safety but that does not address a safety issue with a significant conflict and/or liability risk.
- Higher priority: remedial measure that addresses a safety issue with a high conflict and/or liability risk and that should be prioritized by the City.

Note that no field investigations or historic collision review were conducted as part of this video conflict analysis. The City should confirm the feasibility of the recommended remedial measures before implementing them.

Table 26: Identified Safety Issues.

Safety Issues	Conflict Example
Pedestrians crossing outside of crosswalks Pedestrians crossing outside of crosswalks can lead to conflicts with oncoming motorists in areas where pedestrians are not anticipated to be located. There is no crosswalk on the west side of the intersection to accommodate pedestrian desire lines to West Hillhurst Community Association, outdoor pool, and playground on the northwest corner. There were some pedestrians observed to cross on the west leg.	 Video ID: 63694374
Right-turn conflicts with VRUs A number of conflicts observed at this intersection involved vehicle turning right and pedestrian attempting to cross. Also, the pedestrian has the right of way and the leg of the intersection seen in the picture is stop controlled, the right turning vehicle did not yield to the pedestrian. The sidewalk and curb cut does not fully align with the crosswalk, which may lead to confusion for motorists if the pedestrians are intending to cross the road.	 Video ID: 63696877

Safety Issues	Conflict Example
High right-turn speeds Right-turning motorists were observed turning at high speeds, especially on the eastbound and westbound approaches. This may be due to the parking lane (eastbound approach) and the adjacent roadway (westbound approach) that results in a larger effective radius. In addition, the larger effective radius results in inconsistent vehicle turn paths, which causes additional area for exposure for conflicting VRUs.	
Left-turn conflicts with VRUs Left-turning vehicles encroached onto the path of pedestrians in the east crosswalk. While it cannot be determined if the pedestrian flashing signal was activated, this interaction still represents a conflict between road users.	 Video ID: 63700938

Safety Issues	Conflict Example
Low lighting levels[2] Low lighting levels appear to be provided on the northeast corner of the intersection which reduces the visibility of VRUs under dark conditions. On the northeast corner, there is no light pole installed to illuminate the crosswalks.	 Video ID: 63700169

[2] Note that no formal lighting assessment was conducted as part of this safety review. The comments about the lighting levels are based on a cursory review of the conflict videos and Google Streetview images.

Table 27: Potential Remedial Measures.

Safety Issues	Potential Remedial Measures	Effectiveness	Timeline	Priority Level
Pedestrians crossing outside of crosswalks	**Add crosswalk ladder markings** to improve pedestrian visibility for motorists and to provide positive guidance for designated crossing facilities.	CMF of 0.52 for vehicle-pedestrian collisions[3]	Short-term	Lower
	Realign curb cuts on the southwest and northwest corners of the intersection. This would allow for improved accessibility for pedestrians with mobility devices and reduce the risk of slips and falls.	No specific CMF.	Short/Medium-term	Lower
	Consider installing a signalized intersection. Installing a signal will better establish right-of-way for the highest intersection volumes (northbound left and eastbound through). The addition of a signal will also allow for the provision of a west crosswalk, and provide an opportunity to implement leading	CMF of 0.716 for all collisions[4].	Medium/Long-term	Higher

[3] Sanders, R., Schultheiss, B., Judelman, B., Burchfield, R., Nordback, K., Gelinne, D., ... & Koonce, P. (2020). Guidance to Improve Pedestrian and Bicyclist Safety at Intersections (No. Project 15-63).
[4] Safety Evaluation of Signal Installation With and Without Left Turn Lanes on Two Lane Roads in Rural and Suburban Areas, Srinivasan et al., 2014.

Safety Issues	Potential Remedial Measures	Effectiveness	Timeline	Priority Level
	pedestrian intervals, which provide greater priority for pedestrians. City staff should conduct a traffic signal warrant at this location to determine if the installation of a signal at this location should be explored further.			
High turn speeds	**Addition of curb extensions** on the southwest and northeast corners. This will reduce the right-turn radius and thereby vehicle speeds and reduce pedestrian crossing distances. The curb extension on the northeast corner will constrain the width of the north intersection leg and may reduce the eastbound left-turn speeds.	No specific CMF. However, providing a more constrained intersection, would result in reduced speed and increase the perception-reaction time of motorists at the intersection.	Medium/Long-term	Lower
Low lighting levels	**Assess the lighting conditions** at the intersection to determine if improvements should be installed.	No specific CMF for assessing the lighting conditions at the intersection.	Short-term	Higher

APPENDIX A

Conflicts with a PET/TTC of 2 seconds or less

Conflicts with VRUs

Safety Indicator Value (seconds)	Date	Time	Evasive Action Conflicts	URL
0.97	2022-06-23	15:37:15	No	https://results.trafxsafe.com/indicators/63694374
1	2022-06-25	12:31:09	No	https://results.trafxsafe.com/indicators/63696877
1.27	2022-06-22	15:36:45	No	https://results.trafxsafe.com/indicators/63697903
1.43	2022-06-24	19:03:49	No	https://results.trafxsafe.com/indicators/63694426
1.5	2022-06-23	16:11:20	No	https://results.trafxsafe.com/indicators/63700938
1.67	2022-06-22	15:40:41	No	https://results.trafxsafe.com/indicators/63698063
1.67	2022-06-22	15:49:17	No	https://results.trafxsafe.com/indicators/63698220
1.74	2022-06-22	21:32:31	No	https://results.trafxsafe.com/indicators/63697819
1.74	2022-06-22	15:08:36	No	https://results.trafxsafe.com/indicators/63698343
1.77	2022-06-24	14:44:22	No	https://results.trafxsafe.com/indicators/63695482
1.77	2022-06-25	10:06:46	No	https://results.trafxsafe.com/indicators/63697699
1.97	2022-06-22	16:23:13	No	https://results.trafxsafe.com/indicators/63697602
1.97	2022-06-23	15:15:02	No	https://results.trafxsafe.com/indicators/63694308

Opposing Left Turn

Safety Indicator Value (seconds)	Date	Time	URL
0.7	2022-06-22	15:41:44	https://results.trafxsafe.com/indicators/63698174
1.43	2022-06-22	14:17:29	https://results.trafxsafe.com/indicators/63696342
1.57	2022-06-23	12:43:26	https://results.trafxsafe.com/indicators/63699788
1.6	2022-06-23	21:04:27	https://results.trafxsafe.com/indicators/63699018
1.63	2022-06-22	16:07:24	https://results.trafxsafe.com/indicators/63697427
1.94	2022-06-22	15:40:17	https://results.trafxsafe.com/indicators/63698169

Angle

Safety Indicator Value (seconds)	Date	Time	URL
0.93	2022-06-22	14:18:14	https://results.trafxsafe.com/indicators/63696239
0.93	2022-06-22	16:12:49	https://results.trafxsafe.com/indicators/63697386
0.97	2022-06-22	15:05:46	https://results.trafxsafe.com/indicators/63698089
1.1	2022-06-22	15:45:59	https://results.trafxsafe.com/indicators/63697852
1.2	2022-06-23	20:40:22	https://results.trafxsafe.com/indicators/63698727
1.4	2022-06-22	21:39:42	https://results.trafxsafe.com/indicators/63697748
1.53	2022-06-22	15:05:24	https://results.trafxsafe.com/indicators/63697841
1.57	2022-06-22	17:28:59	https://results.trafxsafe.com/indicators/63695352
1.57	2022-06-25	11:48:52	https://results.trafxsafe.com/indicators/63696765
1.6	2022-06-22	14:56:29	https://results.trafxsafe.com/indicators/63696323
1.63	2022-06-22	15:13:10	https://results.trafxsafe.com/indicators/63698102
1.63	2022-06-22	17:30:40	https://results.trafxsafe.com/indicators/63695191
1.67	2022-06-22	17:09:01	https://results.trafxsafe.com/indicators/63695337
1.7	2022-06-22	18:44:09	https://results.trafxsafe.com/indicators/63694815
1.7	2022-06-22	18:58:11	https://results.trafxsafe.com/indicators/63694593
1.7	2022-06-22	18:06:49	https://results.trafxsafe.com/indicators/63694585
1.74	2022-06-22	17:48:07	https://results.trafxsafe.com/indicators/63694884
1.74	2022-06-22	15:03:50	https://results.trafxsafe.com/indicators/63698084
1.74	2022-06-23	19:49:31	https://results.trafxsafe.com/indicators/63695770
1.77	2022-06-22	19:05:12	https://results.trafxsafe.com/indicators/63698500
1.77	2022-06-22	15:10:08	https://results.trafxsafe.com/indicators/63698094
1.8	2022-06-22	18:54:28	https://results.trafxsafe.com/indicators/63694820
1.84	2022-06-25	14:24:44	https://results.trafxsafe.com/indicators/63695931
1.84	2022-06-24	11:47:59	https://results.trafxsafe.com/indicators/63694104
1.87	2022-06-23	9:52:09	https://results.trafxsafe.com/indicators/63698794
1.87	2022-06-25	14:58:18	https://results.trafxsafe.com/indicators/63695935
1.87	2022-06-22	16:21:47	https://results.trafxsafe.com/indicators/63697130
1.9	2022-06-23	17:41:35	https://results.trafxsafe.com/indicators/63696666
1.9	2022-06-22	17:09:19	https://results.trafxsafe.com/indicators/63694868
1.9	2022-06-22	15:46:10	https://results.trafxsafe.com/indicators/63697853
1.9	2022-06-22	14:51:06	https://results.trafxsafe.com/indicators/63696321
1.9	2022-06-22	15:36:44	https://results.trafxsafe.com/indicators/63697887
1.9	2022-06-25	9:03:58	https://results.trafxsafe.com/indicators/63698399
1.94	2022-06-22	19:05:09	https://results.trafxsafe.com/indicators/63698499
1.94	2022-06-22	17:47:37	https://results.trafxsafe.com/indicators/63694880

Right Turn

Safety Indicator Value (seconds)	Date	Time	URL
0.9	2022-06-22	15:42:29	https://results.trafxsafe.com/indicators/63698041
1.27	2022-06-25	14:32:36	https://results.trafxsafe.com/indicators/63696024
1.47	2022-06-22	18:03:13	https://results.trafxsafe.com/indicators/63694821
1.9	2022-06-22	16:09:49	https://results.trafxsafe.com/indicators/63697590
1.9	2022-06-23	15:45:53	https://results.trafxsafe.com/indicators/63694275

VIDEO CONFLICT ANALYSIS

Location: **19 Street NW and 14 Avenue NW Intersection, Calgary Alberta**

May 2023

TRUE NORTH SAFETY GROUP

VIDEO CONFLICT ANALYSIS

Location: **19 Street NW and 14 Avenue NW Intersection, Calgary, Alberta**

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May 2023

1.0 INTRODUCTION

1.1 Background

The City of Calgary ('the City') retained the Urban Systems Team ('Urban Systems') to conduct the Riley Communities Mobility Study and Improvements Plan. True North Safety Group ('TNS') and Transoft Solutions ('Transoft') were retained to undertake video conflict analysis at five intersections across the City. As part of this study, Transoft collected conflict data, vehicular speed data, and traffic volumes at each intersection. TNS analyzed the outputs and included the key road safety review findings in individual reports.

The following is a summary of the safety assessment conducted for the intersection of 19 Street NW and 14 Avenue NW.

1.2 Study Area

The intersection of 19 Street NW and 14 Avenue NW is four-leg signalized intersection. In vicinity of the intersection, 19 Street NW runs north-south, and 14 Avenue NW runs east-west. The posted speed limit through the intersection is 50 kilometres/hour (km/h). Both 14 Avenue NW and 19 Street NW are collector roads.

There are sidewalks on both sides of 19 Street NW and on the west leg of 14 Avenue NW. On the east leg, a sidewalk is present on the north side and the south sidewalk transitions into a multi-use trail approximately 50 metres (m) east of 19 Street NW. A multi-use trail also connects to the south leg of the intersection. There is an at-grade railway crossing for the CTrain (Red Line) approximately 60 m east of 19 Street NW, with flashing lights and gates on the vehicular approaches.

Adjacent land uses consist of residential on the southwest corner and commercial on the northwest corner. Parks are provided on both the southeast and northeast corners.

Figure 1 provides an image of the lane configuration. **Figure 2** provides an aerial image of the intersection.

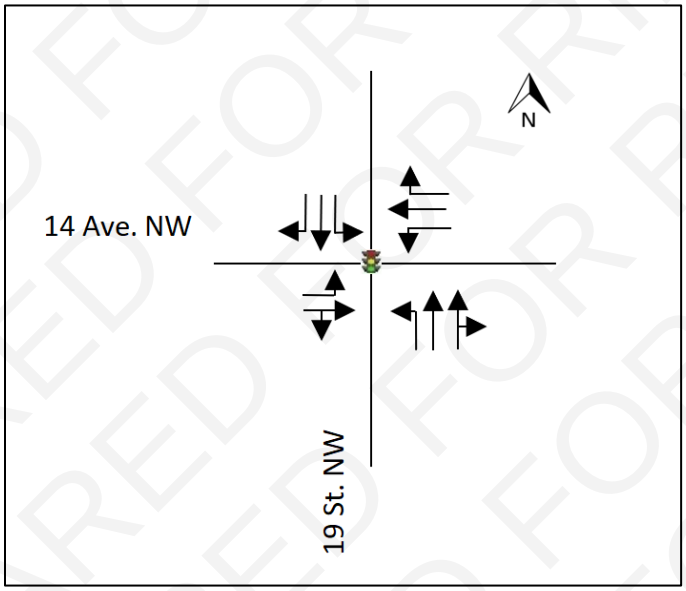


Figure 1: Lane Configuration of 19 Street NW and 14 Avenue NW Intersection.

Figure 2: 19 Street NW and 14 Avenue NW Intersection.

1.3 Video Data Collection

A video camera installed on the northwest corner of the intersection facing southeast captured all traffic movements including pedestrian activities on the crosswalks. Data was collected over a four-day period (July 26 to 29, 2022). **Figure 3** shows the field of view of the camera.

Figure 3: Camera view of the Intersection from the northwest corner.

2.0 VIDEO ANALYTIC OUTPUT

The results of the video analytic assessment related to traffic volumes, speeds, and conflicts for the subject intersection are provided below.

2.1 Volumes

The peak morning hourly traffic for the intersection of 19 Street NW and 14 Avenue NW occurred between 8:45 a.m. to 9:45 a.m. The peak afternoon hourly volume was recorded between 4:30 p.m. to 5:30 p.m. **Figure 4** summarizes the peak hourly volumes of the intersection collected on Thursday, June 23, 2022. Note that given the intersection configuration and the camera orientation, the westbound right turning volumes could not be counted.

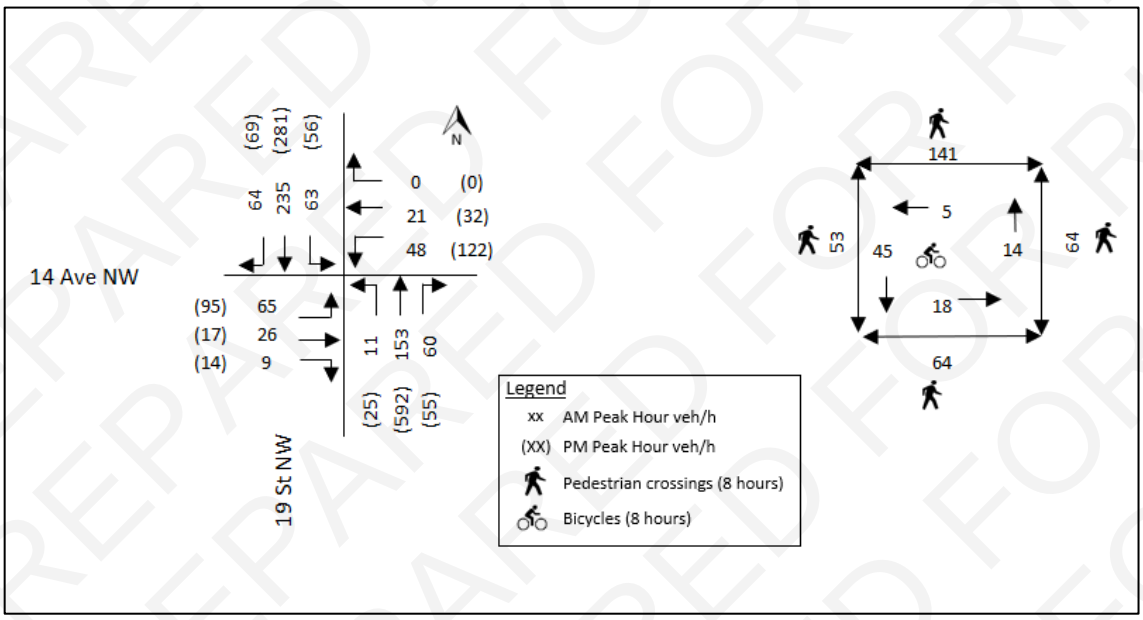


Figure 4: Intersection peak hour volumes on Thursday, June 23, 2022.

2.2 Conflicts

2.2.1 Conflict Analysis Methodology

Traffic conflicts can be grouped in two main types: time-proximity conflicts and evasive action conflicts. Traffic conflicts based on an evasive action consist of an event involving two or more road users, in which the action of one user causes the other user to brake or swerve. Time-proximity conflicts consist of determining how close in time or space the involved road users are to colliding. The time-proximity conflict measures include Post Encroachment Time (PET) and Time to Collision (TTC).

PET is defined as the time between the first road user leaving the common spatial zone (i.e., where two road users could potentially collide) and the second road user arriving to the common spatial zone. TTC describes the time until a collision that would have happened if two conflicting road users were to continue their paths and speeds. The lower the PET and/or TTC, the smaller the temporal and/or spatial proximity between the road users and the lower the available reaction time would be.

Transoft's video conflict algorithm captures all safety-related events with a PET/TTC of less than ten seconds. The information about each safety-related event (e.g., speed of the road users, PET or TTC values, vehicle that arrived first at the conflict location, date, and time) is recorded in a disaggregated database. In general, video footage for each safety-related event with a PET/TTC of less than two seconds is also provided.

The safety-related events identified by Transoft's algorithm are not differentiated as to whether the safety-related event was the result of normal operations or of hazardous road user behaviors that could have resulted in a collision. Therefore, further analysis was required to identify which safety-related events involved hazardous road user behaviors (actual conflicts).

The approach used to differentiate the actual conflicts varied based on the nature of the conflicts and the available data. Table 1 summarizes the approach used to identify which safety-related events involved hazardous road user behaviors for the key conflict types.

Table 1: Approach to Identify Conflicts.

Conflict Type	Approach
Conflicts with vulnerable road users (VRUs) Right-turning, left-turning, or through vehicle in conflict with a vulnerable road user.	• Determining which safety-related events involved a hazardous behavior by the motorist and/or pedestrian can only be accomplished by reviewing individual video footage. • Each video footage for safety-related events of 2 seconds or less are reviewed and the safety-related events that required an evasive action are flagged. • In addition to providing the total number of safety-related events of 2 seconds or less, a description of the safety-related events that required an evasive action is provided.
Opposing Left Turn Vehicle making a left turn in front of a vehicle approaching from the opposing direction.	• The conflict frequency of the safety-related events where the first vehicle to arrive at the conflict point was the left turning motorist is provided. • The frequency of opposing left turn safety-related events where the left turning vehicle arrived second at the conflict point is not considered as part of the analysis.
Angle Vehicles travelling at an angle to each other.	• An angle conflict type occurring at a controlled intersection implies that one vehicle disobeyed the traffic control system. Therefore, all recorded angle safety-related events are considered conflicts.
Right Turn Vehicle making a right turn in front of a perpendicular through vehicle.	• The conflict frequency of the safety-related events where the first vehicle to arrive at the conflict point was the right turning motorist is provided. • The frequency of right turning safety-related events where the right turning vehicle arrived second at the conflict point is not considered as part of this analysis.

Conflicts are also sorted into risk levels. The conflict risk level speed thresholds are based on the Wramborg biomechanical survivability thresholds[1]. These risk levels are shown in **Table 2.**

[1] Jurewicz, Chris, Air Sobhani, Jeremy Woolley, Jeff Dutschke and Bruce Corben. 2016. "Exploration of Vehicle Impact Speed-Injury Severity Relationships for Application in Safer Road Design." Transportation Research Procedia, Volume 14: 4247-4256.

Table 2: Conflict Risk Levels Based on Vehicular and Pedestrian Speeds.

Risk Level	Vehicle-Pedestrian Conflicts	Vehicle-Vehicle Conflicts
Low	< 15 km/h	< 35 km/h
Medium	> 15 km/h	> 35 km/h
High	> 35 km/h	> 50 km/h
Critical	> 50 km/h	> 70 km/h

The results for the conflict analysis are provided below. A list of conflicts less than 2 seconds is presented along with the hyperlink to the associated video footage for each key conflict type is provided in **Appendix A**.

2.2.2 Conflicts with Vulnerable Road Users

Table 3 and **Table 4** summarize the number of conflicts recorded at each crosswalk.

Table 3: Frequency of Conflicts at Each Crosswalk with PET of Less than 2.0 seconds.

Risk Level	North Crosswalk	South Crosswalk	East Crosswalk	West Crosswalk
Low	7 (100%)	1 (5%)	0 (0%)	0 (0%)
Medium	0 (0%)	15 (79%)	14 (100%)	3 (100%)
High	0 (0%)	3 (16%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	7	19	14	3

Table 4: Frequency of Conflicts at Each Crosswalk with PET of 2.0 to 4.0 seconds.

Risk Level	North Crosswalk	South Crosswalk	East Crosswalk	West Crosswalk
Low	51 (78%)	16 (18%)	1 (2%)	19 (63%)
Medium	14 (22%)	68 (77%)	44 (94%)	11 (37%)
High	0 (0%)	3 (3%)	2 (4%)	0 (0%)
Critical	0 (0%)	1 (1%)	0 (0%)	0 (0%)
Total	65	88	47	30

The highest number of pedestrian-vehicle conflicts was recorded on the south crosswalk. However, note that the conflicts between westbound right turning motorists and pedestrians were not recorded at the intersection, which significantly reduced the number of conflicts recorded on the north crosswalk.

Table 5 and **Table 6** summarize the number of conflicts per VRU conflict types.

Table 5: Frequency of Conflicts with PET of less than 2.0 seconds per VRU Conflict Types.

Risk Level	Right Turn	Left Turn	Through
Low	6 (30%)	0 (0%)	2 (33%)
Medium	14 (70%)	17 (100%)	1 (17%)
High	0 (0%)	0 (0%)	3 (50%)
Critical	0 (0%)	0 (0%)	0 (0%)
Total	20	17	6

Table 6: Frequency of Conflicts with PET of 2.0 to 4.0 seconds per VRU Conflict Types.

Risk Level	Right Turn	Left Turn	Through
Low	60 (57%)	15 (15%)	12 (46%)
Medium	46 (43%)	81 (83%)	10 (38%)
High	0 (0%)	2 (2%)	3 (12%)
Critical	0 (0%)	0 (0%)	1 (4%)
Total	106	98	26

Although conflicts between westbound right turning motorists and pedestrians were not recorded, conflicts between VRUs and right turning traffic is still the most common conflict type involving VRUs.

Right Turn with Vulnerable Road Users

Table 7 and **Table 8** summarize the number of conflicts recorded between right turning traffic and VRUs.

Table 7: Frequency of Conflicts Between Right-turning Vehicles and VRUs with PET of less than 2.0 seconds.

Risk Level	North Crosswalk		South Crosswalk		East Crosswalk		West Crosswalk	
	WBRT	SBRT	EBRT	NBRT	NBRT	WBRT	SBRT	EBRT
Low	0 (0%)	5 (100%)	0 (0%)	1 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Medium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	12 (100%)	0 (0%)	2 (100%)	0 (0%)
High	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	0	5	0	1	12	0	2	0

Table 8: Frequency of Conflicts Between Right-turning Vehicles and VRUs with PET of 2.0 to 4.0 seconds.

Risk Level	North Crosswalk		South Crosswalk		East Crosswalk		West Crosswalk	
	WBRT	SBRT	EBRT	NBRT	NBRT	WBRT	SBRT	EBRT
Low	0 (0%)	31 (100%)	0 (0%)	12 (71%)	1 (3%)	0 (0%)	11 (69%)	5 (100%)
Medium	0 (0%)	0 (0%)	7 (100%)	5 (29%)	29 (97%)	0 (0%)	5 (31%)	0 (0%)
High	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	0	31	7	17	30	0	16	5

Most of the conflicts between VRUs and right-turning vehicles occurred on the east (33%) and north (29%) crosswalks.

Left Turn with Vulnerable Road Users

Table 9 and **Table 10** summarize the number of conflicts recorded between left turning traffic and VRUs.

Table 9: Frequency of conflicts between left turning vehicles and VRUs with PET of less than 2.0 seconds.

Risk Level	North Crosswalk		South Crosswalk		East Crosswalk		West Crosswalk	
	EBLT	SBLT	WBLT	NBLT	SBLT	WBLT	NBLT	EBLT
Low	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Medium	0 (0%)	0 (0%)	14 (100%)	0 (0%)	2 (100%)	0 (0%)	1 (100%)	0 (0%)
High	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	0	0	14	0	2	0	1	0

Table 10: Frequency of conflicts between left turning vehicles and VRUs with PET of 2.0 to 4.0 seconds.

Risk Level	North Crosswalk		South Crosswalk		East Crosswalk		West Crosswalk	
	EBLT	SBLT	WBLT	NBLT	SBLT	WBLT	NBLT	EBLT
Low	10 (42%)	1 (100%)	3 (6%)	0 (0%)	0 (0%)	0 (0%)	1 (20%)	0 (0%)
Medium	14 (58%)	0 (0%)	48 (94%)	0 (0%)	13 (87%)	1 (100%)	4 (80%)	1 (100%)
High	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (13%)	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	24	1	51	0	15	1	5	1

Most of the conflicts (57%) between left-turning vehicles and pedestrians occurred on the south crosswalk.

Through with Vulnerable Road Users

Table 11 and **Table 12** summarize the number of conflicts recorded between through traffic and VRUs.

Table 11: Frequency of conflicts between through vehicles and VRUs with PET of less than 2.0 seconds.

Risk Level	North Crosswalk		South Crosswalk		East Crosswalk		West Crosswalk	
	NBT	SBT	NBT	SBT	EBT	WBT	EBT	WBT
Low	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Medium	0 (0%)	0 (0%)	0 (0%)	1 (25%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
High	0 (0%)	0 (0%)	0 (0%)	3 (75%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	0	2	0	4	0	0	0	0

Table 12: Frequency of conflicts between through vehicles and VRUs with PET of 2.0 to 4.0 seconds.

Risk Level	North Crosswalk		South Crosswalk		East Crosswalk		West Crosswalk	
	NBT	SBT	NBT	SBT	EBT	WBT	EBT	WBT
Low	0 (0%)	9(100%)	1 (11%)	0 (0%)	0 (0%)	0 (0%)	2 (67%)	0 (0%)
Medium	0 (0%)	0 (0%)	6 (67%)	2 (50%)	1 (100%)	0 (0%)	1 (33%)	0 (0%)
High	0 (0%)	0 (0%)	1 (11%)	2 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	1 (11%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	0	9	9	4	1	0	3	0

No specific patterns can be identified with conflicts recorded between through traffic and VRUs.

2.2.3 Other Conflict Types

Table 13 and **Table 14** summarize the number of conflicts for the most common vehicular conflict types.

Table 13: Frequency of vehicular conflict types with PET of less than 2.0 seconds.

Risk Level	Right Turn Conflicts	Left Turn with Opposing Through Conflicts	Angle Type Conflicts
Low	1 (100%)	34 (55%)	0 (0%)
Medium	0 (0%)	21 (34%)	0 (0%)
High	0 (0%)	7 (11%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)
Total	1	62	0

Table 14: Frequency of vehicular types with PET of 2.0 to 4.0 seconds.

Risk Level	Right Turn Conflicts	Left Turn with Opposing Through Conflicts	Angle Type Conflicts
Low	19 (51%)	172 (40%)	7 (54%)
Medium	18 (49%)	220 (51%)	5 (38%)
High	0 (0%)	37 (9%)	1 (8%)
Critical	0 (0%)	0 (0%)	0 (0%)
Total	37	429	13

Left turning vehicles with opposing through conflicts is the most common vehicle-vehicle conflict type.

Left Turn Conflicts

Table 15 and **Table 16** summarize the number of conflicts recorded for left turning traffic.

Table 15: Frequency of conflicts with left turning traffic with PET of less than 2.0 seconds.

Risk Level	NBLT with SBT	SBLT with NBT	EBLT with WBT	WBLT with EBT
Low	2 (25%)	28 (61%)	0 (0%)	4 (50%)
Medium	6 (75%)	13 (28%)	0 (0%)	2 (25%)
High	0 (0%)	5 (11%)	0 (0%)	2 (25%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	8	46	0	8

Table 16: Frequency of conflicts with left turning traffic with PET of 2.0 to 4.0 seconds.

Risk Level	NBLT with SBT	SBLT with NBT	EBLT with WBT	WBLT with EBT
Low	5 (8%)	136 (44%)	18 (62%)	13 (46%)
Medium	49 (80%)	149 (48%)	11 (38%)	11 (39%)
High	7 (11%)	26 (8%)	0 (0%)	4 (14%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	61	311	29	28

The highest number of left turn conflicts with opposing through movements was observed between southbound left-turn and northbound through traffic (73%).

Angle Conflicts

No angle conflicts with a PET of less than 2 seconds were recorded at the intersection. **Table 17** summarizes the number of angle conflicts recorded.

Table 17: Frequency of angle conflicts with PET of 2.0 to 4.0 seconds.

Risk Level	NBT with EBT	NBT with WBT	SBT with EBT	SBT with WBT
Low	2 (67%)	1 (33%)	1 (50%)	3 (60%)
Medium	1 (33%)	1 (33%)	1 (50%)	2 (40%)
High	0 (0%)	1 (33%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	3	3	2	5

Right Turn Conflicts

Table 18 and **Table 19** summarize the number of conflicts recorded for right turning traffic conflict types.

Table 18: Frequency of conflicts with right turning traffic with PET of less than 2.0 seconds.

Risk Level	NBRT with EBT	SBRT with WBT	EBRT with SBT	WBRT with NBT
Low	0 (0%)	0 (0%)	1 (100%)	0 (0%)
Medium	0 (0%)	0 (0%)	0 (0%)	0 (0%)
High	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	0	0	1	0

Table 19: Frequency of conflicts with right turning traffic with PET of 2.0 to 4.0 seconds.

Risk Level	NBRT with EBT	SBRT with WBT	EBRT with SBT	WBRT with NBT
Low	0 (0%)	9 (100%)	10 (40%)	0 (0%)
Medium	3 (100%)	0 (0%)	15 (60%)	0 (0%)
High	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	3	9	25	0

Most right turn conflicts (68%) were recorded between eastbound right turn and southbound through traffic.

2.3 Speeds

2.3.1 Conflicts with Vulnerable Road Users

Right Turn with Vulnerable Road Users

A comparison of the 85th percentile speed per movement for the conflicts with right turning traffic and VRUs is summarized in **Table 20**.

Table 20: Speed in kilometers per hour per movement for the conflicts between right turning traffic and VRUs.

Conflict Type	Right Turn Movement	Pedestrian
NBRT vs VRU (East Crosswalk)	19.83	9.72
SBRT vs VRU (West Crosswalk)	14.69	5.30
EBRT vs VRU (South Crosswalk)	15.42	6.44
WBRT vs VRU (North Crosswalk)	-	-

The northbound right turn movements had the highest conflict speed, though the westbound right turn channel was not assessed. The corner radius was measured to be approximately 25 m on the northeast corner, and 11 m on the southeast corner.

Left Turn with Vulnerable Road Users

A comparison of the 85th percentile speed per movement for the conflicts with left turning traffic and VRUs is summarized in **Table 21.**

Table 21: Speed in kilometers per hour per movement for the conflicts between left turning traffic and VRUs.

Conflict Type	Left Turn Movement	Pedestrian
NBLT vs VRU (West Crosswalk)	21.03	5.57
SBLT vs VRU (East Crosswalk)	26.45	8.50
EBLT vs VRU (North Crosswalk)	17.73	6.05
WBLT vs VRU (South Crosswalk)	22.52	6.98

The stop bar setback on the southbound and eastbound approaches was measured to be approximately 11 m from the edge of the adjacent travel lane and may contribute to a higher left turning radius and speed.

2.3.2 Other Conflict Types

Left Turn Conflicts

A comparison of the 85th percentile speed per movement for the left turn conflict types is summarized in **Table 22.**

Table 22: 85th percentile speed per movement for the left turn conflicts.

Conflict Type	Left turn Movement	Through Movement
NBLT with SBT	19.60	43.05
SBLT with NBT	25.48	45.68
EBLT with WBT	20.58	36.39
WBLT with EBT	22.48	32.58

Angle Conflicts

A comparison of the 85th percentile speed per movement for the angle conflict types is summarized in **Table 23.**

Table 23: 85th percentile speed per movement for the angle conflicts.

Conflict Type	Through N/S	Through E/W
NBT with EBT	47.95	31.19
NBT with WBT	48.77	30.84
SBT with EBT	48.05	33.35
SBT with WBT	46.18	34.74

Right Turn Conflicts

A comparison of the 85th percentile speed per movement for the right turn conflict types is summarized in **Table 24**.

Table 24: 85th percentile speed per movement for the right turn conflicts.

Conflict Type	Right turn movement	Through movement
NBRT with EBT	21.26	30.04
SBRT with WBT	14.42	32.78
EBRT with SBT	16.19	42.63
WBRT with NBT	-	-

3.0 POTENTIAL CONTRIBUTING FACTORS AND REMEDIAL MEASURES

The identification of potential contributing factors was based on a review of video clips and the above video analytic outputs. These potential contributing factors and proposed remedial measures are summarized in **Table 25** and **Table 26**.

For each identified remedial measure, the implementation timeline and priority level is specified. The categories used are the following:

Timeline:

- Short-term actions include relatively inexpensive measures that could be implemented in the short-term without major physical changes to the layout of the intersection.
- Medium/long-term recommendations are more costly, which require long-term planning, design, and property.

Priority Level:

- Lower priority: remedial measure that would improve safety but that does not address a safety issue with a significant conflict and/or liability risk.

Higher priority: remedial measure that addresses a safety issue with a high conflict and/or liability risk and that should be prioritized by the City. Note that no field investigations or historic collision review were conducted as part of this video conflict analysis. The City should confirm the feasibility of the recommended remedial measures before implementing them.

Table 25: Identified Safety Issues.

Safety Issues	Conflict Example
High right turning speed The large corner radii on the southeast and northeast corners create conditions where right turning motorists can maintain higher speeds through their turn. The corner radius on the southeast corner was measured to be approximately 12 m.	 Video ID: 64663517
High frequency of right-turn conflicts with VRUs A high frequency of conflicts between northbound right turning motorists and pedestrians walking on the east crosswalk was recorded at the intersection. Most conflicts (60%) between right-turning vehicles and VRUs involved northbound right turning motorists.	

Safety Issues	Conflict Example
High frequency of opposing left turn conflicts A high number of opposing left turn conflicts primarily between southbound left turn and northbound through traffic was recorded at the intersection. These conflicts occurred when southbound left turn motorists turned on a permissive left turn phase. Further, the highest left turn movement speeds were recorded by southbound left turning traffic, which could lead to more severe collisions.	 Video ID: 64616172
Cyclists not dismounting their bicycles A substantial number of cyclists were observed to not dismount their bicycles before crossing the intersection. Cyclists have the potential to surprise turning motorists who are not expecting users travelling on the crosswalks at speeds that are significantly higher than a typical walking speed.	 Video ID: 64667194

Safety Issues	Conflict Example
Pedestrian countdown signals The pedestrian signals at the intersection did not have numeric countdown displays to advise pedestrians of how much time was remaining in the walk phase. It is recommended to install pedestrian countdown signals for all crosswalks.	 Google Streetview (June 2022)
Low lighting levels[2] The lighting levels are not uniform across the intersection. No luminaires are located on the northeast and southeast corners of the intersection. During nighttime conditions, observing VRUs crossing the intersection would be challenging.	 Video ID: 64661121

[2] Note that no formal lighting assessment was conducted as part of this safety review. The comments about the lighting levels are based on a cursory review of the conflict videos and Google Streetview images.

Table 26: Potential Remedial Measures.

Safety Issues	Potential Remedial Measures	Effectiveness	Timeline	Priority Level
High right turning speed and high frequency of right-turn conflicts with VRUs	**Consider reducing the corner radii** to less than 12.0 m or installing a curb extension on the southeast corner. Although the eastbound traffic volumes on the east leg are relatively low (149 vehicles during the morning peak hour and 128 vehicles during the afternoon peak hour), there are currently two receiving lanes on the east leg. Installing a curb extension would significantly reduce the pedestrian and motorists crossing distances, enhance visibility and reduce the speed of motorists.	No specific CMF. However, providing a more constrained intersection, would result in reduced speed and increase the perception-reaction time of motorists at the intersection.	Medium/Long-term	Higher
	Provide a "smart channel" on the northeast corner. The provision of a smart channel aligns right-turning drivers to be more perpendicular with the intersecting roadway and pedestrian crosswalks. Motorists are also required to navigate the channel at lower speeds. It is possible to implement smart channels through pavement markings or truck aprons, which still accommodate turning movements of larger vehicles.	CMF of 0.558 for all collisions[3].	Medium/Long-term	Higher
	Consider a Leading Pedestrian Interval (LPI)[4] at the intersection.	A LPI is an effective treatment to address this conflict type.	Short-term	Higher

[3] Safety Impacts of a Modified Right Turn Lane Design at Intersections, Schattler and Hanson, 2016.
[4] A leading pedestrian interval (LPI) gives pedestrians the opportunity to enter an intersection a few seconds before vehicles are given a green indication.

Safety Issues	Potential Remedial Measures	Effectiveness	Timeline	Priority Level
		CMF of 0.81[5] on pedestrian/vehicle collision type.		
High frequency of opposing left turn conflicts	The City should review the collision history at the intersection and determine if there is a pattern of southbound left turn with northbound through collisions. If such pattern exists, the City should consider implementing southbound protected only left-turn phases to minimize the frequency of conflicts between southbound left turning and northbound through traffic.	Providing protected left-turn phasing has a wide range of CMFs but in general it has great safety benefits on injury and fatal collisions.	Medium/Long-term	Lower
	Install a left turn calming measure on the east leg. The City should consider installing a median nose extension at the east crosswalk. Such treatment would require drivers to approach the crosswalk at a sharper angle instead of cutting across intersections diagonally, resulting in slower turning speeds and better visibility of people walking and cycling.	Potential speed reduction of 10 to 20% and reduction of injuries among people walking by 20%.	Medium-term	Lower

[5] Safety Evaluation of Protected Left-Turn Phasing and Leading Pedestrian Intervals on Pedestrian Safety, Goughnour et al., 2018.

Safety Issues	Potential Remedial Measures	Effectiveness	Timeline	Priority Level
Cyclists not dismounting their bicycles	**Assess the installation of bicycle facilities and consider marking the bicycle lanes through the intersection.**	Although a wide range of CMFs (0.42 to 2.03) are provided for these treatments, safety benefits are expected to be provided when installed at intersections.	Long-term	Lower
Low lighting levels	**Assess the lighting conditions** at the intersection to determine the required improvements.	No specific CMF for assessing the lighting conditions at the intersection.	Short-term	Higher

APPENDIX A: CONFLICTS WITH A PET/TTC OF 2 SECONDS OR LESS

Conflicts with VRUs

Safety Indicator Value (seconds)	Date	Time	Evasive Action Conflicts	URL
0.4	2022-07-27	17:08:25	No	https://results.trafxsafe.com/indicators/64663935
0.47	2022-07-26	13:57:06	No	https://results.trafxsafe.com/indicators/64664931
0.9	2022-07-27	12:11:48	n/a	https://results.trafxsafe.com/indicators/64666622
0.9	2022-07-29	12:24:40	No	https://results.trafxsafe.com/indicators/64657320
0.9	2022-07-25	17:20:41	No	https://results.trafxsafe.com/indicators/64662664
0.93	2022-07-26	10:01:57	No	https://results.trafxsafe.com/indicators/64660173
0.93	2022-07-28	10:32:38	No	https://results.trafxsafe.com/indicators/64668962
1.07	2022-07-25	19:48:02	No	https://results.trafxsafe.com/indicators/64664492
1.07	2022-07-27	20:18:13	No	https://results.trafxsafe.com/indicators/64662294
1.2	2022-07-27	11:28:06	No	https://results.trafxsafe.com/indicators/64667194
1.23	2022-07-26	8:16:02	No	https://results.trafxsafe.com/indicators/64655542
1.23	2022-07-26	15:17:54	No	https://results.trafxsafe.com/indicators/64665842
1.23	2022-07-27	16:04:41	No	https://results.trafxsafe.com/indicators/64663517
1.33	2022-07-26	23:16:13	No	https://results.trafxsafe.com/indicators/64661121
1.37	2022-07-28	16:20:13	No	https://results.trafxsafe.com/indicators/64655696
1.37	2022-07-26	15:46:16	No	https://results.trafxsafe.com/indicators/64665888
1.47	2022-07-29	11:29:22	No	https://results.trafxsafe.com/indicators/64656326
1.5	2022-07-27	12:12:19	No	https://results.trafxsafe.com/indicators/64666544
1.53	2022-07-28	13:18:31	No	https://results.trafxsafe.com/indicators/64664374
1.53	2022-07-28	20:37:28	Yes	https://results.trafxsafe.com/indicators/64662161
1.57	2022-07-26	19:36:06	No	https://results.trafxsafe.com/indicators/64661351
1.6	2022-07-26	10:31:43	No	https://results.trafxsafe.com/indicators/64660147
1.67	2022-07-28	15:17:11	No	https://results.trafxsafe.com/indicators/64665427
1.67	2022-07-26	10:17:05	No	https://results.trafxsafe.com/indicators/64660159
1.67	2022-07-25	16:41:36	No	https://results.trafxsafe.com/indicators/64660605
1.67	2022-07-27	12:44:45	No	https://results.trafxsafe.com/indicators/64666590
1.7	2022-07-28	9:17:41	No	https://results.trafxsafe.com/indicators/64656875
1.7	2022-07-26	20:11:56	No	https://results.trafxsafe.com/indicators/64661230
1.74	2022-07-27	14:22:20	No	https://results.trafxsafe.com/indicators/64662389
1.74	2022-07-27	17:55:13	No	https://results.trafxsafe.com/indicators/64663921
1.77	2022-07-25	18:26:45	No	https://results.trafxsafe.com/indicators/64657801
1.8	2022-07-26	12:13:01	No	https://results.trafxsafe.com/indicators/64661805
1.8	2022-07-27	14:07:53	No	https://results.trafxsafe.com/indicators/64662372
1.84	2022-07-27	21:38:30	No	https://results.trafxsafe.com/indicators/64662075
1.84	2022-07-28	13:53:53	No	https://results.trafxsafe.com/indicators/64664382
1.84	2022-07-29	11:53:29	No	https://results.trafxsafe.com/indicators/64656321
1.87	2022-07-26	17:42:26	No	https://results.trafxsafe.com/indicators/64659815

Safety Indicator Value (seconds)	Date	Time	Evasive Action Conflicts	URL
1.9	2022-07-27	11:33:14	No	https://results.trafxsafe.com/indicators/64667084
1.9	2022-07-26	16:27:33	No	https://results.trafxsafe.com/indicators/64665437
1.9	2022-07-28	8:27:38	No	https://results.trafxsafe.com/indicators/64659135
1.9	2022-07-27	14:37:25	No	https://results.trafxsafe.com/indicators/64662377
1.94	2022-07-28	6:56:45	No	https://results.trafxsafe.com/indicators/64663240
1.97	2022-07-27	7:30:57	No	https://results.trafxsafe.com/indicators/64669596

Opposing Left Turn

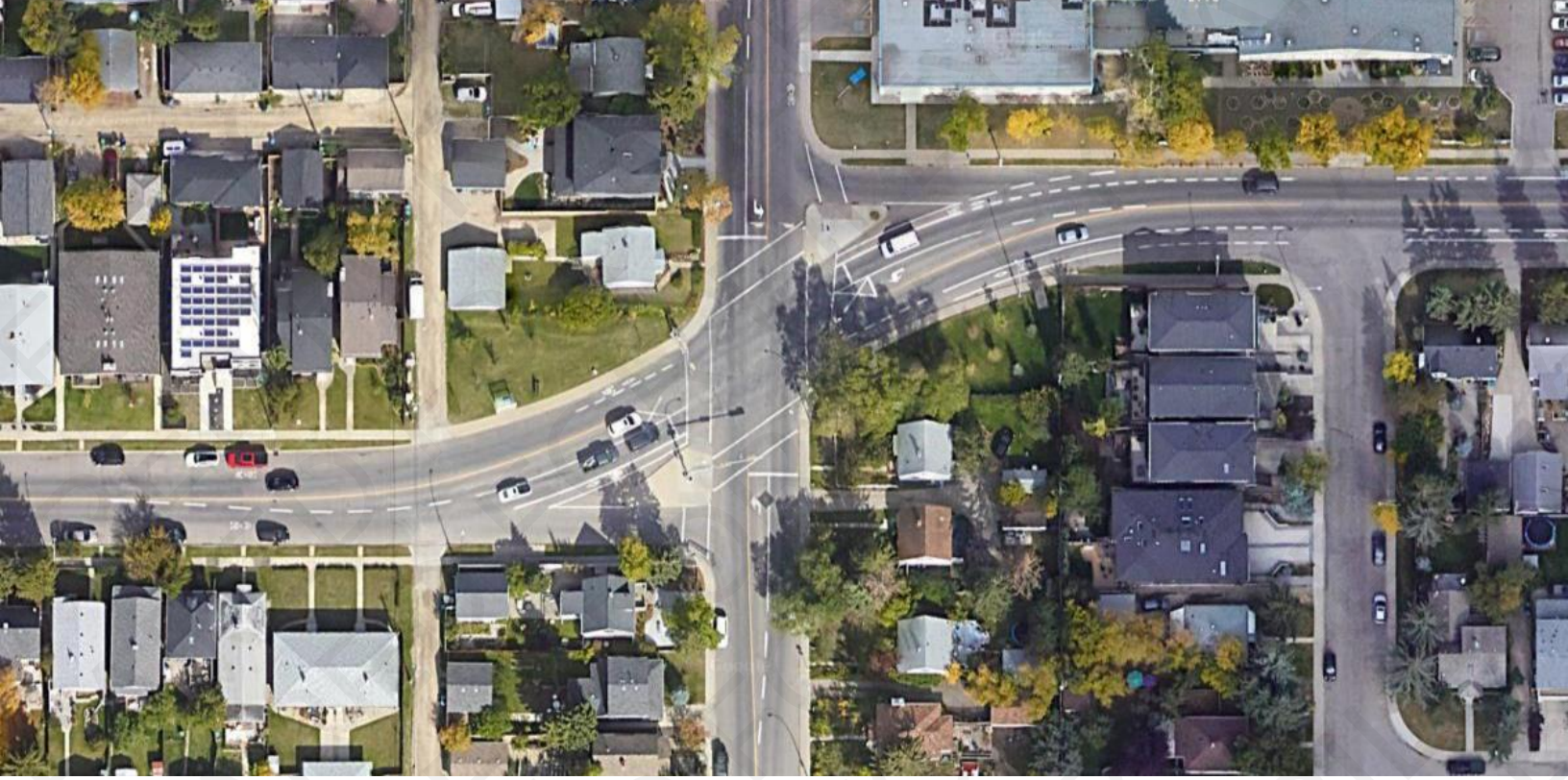
Safety Indicator Value (seconds)	Date	Time	URL
0.47	2022-07-28	10:10:45	https://results.trafxsafe.com/indicators/64669099
0.5	2022-07-25	16:44:13	https://results.trafxsafe.com/indicators/64661039
0.6	2022-07-29	12:32:15	https://results.trafxsafe.com/indicators/64657467
0.73	2022-07-26	16:37:00	https://results.trafxsafe.com/indicators/64665600
0.77	2022-07-28	10:57:18	https://results.trafxsafe.com/indicators/64669053
0.9	2022-07-27	11:16:18	https://results.trafxsafe.com/indicators/64667465
0.9	2022-07-25	18:00:43	https://results.trafxsafe.com/indicators/64657872
0.93	2022-07-29	9:59:36	https://results.trafxsafe.com/indicators/64658045
0.93	2022-07-29	8:57:10	https://results.trafxsafe.com/indicators/64668688
1.03	2022-07-29	13:01:56	https://results.trafxsafe.com/indicators/64667059
1.13	2022-07-25	17:22:30	https://results.trafxsafe.com/indicators/64662994
1.17	2022-07-29	10:05:19	https://results.trafxsafe.com/indicators/64665190
1.17	2022-07-28	19:00:28	https://results.trafxsafe.com/indicators/64664857
1.2	2022-07-28	18:57:13	https://results.trafxsafe.com/indicators/64668230
1.27	2022-07-25	18:28:03	https://results.trafxsafe.com/indicators/64657897
1.37	2022-07-28	11:27:02	https://results.trafxsafe.com/indicators/64668083
1.37	2022-07-27	14:48:10	https://results.trafxsafe.com/indicators/64662634
1.4	2022-07-27	11:29:24	https://results.trafxsafe.com/indicators/64667494
1.4	2022-07-27	16:06:24	https://results.trafxsafe.com/indicators/64663608
1.4	2022-07-28	15:02:37	https://results.trafxsafe.com/indicators/64665843
1.4	2022-07-28	16:56:11	https://results.trafxsafe.com/indicators/64656113
1.43	2022-07-27	17:34:03	https://results.trafxsafe.com/indicators/64664086
1.43	2022-07-29	9:13:50	https://results.trafxsafe.com/indicators/64658080
1.5	2022-07-28	15:02:36	https://results.trafxsafe.com/indicators/64665821
1.57	2022-07-28	16:31:39	https://results.trafxsafe.com/indicators/64655874
1.57	2022-07-26	13:54:13	https://results.trafxsafe.com/indicators/64665025
1.6	2022-07-27	12:56:16	https://results.trafxsafe.com/indicators/64667208

Safety Indicator Value (seconds)	Date	Time	URL
1.63	2022-07-27	12:27:34	https://results.trafxsafe.com/indicators/64667119
1.63	2022-07-27	12:01:23	https://results.trafxsafe.com/indicators/64667069
1.63	2022-07-27	13:26:06	https://results.trafxsafe.com/indicators/64669343
1.67	2022-07-29	11:37:34	https://results.trafxsafe.com/indicators/64656624
1.67	2022-07-27	15:29:06	https://results.trafxsafe.com/indicators/64663280
1.7	2022-07-26	10:46:28	https://results.trafxsafe.com/indicators/64660321
1.7	2022-07-26	23:03:17	https://results.trafxsafe.com/indicators/64661227
1.7	2022-07-27	16:50:55	https://results.trafxsafe.com/indicators/64663876
1.7	2022-07-27	12:29:32	https://results.trafxsafe.com/indicators/64667127
1.7	2022-07-26	12:53:59	https://results.trafxsafe.com/indicators/64661864
1.74	2022-07-27	17:33:28	https://results.trafxsafe.com/indicators/64664278
1.74	2022-07-27	9:42:44	https://results.trafxsafe.com/indicators/64667689
1.74	2022-07-26	18:59:24	https://results.trafxsafe.com/indicators/64661212
1.74	2022-07-26	11:27:21	https://results.trafxsafe.com/indicators/64658751
1.77	2022-07-29	9:33:24	https://results.trafxsafe.com/indicators/64658096
1.77	2022-07-29	13:49:48	https://results.trafxsafe.com/indicators/64667302
1.77	2022-07-25	16:42:00	https://results.trafxsafe.com/indicators/64661022
1.77	2022-07-29	11:55:58	https://results.trafxsafe.com/indicators/64656642
1.8	2022-07-26	9:12:38	https://results.trafxsafe.com/indicators/64660598
1.8	2022-07-25	16:10:03	https://results.trafxsafe.com/indicators/64660800
1.8	2022-07-27	18:25:29	https://results.trafxsafe.com/indicators/64658434
1.8	2022-07-26	17:28:37	https://results.trafxsafe.com/indicators/64659878
1.84	2022-07-26	16:57:24	https://results.trafxsafe.com/indicators/64666236
1.84	2022-07-27	14:57:22	https://results.trafxsafe.com/indicators/64662649
1.84	2022-07-27	9:52:10	https://results.trafxsafe.com/indicators/64667703
1.87	2022-07-27	16:23:24	https://results.trafxsafe.com/indicators/64663716
1.87	2022-07-26	19:25:15	https://results.trafxsafe.com/indicators/64661475
1.87	2022-07-27	17:25:49	https://results.trafxsafe.com/indicators/64664242
1.87	2022-07-25	17:59:25	https://results.trafxsafe.com/indicators/64663107
1.9	2022-07-27	7:37:07	https://results.trafxsafe.com/indicators/64669641
1.9	2022-07-29	8:51:18	https://results.trafxsafe.com/indicators/64668675
1.94	2022-07-29	11:23:38	https://results.trafxsafe.com/indicators/64656418
1.97	2022-07-28	10:40:08	https://results.trafxsafe.com/indicators/64669136
1.97	2022-07-28	20:12:21	https://results.trafxsafe.com/indicators/64662259

Right Turn

Safety Indicator Value (seconds)	Date	Time	URL
0.67	2022-07-27	18:05:59	https://results.trafxsafe.com/indicators/64658330
0.7	2022-07-28	9:40:51	https://results.trafxsafe.com/indicators/64656910
0.8	2022-07-28	6:32:41	https://results.trafxsafe.com/indicators/64663322
0.83	2022-07-26	9:09:24	https://results.trafxsafe.com/indicators/64660624
0.87	2022-07-27	19:43:55	https://results.trafxsafe.com/indicators/64663278
0.93	2022-07-26	10:26:42	https://results.trafxsafe.com/indicators/64660225
0.97	2022-07-27	11:35:31	https://results.trafxsafe.com/indicators/64667308
1	2022-07-26	15:14:09	https://results.trafxsafe.com/indicators/64666141
1.03	2022-07-28	17:20:56	https://results.trafxsafe.com/indicators/64667888
1.03	2022-07-28	18:35:09	https://results.trafxsafe.com/indicators/64667820
1.03	2022-07-28	14:07:00	https://results.trafxsafe.com/indicators/64668770
1.07	2022-07-27	9:54:00	https://results.trafxsafe.com/indicators/64667584
1.1	2022-07-28	13:25:26	https://results.trafxsafe.com/indicators/64664419
1.1	2022-07-25	17:11:40	https://results.trafxsafe.com/indicators/64662704
1.1	2022-07-27	16:32:51	https://results.trafxsafe.com/indicators/64663590
1.1	2022-07-26	7:35:41	https://results.trafxsafe.com/indicators/64661758
1.1	2022-07-28	8:39:54	https://results.trafxsafe.com/indicators/64659162
1.1	2022-07-27	14:50:08	https://results.trafxsafe.com/indicators/64662433
1.13	2022-07-29	9:59:25	https://results.trafxsafe.com/indicators/64658008
1.17	2022-07-27	7:11:53	https://results.trafxsafe.com/indicators/64669604
1.17	2022-07-26	11:36:45	https://results.trafxsafe.com/indicators/64658618
1.2	2022-07-25	17:32:53	https://results.trafxsafe.com/indicators/64662767
1.2	2022-07-28	16:03:49	https://results.trafxsafe.com/indicators/64655797
1.23	2022-07-28	17:43:13	https://results.trafxsafe.com/indicators/64667891
1.23	2022-07-27	8:27:33	https://results.trafxsafe.com/indicators/64657152
1.3	2022-07-28	18:08:44	https://results.trafxsafe.com/indicators/64667810
1.3	2022-07-28	16:20:18	https://results.trafxsafe.com/indicators/64655729
1.3	2022-07-26	10:08:37	https://results.trafxsafe.com/indicators/64660187
1.33	2022-07-29	11:28:01	https://results.trafxsafe.com/indicators/64656450
1.37	2022-07-28	16:29:13	https://results.trafxsafe.com/indicators/64655730
1.4	2022-07-26	15:55:18	https://results.trafxsafe.com/indicators/64666026
1.4	2022-07-28	14:30:18	https://results.trafxsafe.com/indicators/64668729
1.4	2022-07-28	11:42:40	https://results.trafxsafe.com/indicators/64668067
1.47	2022-07-28	16:08:28	https://results.trafxsafe.com/indicators/64655799
1.47	2022-07-29	13:56:35	https://results.trafxsafe.com/indicators/64666645
1.47	2022-07-29	11:01:46	https://results.trafxsafe.com/indicators/64656368
1.5	2022-07-27	12:07:05	https://results.trafxsafe.com/indicators/64666748
1.5	2022-07-27	11:54:11	https://results.trafxsafe.com/indicators/64667344
1.5	2022-07-27	16:38:10	https://results.trafxsafe.com/indicators/64663596
1.5	2022-07-29	10:45:24	https://results.trafxsafe.com/indicators/64665186
1.5	2022-07-27	13:36:26	https://results.trafxsafe.com/indicators/64669211
1.53	2022-07-26	21:34:49	https://results.trafxsafe.com/indicators/64658880
1.53	2022-07-28	18:34:31	https://results.trafxsafe.com/indicators/64667896
1.57	2022-07-26	17:34:39	https://results.trafxsafe.com/indicators/64659921

Safety Indicator Value (seconds)	Date	Time	URL
1.57	2022-07-28	20:35:13	https://results.trafxsafe.com/indicators/64662187
1.6	2022-07-29	11:39:43	https://results.trafxsafe.com/indicators/64656377
1.6	2022-07-27	17:02:49	https://results.trafxsafe.com/indicators/64663960
1.6	2022-07-27	9:00:54	https://results.trafxsafe.com/indicators/64667594
1.6	2022-07-28	19:04:36	https://results.trafxsafe.com/indicators/64664784
1.6	2022-07-27	7:47:47	https://results.trafxsafe.com/indicators/64669610
1.6	2022-07-26	8:40:14	https://results.trafxsafe.com/indicators/64655572
1.6	2022-07-26	16:36:47	https://results.trafxsafe.com/indicators/64665542
1.63	2022-07-27	19:46:42	https://results.trafxsafe.com/indicators/64663349
1.63	2022-07-27	18:05:51	https://results.trafxsafe.com/indicators/64658328
1.63	2022-07-27	13:03:55	https://results.trafxsafe.com/indicators/64669194
1.63	2022-07-29	11:55:29	https://results.trafxsafe.com/indicators/64656455
1.63	2022-07-25	18:33:15	https://results.trafxsafe.com/indicators/64657827
1.63	2022-07-28	8:25:05	https://results.trafxsafe.com/indicators/64659159
1.63	2022-07-26	9:34:18	https://results.trafxsafe.com/indicators/64660768
1.67	2022-07-28	10:58:09	https://results.trafxsafe.com/indicators/64669079
1.67	2022-07-28	18:00:53	https://results.trafxsafe.com/indicators/64667890
1.7	2022-07-28	20:59:58	https://results.trafxsafe.com/indicators/64666484
1.74	2022-07-27	9:02:20	https://results.trafxsafe.com/indicators/64667578
1.74	2022-07-26	10:22:47	https://results.trafxsafe.com/indicators/64660191
1.74	2022-07-27	16:18:34	https://results.trafxsafe.com/indicators/64663585
1.74	2022-07-27	20:25:11	https://results.trafxsafe.com/indicators/64662305
1.74	2022-07-29	12:31:08	https://results.trafxsafe.com/indicators/64657379
1.77	2022-07-29	11:52:52	https://results.trafxsafe.com/indicators/64656454
1.77	2022-07-25	17:57:23	https://results.trafxsafe.com/indicators/64662709
1.8	2022-07-29	12:49:31	https://results.trafxsafe.com/indicators/64657382
1.8	2022-07-27	17:39:55	https://results.trafxsafe.com/indicators/64664024
1.8	2022-07-27	20:07:17	https://results.trafxsafe.com/indicators/64662303
1.8	2022-07-26	16:06:02	https://results.trafxsafe.com/indicators/64665637
1.8	2022-07-26	16:51:32	https://results.trafxsafe.com/indicators/64665561
1.87	2022-07-29	8:37:50	https://results.trafxsafe.com/indicators/64668585
1.87	2022-07-26	17:47:50	https://results.trafxsafe.com/indicators/64659923
1.87	2022-07-26	15:44:16	https://results.trafxsafe.com/indicators/64666012
1.9	2022-07-25	18:17:57	https://results.trafxsafe.com/indicators/64657822
1.9	2022-07-27	17:16:42	https://results.trafxsafe.com/indicators/64663964
1.9	2022-07-26	16:22:46	https://results.trafxsafe.com/indicators/64665528
1.97	2022-07-27	10:55:30	https://results.trafxsafe.com/indicators/64661539
1.97	2022-07-27	7:22:05	https://results.trafxsafe.com/indicators/64669607
1.97	2022-07-28	21:01:16	https://results.trafxsafe.com/indicators/64666445
1.97	2022-07-29	9:42:41	https://results.trafxsafe.com/indicators/64657981
1.97	2022-07-27	17:54:32	https://results.trafxsafe.com/indicators/64663973
1.97	2022-07-28	13:25:42	https://results.trafxsafe.com/indicators/64664423
1.97	2022-07-26	9:51:40	https://results.trafxsafe.com/indicators/64660558



VIDEO CONFLICT ANALYSIS

Location: **5 & 6 Avenue NW and 19 Street NW Intersection, Calgary, Alberta**

May 2023

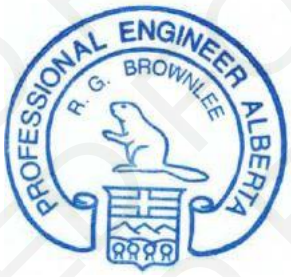
TRUE NORTH SAFETY GROUP

VIDEO CONFLICT ANALYSIS

Location: **5 & 6 Avenue NW and 19 Street NW Intersection, Calgary, Alberta**

Project Team:

Andrew Shan, B.A.Sc., EIT
Alexandre Nolet, M.Eng., RSP_1, P.Eng.



Russell Brownlee, B.Sc., M.A. Sc., RSP1, P. Eng.

Alexandre Nolet, M.Eng., RSP_1, P.Eng.

May 2023

1.0 INTRODUCTION

1.1 Background

The City of Calgary ('the City') retained the Urban Systems Team ('Urban Systems') to conduct the Riley Communities Mobility Study and Improvements Plan. True North Safety Group ('TNS') and Transoft Solutions ('Transoft') were retained to undertake video conflict analysis at five intersections across the City. As part of this study, Transoft collected conflict data, vehicular speed data, and traffic volumes at each intersection. TNS analyzed the outputs and included the key road safety review findings in individual reports.

The following is a summary of the safety assessment conducted for the intersection of 5 & 6 Avenue NW and 19 Street NW.

1.2 Study Area

The intersection of 5 & 6 Avenue NW and 19 Street NW is a four-leg signalized intersection with a skewed configuration. Right-turn channels are provided on both the eastbound and westbound approaches. 6 Avenue NW and 5 Avenue NW are two-lane collector roads that run east-west. 19 Street NW is a collector road that runs north-south.

The posted speed limit through the intersection is 50 kilometres/hour (km/h). Adjacent land uses consist of residential on all corners, except on the northeast corner where there is a community centre. On-street bicycle lanes are provided on 6 Avenue NW. On the west leg, the bicycle lanes are discontinued approximately 25 metres (m) west of 19 Street NW. Shared cycling facilities designated with sharrows are provided on 19 Street NW. Sidewalks are provided on each leg of the intersection.

Figure 1 provides an image of the lane configuration. **Figure 2** provides an aerial image of the intersection.

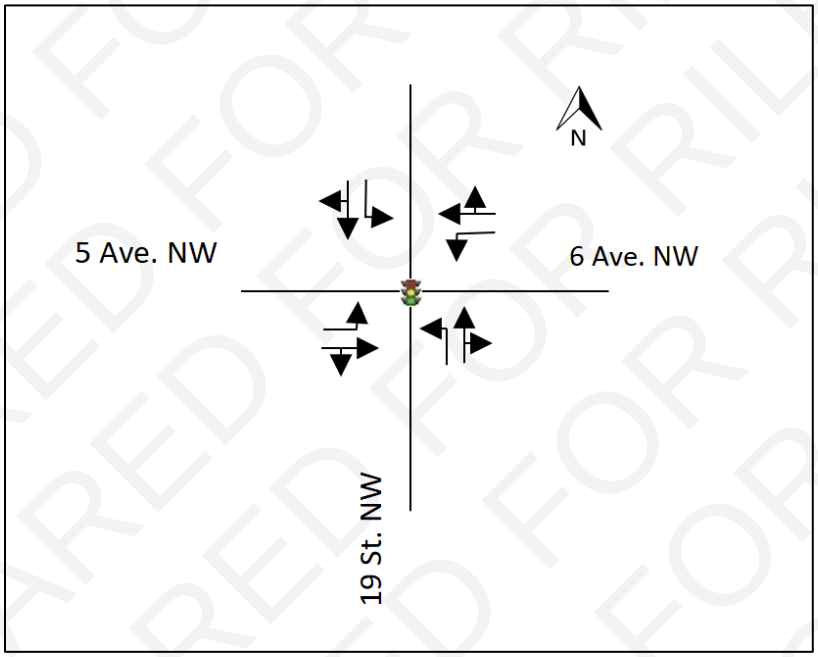


Figure 1: Lane Configuration of 5&6 Avenue NW and 19 Street NW Intersection.

Figure 2: 5 & 6 Avenue NW and 19 Street NW Intersection.

1.3 Video Data Collection

A video camera was installed on the southwest corner of the intersection and was facing north. All traffic movements and the crosswalk were captured. The data of interest was collected over a four-day period (July 26 to 29, 2022). **Figure 3** shows the field of view of the camera.

Figure 3: Camera view of the Intersection from the southwest corner.

2.0 VIDEO ANALYTIC OUTPUT

The results of the video analytic assessment related to traffic volumes, speeds, and conflicts for the subject intersection are provided below.

2.1 Volumes

The peak morning hourly traffic for the intersection of 5 & 6 Avenue NW and 19 Street NW intersection occurred between 8:15 a.m. to 9:15 a.m. The peak afternoon hourly volume was recorded between 4:15 p.m. to 5:15 p.m. **Figure 4** summarizes the intersection peak hourly volumes collected on Tuesday, July 26, 2022.

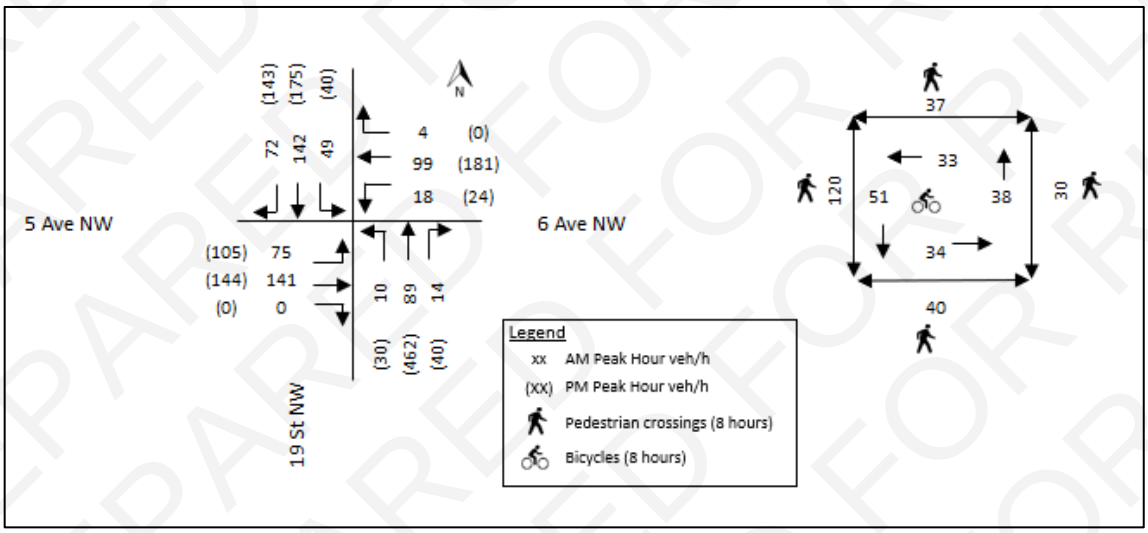


Figure 4: Intersection Peak Hour Volumes on Tuesday, July 26, 2022.

2.2 Conflicts

2.2.1 Conflict Analysis Methodology

Traffic conflicts can be grouped in two main types: time-proximity conflicts and evasive action conflicts. Traffic conflicts based on an evasive action consist of an event involving two or more road users, in which the action of one user causes the other user to brake or swerve. Time-proximity conflicts consist of determining how close in time or space the involved road users are to colliding. The time-proximity conflict measures include Post Encroachment Time (PET) and Time to Collision (TTC).

PET is defined as the time between the first road user leaving the common spatial zone (i.e., where two road users could potentially collide) and the second road user arriving to the common spatial zone. TTC describes the time until a collision that would have happened if two conflicting road users were to continue their paths and speeds. The lower the PET and/or TTC, the smaller the temporal and/or spatial proximity between the road users and the lower the available reaction time would be.

Transoft's video conflict algorithm captures all safety-related events with a PET/TTC of less than ten seconds. The information about each safety-related event (e.g., speed of the road users, PET or TTC values, vehicle that arrived first at the conflict location, date, and time) is recorded in a disaggregated database. In general, video footage for each safety-related event with a PET/TTC of less than two seconds is also provided.

The safety-related events identified by Transoft's algorithm are not differentiated as to whether the safety-related event was the result of normal operations or of hazardous road user behaviors that could have resulted in a collision. Therefore, further analysis was required to identify which safety-related events involved hazardous road user behaviors (actual conflicts).

The approach used to differentiate the actual conflicts varied based on the nature of the conflicts and the available data. Table 1 summarizes the approach used to identify which safety-related events involved hazardous road user behaviors for the key conflict types.

Table 1: Approach to Identify Conflicts.

Conflict Type	Approach
Conflicts with vulnerable road users (VRUs) Right-turning, left-turning, or through vehicle in conflict with a vulnerable road user.	• Determining which safety-related events involved hazardous behavior by the motorist and/or pedestrian can only be accomplished by reviewing individual video footage. • Each video footage for safety-related events of 2 seconds or less are reviewed and the safety-related events that required an evasive action are flagged. • In addition to providing the total number of safety-related events of 2 seconds or less, a description of the safety-related events that required an evasive action is provided.
Opposing Left Turn Vehicle making a left turn in front of a vehicle approaching from the opposing direction.	• The conflict frequency of the safety-related events where the first vehicle to arrive at the conflict point was the left turning motorist is provided. • The frequency of opposing left turn safety-related events where the left turning vehicle arrived second at the conflict point is not considered as part of the analysis.
Angle Vehicles travelling at an angle to each other.	• An angle conflict type occurring at a controlled intersection implies that one vehicle disobeyed the traffic control system. Therefore, all recorded angle safety-related events are considered conflicts.
Right Turn Vehicle making a right turn in front of a perpendicular through vehicle.	• The conflict frequency of the safety-related events where the first vehicle to arrive at the conflict point was the right turning motorist is provided. • The frequency of right turning safety-related events where the right turning vehicle arrived second at the conflict point is not considered as part of this analysis.

Conflicts are also sorted into risk levels. The conflict risk level speed thresholds are based on the Wramborg biomechanical survivability thresholds[1]. These risk levels are shown in **Table 2.**

[1] Jurewicz, Chris, Air Sobhani, Jeremy Woolley, Jeff Dutschke and Bruce Corben. 2016. "Exploration of Vehicle Impact Speed-Injury Severity Relationships for Application in Safer Road Design." Transportation Research Procedia, Volume 14: 4247-4256.

Table 2: Conflict Risk Levels Based on Vehicular and Pedestrian Speeds.

Risk Level	Vehicle-Pedestrian Conflicts	Vehicle-Vehicle Conflicts
Low	< 15 km/h	< 35 km/h
Medium	> 15 km/h	> 35 km/h
High	> 35 km/h	> 50 km/h
Critical	> 50 km/h	> 70 km/h

The results for the conflict analysis are provided below. A list of conflicts less than 2 seconds is presented along with the hyperlink to the associated video footage for each key conflict type is provided in **Appendix A**.

2.2.2 Conflicts with Vulnerable Road Users

Table 3 and **Table 4** summarize the number of conflicts recorded at each crosswalk.

Table 3: Frequency of Conflicts at Each Crosswalk with PET of Less than 2.0 seconds.

Risk Level	North Crosswalk	South Crosswalk	East Crosswalk	West Crosswalk
Low	0 (0%)	0 (0%)	1 (33%)	4 (14%)
Medium	1 (100%)	1 (100%)	2 (67%)	25 (86%)
High	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	1	1	3	29

Table 4: Frequency of Conflicts at Each Crosswalk with PET of 2.0 to 4.0 seconds.

Risk Level	North Crosswalk	South Crosswalk	East Crosswalk	West Crosswalk
Low	4 (15%)	0 (0%)	1 (4%)	11 (13%)
Medium	14 (54%)	12 (100%)	19 (79%)	77 (88%)
High	8 (31%)	0 (0%)	3 (13%)	0 (0%)
Critical	0 (0%)	0 (0%)	1 (4%)	0 (0%)
Total	26	12	24	88

The west crosswalk experienced the highest number of pedestrian-vehicle conflicts. The west crosswalk is also where the highest pedestrian volumes were recorded. **Table 5** and **Table 6** summarize the number of conflicts per VRU conflict types.

Table 5: Frequency of Conflicts with PET of less than 2.0 seconds per VRU Conflict Types.

Risk Level	Right Turn	Left Turn	Through
Low	4 (13%)	1 (33%)	0 (0%)
Medium	27 (87%)	2 (67%)	0 (0%)
High	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)
Total	31	3	0

Table 6: Frequency of Conflicts with PET of 2.0 to 4.0 seconds per VRU Conflict Types.

Risk Level	Right Turn	Left Turn	Through
Low	12 (12%)	4 (10%)	0 (0%)
Medium	85 (87%)	29 (74%)	8 (62%)
High	1 (1%)	6 (15%)	4 (31%)
Critical	0 (0%)	0 (0%)	1 (8%)
Total	98	39	13

Right turn conflicts with VRUs are significantly more frequent than the other conflict types with VRUs. They represented more than 60% of conflicts involving VRUs.

Right Turn with Vulnerable Road Users

Table 7 and **Table 8** summarize the number of conflicts recorded between right turning traffic and VRUs.

Table 7: Frequency of Conflicts Between Right-turning Vehicles and VRUs with PET of less than 2.0 seconds.

Risk Level	North Crosswalk		South Crosswalk		East Crosswalk		West Crosswalk	
	WBRT	SBRT	EBRT	NBRT	NBRT	WBRT	SBRT	EBRT
Low	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	3 (11%)	0 (0%)
Medium	0 (0%)	1 (100%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	25 (89%)	0 (0%)
High	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	0	1	0	0	2	0	28	0

Table 8: Frequency of Conflicts Between Right-turning Vehicles and VRUs with PET of 2.0 to 4.0 seconds.

Risk Level	North Crosswalk		South Crosswalk		East Crosswalk		West Crosswalk	
	WBRT	SBRT	EBRT	NBRT	NBRT	WBRT	SBRT	EBRT
Low	0 (0%)	3 (33%)	0 (0%)	0 (0%)	1 (14%)	0 (0%)	7 (9%)	1 (100%)
Medium	0 (0%)	6 (67%)	0 (0%)	1 (100%)	5 (71%)	0 (0%)	73 (91%)	0 (0%)
High	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (14%)	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	0	9	0	1	7	0	80	1

Table 7 and **Table 8** show that the southbound right-turn movement is the most common conflict type with pedestrians, predominately on the west crosswalk.

Left Turn with Vulnerable Road Users

Table 9 and **Table 10** summarize the number of conflicts recorded between left turning traffic and VRUs.

Table 9: Frequency of conflicts between left turning vehicles and VRUs with PET of less than 2.0 seconds.

Risk Level	North Crosswalk		South Crosswalk		East Crosswalk		West Crosswalk	
	EBLT	SBLT	WBLT	NBLT	SBLT	WBLT	NBLT	EBLT
Low	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (100%)	0 (0%)
Medium	0 (0%)	0 (0%)	1 (100%)	0 (0%)	1 (100%)	0 (0%)	0 (0%)	0 (0%)
High	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	0	0	1	0	1	0	1	0

Table 10: Frequency of conflicts between left turning vehicles and VRUs with PET of 2.0 to 4.0 seconds.

Risk Level	North Crosswalk		South Crosswalk		East Crosswalk		West Crosswalk	
	EBLT	SBLT	WBLT	NBLT	SBLT	WBLT	NBLT	EBLT
Low	0 (0%)	1 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	3 (50%)	0 (0%)
Medium	6 (55%)	0 (0%)	6 (100%)	0 (0%)	14 (100%)	0 (0%)	3 (50%)	0 (0%)
High	5 (45%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (100%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	11	1	6	0	14	1	6	0

Most conflicts involving VRUs and left turning motorists were recorded between southbound left turning motorists with pedestrians on the east crosswalk (36%), and eastbound left turning motorists with pedestrians on the north crosswalk (26%).

Through with Vulnerable Road Users

Table 11 and **Table 12** summarize the number of conflicts recorded between through traffic and VRUs.

Table 11: Frequency of conflicts between through vehicles and VRUs with PET of less than 2.0 seconds.

Risk Level	North Crosswalk		South Crosswalk		East Crosswalk		West Crosswalk	
	NBT	SBT	NBT	SBT	EBT	WBT	EBT	WBT
Low	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Medium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
High	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	0	0	0	0	0	0	0	0

Table 12: Frequency of conflicts between through vehicles and VRUs with PET of 2.0 to 4.0 seconds.

Risk Level	North Crosswalk		South Crosswalk		East Crosswalk		West Crosswalk	
	NBT	SBT	NBT	SBT	EBT	WBT	EBT	WBT
Low	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Medium	0 (0%)	2 (100%)	1 (100%)	4 (100%)	0 (0%)	0 (0%)	0 (0%)	1 (100%)
High	3 (100%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)
Total	3	2	1	4	2	0	0	1

Table 11 and **Table 12** do not show any specific patterns with conflicts between through vehicles and VRUs.

2.2.3 Other Conflict Types

Table 13 and **Table 14** summarize the number of conflicts for the most common vehicular conflict types.

Table 13: Frequency of vehicular conflict types with PET of less than 2.0 seconds.

Risk Level	Right Turn Conflicts	Left Turn with Opposing Through Conflicts	Angle Type Conflicts
Low	7 (47%)	11 (16%)	3 (43%)
Medium	7 (47%)	46 (68%)	4 (57%)
High	1 (7%)	11 (16%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)
Total	15	68	7

Table 14: Frequency of vehicular types with PET of 2.0 to 4.0 seconds.

Risk Level	Right Turn Conflicts	Left Turn with Opposing Through Conflicts	Angle Type Conflicts
Low	26 (34%)	66 (14%)	12 (63%)
Medium	50 (65%)	338 (71%)	7 (37%)
High	1 (1%)	72 (15%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)
Total	77	476	19

Left turning vehicles with opposing through conflicts is the most common conflict type. This conflict type represented more than 80% of the vehicular conflicts at the intersection.

Left Turn Conflicts

Table 15 and **Table 16** summarize the number of conflicts recorded for left turning traffic conflict types.

Table 15: Frequency of conflicts with left turning traffic with PET of less than 2.0 seconds.

Risk Level	NBLT with SBT	SBLT with NBT	EBLT with WBT	WBLT with EBT
Low	3 (38%)	1 (9%)	6 (14%)	1 (13%)
Medium	4 (50%)	7 (64%)	31 (74%)	5 (63%)
High	1 (13%)	3 (27%)	5 (12%)	2 (25%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	8	11	42	8

Table 16: Frequency of conflicts with left turning traffic with PET of 2.0 to 4.0 seconds.

Risk Level	NBLT with SBT	SBLT with NBT	EBLT with WBT	WBLT with EBT
Low	9 (26%)	11 (7%)	39 (17%)	7 (10%)
Medium	25 (74%)	81 (55%)	179 (79%)	56 (78%)
High	0 (0%)	55 (37%)	8 (4%)	9 (13%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	34	147	226	72

The highest number of vehicular left turn conflicts with opposing through movements was observed between eastbound left-turn and westbound through traffic.

Angle Conflicts

No angle conflicts with a PET of less than 2 seconds were recorded at the intersection. **Table 17** summarizes the number of angle conflicts recorded.

Table 17: Frequency of angle conflicts with PET of 2.0 to 4.0 seconds.

Risk Level	NBT with EBT	NBT with WBT	SBT with EBT	SBT with WBT
Low	0 (0%)	1 (17%)	8 (80%)	3 (100%)
Medium	0 (0%)	5 (83%)	2 (20%)	0 (0%)
High	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	0	6	10	3

Upon a manual review of conflict videos of angle conflicts with a PET of less than 2 seconds, it was determined that the flagged angle conflicts were false positives. It is likely that the recorded angle conflicts with a PET between 2 and 4 seconds also contain similar false positives.

Right Turn Conflicts

Table 18 and **Table 19** summarize the number of conflicts recorded for right turning traffic conflict types.

Table 18: Frequency of conflicts with right turning traffic with PET of less than 2.0 seconds.

Risk Level	NBRT with EBT	SBRT with WBT	EBRT with SBT	WBRT with NBT
Low	0 (0%)	7 (70%)	0 (0%)	0 (0%)
Medium	4 (80%)	3 (30%)	0 (0%)	0 (0%)
High	1 (20%)	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	5	10	0	0

Table 19: Frequency of conflicts with right turning traffic with PET of 2.0 to 4.0 seconds.

Risk Level	NBRT with EBT	SBRT with WBT	EBRT with SBT	WBRT with NBT
Low	2 (20%)	24 (36%)	0 (0%)	0 (0%)
Medium	8 (80%)	42 (63%)	0 (0%)	0 (0%)
High	0 (0%)	1 (1%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	10	67	0	0

Table 18 and **Table 19** show that most vehicular right turn conflicts (84%) were recorded between southbound right turn and westbound through traffic.

2.3 Speeds

2.3.1 Conflicts with Vulnerable Road Users

Right Turn with Vulnerable Road Users

A comparison of the 85th percentile speed per movement for the conflicts with right turning traffic and VRUs is summarized in **Table 20**.

Table 20: Speed in kilometers per hour per movement for the conflicts between right turning traffic and VRUs.

Conflict Type	Right Turn Movement	Pedestrian
NBRT vs VRU (East Crosswalk)	23.18	6.86
SBRT vs VRU (West Crosswalk)	22.64	6.32
EBRT vs VRU (South Crosswalk)	13.10	6.13
WBRT vs VRU (North Crosswalk)	-	-

The corner radii were measured to be approximately 14 m on the northwest and southeast corners, compared to 7 m on the northeast and southwest corners.

Left Turn with Vulnerable Road Users

A comparison of the 85th percentile speed per movement for the conflicts with left turning traffic and VRUs is summarized in **Table 21.**

Table 21: Speed in kilometers per hour per movement for the conflicts between left turning traffic and VRUs.

Conflict Type	Left Turn Movement	Pedestrian
NBLT vs VRU (West Crosswalk)	15.95	6.82
SBLT vs VRU (East Crosswalk)	19.58	9.65
EBLT vs VRU (North Crosswalk)	22.46	6.87
WBLT vs VRU (South Crosswalk)	21.89	6.18

The skewed intersection configuration is leading to higher left turn speeds in the eastbound and westbound directions.

2.3.2 Other Conflict Types

Left Turn Conflicts

A comparison of the 85th percentile speed per movement for the left turn conflict types is summarized in **Table 22.**

Table 22: 85th percentile speed per movement for the left turn conflicts.

Conflict Type	Left turn Movement	Through Movement
NBLT with SBT	17.87	38.70
SBLT with NBT	20.39	45.33
EBLT with WBT	25.72	41.69
WBLT with EBT	26.20	41.69

Angle Conflicts

A comparison of the 85th percentile speed per movement for the angle conflict types is summarized in **Table 23.**

Table 23: 85th percentile speed per movement for the angle conflicts.

Conflict Type	Through N/S	Through E/W
NBT with EBT	48.45	46.01
NBT with WBT	48.79	45.59
SBT with EBT	41.73	42.78
SBT with WBT	42.71	43.52

Right Turn Conflicts

A comparison of the 85th percentile speed per movement for the right turn conflict types is summarized in **Table 24**.

Table 24: 85th percentile speed per movement for the right turn conflicts.

Conflict Type	Right turn movement	Through movement
NBRT with EBT	22.95	40.72
SBRT with WBT	21.97	42.07
EBRT with SBT	14.04	31.07
WBRT with NBT	9.03	33.16

3.0 POTENTIAL CONTRIBUTING FACTORS AND REMEDIAL MEASURES

The identification of potential contributing factors was based on a review of video clips and the above video analytic outputs. These potential contributing factors and proposed remedial measures are summarized in **Table 25** and **Table 26**.

For each identified remedial measure, the implementation timeline and priority level is specified. The categories used are the following:

Timeline:

- Short-term actions include relatively inexpensive measures that could be implemented in the short-term without major physical changes to the layout of the intersection.
- Medium/long-term recommendations are more costly, which require long-term planning, design, and property.

Priority Level:

- Lower priority: remedial measure that would improve safety but that does not address a safety issue with a significant conflict and/or liability risk.
- Higher priority: remedial measure that addresses a safety issue with a high conflict and/or liability risk and that should be prioritized by the City.

Note that no field investigations or historic collision review were conducted as part of this video conflict analysis. The City should confirm the feasibility of the recommended remedial measures before implementing them.

Table 25: Identified Safety Issues.

Safety Issues	Conflict Example
High frequency of right-turn conflicts with VRUs A high frequency of conflicts between southbound right turning motorists and pedestrians walking on the west crosswalk was recorded at the intersection. Almost all conflicts (more than 90%) between right-turning vehicles and VRUs involved southbound right turning motorists and pedestrians on the west crosswalk. A contributing factor to this conflict is the limited visibility between turning motorists and pedestrians caused by the skewed configuration, vegetation, and a significant stop bar setback. Drivers making a southbound right-turn onto 5 Avenue NW tend to encroach on the north crosswalk, especially when waiting on a red signal, so that they can have a better visibility of westbound vehicles and pedestrians.	 Video ID: 64626040  Video ID: 64622652

Safety Issues	Conflict Example
Pedestrian visibility Standard crosswalks with two parallel white edge lines are installed on each approach. High visibility crosswalks such as ladder type crosswalks increase driver's awareness of potential conflicts with pedestrians. Further, the crosswalks are faded.	 Video ID: 64618702
High frequency of opposing left turn conflicts A high number of opposing left turn conflicts, primarily between eastbound left turn and westbound through traffic, was recorded at the intersection. These conflicts occurred when eastbound left turn motorists turned on a permissive left turn phase. The skewed configuration is resulting in limited sight lines and increasing the risk of severe collisions at the intersection.	

Safety Issues	Conflict Example
Cyclists not dismounting their bicycles A substantial number of cyclists were observed to not dismount their bicycles before crossing the intersection. Cyclists have the potential to surprise turning motorists who are not expecting users travelling on the crosswalks at speeds that are significantly higher than a typical walking speed.	 Video ID: 64619987

Table 26: Potential Remedial Measures.

Safety Issues	Potential Remedial Measures	Effectiveness	Timeline	Priority Level
High frequency of right turn conflicts with VRUs	**Paint ladder type crosswalks to increase the visibility of pedestrians.**	CMF of 0.52 for vehicle-pedestrian collisions[2]	Short-term	Lower
	Install NO RIGHT TURN ON RED signs on the northbound and southbound approaches given the restricted visibility available on the northwest and southeast corners.	CMF of 0.57[3] on vehicle/ pedestrian conflicts.	Short-term	Higher
	Consider a Leading Pedestrian Interval (LPI)[4] at the intersection.	A LPI is an effective treatment to address this conflict type. CMF of 0.81[5] on pedestrian/vehicle collision type.	Short-term	Higher

[2]Sanders, R., Schultheiss, B., Judelman, B., Burchfield, R., Nordback, K., Gelinne, D., ... & Koonce, P. (2020). Guidance to Improve Pedestrian and Bicyclist Safety at Intersections (No. Project 15-63).

[3] The Effect of Right-Turn-on-Red on Pedestrian and Bicyclist Accidents, Preusser et al., 1982.

[4] A leading pedestrian interval (LPI) gives pedestrians the opportunity to enter an intersection a few seconds before vehicles are given a green indication.

[5] Safety Evaluation of Protected Left-Turn Phasing and Leading Pedestrian Intervals on Pedestrian Safety, Goughnour et al., 2018.

Safety Issues	Potential Remedial Measures	Effectiveness	Timeline	Priority Level
High frequency of opposing left turn conflicts	The City should review the collision history at the intersection and determine if there is a pattern of eastbound left turn with westbound through collisions. If such pattern exists, the City should consider implementing eastbound protected only left-turn phases to minimize the frequency of conflicts between eastbound left turning and through traffic.	Providing protected left-turn phasing has a wide range of CMFs but in general it has great safety benefits on injury and fatal collisions.	Short-term	Lower
	Extend the bicycle lane pavement markings through the intersection to increase the visibility of VRUs and minimize the risk of conflicts between VRUs and turning motorists.	No CMF for this remedial measure.	Short-term	Higher
Cyclists not dismounting their bicycles	**Assess the installation of bicycle facilities and consider marking the bicycle lanes through the intersection.**	Although a wide range of CMFs (0.42 to 2.03) are provided for these treatments, safety benefits are expected to be provided when installed at intersections.	Long-term	Lower

APPENDIX A: CONFLICTS WITH A PET/TTC OF 2 SECONDS OR LESS

Conflicts with VRUs

Safety Indicator Value(seconds)	Date	Time	Evasive Action Conflicts	URL
1.97	2022-07-29	11:27:35	No	https://results.trafxsafe.com/indicators/64619320
1.97	2022-07-26	19:51:12	No	https://results.trafxsafe.com/indicators/64626675
0.43	2022-07-26	15:54:30	No	https://results.trafxsafe.com/indicators/64622652
0.83	2022-07-28	19:57:44	No	https://results.trafxsafe.com/indicators/64616303
0.93	2022-07-29	8:25:35	No	https://results.trafxsafe.com/indicators/64615795
1.03	2022-07-27	14:34:07	No	https://results.trafxsafe.com/indicators/64626040
1.03	2022-07-29	12:55:47	No	https://results.trafxsafe.com/indicators/64616938
1.03	2022-07-27	21:06:41	No	https://results.trafxsafe.com/indicators/64624567
1.17	2022-07-27	11:57:49	No	https://results.trafxsafe.com/indicators/64624416
1.17	2022-07-26	11:28:35	No	https://results.trafxsafe.com/indicators/64622198
1.23	2022-07-25	16:19:38	No	https://results.trafxsafe.com/indicators/64625326
1.23	2022-07-26	18:40:24	No	https://results.trafxsafe.com/indicators/64624084
1.33	2022-07-27	18:31:35	No	https://results.trafxsafe.com/indicators/64627614
1.33	2022-07-26	15:23:49	No	https://results.trafxsafe.com/indicators/64622641
1.47	2022-07-29	13:34:36	No	https://results.trafxsafe.com/indicators/64616400
1.57	2022-07-29	12:23:34	No	https://results.trafxsafe.com/indicators/64616926
1.6	2022-07-25	19:36:35	No	https://results.trafxsafe.com/indicators/64621528
1.6	2022-07-28	16:51:44	No	https://results.trafxsafe.com/indicators/64619397
1.63	2022-07-27	12:58:26	No	https://results.trafxsafe.com/indicators/64624966
1.67	2022-07-29	12:49:47	No	https://results.trafxsafe.com/indicators/64616931
1.67	2022-07-26	14:58:53	No	https://results.trafxsafe.com/indicators/64619728
1.67	2022-07-27	16:20:31	No	https://results.trafxsafe.com/indicators/64630045
1.7	2022-07-26	15:40:58	No	https://results.trafxsafe.com/indicators/64622570
1.7	2022-07-25	19:36:35	No	https://results.trafxsafe.com/indicators/64621529
1.74	2022-07-27	18:26:03	No	https://results.trafxsafe.com/indicators/64627612
1.74	2022-07-26	15:46:47	No	https://results.trafxsafe.com/indicators/64622646
1.74	2022-07-27	20:43:09	No	https://results.trafxsafe.com/indicators/64626414
1.8	2022-07-26	21:26:08	No	https://results.trafxsafe.com/indicators/64619987
1.84	2022-07-28	19:38:51	No	https://results.trafxsafe.com/indicators/64616302
1.84	2022-07-29	10:14:20	No	https://results.trafxsafe.com/indicators/64615143
1.87	2022-07-28	15:54:23	No	https://results.trafxsafe.com/indicators/64617339
1.9	2022-07-29	9:52:42	No	https://results.trafxsafe.com/indicators/64615315
1.94	2022-07-25	16:45:25	No	https://results.trafxsafe.com/indicators/64625397
1.97	2022-07-29	10:35:59	No	https://results.trafxsafe.com/indicators/64615147

Opposing Left Turn

Safety Indicator Value(seconds)	Date	Time	URL
1.97	2022-07-28	19:19:11	https://results.trafxsafe.com/indicators/64616172
1.97	2022-07-28	16:16:07	https://results.trafxsafe.com/indicators/64619719
0.47	2022-07-28	12:04:13	https://results.trafxsafe.com/indicators/64617771
0.93	2022-07-27	7:56:43	https://results.trafxsafe.com/indicators/64626288
1.03	2022-07-27	18:21:10	https://results.trafxsafe.com/indicators/64627706
1.03	2022-07-28	11:55:32	https://results.trafxsafe.com/indicators/64618702
1.07	2022-07-27	18:38:11	https://results.trafxsafe.com/indicators/64627737
1.13	2022-07-26	9:05:31	https://results.trafxsafe.com/indicators/64627145
1.17	2022-07-28	11:59:24	https://results.trafxsafe.com/indicators/64618371
1.23	2022-07-26	11:54:31	https://results.trafxsafe.com/indicators/64622092
1.23	2022-07-27	16:22:33	https://results.trafxsafe.com/indicators/64630921
1.27	2022-07-27	16:00:04	https://results.trafxsafe.com/indicators/64630598
1.27	2022-07-27	15:53:10	https://results.trafxsafe.com/indicators/64627849
1.27	2022-07-28	23:40:20	https://results.trafxsafe.com/indicators/64614687
1.3	2022-07-29	12:01:10	https://results.trafxsafe.com/indicators/64616625
1.33	2022-07-25	20:51:24	https://results.trafxsafe.com/indicators/64622404
1.37	2022-07-28	15:08:34	https://results.trafxsafe.com/indicators/64617441
1.37	2022-07-27	16:55:27	https://results.trafxsafe.com/indicators/64629573
1.4	2022-07-26	14:43:39	https://results.trafxsafe.com/indicators/64619979
1.47	2022-07-28	15:25:05	https://results.trafxsafe.com/indicators/64617487
1.5	2022-07-27	9:46:23	https://results.trafxsafe.com/indicators/64623665
1.5	2022-07-28	15:42:10	https://results.trafxsafe.com/indicators/64617283
1.5	2022-07-25	17:06:52	https://results.trafxsafe.com/indicators/64623357
1.53	2022-07-27	15:39:40	https://results.trafxsafe.com/indicators/64628203
1.53	2022-07-26	16:55:08	https://results.trafxsafe.com/indicators/64622371
1.53	2022-07-26	14:43:04	https://results.trafxsafe.com/indicators/64619583
1.57	2022-07-27	12:50:47	https://results.trafxsafe.com/indicators/64625323
1.6	2022-07-28	14:31:01	https://results.trafxsafe.com/indicators/64615704
1.63	2022-07-27	20:32:58	https://results.trafxsafe.com/indicators/64626535
1.63	2022-07-29	11:29:58	https://results.trafxsafe.com/indicators/64619304
1.67	2022-07-26	18:42:39	https://results.trafxsafe.com/indicators/64624332
1.67	2022-07-27	16:11:25	https://results.trafxsafe.com/indicators/64629303
1.67	2022-07-27	17:26:39	https://results.trafxsafe.com/indicators/64628694
1.67	2022-07-26	19:31:39	https://results.trafxsafe.com/indicators/64626661
1.67	2022-07-25	16:58:55	https://results.trafxsafe.com/indicators/64625762
1.67	2022-07-28	13:05:57	https://results.trafxsafe.com/indicators/64617021

Safety Indicator Value(seconds)	Date	Time	URL
1.7	2022-07-28	17:28:04	https://results.trafxsafe.com/indicators/64618146
1.7	2022-07-28	8:22:45	https://results.trafxsafe.com/indicators/64620321
1.7	2022-07-26	11:49:01	https://results.trafxsafe.com/indicators/64622072
1.7	2022-07-26	17:23:23	https://results.trafxsafe.com/indicators/64627059
1.7	2022-07-26	8:04:59	https://results.trafxsafe.com/indicators/64621145
1.74	2022-07-28	14:30:12	https://results.trafxsafe.com/indicators/64615696
1.74	2022-07-27	15:40:30	https://results.trafxsafe.com/indicators/64628209
1.74	2022-07-28	9:33:36	https://results.trafxsafe.com/indicators/64625580
1.74	2022-07-28	16:59:49	https://results.trafxsafe.com/indicators/64618070
1.77	2022-07-27	18:41:52	https://results.trafxsafe.com/indicators/64627511
1.77	2022-07-25	17:58:44	https://results.trafxsafe.com/indicators/64623458
1.77	2022-07-25	16:47:02	https://results.trafxsafe.com/indicators/64625704
1.77	2022-07-25	16:48:03	https://results.trafxsafe.com/indicators/64625707
1.8	2022-07-26	16:40:17	https://results.trafxsafe.com/indicators/64622298
1.8	2022-07-27	14:02:24	https://results.trafxsafe.com/indicators/64626099
1.8	2022-07-27	14:04:54	https://results.trafxsafe.com/indicators/64625973
1.8	2022-07-26	15:54:56	https://results.trafxsafe.com/indicators/64622828
1.84	2022-07-27	21:27:40	https://results.trafxsafe.com/indicators/64624539
1.84	2022-07-27	16:58:04	https://results.trafxsafe.com/indicators/64630022
1.87	2022-07-27	16:54:30	https://results.trafxsafe.com/indicators/64629570
1.87	2022-07-27	18:26:07	https://results.trafxsafe.com/indicators/64627558
1.87	2022-07-28	16:32:52	https://results.trafxsafe.com/indicators/64619846
1.9	2022-07-27	15:53:02	https://results.trafxsafe.com/indicators/64627847
1.9	2022-07-28	17:11:37	https://results.trafxsafe.com/indicators/64618406
1.9	2022-07-25	17:16:05	https://results.trafxsafe.com/indicators/64623062
1.9	2022-07-26	11:21:21	https://results.trafxsafe.com/indicators/64622419
1.9	2022-07-28	21:56:17	https://results.trafxsafe.com/indicators/64614855
1.9	2022-07-26	8:43:53	https://results.trafxsafe.com/indicators/64621431
1.94	2022-07-27	12:53:21	https://results.trafxsafe.com/indicators/64625330
1.94	2022-07-28	15:06:36	https://results.trafxsafe.com/indicators/64617434
1.94	2022-07-25	17:40:02	https://results.trafxsafe.com/indicators/64623416
1.97	2022-07-26	18:34:08	https://results.trafxsafe.com/indicators/64624302

Right Turn

Safety Indicator Value(seconds)	Date	Time	URL
1.97	2022-07-28	14:09:21	https://results.trafxsafe.com/indicators/64615600
0.7	2022-07-26	17:25:00	https://results.trafxsafe.com/indicators/64627223
1.03	2022-07-25	17:58:46	https://results.trafxsafe.com/indicators/64623311
1.23	2022-07-26	7:51:38	https://results.trafxsafe.com/indicators/64620831
1.37	2022-07-29	6:49:03	https://results.trafxsafe.com/indicators/64614555
1.57	2022-07-26	9:00:31	https://results.trafxsafe.com/indicators/64626862
1.57	2022-07-28	20:41:30	https://results.trafxsafe.com/indicators/64614963
1.67	2022-07-28	10:24:25	https://results.trafxsafe.com/indicators/64618734
1.77	2022-07-26	17:27:30	https://results.trafxsafe.com/indicators/64627004
1.8	2022-07-27	9:38:57	https://results.trafxsafe.com/indicators/64623588
1.87	2022-07-26	12:04:12	https://results.trafxsafe.com/indicators/64621083
1.9	2022-07-28	19:29:53	https://results.trafxsafe.com/indicators/64616338
1.9	2022-07-28	13:41:41	https://results.trafxsafe.com/indicators/64616958
1.9	2022-07-26	14:30:57	https://results.trafxsafe.com/indicators/64619626
1.9	2022-07-27	8:57:06	https://results.trafxsafe.com/indicators/64623744

VIDEO CONFLICT ANALYSIS

Location: **14 Street NW and 6 Avenue NW Intersection, Calgary, Alberta**

May 2023

TRUE NORTH SAFETY GROUP

VIDEO CONFLICT ANALYSIS

Location: **14th Street NW and 6 Avenue NW Intersection, Calgary, Alberta**

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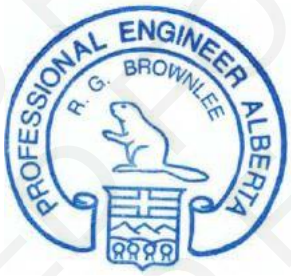

Russell Brownlee, B.Sc., M.A. Sc., RSP1, P. Eng.

Alexandre Nolet, M.Eng., RSP_1, P.Eng.

May 2023

1.0 INTRODUCTION

1.1 Background

The City of Calgary ('the City') retained the Urban Systems Team ('Urban Systems') to conduct the Riley Communities Mobility Study and Improvements Plan. True North Safety Group ('TNS') and Transoft Solutions ('Transoft') were retained to undertake video conflict analysis at five intersections across the City. As part of this study, Transoft collected conflict analysis data, vehicular speed data, and traffic volumes at each intersection. TNS analyzed the outputs and included the key road safety review findings in individual reports. The following is a summary of the safety assessment conducted for the intersection of 14 Street NW and 6 Avenue NW.

1.2 Study Area

The intersection of 14 Street NW and 6 Avenue NW is a signalized intersection with pedestrian crosswalks on all 4 legs. 14 Street NW is a 4-lane arterial road that runs in the north-south direction with a painted median. 6 Avenue is a local collector road with a dedicated bicycle lane.

The posted speed limit through the intersection is 50 kilometres per hour (km/h). Adjacent land uses consist primarily of mixed-use residential developments with retail on the ground floor, and Hillhurst Sunnyside Park on the northeast corner.

Figure 1 provides an image of the lane configuration. **Figure 2** provides an aerial image of the intersection.

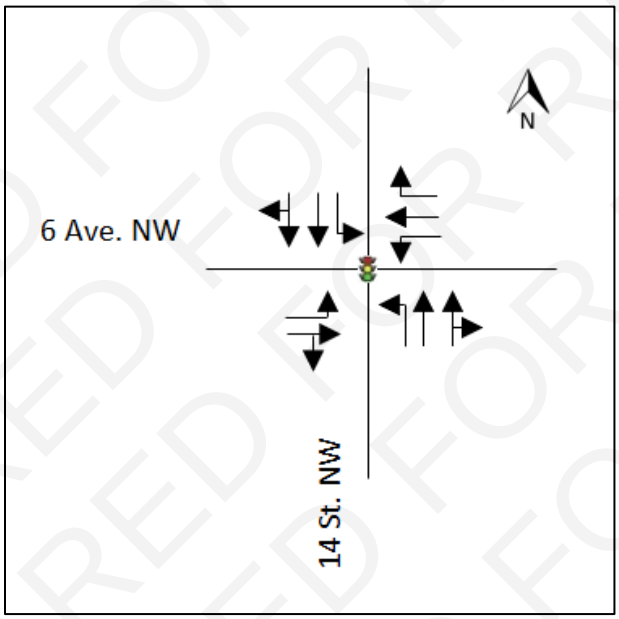

Figure 1: Lane Configuration of 14 Street NW and 6 Avenue NW Intersection

Figure 2: 14 Street NW and 6 Avenue NW Intersection

1.3 Video Data Collection

One camera was installed on the southeast corner of the intersection to capture all traffic movements. The view of the camera is shown in **Figure 3**. Data was collected for a total of 72 hours over a three-day period (June 23 to 26, 2022).

Figure 3: Camera View at the Intersection.

2.0 VIDEO ANALYTIC OUTPUT

The results of the video analytic assessment related to traffic volumes, speeds, and conflicts for the subject intersection are provided below.

2.1 Volumes

The peak hours at this intersection occurred from 7:30 a.m. to 8:30 a.m. (morning peak hour), and from 4:30 p.m. to 5:30 p.m. (afternoon peak hour). This aligns with typical peak hours for an urban environment, with vehicle demand along 14 Street significantly higher compared to 6 Avenue. Most of the pedestrian volume was recorded on the south leg of the intersection. The intersection peak hour volumes collected on Thursday, June 23, 2022, are summarized in **Figure 4**. Note that given the intersection geometry and the camera angle, the traffic volume and conflicts involving southbound right turn motorists could not be captured.

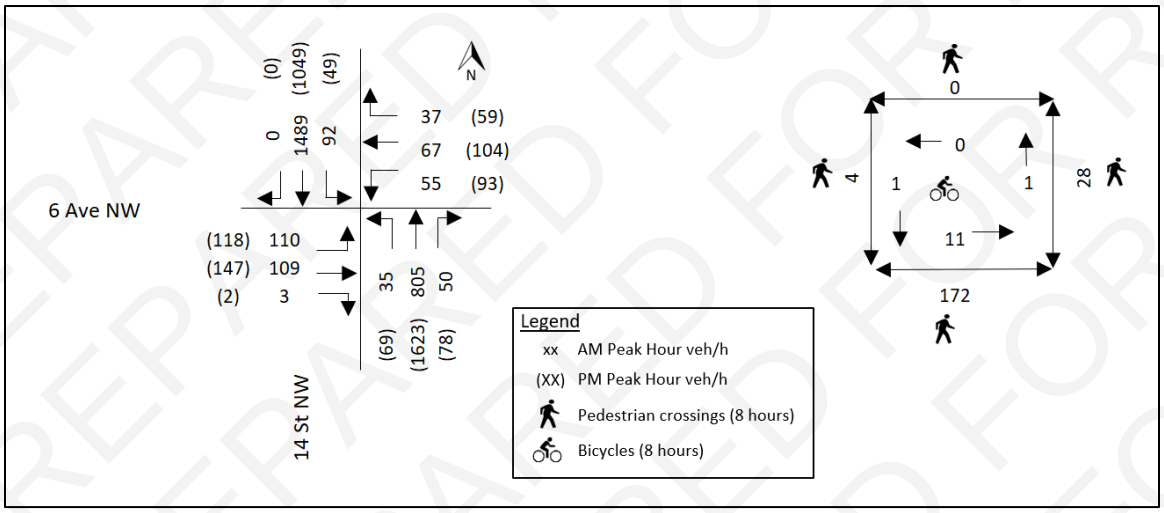

Figure 4: Intersection peak hour volumes on Thursday, June 23, 2022

2.2 Conflicts

2.2.1 Conflict Analysis Methodology

Traffic conflicts can be grouped in two main types: time-proximity conflicts and evasive action conflicts. Traffic conflicts based on an evasive action consist of an event involving two or more road users, in which the action of one user causes the other user to brake or swerve. Time-proximity conflicts consist of determining how close in time or space the involved road users are to colliding. The time-proximity conflict measures include Post Encroachment Time (PET) and Time to Collision (TTC).

PET is defined as the time between the first road user leaving the common spatial zone (i.e., where two road users could potentially collide) and the second road user arriving to the common spatial zone. TTC describes the time until a collision that would have happened if two conflicting road users were to continue their paths and speeds. The lower the PET and/or TTC, the smaller the temporal and/or spatial proximity between the road users and the lower the available reaction time would be.

Transoft's video conflict algorithm captures all safety-related events with a PET/TTC of less than ten seconds. The information about each safety-related event (e.g., speed of the road users, PET or TTC values, vehicle that arrived first at the conflict location, date, and time) is recorded in a disaggregated database. In general, video footage for each safety-related event with a PET/TTC of less than two seconds is also provided.

The safety-related events identified by Transoft's algorithm are not differentiated as to whether the safety-related event was the result of normal operations or of hazardous road user behaviors that could have resulted in a collision. Therefore, further analysis was required to identify which safety-related events involved hazardous road user behaviors (actual conflicts).

The approach used to differentiate the actual conflicts varied based on the nature of the conflicts and the available data. **Table 1** summarizes the approach used to identify which safety-related events involved hazardous road user behaviors for the key conflict types.

Table 1: Approach to identify conflicts.

Conflict Type	Approach
Conflicts with vulnerable road users (VRUs) Right-turning, left-turning, or through vehicle in conflict with a vulnerable road user.	Determining which safety-related events involved a hazardous behavior by the motorist and/or pedestrian can only be accomplished by reviewing individual video footage. Each video footage for safety-related events of 2 seconds or less are reviewed and the safety-related events that required an evasive action are flagged. In addition to providing the total number of safety-related events of 2 seconds or less, a description of the safety-related events that required an evasive action is provided.
Opposing Left Turn Vehicle making a left turn in front of a vehicle approaching from the opposing direction.	The conflict frequency of the safety-related events where the first vehicle to arrive at the conflict point was the left turning motorist is provided. The frequency of opposing left turn safety-related events where the left turning vehicle arrived second at the conflict point is not considered as part of the analysis.
Angle Vehicles travelling at an angle to each other.	An angle conflict type occurring at a controlled intersection implies that one vehicle disobeyed the traffic control system. Therefore, all recorded angle safety-related events are considered conflicts.
Right turn Vehicle making a right turn in front of a perpendicular through vehicle.	The conflict frequency of the safety-related events where the first vehicle to arrive at the conflict point was the right turning motorist is provided. The frequency of right turning safety-related events where the right turning vehicle arrived second at the conflict point is not considered as part of this analysis.

Conflicts are also sorted into risk levels. The conflict risk level speed thresholds are based on the Wramborg biomechanical survivability thresholds[1]. These risk levels are shown in **Table 2.**

[1] Jurewicz, Chris, Air Sobhani, Jeremy Woolley, Jeff Dutschke and Bruce Corben. 2016. "Exploration of Vehicle Impact Speed-Injury Severity Relationships for Application in Safer Road Design." Transportation Research Procedia, Volume 14: 4247-4256.

Table 2: Conflict risk levels based on vehicular and pedestrian speeds.

Risk Level	Vehicle-Pedestrian Conflicts	Vehicle-Vehicle Conflicts
Low	< 15 km/h	< 35 km/h
Medium	> 15 km/h	> 35 km/h
High	> 35 km/h	> 50 km/h
Critical	> 50 km/h	> 70 km/h

The results for the conflict analysis are provided below. In **Appendix A**, a list of the less than 2 seconds conflicts with the hyperlink to the associated video footage for each key conflict type is provided.

2.2.2 Conflicts with Vulnerable Road Users

Table 3 and **Table 4** summarize the number of conflicts recorded at each crosswalk.

Table 3: Frequency of conflicts at each crosswalk with PET of less than 2.0 seconds[2]

Risk Level	North Crosswalk	South Crosswalk	East Crosswalk	West Crosswalk
Low	0 (0%)	1 (100%)	1 (100%)	0 (0%)
Medium	0 (0%)	0 (0%)	0 (0%)	0 (0%)
High	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	0	1	1	0

Table 4: Frequency of conflicts at each crosswalk with PET of 2.0 to 4.0 seconds

Risk Level	North Crosswalk	South Crosswalk	East Crosswalk	West Crosswalk
Low	0 (0%)	7 (16%)	1 (20%)	0 (0%)
Medium	0 (0%)	35 (81%)	3 (60%)	0 (0%)
High	0 (0%)	0 (0%)	1 (20%)	0 (0%)
Critical	0 (0%)	1 (2%)	0 (0%)	0 (0%)
Total	0	43	5	0

The highest frequency of VRU conflicts and pedestrian volumes were recorded on the south crosswalk.

[2] Note that the conflict indicators (PET and TTC values) were increased by one second to account for the difficulties with the video processing caused by camera placement.

Table 5 and **Table 6** summarize the number of conflicts per VRU conflict types.

Table 5: Frequency of conflicts with PET of less than 2.0 seconds per VRU conflict types

Risk Level	Right Turn	Left Turn	Through
Low	0 (0%)	2(100%)	0 (0%)
Medium	0 (0%)	0 (0%)	0 (0%)
High	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)
Total	0	2	0

Table 6: Frequency of conflicts with PET of 2.0 to 4.0 seconds per VRU conflict types

Risk Level	Right Turn	Left Turn	Through
Low	2 (29%)	1 (6%)	5 (21%)
Medium	5 (71%)	16 (94%)	17 (71%)
High	0 (0%)	0 (0%)	1 (4%)
Critical	0 (0%)	0 (0%)	1 (4%)
Total	7	17	24

A high frequency of conflicts between VRUs and through travelling motorists was recorded, followed by VRUs and left turning motorists.

Right Turn with Vulnerable Road Users

No right turn conflicts with VRUs were recorded with a PET of less than 2 seconds. **Table 7** summarizes the number of conflicts recorded between right turning traffic and VRUs. Note that southbound right turn movements could not be captured.

Table 7: Frequency of conflicts between right turning vehicles and VRUs with PET of 2.0 to 4.0 seconds

Risk Level	North Crosswalk		South Crosswalk		East Crosswalk		West Crosswalk	
	WBRT	SBRT	EBRT	NBRT	NBRT	WBRT	SBRT	EBRT
Low	0 (0%)	n/a	1 (50%)	0 (0%)	1 (25%)	0 (0%)	n/a	0 (0%)
Medium	0 (0%)	n/a	1 (50%)	1 (100%)	3 (75%)	0 (0%)	n/a	0 (0%)
High	0 (0%)	n/a	0 (0%)	0 (0%)	0 (0%)	0 (0%)	n/a	0 (0%)
Critical	0 (0%)	n/a	0 (0%)	0 (0%)	0 (0%)	0 (0%)	n/a	0 (0%)
Total	0	n/a	2	1	4	0	n/a	0

Left Turn with Vulnerable Road Users

Table 8 and **Table 9** summarize the number of conflicts recorded between left turning traffic and VRUs.

Table 8: Frequency of conflicts between left turning vehicles and VRUs with PET of less than 2.0 seconds

Risk Level	North Crosswalk		South Crosswalk		East Crosswalk		West Crosswalk	
	EBLT	SBLT	WBLT	NBLT	SBLT	WBLT	NBLT	EBLT
Low	0 (0%)	0 (0%)	1 (100%)	0 (0%)	1 (100%)	0 (0%)	0 (0%)	0 (0%)
Medium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
High	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	0	0	1	0	1	0	0	0

Table 9: Frequency of conflicts between left turning vehicles and VRUs with PET of 2.0 to 4.0 seconds

Risk Level	North Crosswalk		South Crosswalk		East Crosswalk		West Crosswalk	
	EBLT	SBLT	WBLT	NBLT	SBLT	WBLT	NBLT	EBLT
Low	0 (0%)	0 (0%)	1 (6%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Medium	0 (0%)	0 (0%)	16 (94%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
High	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	0	0	17	0	0	0	0	0

Almost all left turn conflicts with VRUs were recorded on the south crosswalk with westbound left turning motorists.

Through with Vulnerable Road Users

Table 10 summarizes the number of conflicts recorded between through traffic and VRUs. There were no through conflicts with VRUs recorded with PET of less than 2 seconds.

Table 10: Frequency of conflicts between through vehicles and VRUs with PET of 2.0 to 4.0 seconds

Risk Level	North Crosswalk		South Crosswalk		East Crosswalk		West Crosswalk	
	NBT	SBT	NBT	SBT	EBT	WBT	EBT	WBT
Low	0 (0%)	0 (0%)	0 (0%)	5 (23%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Medium	0 (0%)	0 (0%)	1 (100%)	16 (73%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
High	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (100%)	0 (0%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	1 (5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	0	0	1	22	1	0	0	0

Almost all through conflicts with VRUs were recorded on the south crosswalk with southbound through motorists.

2.2.3 Other Conflict Types

Table 11 and **Table 12** summarize the number of conflicts for the most common vehicular conflict types.

Table 11: Frequency of vehicular conflict types with PET of less than 2.0 seconds

Risk Level	Right Turn Conflicts	Left Turn with Opposing Through Conflicts	Angle Type Conflicts
Low	0 (0%)	2 (25%)	0 (0%)
Medium	0 (0%)	4 (50%)	0 (0%)
High	0 (0%)	2 (25%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)
Total	0	8	0

Table 12: Frequency of vehicular types with PET of 2.0 to 4.0 seconds

Risk Level	Right Turn Conflicts	Left Turn with Opposing Through Conflicts	Angle Type Conflicts
Low	6 (11%)	59 (11%)	4 (25%)
Medium	14 (26%)	181 (35%)	3 (19%)
High	28 (52%)	249 (48%)	8 (50%)
Critical	6 (11%)	29 (6%)	1 (6%)
Total	54	518	16

Most vehicle-vehicle conflicts (88%) were left turn with opposing through conflicts.

Left Turn Conflicts

Table 13 and **Table 14** summarize the number of conflicts recorded for left turning traffic conflict types.

Table 13: Frequency of conflicts with left turning traffic with PET of less than 2.0 seconds

Risk Level	NBLT with SBT	SBLT with NBT	EBLT with WBT	WBLT with EBT
Low	0 (0%)	1 (33%)	0 (0%)	1 (100%)
Medium	3 (75%)	1 (33%)	0 (0%)	0 (0%)
High	1 (25%)	1 (33%)	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	4	3	0	1

Table 14: Frequency of conflicts with left turning traffic with PET of 2.0 to 4.0 seconds

Risk Level	NBLT with SBT	SBLT with NBT	EBLT with WBT	WBLT with EBT
Low	27 (12%)	5 (2%)	10 (23%)	17 (49%)
Medium	79 (36%)	63 (29%)	21 (48%)	18 (51%)
High	107 (48%)	129 (59%)	13 (30%)	0 (0%)
Critical	8 (4%)	21 (10%)	0 (0%)	0 (0%)
Total	221	218	44	35

Most left turn conflicts (85%) involved northbound and southbound motorists.

Angle

Table 15 summarizes the number of angle conflicts recorded. There were no angle conflicts with PET of less than 2 seconds.

Table 15: Frequency of angle conflicts with PET of 2.0 to 4.0 seconds

Risk Level	NBT with EBT	NBT with WBT	SBT with EBT	SBT with WBT
Low	2 (100%)	0 (0%)	0 (0%)	2 (33%)
Medium	0 (0%)	0 (0%)	0 (0%)	3 (50%)
High	0 (0%)	7 (88%)	0 (0%)	1 (17%)
Critical	0 (0%)	1 (13%)	0 (0%)	0 (0%)
Total	2	8	0	6

Most (88%) of the recorded angle conflicts involved a westbound through motorist.

Right Turn Conflicts

Table 16 summarizes the number of conflicts recorded for right turning traffic conflict types. There were no vehicular right turn conflicts recorded with PET of less than 2 seconds.

Table 16: Frequency of conflicts with right turning traffic with PET of 2.0 to 4.0 seconds

Risk Level	NBRT with EBT	SBRT with WBT	EBRT with SBT	WBRT with NBT
Low	0 (0%)	n/a	3 (75%)	3 (6%)
Medium	0 (0%)	n/a	0 (0%)	14 (28%)
High	0 (0%)	n/a	0 (0%)	28 (56%)
Critical	0 (0%)	n/a	1 (25%)	5 (10%)
Total	0	n/a	4	50

Most right turn conflicts (93%) involved westbound right turning and northbound through motorists. Note that southbound right turn movements could not be captured.

2.3 Speeds

2.3.1 Conflicts with Vulnerable Road Users

Right Turn with Vulnerable Road Users

A comparison of the 85th percentile speed per movement for the conflicts with right turning traffic and VRUs is summarized in **Table 17**.

Table 17: Speed in kilometres per hour per movement for the conflicts between right turning traffic and VRUs

Conflict Type	Right Turn Movement	Pedestrian
NBRT vs VRU (East Crosswalk)	25.08	6.80
SBRT vs VRU (West Crosswalk)	-	-
EBRT vs VRU (South Crosswalk)	17.86	5.23
WBRT vs VRU (North Crosswalk)	-	-

High right turning speeds were measured on the southeast right turn channel. The corner radius on the southeast corner was measured to be approximately 17 m.

Left Turn with Vulnerable Road Users

A comparison of the 85th percentile speed per movement for the conflicts with left turning traffic and VRUs is summarized in **Table 18**.

Table 18: Speed in kilometres per hour per movement for the conflicts between left turning traffic and VRUs

Conflict Type	Left Turn Movement	Pedestrian
NBLT vs VRU (West Crosswalk)	12.18	3.48
SBLT vs VRU (East Crosswalk)	22.31	6.10
EBLT vs VRU (North Crosswalk)	-	-
WBLT vs VRU (South Crosswalk)	25.65	6.80

2.3.2 Other Conflict Types

Left Turn Conflicts

A comparison of the 85th percentile speed per movement for the left turn conflict types is summarized in **Table 19**.

Table 19: 85th percentile speed per movement for the left turn conflicts

Conflict Type	Left turn Movement	Through Movement
NBLT with SBT	25.69	52.19
SBLT with NBT	27.61	54.38
EBLT with WBT	26.43	43.18
WBLT with EBT	26.10	32.56

High left turning speeds were measured on all approaches. The skewed configuration of the intersection and stop bar setback allow motorists to maintain a higher speed through their turn.

Angle

A comparison of the 85th percentile speed per movement for the angle conflict types is summarized in **Table 20**.

Table 20: 85th percentile speed per movement for the angle conflicts

Conflict Type	Through N/S	Through E/W
NBT with EBT	22.01	42.83
NBT with WBT	56.65	41.63
SBT with EBT	-	-
SBT with WBT	53.89	30.34

Right Turn Conflicts

A comparison of the 85th percentile speed per movement for the right turn conflict types is summarized in **Table 21**.

Table 21: 85th percentile speed per movement for the right turn conflicts

Conflict Type	Right turn movement	Through movement
NBRT with EBT	-	-
SBRT with WBT	-	-
EBRT with SBT	24.64	48.02
WBRT with NBT	15.56	51.58

3.0 POTENTIAL CONTRIBUTING FACTORS AND REMEDIAL MEASURES

The identification of potential contributing factors was based on a review of video clips and the above video analytic outputs. These potential contributing factors are summarized in **Table 22**. The potential remedial measures to address the identified safety issues are summarized in **Table 23**.

For each identified remedial measure, the implementation timeline and priority level is specified. The categories used are the following:

Timeline:

- Short-term actions include relatively inexpensive measures that could be implemented in the short-term without major physical changes to the layout of the intersection.
- Medium/long-term recommendations are more costly, which require long-term planning, design, and property.

Priority Level:

- Lower priority: remedial measure that would improve safety but that does not address a safety issue with a significant conflict and/or liability risk.
- Higher priority: remedial measure that addresses a safety issue with a high conflict and/or liability risk and that should be prioritized by the City.

Note that no field investigations were conducted as part of this video conflict analysis. The City should confirm the feasibility of the recommended remedial measures before implementing them.

Table 22: Identified Safety Issues

Safety Issues	Conflict Example
Left turn conflicts with VRUs Some conflicts between left turn motorists and VRUs were recorded at the intersection. The skewed configuration of the intersection and the restricted visibility provided on the eastbound/westbound approaches due to the curve in the roadway make it challenging for road users to observe each other in advance of the intersection.	 *Video ID: 63746464*
Pedestrian visibility Standard crosswalks with two parallel white edge lines are installed on each approach. High visibility crosswalks such as ladder type crosswalks increase driver's awareness of potential conflicts with pedestrians.	 *Video ID: 63742099*

Safety Issues	Conflict Example
High frequency of left turn conflicts Many northbound and southbound left turning motorists are required to turn on a permissive phase. Given the high traffic volumes on 14 Street NW, selecting adequate gaps in opposing traffic can be difficult and can lead to driver frustration and risky behavior. 85% of vehicle-vehicle conflicts recorded at the intersection consisted of left turn with opposing through traffic.	 *Video ID: 63718596*
High right turning speed The large corner radii and right turn channels create conditions where right turning motorists can maintain higher speeds through their turn.	 *Video ID: 63742110*

Table 23: Potential Remedial Measures

Safety Issues	Potential Remedial Measures	Effectiveness	Timeline	Priority Level
Left turn conflicts with VRUs	**Extend the bicycle lane pavement markings through the intersection** to increase the visibility of VRUs and minimize the risk of conflicts between VRUs and turning motorists.	No CMF for this remedial measure.	Short-term	Higher
	Paint ladder type crosswalks to increase the visibility of pedestrians.	CMF of 0.52 for vehicle-pedestrian collisions[3].	Short-term	Lower
High frequency of left turn conflicts	**Consider implementing and/or extending northbound and southbound protected left-turn phases** to minimize the frequency of conflicts between left turning and through traffic.	While exclusive left turn phases would significantly reduce the frequency of these types of conflict, it would require a longer cycle length, delays and waiting time for pedestrians. CMF from 0.718 to 1.106 for collisions between	Short-term	Lower

[3] Sanders, R., Schultheiss, B., Judelman, B., Burchfield, R., Nordback, K., Gelinne, D., ... & Koonce, P. (2020). Guidance to Improve Pedestrian and Bicyclist Safety at Intersections (No. Project 15-63).

Safety Issues	Potential Remedial Measures	Effectiveness	Timeline	Priority Level
		vehicles and pedestrians.		
High right turning speeds	**Provide "Smart Channels"** on the northwest and southeast corners. The provision of Smart Channels align right-turning drivers to be more perpendicular with the intersecting roadway and pedestrian crosswalks. Motorists are also required to navigate the channel at lower speeds. It is possible to implement Smart Channels through pavement markings or truck aprons, which still accommodate turning movements of larger vehicles.	CMF of 0.558 for all collisions[4].	Medium-term	Lower

[4] Safety Impacts of a Modified Right Turn Lane Design at Intersections, Schattler and Hanson, 2016.

APPENDIX A

Conflicts with a PET/TTC of 2 seconds or less

Conflicts with VRUs

Safety Indicator Value(seconds)	Date	Time	URL
1.37	PET	2022-06-25	https://results.trafxsafe.com/indicators/63746464
1.83	PET	2022-06-24	https://results.trafxsafe.com/indicators/63742099

Opposing Left Turn

Safety Indicator Value(seconds)	Date	Time	URL
1.47	PET	2022-06-25	https://results.trafxsafe.com/indicators/63755991
1.5	PET	2022-06-24	https://results.trafxsafe.com/indicators/63768480
1.7	PET	2022-06-25	https://results.trafxsafe.com/indicators/63718596
1.73	PET	2022-06-22	https://results.trafxsafe.com/indicators/63767182
1.9	PET	2022-06-23	https://results.trafxsafe.com/indicators/63729824
1.93	PET	2022-06-22	https://results.trafxsafe.com/indicators/63767154
1.97	PET	2022-06-23	https://results.trafxsafe.com/indicators/63749545
1.97	PET	2022-06-23	https://results.trafxsafe.com/indicators/63756258