Norwood Boulevard Mobility Assessment

Stantec

Edmonton

Executive Summary

Edmonton is undergoing an exciting and important transformation. *The Way We Move*, *The Way We Grow*, and the full complement of *The Ways* plans anticipate and direct urban changes that are shifting the way Edmontonians live and move in their city, from predominantly low density and automobile-focused neighbourhoods, towards more multi-use and dense neighbourhoods that support greater use of transit, walking, wheeling and cycling.

The Norwood Boulevard corridor is one of these areas. The core area of Norwood Boulevard is 111 Avenue/112 Avenue from 90 Street to 101 Street and has a mix of residential, commercial, and educational land uses. The general study area is shown in Figure 1, though the boundaries were expanded during analysis to include consideration for a parallel cycling network. As the Norwood Boulevard area begins to see reinvestment due to the advantages of its central location, the availability of high quality transit service, and the relatively affordable housing stock, this area is ready for a recalibration back towards a more transit-focused, walkable, and bikeable transportation environment. This mobility assessment will contribute to identifying actions that will take Norwood Boulevard from an "Aspiring Main Street" to a "Main Street" as noted in the City's *Main Streets Guideline*.

Mobility Assessment

This mobility assessment includes a multi-modal evaluation of the quality of service provided for each of the modes operating on Norwood Boulevard: walking, biking, riding transit, delivering goods, and driving/parking. Each mode has different requirements. The guiding principles developed as part of this project were applied in this assessment to define evaluation criteria used to assess quality of service for each mode.

The mobility assessment on the existing conditions identified that Norwood Boulevard is currently overserving driving modes, and underserving people walking, biking, and taking transit. Knowing that the existing right-of-way currently over allocates space to those driving, and under allocates space to those walking and wheeling, cycling and taking transit, a number of alternative options were prepared to present to the public for feedback.

Public feedback aligned with the findings of the mobility assessment, identifying that changes were needed to "humanize" the street and address the lack of infrastructure for walking and cycling, particularly for those with mobility issues.

Recommended Network

The Recommended Network was based on the outcome of the community involvement. The mobility assessment was repeated on the Recommended Network to confirm that modes were being appropriately prioritized in the future, with better outcomes for those walking, cycling and taking transit, while still accommodating those driving and delivering goods. Key features of the Recommended Network include:

- At a minimum, remove one driving lane in each direction along the entire corridor,
- Widen sidewalks to provide wider pedestrian through zone,
- Provide curb extensions at intersections,
- Realign 101 Street, 97 Street, and 95 Street intersections,
- Signalize 95A Street, 94 Street, 93 Street, 92 Street, and 90 Street,
- Provide a cycling route paralleling Norwood Boulevard on 114 Avenue with connections to Norwood Boulevard via 96 Street and 92 Street,
- Include universal design principles at intersections, transit stops and throughout corridor,
- Provide all-day on street parking between 97 Street and 90 Street, and
- Reduce lane widths along corridor to align with recommendations found in the Main Street Guidelines.

Table of Contents

1.0 Introduction & Objectives

Edmonton is undergoing an exciting and important transformation. *The Way We Move*, *The Way We Grow*, and the full complement of *The Ways* plans anticipate and direct urban changes that are shifting the way Edmontonians live and move in their city, from predominantly low density and automobile-focused neighbourhoods towards more multi-use and dense neighbourhoods that support greater use of transit, walking, and cycling.

The Norwood Boulevard corridor is one of these areas. The core area of Norwood Boulevard is 111 Avenue/112 Avenue from 90 Street to 101 Street and has a mix of residential, commercial, and educational land uses. There are further extensions along Norwood Boulevard from the core area to the east extending to 82 Street and to the west extending to 109 Street to take into account the nearby transit centres at either end of the corridor study. The general study area is shown in Figure 1, though the boundaries were expanded during analysis to include consideration for a parallel cycling network.

Norwood Boulevard acts as the boundary road for the McCauley neighbourhood to the south, and Spruce Avenue and Alberta Avenue to the north within the core study area. Parkdale is further to the northeast and Central McDougall to the southwest. There are also LRT stations to the east along the Capital Line (Stadium LRT station and transit centre) and to the west along the Metro Line (Kingsway/Royal Alex LRT station and transit centre). Major destinations along Norwood Boulevard include Kingsway Mall and the Royal Alexandra and Glenrose Rehabilitation Hospitals to the west and Commonwealth Stadium and Community Recreation Centre to the east.

As the Norwood Boulevard area begins to see reinvestment due to the advantages of its central location, the availability of high quality transit service, and the relatively affordable housing stock, this area is ready for a recalibration back towards a more transit-focused, walkable and bikeable transportation environment. Making targeted investments to make sure that the transportation network in the study area supports a full range of mobility options and access for all Edmontonians regardless of age and abilities will support positive neighbourhood change by bolstering the attractiveness of these areas for private reinvestment.

This mobility assessment will contribute to identifying actions that will take Norwood Boulevard from an “Aspiring Main Street” to a “Main Street” as noted in the City’s *Main Streets Guideline*. This project is one part of a full range of

analyses being undertaken by the City of Edmonton (land use, urban design, and market). This collective set of analyses will consider land use and built form, area services and facilities, history and heritage assets, transportation, and the quality and character of the public realm.

This report documents the multi-modal assessment of the current conditions for accessibility and mobility along Norwood Boulevard for people using all modes of transportation and completes an assessment of the quality of service and notes deficiencies. The report then presents design options for the corridor to improve multi-modal transportation with a focus on creating and supporting Norwood Boulevard as a walkable, urban street that will become an even better place to live, work, play and shop.

Norwood Boulevard Mobility Assessment

Figure 1 Study Area Map

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2.0 Policy Context & Guiding Principles

The development of the Norwood Boulevard Mobility Assessment will be based on the following principles, goals, and objectives from key City of Edmonton guiding documents and key industry best practices.

2.1 City of Edmonton Policy

2.1.1 TMP & MDP Goals & Objectives

The City of Edmonton's Transportation Master Plan, *The Way We Move*, and Municipal Development Plan, *The Way We Grow*, outline strategic goals and objectives, stemming from *The Way Ahead* and the City Vision, that are relevant to Norwood Boulevard.

The Way We Move

- **Transportation & Land Use Integration**: The transportation system and land use/urban design complement and support each other
- **Access & Mobility**: The transportation system is interconnected and integrated to allow people and goods to move efficiently through the city and provide reasonable access with a variety of modes for people across demographic, geographic, socio-economic, and mobility spectrums
- **Transportation Mode Shift**: Public transportation and active transportation are the preferred choice for people
- **Sustainability**: Transportation decisions reflect an integrated approach to environmental, financial, and social impacts thereby creating sustainable, livable communities that increase residents' quality of life

The Way We Grow

- **Integrated Land Use & Transportation**: Land use and design complement and support the transportation system, while the transportation network supports areas of increased density and employment
- **Complete, Healthy, Livable Communities**: Communities which are designed to encourage healthy lifestyles and social interaction for people
- **Urban Design**: High quality urban spaces, buildings and streets make Edmonton a great place to live
- **Sustainable Urban Form**: Edmonton manages growth to move the city toward a culturally, financially, and socially sustainable state

- **Health & Safety**: The transportation system supports healthy, active lifestyles and addresses user safety and security

2.1.2 Main Streets Principles

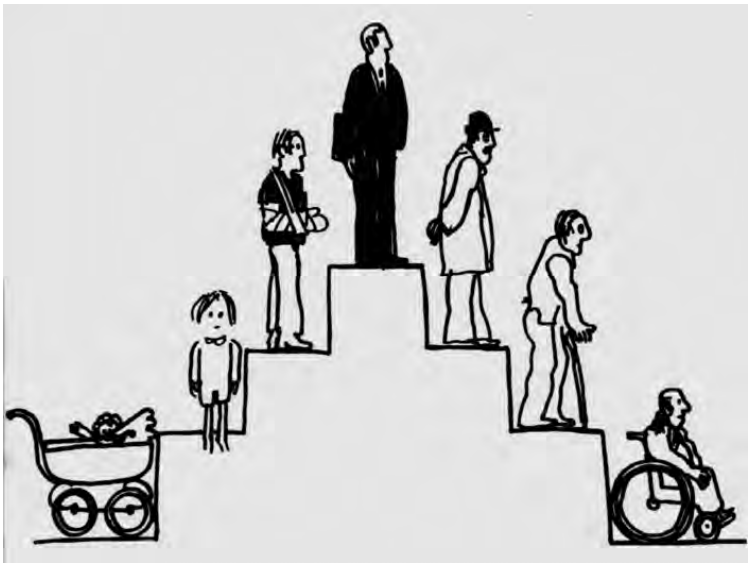
City Policy C573A defines Main Streets as "not only transportation links, they are streets that will be designed to act as strong community places." The Policy goes on to state "Main Streets support a mix of street-oriented land uses...[and] are designed and maintained to an enhanced standard." The following Main Streets Principles, based on the City of Edmonton's Complete Streets Principles, form an important basis for the consideration of Norwood Boulevard.

- Vibrant All Seasons People Places: Main Streets are vibrant and attractive places for people, especially people on foot, in all seasons.
- Travel Options: Main Streets provide safe and accessible travel options for all users and trip purposes, with an emphasis on creating places for pedestrian activity.
- Network of Streets: Main Streets support a network of streets that together accommodate all users and allow for efficient and high quality travel experiences.
- Adaptable: Main Streets are adaptable to accommodate the many functions and uses of the street.
- Contribute to Sustainability: Main Streets contribute to the sustainability and resiliency of the city.
- Cost Effective & Provide Value: Main Streets are cost effective investments that increase value and provide benefits to their surrounding communities and the city.

2.2 Industry Best Practice

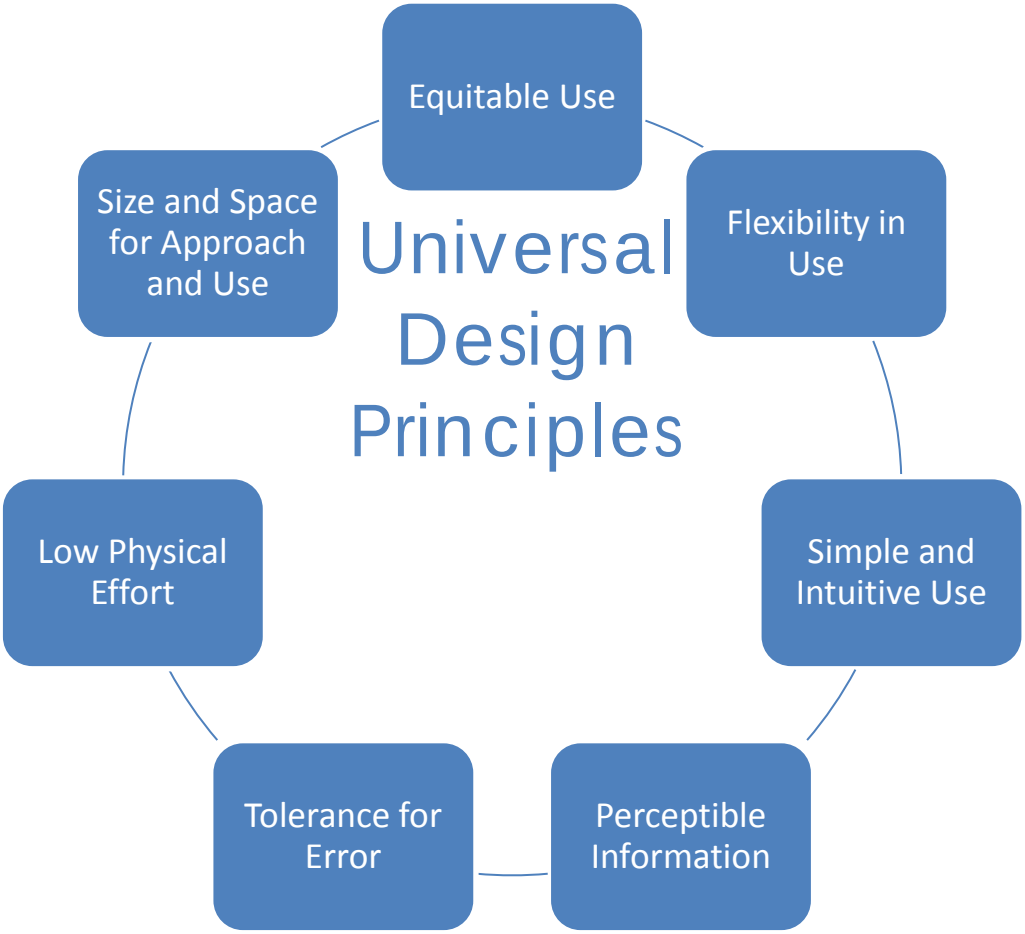
2.2.1 Universal Design

Universal Design is an approach to design that increases the potential for developing a better quality of life for a wide range of individuals. The goal underscoring Universal Design is social inclusion which addresses the barriers faced by people with disabilities, older adults, children, and other populations that are commonly overlooked in the design process. In so doing, streets will be designed for the movement of all people at various stages of life and regardless of ability.



Source: Building for Everyone – The Disabled and the Built Environment in Sweden, written by Mats Beckman. A contribution to the United Nations Conference on Human Settlements, Ministry of Housing and Physical Planning, Stockholm, 1976

The Center for Universal Design published *The Principles for Universal Design* in 1997. These Principles will be used for the Norwood Boulevard Mobility Assessment.



2.2.2 Crime Prevention Through Environmental Design

Crime Prevention Through Environmental Design (CPTED) is a multi-disciplinary approach to deterring criminal behaviour through environmental design. CPTED focuses on influencing offender decisions that precede criminal acts by affecting the built, social, and administrative environment. Applied to streets, CPTED is used to create an environment that incorporates the built form, landscape, lighting, and other elements to create spaces that increase the number of people using a space throughout the day and night, offer open sightlines, and has adequate lighting of the public realm. It is based on the

concept of natural surveillance and the creation of environments with "eyes on the street."

The Norwood Mobility Assessment will include CPTED principles when considering the existing and potential street designs to create a street environment that is inviting and feels safe (i.e., personal security).

2.2.3 ITE Designing Walkable Urban Thoroughfares

The Institute of Transportation Engineers (ITE) approved the *Designing Walkable Urban Thoroughfares: A Context Sensitive Approach* in 2010. The report was developed in response to widespread interest for improving both mobility choices and community character through a commitment to creating and enhancing walkable communities. The report applies the concepts and principles of Context Sensitive Solutions (CSS), the precursor to Complete Streets, to thoroughfares in urban areas. The document outlines a collaborative, multi-disciplinary process that designs streets not only based on their transportation function but also the surrounding area and its land uses, developments, economic, and other activities and environmental conditions. Further, the transportation function is focused on all users.

The document outlines ten Thoroughfare Network Planning Principles (see side panel) that will be considered in the Norwood Boulevard Mobility Assessment.

10 THOROUGHFARE NETWORK PLANNING PRINCIPLES

Major thoroughfare networks should:

1. Connect and provide access to and between communities, centres of activity and neighbourhoods of all types, as well as recreational and cultural facilities;
2. Form a grid-like pattern of continuous thoroughfares except as precluded by topographic barriers;
3. Conform with and follow natural topographic features and avoid adverse impacts to natural resource areas;
4. Have more than 1.4 nodes (intersection) per link (street) for a well-connected grid (link and node index).
5. Be designed to efficiently accommodate emergency vehicles, providing multiple routes to reach any block;
6. Have thoroughfares interconnected with specified distances between intersections (less than 120 m) to provide choices of routes to reduce travel distances; to promote use of transit, bicycles, and walking; and to efficiently accommodate utility needs;
7. Provide signalized crossings to encourage use of walking, bicycles, and transit;
8. Be comprehensible to the average traveler;
9. Communicate the intended functions of individual thoroughfares through both design characteristics and appearance;
10. Develop operating plans to serve all modes and all users, with uses varying on some thoroughfares according to context, needs, objectives and priorities while considering overall network needs.

3.0 Mobility Assessment Evaluation Approach

This mobility assessment includes a multi-modal evaluation of the quality of service provided for each of the modes: walking, biking, riding transit, delivering goods, and driving/parking. Each mode has different requirements. The guiding principles discussed in Section 2.0 were applied in this assessment to define evaluation criteria used to assess quality of service for each mode.

The quality of service evaluation was applied to the existing conditions on the corridor, based on the criteria presented in this section. This assessment identified which modes are currently underserved, and where opportunities may exist to change the existing paradigm (if necessary). The quality of service evaluation was combined with the public feedback to ultimately identify the recommended long term vision for the corridor.

Quality of service evaluation is based on the consideration of a combination of factors that contribute to mobility, accessibility, safety, and comfort. The assessment applies a Good-Fair-Poor-Gap scale system to determine the quality of service for each criterion for each mode. In general, the scoring can be defined as follows:

- **Good** represents fully meeting the requirements for the evaluated mode.
- **Fair** represents meeting the elements for each mode but typically only at minimum levels.
- **Poor** represents an environment that is deficient in meeting one or more of the elements for the evaluated mode.
- **Gap/Barrier** represents a significant deficiency or lack of elements to create a safe environment.

The remainder of this Section provides details for the application of this scoring system for each mode.

3.1 Walking and Wheeling

An area acceptable for those walking or using mobility aids is typically one that has an attractive environment for people, provides a high level of connectivity for walking and wheeling trips, and has a sense of "place" that makes it a destination. The typical elements of a walkable environment that have been considered in this study are summarized in Table 1.

Table 1 Elements of a Walking-Friendly Environment

Criteria	Description of Criteria
Space	There is appropriate space provided along a street for people walking. Sidewalks should provide a comfortable buffer from adjacent vehicles.
Place	The street should be a destination in its own right with buildings that are oriented towards the street and provide an interesting environment for people.
Crossings	Pedestrian crossings are conveniently located along desired travel paths and are comfortable and safe. Devices are provided to support crossing by people of all ages and abilities.
Security	People feel comfortable walking alone at all times of the day and areas are overlooked by people in surrounding buildings and those interacting with the street.
Connectivity	Direct walking routes with minimal deviation exist between destinations, reducing travel times.

The City of Edmonton's *Complete Streets Guidelines* also offer guidance on several of these elements.

3.1.1 Evaluation Criteria

Evaluation of the walking environment along Norwood Boulevard and in the study area will include reviews of the infrastructure at mid-block and intersection locations. The assessment criteria for **Good**-**Fair**-**Poor**-**Gap/Barrier** related to walking is described in Table 2.

Table 2 – Walking/Wheeling Evaluation Criteria

	Good	Fair	Poor	Gap/Barrier
Mid-Block	Pedestrian through zone width ≥ 3m **AND** Buffer from moving traffic all day (e.g., parking) or furnishing zone of ≥ 1.7m **AND** Pedestrian-oriented lighting	Pedestrian through zone width <3m and >2m **AND** Buffer from moving traffic but may be narrow or not all day (e.g., off-peak parking only) **AND** Street lighting	Pedestrian through zone width <2m **OR** No buffer **OR** No lighting	No sidewalk
Intersection	**All FAIR elements are present** **AND** Universal Design elements (e.g., tactile walking surface indicators) **AND** Curb Radii > 4.5m and < 6.0m	For Speed Limits of 50km/hr & **2 lanes**: • RRFB* & marked crosswalk • Curb ramps aligned with crosswalk For Speed Limits of 50km/hr & **> 2 lanes**: • RRFB for ADT < 15,000 and up to 4 lanes • Traffic signal where > 4 lanes or at schools • Marked crosswalk • Curb ramps aligned with crosswalk **AND** Curb Radii >6.0m and ≤ 10.0m	**Does not meet FAIR elements** **OR** Unmarked crossings where ADT >1500 **OR** Crosswalk is skewed **OR** Curb ramp is not oriented to crosswalk **OR** Curb Radii > 10m	No marked crossing or traffic controls for: • Streets with operating speeds >50km/hr • Crossings near schools **OR** No curb ramps

RRFB = Rectangular Rapid Flashing Beacon

3.2 Cycling

Three key elements were identified as important to evaluate the bicycle transportation network: Connectivity, Cycling Infrastructure (e.g. bike lanes), and End-of-Trip Facilities. Connectivity and infrastructure are global concepts that are considered over the entire study area and not just along Norwood Boulevard. End-of-trip facilities are appropriate to discuss at a high level for the entirety of the study area, but will be implemented at a site-specific level through streetscape design and application of zoning requirements. The typical elements of creating a positive environment for people cycling that have been considered in this study are included in the following table.

Table 3 Elements of a Cycling-Friendly Environment

Criteria	Description of Criteria
Space	Comfortable and safe cycling infrastructure that separates people cycling from motor vehicle traffic, improving safety and encouraging less experienced people to ride a bicycle.
Facilities	End-of-trip facilities, including secure bicycle parking, lockers, and showers, are provided.
Connectivity	Direct cycling routes with minimal deviation exist between destinations, reducing travel times.

3.2.1 Evaluation Criteria

Evaluation of the cycling environment along Norwood Boulevard and within the study area will include reviews of the infrastructure at mid-block and intersection locations. The assessment criteria for **Good**-**Fair**-**Poor**-**Gap/Barrier** related to cycling is described in Table 4.

While end-of-trip facilities and network connectivity are important to attract and retain people cycling, the criteria used for this study focuses on bicycle infrastructure provided within the public right-of-way along the streets and its associated level of quality based on the operating characteristics of the street.

Table 4 - Cycling Evaluation Criteria

	Good	Fair	Poor	Gap/Barrier
Mid-Block	Protected bike lane OR Shared use path (SUP) if < 33 persons per hour per metre of path width **OR** For Speed Limits ≤ 30km/hr: • Shared lane with traffic calming to reinforce posted speed and limit ADT to < 2,500 For Speed Limits > 30km/hr and ≤ 40km/hr: • Shared lane with traffic calming to reinforce posted speed and limit ADT to < 1,000 • Buffered bike lane if ADT < 4,000 For Speed Limits > 40km/hr and ≤ 50km/hr: • Buffered bike lane if ADT < 4,000 **AND** Sufficient width for snow clearing	Shared use path (SUP) if > 33 persons per hour per metre of path width **OR** For Speed Limits ≤ 30km/hr: • Shared Lane Operation and ADT < 2,500 For Speed Limits > 30km/hr and ≤ 40km/hr: • Shared lane operation if ADT < 1,000 • Bike lane if ADT < 4,000 For Speed Limits > 40km/hr and ≤ 50km/hr: • Bike lane if ADT < 4,000 **AND** Sufficient width for snow clearing	Speed Limits ≤ 40km/hr: • Infrastructure provided as per FAIR but ADT exceeds thresholds For Speed Limits > 40km/hr and ≤ 50km/hr: • Bike lane if ADT ≥ 4,000 and < 8,000 **OR** Infrastructure as per GOOD or FAIR elements but insufficient width based on demand or insufficient width to allow snow clearing	Shared lane operation if Speed Limit > 40km/hr For Speed Limits > 40km/hr and ≤ 50km/hr: • Bike lane if ADT ≥ 8,000 For Speed Limits > 50km/hr: • Any facility other than protected bike lane OR SUP
Intersection	Traffic signals and/or controls specific for people cycling (e.g., bike signals) **OR** Controls that prioritize people cycling	Traffic controls exist to manage conflicts and specify right-of-way	Unmarked crossings at minor intersections **OR** Traffic controls require out-of-direction travel	Unmarked crossings at major intersections **OR** Traffic controls do not clearly define right-of-way and/or create safety concerns

3.3 Riding Transit

Seven User Expectations[1] can characterize successful transit service as summarized in Table 5. Some expectations, such as cost, are usually assessed on a network wide basis, whereas local development may influence others.

Table 5 Elements of a Transit-Friendly Environment

User Expectation	Description of User Expectation
It takes me where I want to go.	Service is available between different origins and destinations and stops are conveniently accessible. The transfer from either walking or cycling is convenient.
It takes me when I want to go.	Service is available during the right times (morning, midday, evening, etc.) and frequent enough to be convenient.
It is a good use of my time.	Travel time, including time for walking to stops and waiting for transfers, is reasonable. It has been shown that most users find time spent walking or waiting to be significantly more onerous than time spent in a transit vehicle.
It is a good use of my money.	Cost of travel is reasonable.
It respects me in the level of safety, comfort, and amenity it provides.	Transit stops and vehicles are secure, clean, and comfortable. The system operates with an acceptable level of civility.
I can trust it.	Transit service is reliable with actual travel times matching schedules.
It gives me freedom to change my plans.	Service is flexible enough to allow for spontaneous unscheduled trips.

[1] See Walker, J. *Human Transit*. Island Press, Washington, DC: 2012.

3.3.1 Evaluation Criteria

The evaluation of transit quality of service included two components: transit service and transit stops.

Transit service evaluation considered the combined service provision during weekday peaks, weekday off-peaks, and weekends in assessing the quality of the transit service available to people living in the Norwood area or travelling to/from the businesses, services, and jobs in the Norwood area.

The assessment of the quality of the bus stops for transit riders, the interface between the vehicle and the street, was evaluated based on the infrastructure provided at the stop.

The assessment criteria for **Good**-**Fair**-**Poor**-**Gap/Barrier** related to transit is described in Table 6.

Table 6 - Transit Evaluation Criteria

	Good	Fair	Poor	Gap/Barrier
Transit Service	4 or more buses per hour all day	GOOD elements met but with one or more time periods with 2 to 3 buses per hour	GOOD or FAIR elements met but with one or more tiem periods with < 2 buses per hour	Major street or destination without transit service
Transit Stop	Shelters and seating provided at stop	Only seating provided	No seating or shelter provided	No sidewalk access to the stop

3.4 Delivering Goods

The delivery of goods to local businesses and access by service vehicles and private transportation providers/taxis is important for the operation of businesses. The movement of large vehicles and designing streets for these vehicles should consider the frequency of these vehicles on streets. Where deliveries occur is another important consideration. Deliveries via an alley allows on-street curb space to be used for other purposes such as parking or activating the space for use by people.

Table 7 Elements to Support Delivering Goods Conditions

Criteria	Description of Criteria
Movement	Lane widths and major intersections are designed to accommodate movement of delivery vehicles with acknowledgement that larger vehicles may encroach into adjacent lanes (non-opposing lanes for arterial streets) when making right turns.
Access	Alleys exist to accommodate delivery of larger amounts of goods, while loading on-street can be accommodated for private transportation providers and smaller deliveries (e.g., mail).

3.4.1 Evaluation Criteria

The criteria reviewed for goods focus on the accessibility of the street and buildings for goods circulation and delivery based on two considerations: street design and deliveries. The assessment criteria for **Good**-**Fair**-**Poor**-**Gap/Barrier** related to goods is described in Table 8.

Table 8 - Goods Movement Evaluation Criteria

	Good	Fair	Poor	Gap/Barrier
Street Design (Main Street only)	Lanes width of 3.5m **AND** Corner radii prevent encroachment into adjacent lanes for right turns	Lanes are wide enough for goods movement vehicles (3.3m) **AND** Corner radii require encroachment into adjacent (non-opposing) lanes for right turns and possibly requiring advanced stop lines to accommodate large vehicles	Lane width < 3.3m and > 3m **OR** Right turns not possible without use of flag person	Lane width < 3m **OR** Right turns not possible due to geometry
Deliveries	All deliveries occur in the alley **AND** On-street curb-side area available along the block for mail delivery all day	Deliveries mainly done via alley **AND** On-street curb-side area available along the block for mail delivery during off-peak hours	Deliveries occur only in front of buildings **AND** On-street curb-side area available along the block for mail delivery during off-peak hours	No stopping zone on-street restricts deliveries **AND** No alleys

3.5 Driving & Parking

Motor vehicle traffic is being approached differently in this Transportation and Mobility Assessment compared to a typical Transportation Impact Assessment. Conventional analysis methodologies have difficulty anticipating shifts to other modes of transportation and fail to recognize that forecasted vehicular travel delay is expected to be less of a concern in areas of the city where more travel options are available. The analysis provided in this assessment gives equal consideration to all modes of travel. Compared to typical transportation planning studies, driving was assessed with an understanding that some delay is acceptable because of balancing service for other modes. This idea is further emphasized in the City of Edmonton Main Streets Guideline[2] "Design Parameters" where it states the following:

> *Main Streets design focuses on fulfilling the Principles throughout the week, rather than prioritizing traffic capacity for commuter peak periods. As a result, they may exhibit congestion for motor vehicles during peak travel periods.*

Traffic analysis was completed at key arterial – arterial intersections in the study area and at any signalized crossing along the corridor. For congested intersections, the extent to which intersections and individual movements are overcapacity was considered. If intersections were found to be operating considerably overcapacity, an increase in vehicular capacity is considered. Where the overcapacity is low or moderate, the possibility of drivers travelling using a different mode, such as transit, shifting travel times to a different (off-peak) time, or using a different less-congested route also requires consideration, particularly for long term scenarios.

The concept of "traffic evaporation" has been researched and the findings clearly suggest that reductions in vehicle capacity will result in (1) traffic being absorbed by the surrounding street network, (2) shifts to a different travel mode occurs, or (3) the trip is altered (i.e., traveler changes destination or trip frequency). Based on numerous case studies, "reductions in road capacity have not been followed by prolonged gridlock, and major increases in existing levels of congestion are typically only temporary…instead, there is evidence to suggest that some proportion of traffic effectively 'disappears'…"[3] The concept

[2] City of Edmonton. *Main Streets Guideline.* 2016.
[3] Lee DB, Klein LA, Camus G. Induced traffic and induced demand. *Transportation Research Record: Journal of the Transportation Research Board* 1999; 1659; Appendix B.
Cairns S, Hass-Klau C, Goodwin P. *Traffic Impact of Highway Capacity Reductions: Assessment of the*

mainly applies to through traffic; that is, traffic that would not be stopping and using services in the area.

Existing on-street and off-street parking supply was also assessed to support multi-modal access to businesses along Norwood Boulevard.

Table 9 Elements for Assessing the Driving/Parking Conditions

Criteria	Description of Criteria
Movement	Driving level of service is anticipated to be congested along Main Streets. Assessment of the volume-to-capacity ratio (v/c ratio) of individual movements at intersections will be evaluated. A v/c ratio of 1.0 is acceptable at an arterial-arterial intersection.
Parking	On-street parking is available for use by customers of businesses and off-street parking, located at the rear of buildings, is provided for staff and customers.

3.5.1 Evaluation Criteria

The Edmonton Main Street Guideline identifies that Main Streets may be congested, especially during peak periods, because the design should prioritize pedestrians. The driving assessment was completed using the v/c ratio as a metric to compare the theoretic available road capacity to the current traffic volumes (usage). The v/c ratio is generally measured at intersections, because this is where the capacity is the most constrained. For each individual movements at the intersection (e.g., right turn), the number of lanes, traffic volumes, and traffic signal green time serve as inputs into the v/c calculation.

The assessment criteria for **Good**-**Fair**-**Poor**-**Gap/Barrier** related to driving and parking is described in Table 10.

Evidence. 29. London: Landor Publishing, 1998.
Cairns S, Atkins S, Goodwin P. Disappearing traffic? The story so far. *Municipal Engineer* 2001;151;13-22.

Table 10 - Driving and Parking Evaluation Criteria

	Good	Fair	Poor	Gap/Barrier
Driving	v/c ratio < 0.85	0.85 ≤ v/c ratio ≤ 1.0	v/c ratio > 1.0	No vehicle access provided
Parking	Off-street parking provided at buildings **OR** On-street parking available all day	Off-street parking available every block **OR** On-street parking available off-peak	Off-street parking located more than a block away **OR** On-street parking is a block or further away	No off-street parking available **AND** No on-street parking provided

4.0 Existing Conditions Evaluation

Travel by walking, cycling, transit, and driving (people and goods) were assessed throughout the entire study area based on the assessment criteria outlined previously. The assessment focused along the Norwood Boulevard Corridor from 89 Street to 102 Street but also considered a broader area for connectivity to regional and city-wide networks.

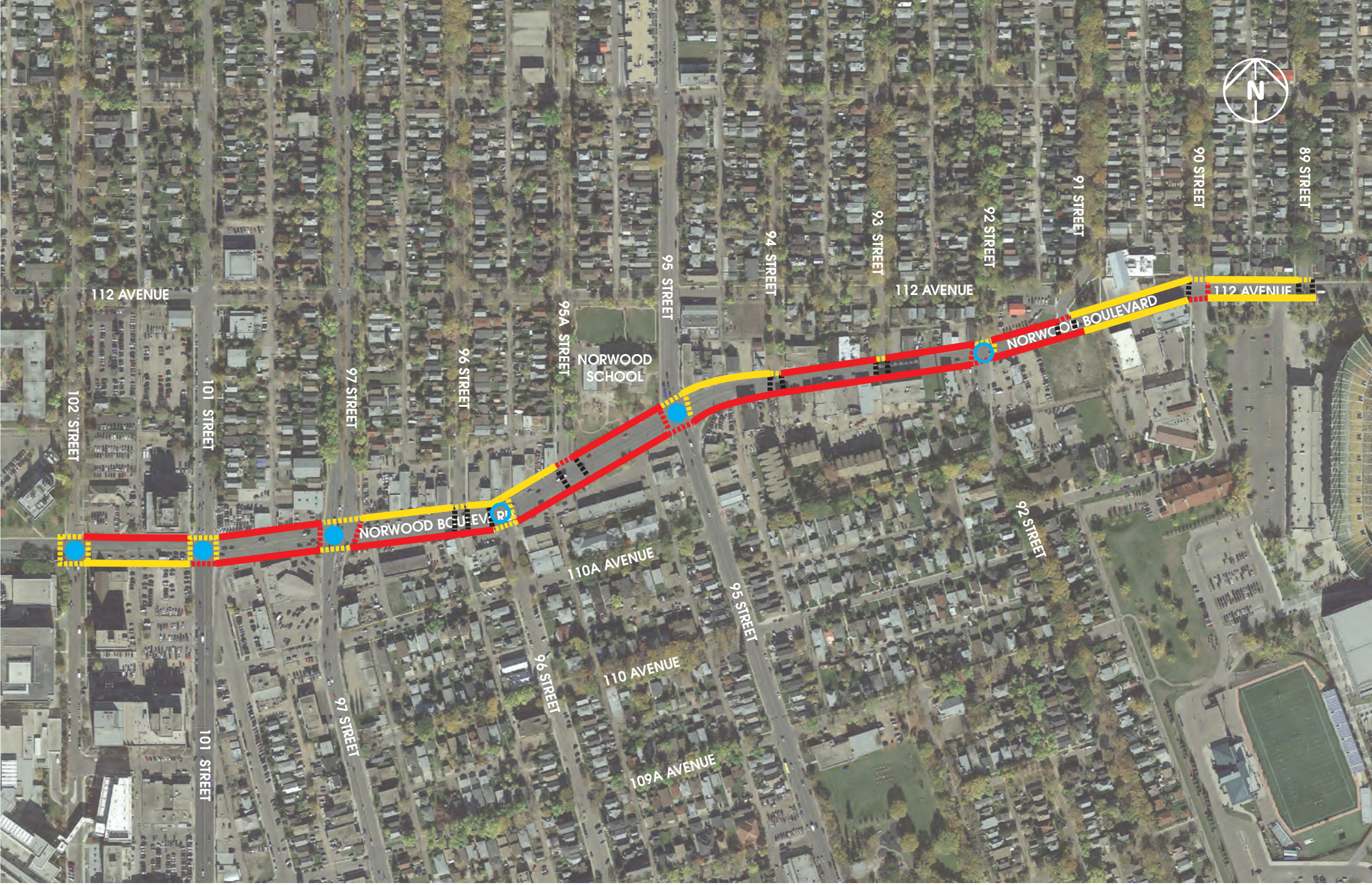
4.1 Walking and Wheeling

The assessment of the current walkable environment conditions was completed for mid-block locations and at intersections. Overall, there is significant room for improvement of the walking environment along Norwood Boulevard. Assessment of the walking environment was completed through site visits, review of CAD files, and a desktop review using photos of the street. Each mid-block segment and intersection crossing were individually assessed as illustrated in Figure 2.

4.1.1 Analysis Summary

There are few signalized crossings of Norwood Boulevard, particularly along the commercial area core of Norwood Boulevard east of 97 Street and west of 90 Street. The lack of marked, signed, signalized, or controlled crossings of Norwood Boulevard creates an environment that impedes and dissuades walking in the area particularly to cross from one side of Norwood Boulevard to the other. This **Gap/Barrier** to walking is found at almost every intersection east of 97 Street except for 95 Street and 92 Street. Most critically, the intersection of 95A Street, the intersection to the west of Norwood School, is uncontrolled and involves crossing six vehicle lanes by children to get to or from the school.

The minimal width of the sidewalks, placement of street light poles and signs, and lack of buffer from moving traffic result in a consistent **Poor** condition for walking. In addition to these infrastructure deficiencies for walking, the built environment along Norwood Boulevard includes vacant buildings, buildings with setbacks and parking between the building and sidewalk, and parking lots that limit the attractiveness of the street and likely perceived personal security of people walking. Like all streets in Edmonton, there is also a lack of provision of universal design features to support walking by people of all ages and abilities including those with vision impairments.



Norwood Boulevard Mobility Study

Figure 2 Existing Walking Conditions

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Legend

RATING

- GOOD
- FAIR
- POOR
- BARRIER/GAP

- FULL SIGNALS
- HALF SIGNALS
- RAPID RECTANGULAR FLASHING BEACON
- OVERHEAD PEDESTRIAN FLASHERS

4.2 Cycling

The assessment of cycling conditions was straightforward due to the overall lack of provision of cycling routes within the study area.

4.2.1 Analysis

There are no well-designed or marked cycling routes within the study area or surrounding parallel corridors. While there is a path along the Capital Line and Metro Line LRT corridors, east-west connectivity is a significant **Gap/Barrier**. There is a marked neighbourhood bikeway along 96 Street extending south of Norwood Boulevard but the crossing of Norwood is considered **Poor** in the northbound direction as the current design does not efficiently support cycling along 96 Street from south to north across Norwood Boulevard. The north to south crossing at this intersection is a **Gap/Barrier** because the crossing is not provided.

While the 96 Street route exists with pavement markings, signs, and curb extensions, it is currently assessed as **Fair** due to the removal of the traffic diverter at 107a Avenue which does not support creating a low traffic volume and speed street that people feel comfortable and safe cycling along. Removal of this diverter allows for traffic to shortcut via 96 Street to avoid traffic along 95 and/or 97 Streets.

Most neighbourhood streets have been assessed as **Fair** because the traffic volumes and speeds support bicycle riding as shared lanes along these streets. However, many of these streets should be repaved to improve the quality of the pavement surface. Where streets have been assessed as **Poor**, these locations have higher volumes of traffic or traffic speeds and are the immediately intersecting streets with Norwood Boulevard. These links will experience higher volumes of delivery vehicles and turning traffic from Norwood Boulevard.

In terms of end of trip facilities, the study area could also benefit from bicycle parking to support cycling in the area. It is unknown whether individual businesses provide facilities such as secure parking, showers, and change rooms for staff.

Current cycling conditions are summarized in Figure 3.


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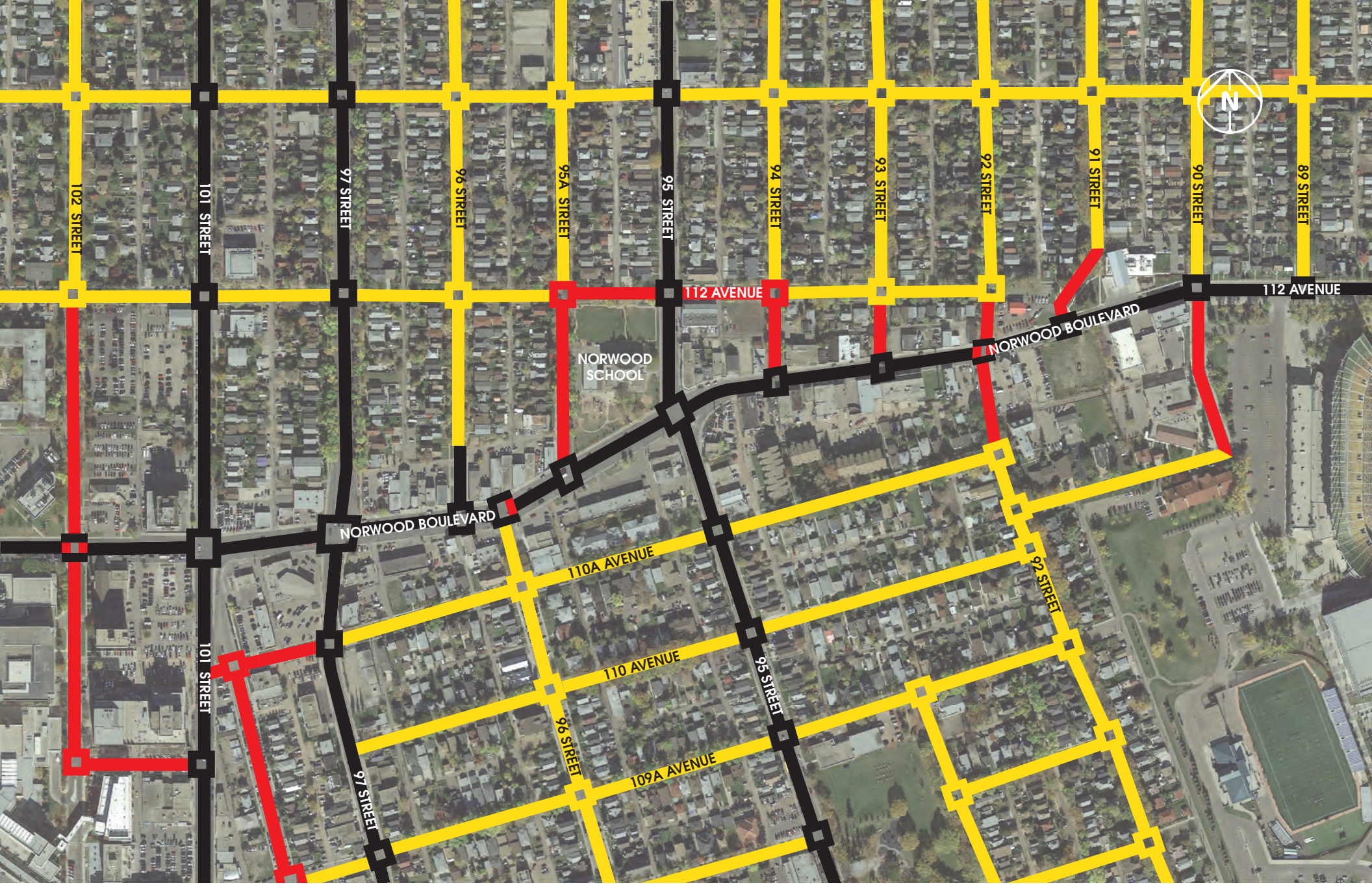


Norwood Boulevard Mobility Study

Figure 3 Existing Cycling Conditions

Stantec

Legend

RATING

- GOOD
- FAIR
- POOR
- BARRIER/GAP

4.3 Riding Transit

The quality of the transit environment was evaluated at the stops, the interface for transit riders between the street and transit vehicle, and the transit service provided along the corridors. Quality of the transit service, based on the number of buses per hour and known reliability of that service, was reviewed along Norwood Boulevard as well as intersecting corridors that provide access to Edmonton and regional destinations.

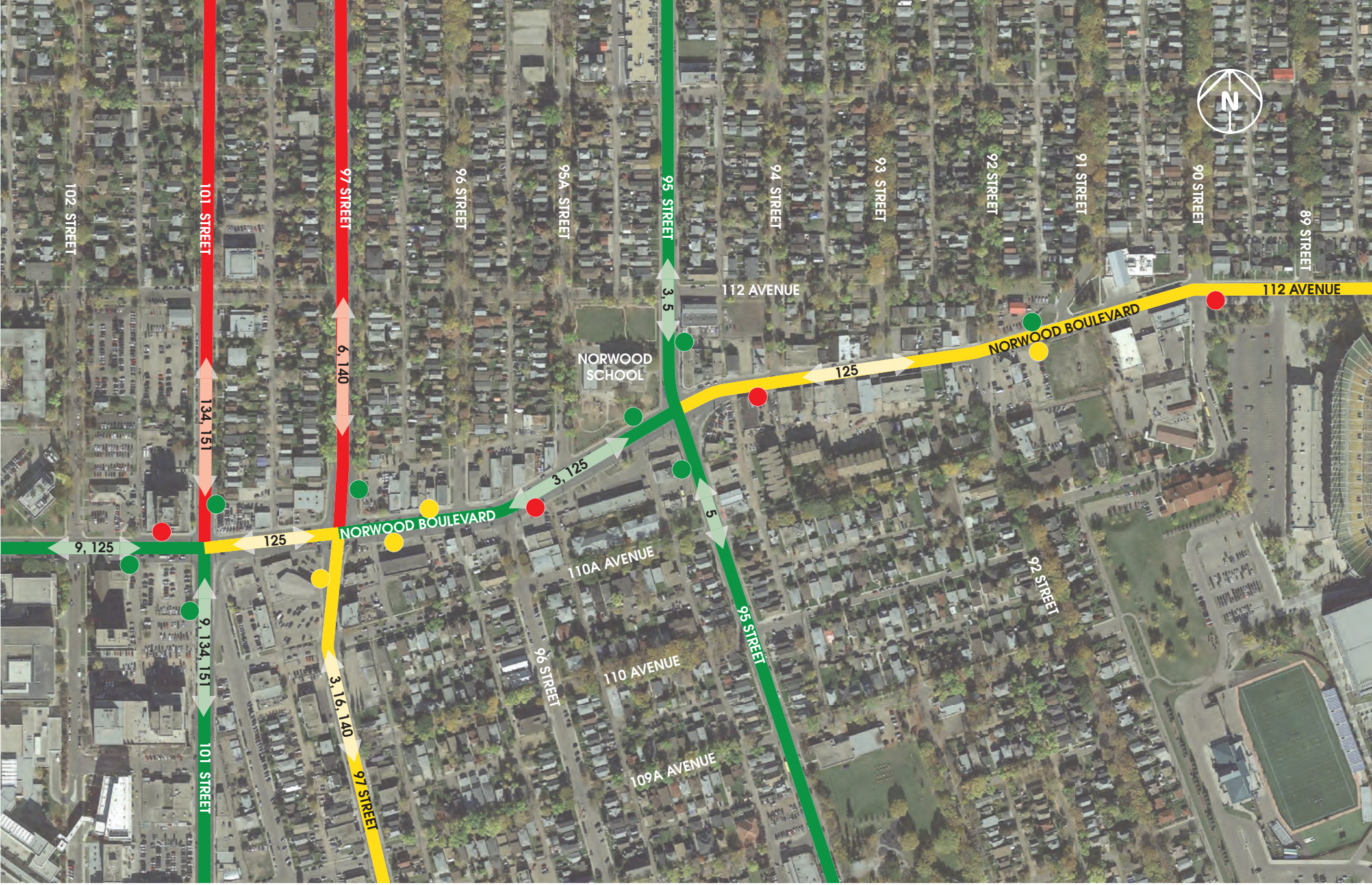
The area is served by a number of bus routes: 3, 5, 9, 16, 125, 134, 140, 151, and a number of peak hour only routes. In addition, the Metro Line LRT operates west of 102 Street and the Capital Line operates east of 89 Street. The bus routes operate exclusively along some streets and combine service for riders along other streets.

4.3.1 Analysis

Figure 4 illustrates the quality of the transit environment for transit riders based on the transit service provided and the quality of the bus stops. Norwood Boulevard predominantly rates as **Fair** due to limited weekday off-peak and weekend transit service. The service along 97 and 101 Streets north of Norwood Boulevard is **Poor** due to very low service provision in the evenings and weekends.

Bus stops along Norwood Boulevard range in quality with the stops nearest Norwood School and the Royal Alexandra Hospital rating as **Good**. Most of the bus stops along Norwood Boulevard are **Poor** or **Fair** and lack shelters or benches, which, coupled with limited transit service during certain periods, makes the environment limited in its friendliness to transit riders.

Improvements to the service along the corridor and transit stops will greatly improve that quality of the corridor for transit riders. It is also critical to note that the quality of the walking infrastructure will significantly influence the experience of those riding transit, as transit riders begin and end their trips as a person walking.



Norwood Boulevard Mobility Study

Figure 4 Existing Transit Conditions

Stantec

Legend

SERVICE RATING
- GOOD
- FAIR
- POOR
- BARRIER/GAP

STOP RATING
- GOOD
- FAIR
- POOR

125 BUS ROUTE

4.4 Delivering Goods

The assessment of the quality of the environment for delivering goods and services was also straightforward based on reviewing the lane widths along Norwood Bouelvard, the curb radii at arterial-arterial intersections, and the ability to make deliveries along the curb and via alleys.

4.4.1 Analysis

The current conditions are **Good** to support delivery of goods to the Norwood area and movement of goods through Norwood due to the wide streets and large corner radii as well as alleys that support the businesses. However, as will be shown in the assessment of driving and parking conditions, the limited provision of all-day on-street parking/loading zones along Norwood Boulevard impact the ease of delivery during peak periods.

4.5 Driving & Parking

The assessment of driving and parking in the study area focused on reviewing the capacity. Driving was assessed based on the capacity of the roadway and the existing volumes of vehicles during the AM and PM peak periods at intersections. Parking was evaluated based on reviewing the location of existing parking supply in the area.

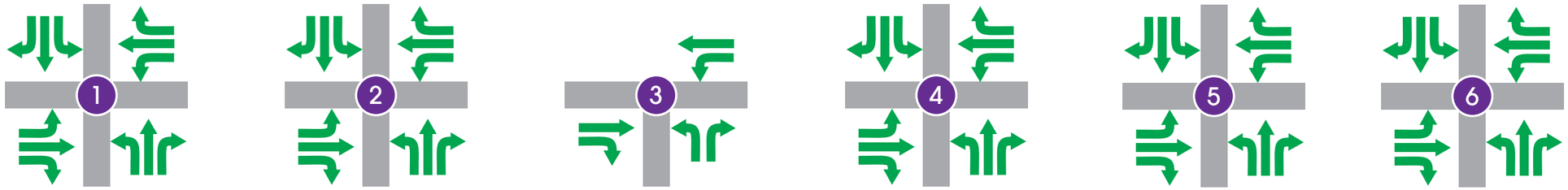
4.5.1 Analysis

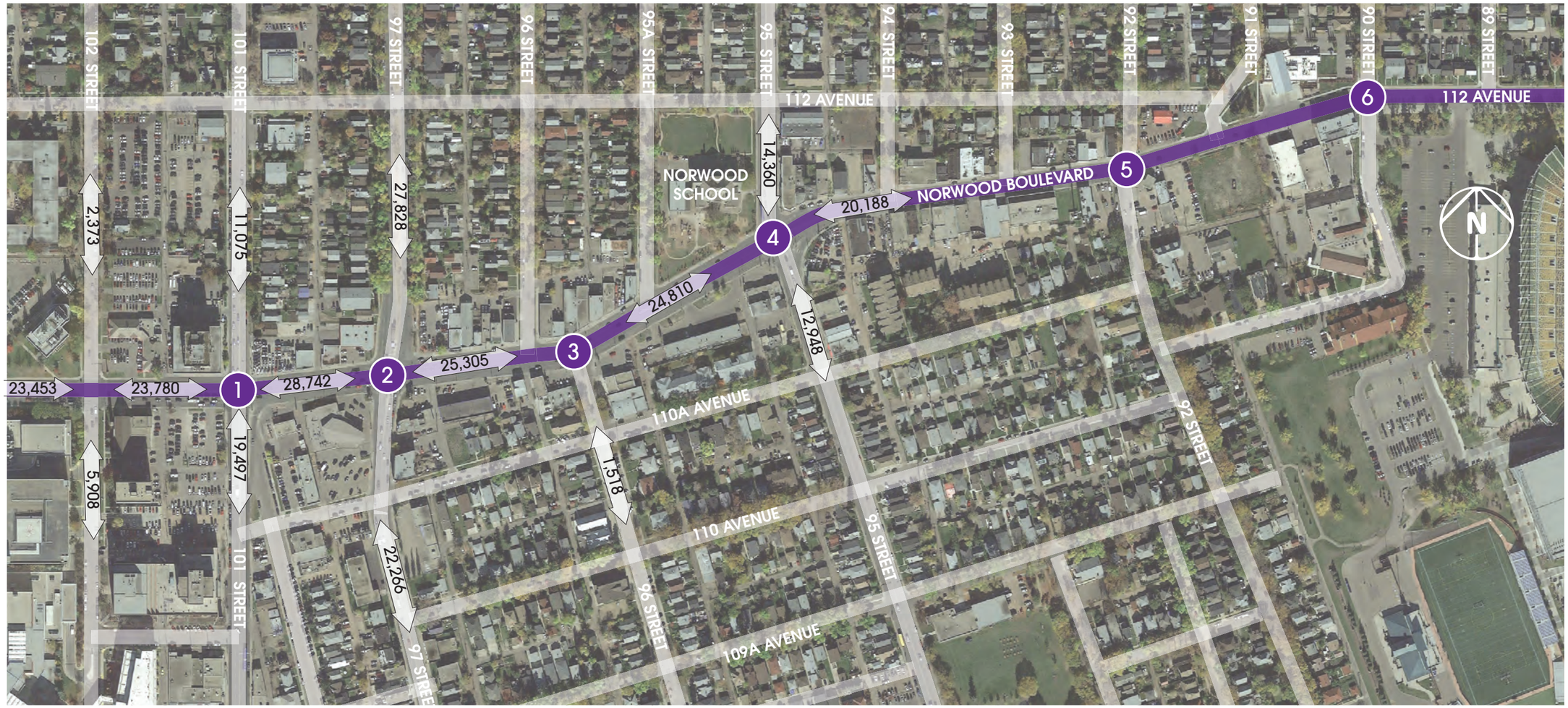
Every individual movement under existing conditions is well below the capacity provided for it (i.e., less than 0.85), which translates to every approach being assessed as **Good**. There is only one movement along the Norwood Boulevard corridor in the AM or PM peak hours that is over 0.80 and it is below 0.85. Based on this assessment criterion, there is significant additional capacity for moving vehicles through this area which may create the opportunity to reallocate some of this space to improving the quality of conditions for people using other modes of transportation.

The conditions for parking are plentiful in some ways but lacking in others, and the current supply poses some issues. Currently, there is plentiful off-street parking along the alleys of Norwood Boulevard for staff and patrons of businesses and services. There is significant off-street parking located at the front of buildings along Norwood; while this is convenient for people arriving by vehicles, it impacts the attractiveness of the corridor for people walking to, from, and through the corridor to access the businesses and services.

The biggest deficiency for parking that can be seen in Figure 7 – Existing Parking Conditions, is the lack of all-day on-street parking along Norwood Boulevard. What currently exists is limited in most cases.

Overall, the current conditions for driving are **Good** with limited issues except for the location of parking. Existing parking, especially on the south side of the street is plentiful in front of buildings, but on-street parking is lacking. Overall, parking along Norwood Boulevard is assessed as **Fair**. Parking that is located at the rear of buildings and on-street along Norwood Boulevard all day would better support the local businesses and the Main Street.





Norwood Boulevard Mobility Study

Figure 5 Existing Driving Conditions: AM

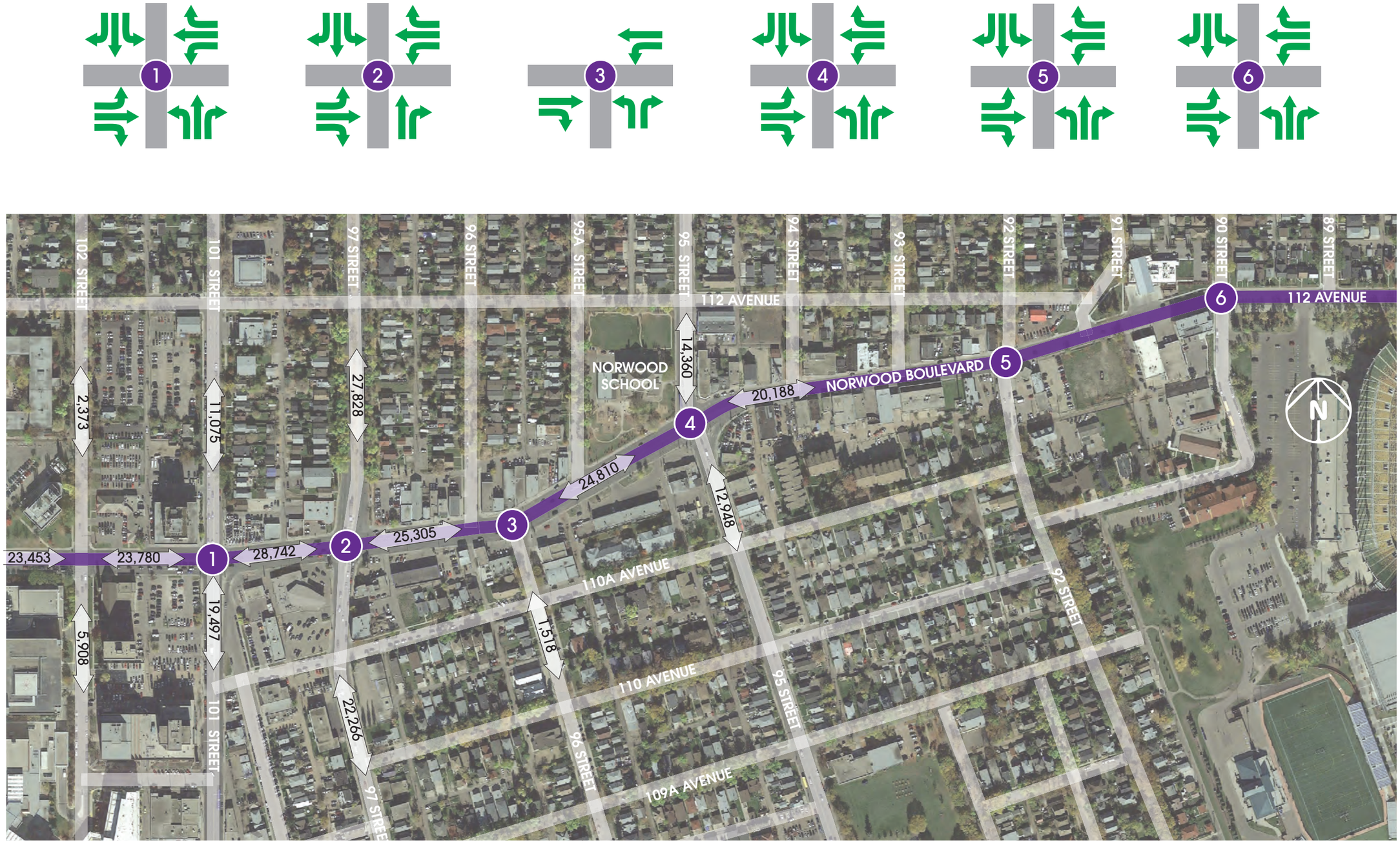
Stantec

Legend

RATING

- GOOD
- FAIR
- POOR
- BARRIER/GAP

23,780 DAILY VOLUME



Norwood Boulevard Mobility Study

Figure 6 Existing Driving Conditions: PM

Stantec

Legend

RATING

- GOOD
- FAIR
- POOR
- BARRIER/GAP

23,780 DAILY VOLUME

Norwood Boulevard Mobility Study

Figure 7 Existing Parking Conditions

Stantec

Legend

- FRONT PARKING
- REAR PARKING
- ALL DAY PARKING: 30-60 MINUTE LIMIT
- ALL DAY PARKING: UNLIMITED
- OFF-PEAK ONLY PARKING

4.6 Travel Behaviour & Safety Performance

In addition to the assessment of the quality of the environments for each mode of travel, a review was also completed to assess how residents of the area currently move and the safety history of Norwood Boulevard.

4.6.1 Travel Behaviour

While the "commute to work" trip only represents 20 to 25% of daily trips, it is an important consideration as it has historically driven street design decisions. From the following figure, it is clear the Norwood Boulevard area neighbourhoods do not drive to the same degree as the Edmonton average (70%). The average in the Norwood Boulevard area is closer to 50% of residents drive to work alone and just over 30% take transit according to the 2014 Municipal Census.

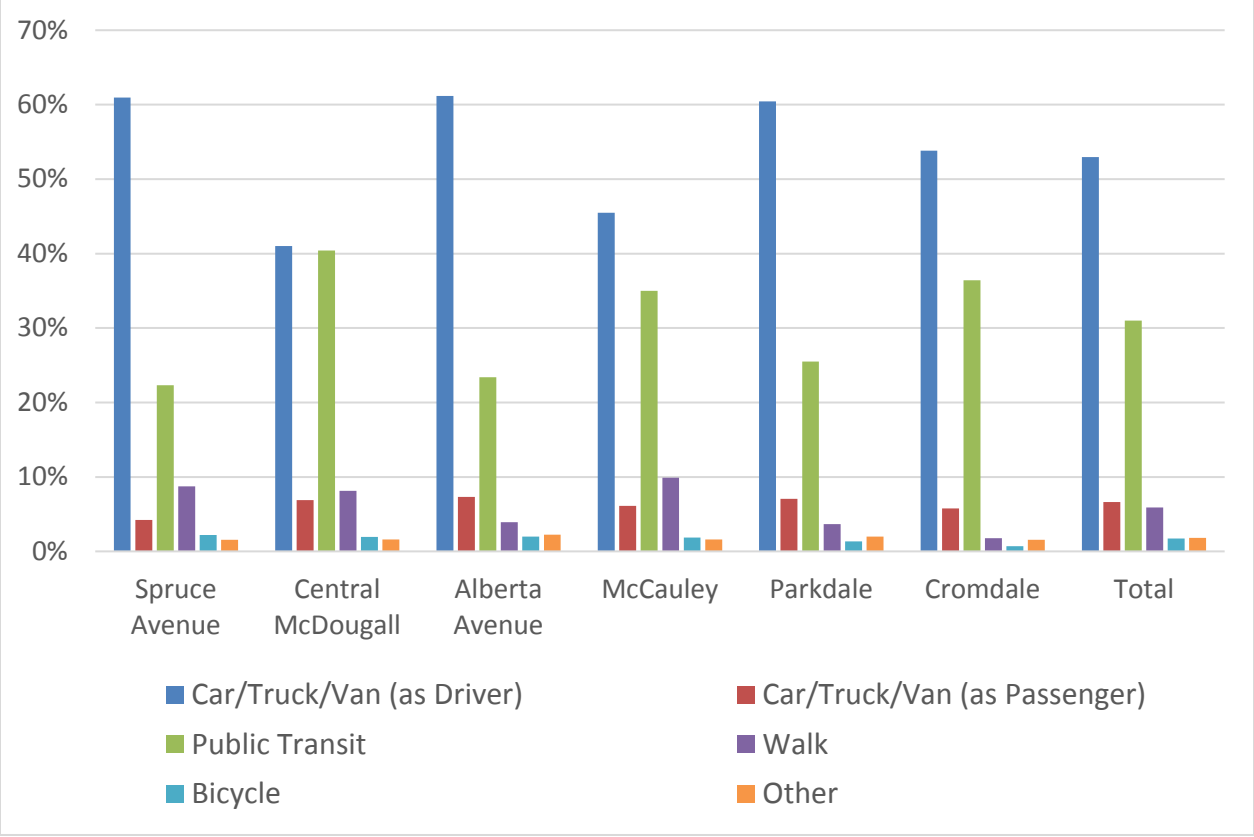


Figure 8 Mode Share for Norwood Boulevard Neighbourhoods

4.6.2 Safety Performance

In the period of 2011 through 2015 (inclusive), there were a total of 1187 collisions involving a driver of a motor vehicle colliding with a fixed object or another person walking, riding a bike, or driving a vehicle along Norwood Boulevard from 82 to 109 Streets. There were 612 collisions within the core study area along Norwood Boulevard (89 to 102 Streets). There were another 72 collisions along 110 and 110A Avenues. 80% of the collisions occurred at intersections.

Approximately 4% of the total collisions involved someone walking or cycling but almost 20% of collisions causing injury involved someone walking or cycling. This is significant and, with 80% of collisions involving people walking or cycling occurring at intersections, intersection crossing upgrades could lead to significant improvements to safety and reducing injury and fatal collisions closer to zero in line with the City's Vision Zero Policy.

Year after year since 2011, as illustrated in the figure below, the total number of collisions and number of collisions involving injuries are trending upward along the entire length of the Study Area. Other than a drop from 2011 to 2012, injury collisions involving people walking or cycling have trended upward and are constant in 2014 and 2015 at about 10 per year.

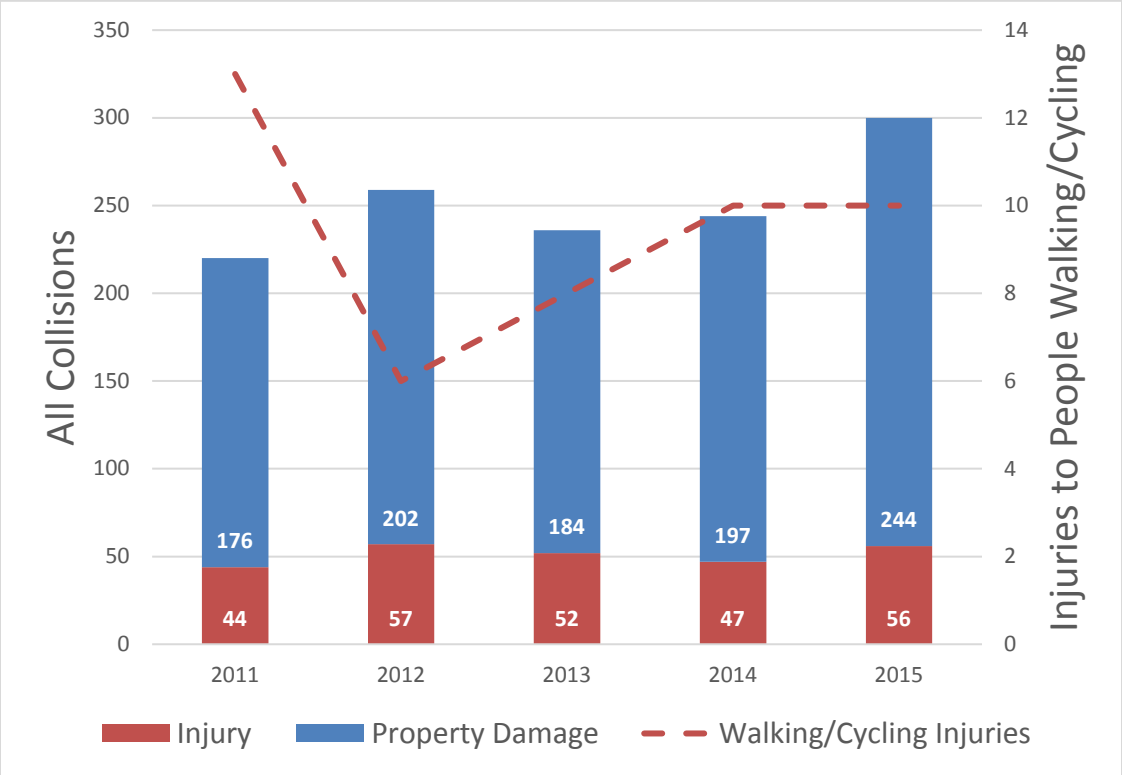


Figure 9 Collision History

4.6.3 Summary of Travel Behaviour & Safety

Overall, mode share in the Norwood Boulevard study area suggests area residents are much more multi-modal than the Edmonton average. Just over 50% of the area residents drive alone to work. Coupled with the number of collisions involving people walking and cycling, the design of Norwood Boulevard and the supporting network should be focused on improving conditions for people walking, riding transit, and cycling.

4.7 Public Engagement 1

As part of early stages of engagement for this project, the community provided input on existing issues and future opportunities in the Norwood Boulevard area. This section summarizes this input. Details on the engagement can be found at www.edmonton.ca/norwoodboulevard.

The notes taken from the June 22, 2016 meeting were reviewed and summarized on the following maps. In general, the comments range from topics related to transportation, land uses, and urban design. Much of the input that was received from the community related to current issues were also noted in the technical assessment of the current conditions. They primarily relate to traffic safety issues (speed and safety of intersections and crosswalks), universal design deficiencies, and the need for land uses that support a walkable community.

Norwood Boulevard Mobility Study

Figure 10 Community Input: Central

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Norwood Boulevard Mobility Study

Figure 11 Community Input: West

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Norwood Boulevard Mobility Study

Figure 12 Community Input: East

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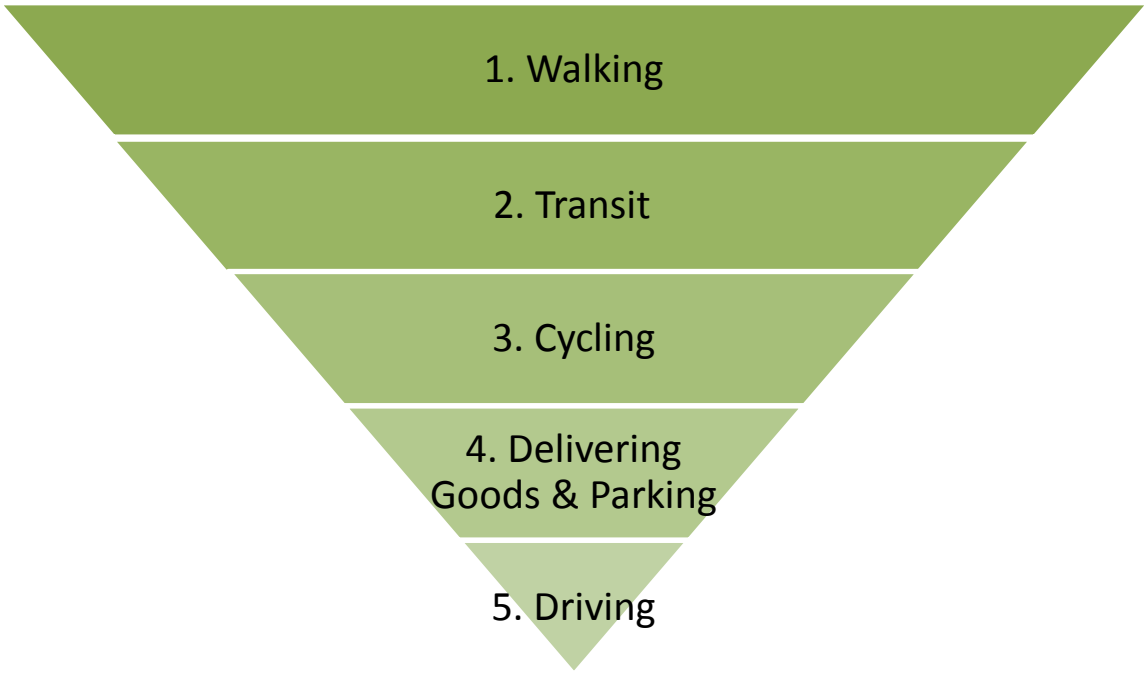
5.0 Developing Options

Based on analysis from Section 4 and input from the community, redesigning Norwood Boulevard as a Main Street is important to the community and warranted based on the quality of the existing conditions. The analysis of the driving conditions also indicates that Norwood Boulevard is currently over-designed, based on volume-to-capacity ratio. This means that there is an opportunity to reallocate space currently dedicated to vehicle travel to other uses in support of creating an area that prioritizes people and place.

This Section summarizes design options based on the 'Main Street Guidelines' document and engagement feedback for Norwood Boulevard.

5.1 Modal Prioirty

As an Aspiring Main Street, Norwood Boulevard is a pedestrian priority area and "operations will be optimized for pedestrians" according to the City's *Main Streets Guideline*. To develop design options for Norwood Boulevard, and reflect the walking, transit, and cycling use of the surrounding neighbourhoods, the following transportation modal priorities will be used. As per the Complete Streets Guidelines, those modes lower in the hierarchy will be adjusted for space and design before higher priority modes where conditions are constrained.



5.2 Norwood Boulevard Options

Four design options were generated for the core area of Norwood Boulevard (90 Street to 95 Street) while three options were generated for the corridor between 101 Street and 95 Street. In addition, two cycling networks were produced to supplement the design options to show cycling facilities on parallel facilities if they are not accommodated on Norwood Boulevard. Advantages and disadvantages were provided for each option to aid in discussion and collect feedback.

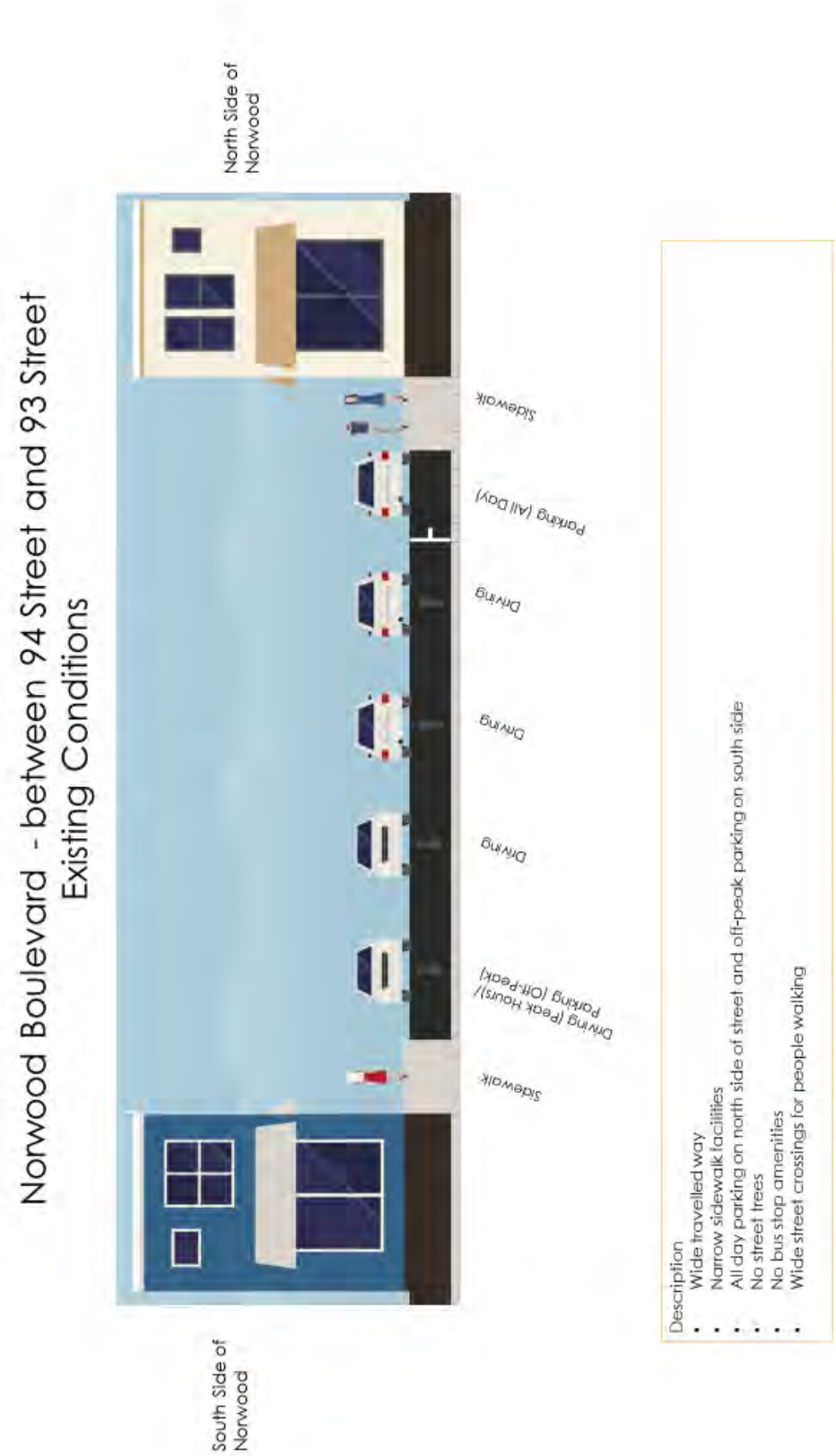
These design options are included in Appendix A while the figures on the following pages are examples of the materials that were shown to the community for feedback. In addition to the examples options provided, feedback was solicited regarding the community's priorities, to determine which aspects of the example designs they liked or disliked (and why), and to provide the opportunity for the community to generate their own design options.

5.3 Public Engagement 2

The City of Edmonton hosted a second community engagement session on November 30, 2016, which had over 80 people in attendance and over 50 respondents to the online survey. Most felt that major changes were needed to "humanize" the street and address the lack of infrastructure for walking and cycling. A number raised concerns with the difficulty of navigating the street for people that have mobility issues. Most were supportive of removing at least one vehicle travel lane in both directions. More details on the engagement can be found at www.edmonton.ca/norwoodboulevard.

No one single option presented met with unanimous approval. Overall, the feedback received confirmed the following.

- The modal priority reflected the community's vision.
- Focus on people walking and cycling including street trees, places to sit, wider sidewalks, pedestrian-oriented street lighting, and intersection improvements for walking and cycling.
- Cycling facilities along Norwood could be an option as could a well-designed, connected network parallel to and crossing Norwood.
- Removing vehicle travel lanes and narrowing the remaining lanes to provide more space for people.
- On-street parking could be beneficial and a potential opportunity for future reallocation to other uses (e.g., protected bike lanes, seating).
- A bus lane was not a priority.


Norwood Boulevard - between 94 Street and 93 Street
Existing Conditions
North Side of Norwood
South Side of Norwood
Sidewalk
Parking (All Day)
Driving
Driving
Driving
Driving (Peak Hours)/ Parking (Off-peak)
Sidewalk
Description
Wide travelled way
Narrow sidewalk facilities
All day parking on north side of street and off-peak parking on south side
No street trees
No bus stop amenities
Wide street crossings for people walking


Norwood Boulevard - between 94 Street and 93 Street
Option 1
North Side of Norwood
South Side of Norwood
Sidewalk
Parking (All Day)
Driving
Driving
Parking (All Day)
Sidewalk
Description
Eliminate two through lanes of traffic from existing street
All day parking on both sides of street
Street trees and widened sidewalks
Space for enhanced bus stops
Advantages
Wide sidewalks prioritizes people walking
Street trees improve quality of walking environment
On street parking available at all times
On street parking acts as buffer from street for people walking and reduce vehicle speeds
All day parking space can be used by businesses for parklets
Disadvantages
No cycling facilities (would be provided on parallel streets)
No prioritized transit facilities


Norwood Boulevard - between 94 Street and 93 Street
Option 2
North Side of Norwood
South Side of Norwood
Sidewalk
Protected Bike Lane
Driving
Driving
Parking (All Day)
Sidewalk
Description
Eliminate two through lanes of traffic from existing street
All day parking on north side of street
Protected bidirectional bike lane on south side of street
Widened sidewalks and street tress
Advantages
Wide sidewalks prioritizes people walking
All day on street parking on north side of street provides parking for businesses and acts as a buffer from traffic for people walking
All day parking space can be used by businesses for parklets
Protected cycling facilities provide safe location for people biking
Disadvantages
No prioritized transit facilities
Less space for street trees
Require consideration for how cycling facilities will fit into greater network and operate bus stops


Upgraded Intersections
Upgraded Cycling Route
Bike Parking
COE Trail
COE Bicycle Friendly Road
Option 1 – Cycling Route
Paralleling Norwood
Not to scale
114 Avenue
92 Street
95 Street
96 Street
101 Street
Norwood Boulevard
PARKDALE
CROMDALE
ALBERTA AVENUE
SPRUCE AVENUE
Commonwealth Stadium
Joe Clarke Athletic Grounds
Spruce Avenue School
St Basil School
Garden Court
82 St NW
97 St NW
101 St NW
118 Ave NW
112 Ave NW
Google Maps
11/21/2016
N

6.0 Mobility Options & Strategies

The mobility options developed for Norwood Boulevard re-prioritize the right-of-way along the corridor to provide more space to non-motorized transportation.

The foundation for future design options of Norwood Boulevard is the creation of a safe and welcoming space for people walking, riding bikes, and taking transit. Based on the mobility assessment of the current design and operation, these modes are generally underserved, with unmarked/uncontrolled crossings of the wide and busy street, narrow sidewalks with further restrictions due to poles and signs, no east-west bike infrastructure, limited to no infrastructure for transit passengers, and little consideration of universal design. There is good transit service via LRT at either end of the corridor, but limited frequency of all day bus service to connect people living, working, and shopping along Norwood Boulevard. The study identified that the existing corridor has more capacity than needed for people driving, though more on-street parking could be beneficial.

Based on this analysis and feedback from the public, the design options presented to the public were refined and evaluated against future conditions to confirm that the revised corridor will better serve the priority modes.

6.1 Future Development Scenarios

The *Norwood Boulevard Corridor Study – Real Estate Development Market Assessment* (Market Assessment) was completed for the City of Edmonton in 2016 to evaluate the current and future land development within the study area, based on market conditions. The Market Assessment identified that, based on the opportunity created by transit oriented development, the study area has high potential for redevelopment with medium and low density residential infill at a rate of approximately 130 units/year over a 10-year period. The impact of that population increase would support growth in commercial and retail services, totaling around 25,000 to 35,000 square feet in the study area.

The full build out of the Market Assessment is used to determine future transportation patterns for the Norwood Boulevard study area. The projected new trips generated from the build out of the Market Assessment were evaluated at two horizons:

- A medium term growth horizon that adds the new trips generated from the Market Assessment to existing traffic volumes.

- A long term growth horizon that includes additional background development and associated traffic growth. The volumes for this horizon were based on City of Edmonton's 2047 EMME model.

6.1.1 Transportation Impacts of the Market Assessment

The proposed redevelopment within the Norwood Boulevard study area is expected to generate more trips to, from, and within the area. New driving, transit, cycling, and walking trips will be created.

Trip generation is estimated based on land use estimates, trip generation rates, and mode split considerations.

- Land Use: The quantity and type of land use growth anticipated in the corridor were identified in the Market Assessment. For trip generation, the land uses were distributed along the corridor based on the following assumptions:
  - Commercial uses distributed evenly along the corridor,
  - Lower density residential growth distributed evenly along the corridor, and
  - Medium density residential growth clustered at either end of the corridor close to LRT stations, with some distributed evenly along the corridor.
- Trip Generation Rates:
  - Commercial trip generation was completed using the Institute of Transportation Engineers (ITE) Trip Generation Manual (9th Edition) for Specialty Retail Centre (Land Use 826),
  - Lower density residential trip generation was based on the City of Edmonton's Low Density Residential and RF5 Row Housing Trip Generation Rate, and
  - Medium density residential trip generation was based on the City of Edmonton's RA7/RA8 Apartment Housing trip generation rate.

When applied to the quantity of development identified in the Market Assessment, this estimate provides a driving trip generation rate for the corridor. The driving trip rate was converted to a "person-trip" rate, based on vehicle occupancy estimates and mode share estimates to reflect that the trip generation rates were based on suburban locations with low use of non-motorized mode. Vehicle occupancy estimates were obtained from City of Edmonton Household Travel Survey and the US National Household Travel Survey Report.

The total person trips generated for the corridor were then distributed based on estimated mode share for the existing corridor, based on the 2005 City of Edmonton Household Travel Survey. Those results are summarized in Table 11.

Table 11 - Trips Generated from New Development

Peak Hour	Mode	Mode Share	Total Trips by Mode
AM Peak Hour	Driving	63%	467
	Transit	22%	163
	Walking	13%	96
	Cycling	2%	15
		Total	**741**
PM Peak Hour	Driving	63%	574
	Transit	22%	200
	Walking	13%	118
	Cycling	2%	18
		Total	**910**

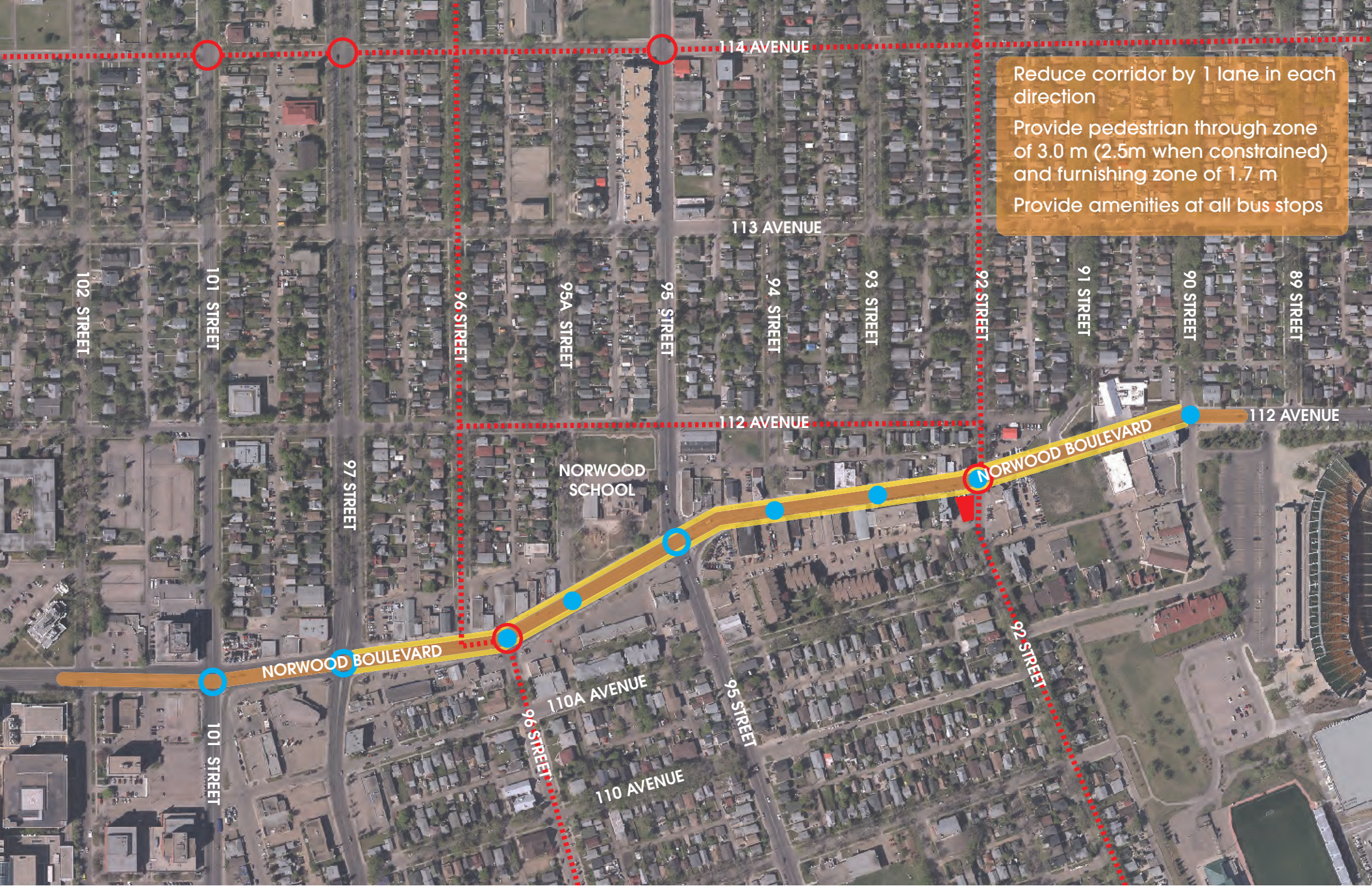
The added vehicle traffic represents growth of about 10% along Norwood Boulevard. Walking trips will increase and will do so even more than represented in Table 11, because all trips begin and end with a walking segment. Cycling and transit trips are representative of the impact of existing infrastructure; improvements to cycling and transit access could improve that mode share and further reduce driving trips.

The Market Assessment-related driving trips are added to the street network to evaluate the future performance within the study area for the two future horizons. The Recommended Network, described in the following section, was created based on existing opportunities and demands, and tested against the future volumes.

Detailed explanation of the trip generation, mode share, and trip distribution are provided in Appendix B.

6.2 Recommended Network

Norwood Boulevard, between 101 Street and 90 Street has more driving capacity than currently needed, and insufficient infrastructure for people walking, cycling, and taking transit. The recommended network considers these factors, along with the existing available right-of-way, to create a redesigned Norwood Boulevard. The recommended network is shown in Figure 13 and described below.



Norwood Boulevard Mobility Study

Figure 13 Recommended Network

Stantec

Legend

- UPGRADE CROSSING
- REALIGN CROSSING
- ALL DAY ON-STREET PARKING
- BIKE ROUTE
- BIKE INTERSECTION ACCOMMODATION
- BIKE PARKING

The analysis of the existing network indicated that there is sufficient driving capacity along Norwood Boulevard to eliminate one driving lane in each direction along the entire corridor. This change in space allocation allows the corridor to be redesigned as a place for people walking, cycling, and taking transit.

6.2.1 Walking and Wheeling

- Use additional space available in right-of-way obtained from removing traffic lanes to improve the pedestrian realm, following the Main Street Guidelines.
- Provide pedestrian through zones that are a minimum of 3.0 m wide where possible. The constrained right-of-way east of 95 Street will limit the through zone to 2.5 m.
- Provide pedestrian oriented street lighting.
- Provide a furnishing zone of 1.7 m or greater.
- Frontage zones will be provided via building setbacks during redevelopment due to right-of-way constraints (particularly east of 95 Street).
- Follow accessibility and universal design requirements, including curb ramps with high visibility tactile walking surface indicators.
- Use curb extensions at intersections to reduce crossing distances and turning speeds.
  - Improvements are needed at every intersection in the study area, as no intersection provides universal design accommodation.
  - Corner radii at all intersections should be limited to between 4.5 and 6.0m.
- Additional intersection improvements include:
  - Eliminate slip lane for northbound right turning movement at 101 Street.
  - Realign intersection to eliminate skew of west crossing and south crossing at 97 Street.
  - Include crosswalks for both east and west side crossings of Norwood Boulevard and include signal actuation control on both sides of the intersection that are accessible for people walking and people cycling at 96 Street.
  - Realign the 95 Street intersection as shown in Figure 16 (page 6.14), to reduce crossing distances, slow turning traffic, and provide additional queuing space for people walking.
  - Improve crossing infrastructure to include full or half signals at 95A Street, 94 Street, 93 Street, 92 Street, and 90 Street.
- Add wayfinding for walking and cycling.

6.2.2 Cycling

- Provide cycling routes for the Norwood Boulevard study area that are parallel to and connected with Norwood Boulevard. The cycling network was identified to include 114 Avenue, connecting to the shared use path along the LRT right-of-way to the east and Kingsway Mall at the west.
- Provide connections to Norwood Boulevard at 96 Street and 92 Street from 114 Avenue, with upgraded crossings at those locations to support north-south connections.
- The sidewalk on the north side of the intersection at 96 Street should be widened to accommodate a segregated shared use facility to support north-south travel and the skewed street alignment.
- Provide an upgraded cycling route between 96 Street and 92 Street on 112 Avenue to serve Norwood School.
- Provide bike parking station at intersection of Norwood Boulevard and 92 Street to connect bike routes directly to corridor and improve accessibility for people cycling to transfer to people walking within the commercial areas.
- Use ancillary zone to create additional bike parking to meet demand.

6.2.3 Riding Transit

- Include universal design principles with amenities like benches, wayfinding, and transit shelters at all transit stops.
- Use the ancillary zone to create transit platforms for transit stops and to provide necessary space for transit amenities.
- While transit is a priority, transit lanes are not included in the recommended network due to right-of-way constraints.
- Routes should be reviewed to provide frequent service with 4 or more buses per hour all day.

6.2.4 Goods Movement

- The width of travel lanes described under Driving will support movement of WB-20 vehicles, waste services, and deliveries (SU-9).
- Provide loading zones in the ancillary zone and larger deliveries for commercial developments can be completed in alleys.

6.2.5 Driving

- At a minimum, eliminate one lane of traffic along the entire corridor in each direction.
- Reduce lane widths through the corridor to align with recommendations found in the Main Street Guidelines:
  - Adjacent to curb: 3.45 m (to accommodate goods movement and transit)
  - Adjacent to on-street parking: 3.3 m
  - Non-curbside lane: 3.0 m
  - Ancillary Zone (on-street parking): 2.5m
- Redesign intersections to improve safety including removal of right turn cut-offs, reduction of curb radii, addition of curb extensions, and installation of additional traffic control devices as described under Walking.

6.2.6 Parking

- Provide on-street parking all day between 97 Street and 90 Street.
- Require redevelopment to have parking located off-street behind buildings via alley access.
- Review on-street parking options between 97 Street and 102 Street.
- Provide accessible parking space on-street with curb ramps to allow access to the sidewalk.

6.3 Network Comparison

The Recommended Network creates a new Norwood Boulevard where people walking take priority over those driving. The impact of this is shown in the revised cross sections and reallocation of space summary, shown in the following figures and tables.

6.3.1 95 Street to 90 Street

Between 95 Street and 90 Street, the right-of-way is around 20 m, though it varies slightly throughout the corridor. The reallocation of space for this right-of-way is illustrated in Table 12 and Figure 14.

Table 12 Allocation of Space for Revised 20.0 m Right-of-way

Design Zone	Existing Width (Total)	Proportion of Right-of-way – Existing	Revised Main Street Width (Total)	Proportion of Public Right-of-way – Main Street
Frontage Zone	4.2 m	21%	0 m	67%
Pedestrian Through Zone			5.0 m	
Furnishing Zone			3.4 m	
Ancillary Zone	0 m		5.0 m	
Travelled Way	15.8 m	79%	6.6 m	33%

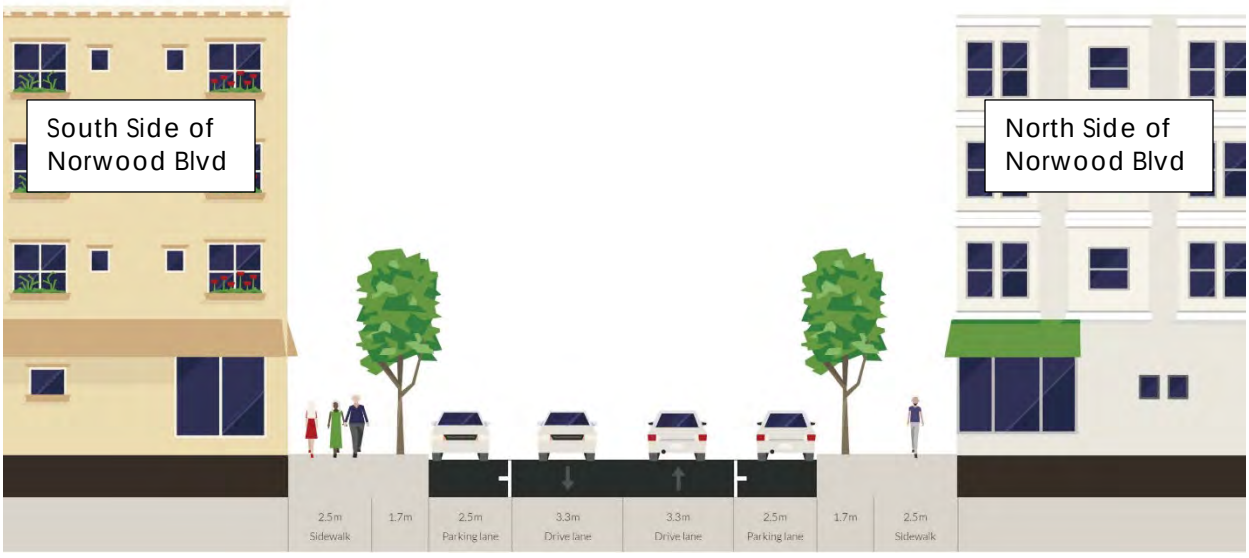


Figure 14 Recommended Main Street East of 95 Street

6.3.2 97 Street to 95 Street

The existing segment between 97 Street and 95 Street has a right-of-way that ranges between 30.1 m and 34.7 m. The following comparison illustrates the difference in space allocation for this segment with the recommended changes assuming a 30.1 m right-of-way. The reallocation of space for this right-of-way is illustrated in Table 13 and Figure 15.

Table 13 Allocation of Space for Revised 30.1 m Right-of-way

Design Zone	Existing Width (Total)	Proportion of Right-of-way – Existing	Revised Main Street Width (Total)	Proportion of Public Right-of-way – Main Street
Frontage Zone	7.7 m	26%	3.1 m	58%
Pedestrian Through Zone			6.0 m	
Furnishing Zone			3.4 m	
Ancillary Zone	0 m		5.0 m	
Travelled Way	22.4 m	74%	12.6 m	42%

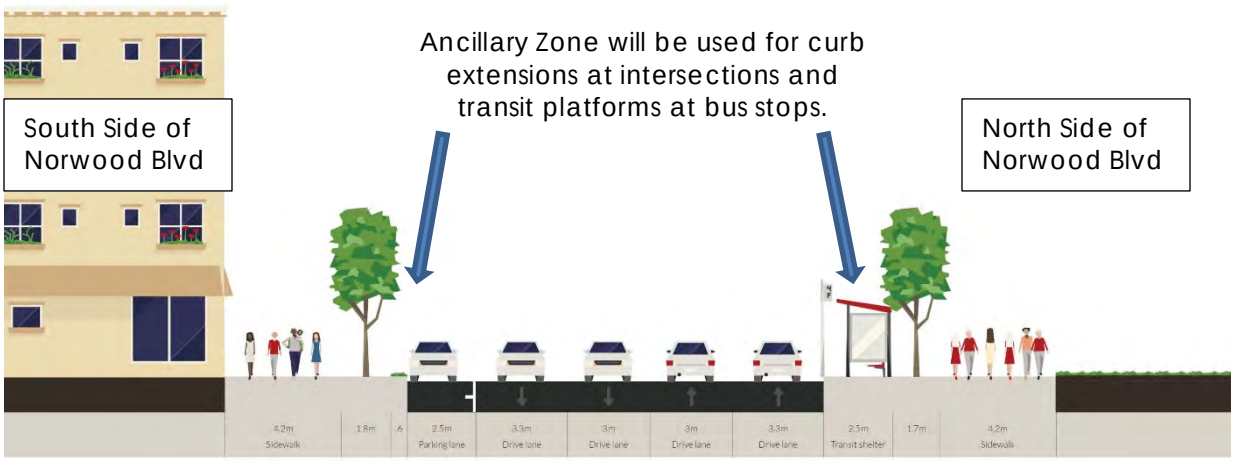


Figure 15 Recommended Right-of-way from 97 Street to 95 Street

6.4 Mobility Assessment of Recommended Network

The impact of the Recommended Network on each mode is discussed below.

6.4.1 Walking

New trips by all modes generate additional walking trips, including cycling, transit, and driving, because these trips all begin and end with a walking segment. Without any changes to the existing corridor, the currents gaps and poor segments will disadvantage more users. Furthermore, with growing residential and mixed use development within the study area, pedestrian realm improvements could encourage residents to shop locally and walk to local destinations. Residential growth in the area could add new students to the Norwood School, and further emphasize the need to address safety concerns for people walking as the highest priority for redesigning Norwood Boulevard.

The Recommended Network will make the mid-block walking environment west of 95 Street **Good**, with pedestrian through zones of 3.0 m, buffers from moving vehicles (furnishing zone and ancillary zone), and pedestrian oriented lighting. Segments between 90 Street and 95 Street will be **Fair,** due to the constrained right-of-way limiting the width of the through zone to around 2.5m, which is significantly better than current conditions. The buffer from moving traffic and pedestrian oriented lighting will also be provided east of 95 Street.

As part of the long term plan, this study recommends installing full signals at all intersections along the corridor, including minor ones. The Transportation Association of Canada (TAC) *Pedestrian Crossing Control Guide* includes a warrant process to identify what type, if any, of pedestrian crossing control device is required. Inputs into this warrant include pedestrian volumes, driving volumes, proximity to other traffic controls, and pedestrian desire lines.

Within the core area of Norwood Boulevard (between 95 Street and 90 Street), traffic volumes and volumes of people walking are high enough to warrant some type of crossing infrastructure, though likely not traffic signals, based on TAC warrant procedures. Because the area is a Main Street, where people walking are the priority, and street-oriented commercial will create desire lines between the north and south sides of Norwood Boulevard, the crossing infrastructure should exceed the minimum based on this TAC consideration.

Implementation of Universal Design elements like tactile walking surface indicators and curb extensions at intersections, along with appropriate, defined crossing infrastructure will move all or most intersections along the corridor to **Good**.

6.4.2 Cycling

The preliminary assessment identified at least 40 new cycling trips in the corridor in the peak hours based on current mode share of the study area. While this number is small when compared to other modes, local and international experience has shown that the number of people cycling in an area is heavily influenced by the infrastructure provided, and this mode share could be significantly increased by providing suitable all ages and abilities cycling facilities in the study area to travel to, from, and through Norwood Boulevard. It is also important to note for cycling, as well as walking, that a greater proportion of the total trips can and will likely occur by walking and cycling in non-peak hours given the mixed use future envisioned for Norwood and surrounding area.

The recommended cycling network has been identified to parallel Norwood Boulevard, based on feedback received from the public and the desire to continue to prioritize Norwood Boulevard as a place for people walking. Particularly along the core area (90 Street to 95 Street), the constrained right-of-way limits the ability to provide facilities for all modes.

The study has not identified the recommended infrastructure for the parallel and connecting routes. As a lower traffic volume and speed local street, the parallel network could be designed to mitigate potential traffic volume increases through the use of traffic calming to create a bicycle boulevard, though a detailed suitability assessment should be completed prior to design. Traffic calming could come in the form of traffic diverters, curb extensions, and mini-roundabouts to increase the attractiveness of these routes to people walking and cycling by impeding fast and through moving motor vehicle traffic, including people short-cutting through the neighbourhood. Ongoing maintenance and winter snow clearing should also be considered.

Intersections, particularly those crossing Norwood Boulevard and arterial streets (e.g., 97 Street), should be designed to accommodate the movements of people cycling. This will include adding half or full signals to a number of intersections as noted in Figure 13, and timing signals for the travel speeds of people cycling (eg. clearance time). Many of the intersection improvements identified to improve walking safety and accessibility will also increase the accessibility and safety of crossing Norwood Boulevard for people cycling.

Providing a suitable facility along the identified parallel network, the noted intersection improvements, and bicycle parking will result in the Norwood Boulevard achieving a cycling quality of service of **Good**.

6.4.3 Riding Transit

Transit ridership remains high as a percentage of transportation mode share. Residential development around the nodes of the corridor are expected to primarily serve LRT riders. Bus service along the corridor will supplement LRT trips through providing access to the LRT stops and additional areas not serviced by LRT. The existing population along the corridor is less likely than the rest of the City to drive; transit is and will continue to be an important tool for access to employment and recreation for people living in Norwood.

An additional 350 transit trips are expected during the AM and PM peak, which translates to an additional 350 walking trips (or cycling trips) to and from transit stops. Review of the frequency and capacity of bus service along Norwood Boulevard should be completed to allow sufficient capacity to serve the additional people riding transit.

By providing improved transit stop amenities such as shelters and benches in the ancillary zone transit platforms and providing improved walking facilities, the quality of the transit stops will be upgraded to **Good** with the recommended network. Transit service should be continually evaluated to meet demand and allow transit to be a viable and attractive option for people living, working, and visiting Norwood Boulevard.

6.4.4 Goods Movement

Growth in commercial development along the corridor will generate additional goods movement trips to deliver products to the businesses.

The width of vehicle lanes along the corridor under the Recommended Network will accommodate goods movement vehicles. One of the key intersections to redesign is the intersection of 95 Street and Norwood Boulevard, where students walking to Norwood School currently cross a very wide intersection with high traffic volumes, including turns occurring at high speed. The design also does not currently accommodate the numbers of people waiting to walk across the street, particularly at the end of the school day. Redesign of this intersection will allow for shorter crossing distances for people walking, while still accommodating necessary turning movements for transit vehicles and waste services. This is illustrated in Figure 16.

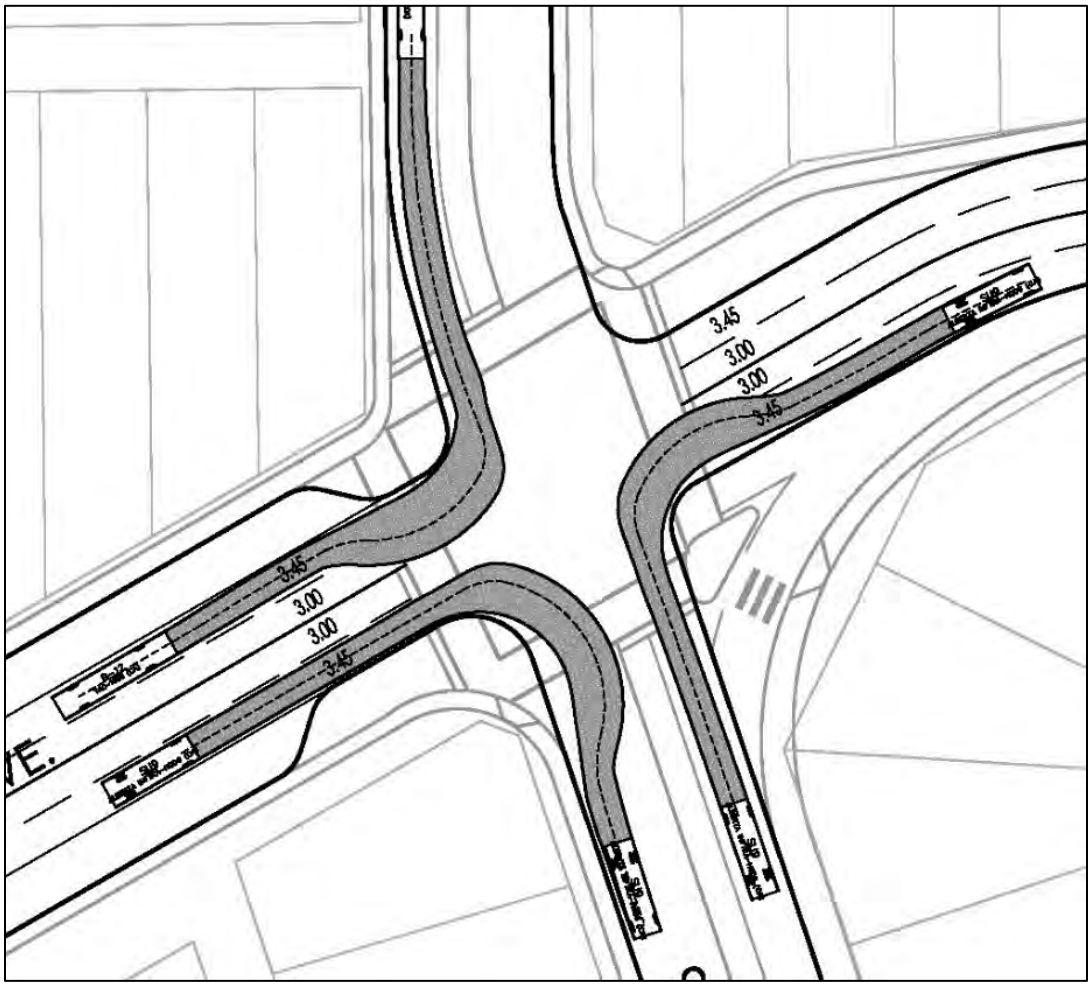


Figure 16 Recommended Alignment for 95 Street and Norwood Boulevard Intersection

Provision of on-street loading in the permanent, 24-hour ancillary zone, will support goods deliveries and alleys should be kept available for larger deliveries from vehicles such as a WB-20 and for the collection of waste. These recommendations will allow goods movement to be **Fair** to **Good** throughout the corridor.

6.4.5 Driving

A detailed summary of the results of the traffic analysis for the impact of increased driving trips along Norwood Boulevard and within the study area is included in Appendix C. In general, the corridor had available capacity to be able to accommodate growth.

The traffic from the build out of the Market Assessment development was modeled on the recommended network. The analysis identified that most movements continue to be **Good** for people driving in the AM and PM peak periods. The following movements were identified as **Fair** during the PM Peak:

- 101 Street: eastbound through-right
- 97 Street: eastbound (all movements) and northbound (all movements)
- 95 Street: eastbound (all movements).

A quality of service of **Fair** is acceptable for driving, as driving is a lower priority mode for Norwood Boulevard.

The driving analysis was also completed on the network with the additional volumes as identified in the 2047 City of Edmonton Emme model. The additional volumes result in more movements along the corridor to be **Fair**, and eastbound and northbound movements at 97 Street become **Poor** in the PM Peak.

However, travel demand model results are based on a set of assumptions, which include the location and density of population and employment growth, as well as the capacity in the street network. Reducing the capacity of part of the network and rerunning the model with the same land use and employment assumptions will cause the volumes to adjust: some may take an alternate route, others may shift to an alternate mode that becomes more favourable because of the increasing congestion, others may choose to take the intended trip outside of the peak hour.

As was discussed in Section 3.5, by redesigning Norwood Boulevard to be a “Main Street” with less vehicle capacity but more capacity for people walking, some of that excess traffic volume would likely disappear. As such, the movements in the analysis shown as operating with a v/c ratio > 1.0 in the 2047 scenario would likely see driving demand reduce due to the reasons outlined above. The more likely traffic operation would see the demand at the intersections match the capacity.

6.4.6 Parking

By providing on-street parking all day throughout the corridor, parking conditions improve to Good along Norwood Boulevard in this plan. Ensuring that new development provides off-street parking with access from the alley and no additional parking lots are built between buildings and the street, the off-street parking will supplement on-street parking effectively.

7.0 Implementation

The recommended upgrades to Norwood Boulevard can precede development. To help prioritize the corridor as a Main Street in the short, medium, and long term, key implementation outcomes for the various scenarios have been identified.

7.1 Short Term

Improvements in the short term should focus on immediately addressing some of the gaps and barriers to walking along the corridor.

There are several temporary measures that can be used to implement the Norwood Boulevard objectives and principles quickly and at relatively low cost.

7.1.1 Walking

Short term intersection upgrades include:

- 95 Street
  - Develop curb extensions using temporary materials like concrete barriers or flex posts. The resulting intersection configuration is shown in Figure 17. The realignment shows temporary curb extensions extending the southeast and northwest curbs which shortens crossing distances, realigns the skewed crossings, and slows turning driving traffic. Examples of temporary infrastructure for this type of improvement are shown in Figure 18.

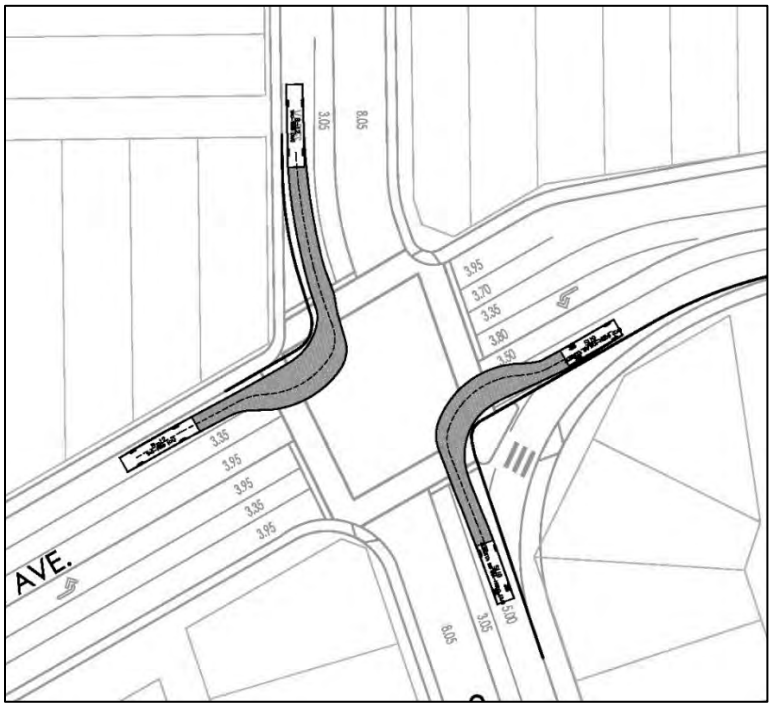
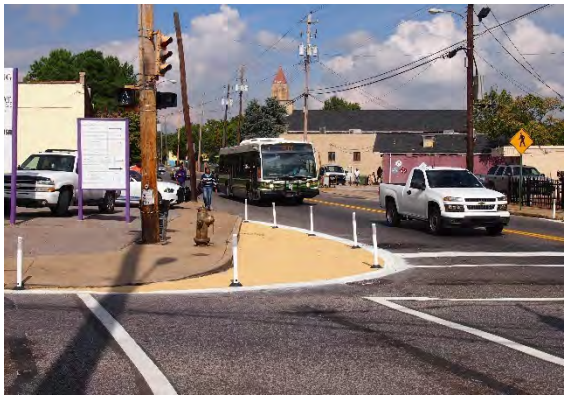


Figure 17 Short Term Intersection Improvements at 95 Street

Traffic Calming Curbs[4]



Flex-Post Bollards with MMA Paint[5]

Figure 18 Temporary Curb Extension Examples

[4] Metro Calgary. Thursday October 20, 2016. Photo from: http://www.metronews.ca/news/calgary/2016/10/20/calgary-traffic-calming-pilot-community-results.html
[5] Bike Ped Memphis. 2013. Photo from: https://bikepedmemphis.wordpress.com/2013/11/01/memfix-pedestrian-improvements-in-south-memphis/

- 95A Street, 94 Street, and 93 Street
  - Install rectangular rapid flashing beacons (RRFBs), supplemented with warning signs and zebra crossings. RRFBs are a lower cost alternative to traffic signals and hybrid signals. They are shown to increase driver yielding behavior when supplementing traditional pedestrian crossing signage and infrastructure[6]. They are flexible and fast to implement because they are solar powered.

7.1.2 Cycling

Areas around Norwood School are the highest priority for cycling, and key short term improvements have been identified to focus on improving the crossing at 96 Street, in addition to the already mentioned walking improvements at 95A Street.

- Designate the north sidewalk on Norwood Boulevard between the southern leg of 96 Street and the northern leg of 96 Street as a shared use path or sidewalk (for northbound movements) to allow people on bikes to legally use the space.
- Include crosswalks on both the east side and west side of 96 Street at Norwood Boulevard.
- Include cyclist-accessible actuation buttons on the west side of 96 Street (north side of Norwood Boulevard) for southbound movements.

Other short term cycling improvements that should be considered include:

- Provide bike parking along the corridor in the form of bike corrals that are installed in on-street parking spaces.
- Provide temporary upgrades to 114 Avenue to improve its function as a bike boulevard. Improvements can include curb extensions as shown in Figure 18, mini roundabouts at intersections and other traffic calming interventions to slow traffic and improve access for people on bikes in the corridor.

[6] US. Department of Transportation Federal Highway Administration. (2009). *Rectangular Rapid Flashing Beacons. https://safety.fhwa.dot.gov/intersection/conventional/unsignalized/tech_sum/fhwasa09009/fhwasa09009.pdf*

7.1.3 Riding Transit

Transit upgrades will take place as the corridor intensifies and routes are reviewed. Identified upgrades to the walking environment and crossings will improve the corridor for transit riders. Other short term improvements to consider include adding seating at all existing transit stops where there is currently space that would not constrain the sidewalk, and upgrading to transit shelters as space permits.

7.1.4 Goods Movement

Converting existing time restricted on-street parking to all day parking will add loading and unloading zones for goods movement, and can be implemented in the short term.

7.1.5 Driving and Parking

Convert the existing time-restricted parking to all-day on-street parking, possibly through the use of temporary curb extensions. Ensure that new developments in the corridor have parking located in the rear of buildings.

7.2 Medium Term

In the medium term, the construction of the recommended network's design elements will be completed using permanent materials. The work will involve adding traffic signals or upgraded crossings at 96 Street, 94 Street, 93 Street, 92 Street and 90 Street, and reconstructing the street to include the walking, universal design, transit, parking, lane widths, and intersection design elements outlined in the Recommended Network as well as the cycling facilities. This can occur prior to full build out of the development projected in the Market Assessment.

The medium term implementation is visualized in Figure 19.

Figure 19 Medium Term Norwood Boulevard

7.3 Long Term

The long term scenario includes the full build out of the development projected in the Market Assessment to the constructed public infrastructure improvements from the medium term.

In addition to infrastructure, other measures can be used to moderate driving and parking demand in the long term. These include providing the following through encouragement programs with employers and higher density residential buildings, city-wide initiatives, and regulations such as the Zoning Bylaw:

- Transit incentive programs;
- Car sharing;
- Shared parking between different businesses;

- Unbundling parking and reducing parking requirements for redevelopment projects; and
- Parking pricing.

The long term scenario is visualized in Figures 20 and 21.

Figure 20 Long Term Implementation Sidewalk View

Figure 21 Long Term Implementation Street View

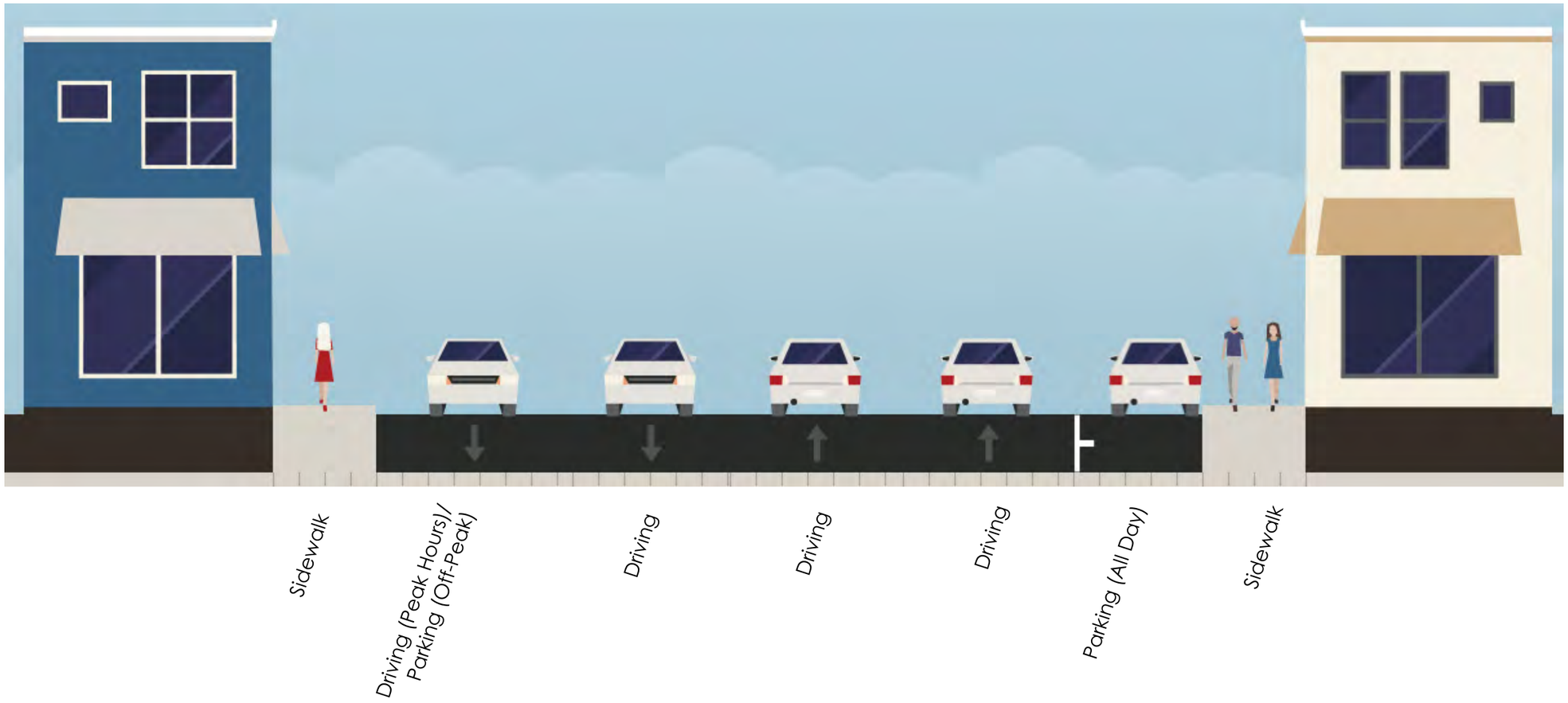
APPENDICES

Appendix A Draft Design Options

The design options presented at the November 30, 2016 Public Event are included in this Appendix.

Norwood Boulevard - between 94 Street and 93 Street
Existing Conditions

South Side of Norwood

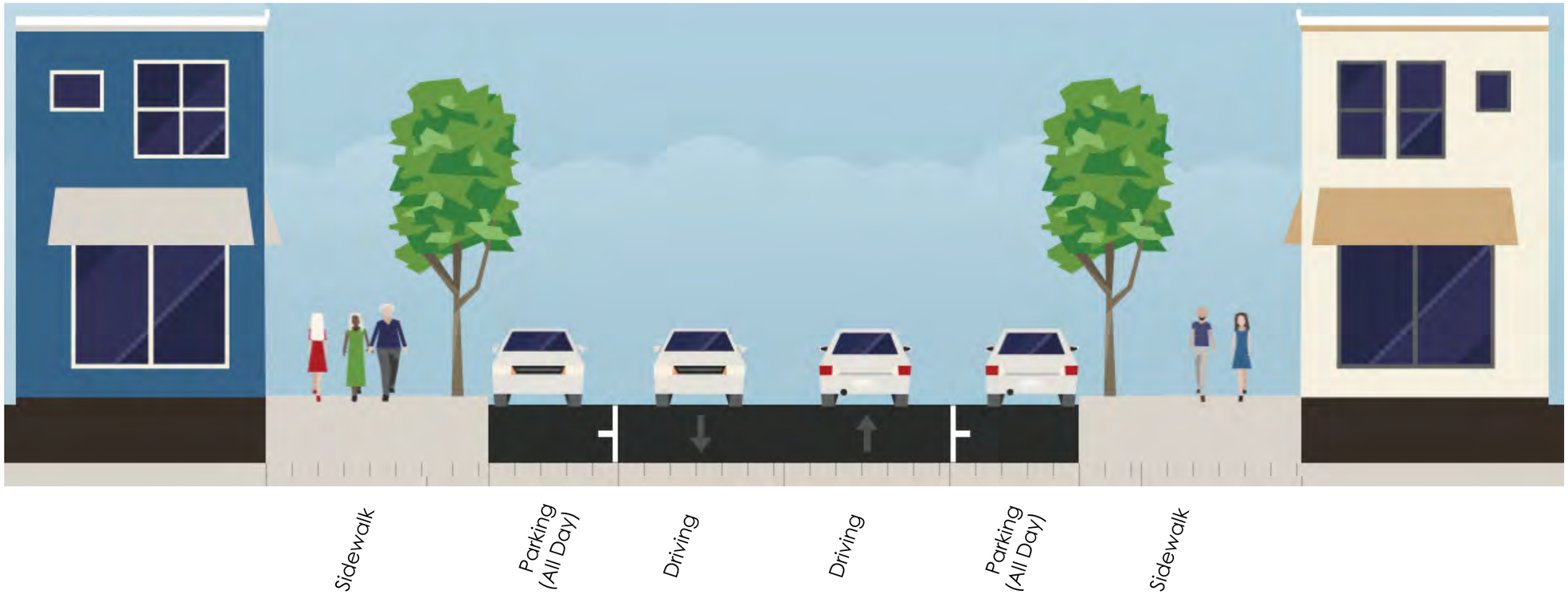


North Side of Norwood

Description
- Wide travelled way
- Narrow sidewalk facilities
- All day parking on north side of street and off-peak parking on south side
- No street trees
- No bus stop amenities
- Wide street crossings for people walking

Norwood Boulevard - between 94 Street and 93 Street
Option 1

South Side of Norwood



North Side of Norwood

Description
- Eliminate two through lanes of traffic from existing street
- All day parking on both sides of street
- Street trees and widened sidewalks
- Space for enhanced bus stops

Advantages	Disadvantages
• Wide sidewalks prioritizes people walking • Street trees improve quality of walking environment • On street parking available at all times • On street parking acts as buffer from street for people walking and reduce vehicle speeds • All day parking space can be used by businesses for parklets	• No cycling facilities (would be provided on parallel streets) • No prioritized transit facilities

Norwood Boulevard - between 94 Street and 93 Street
Option 2

South Side of Norwood

North Side of Norwood

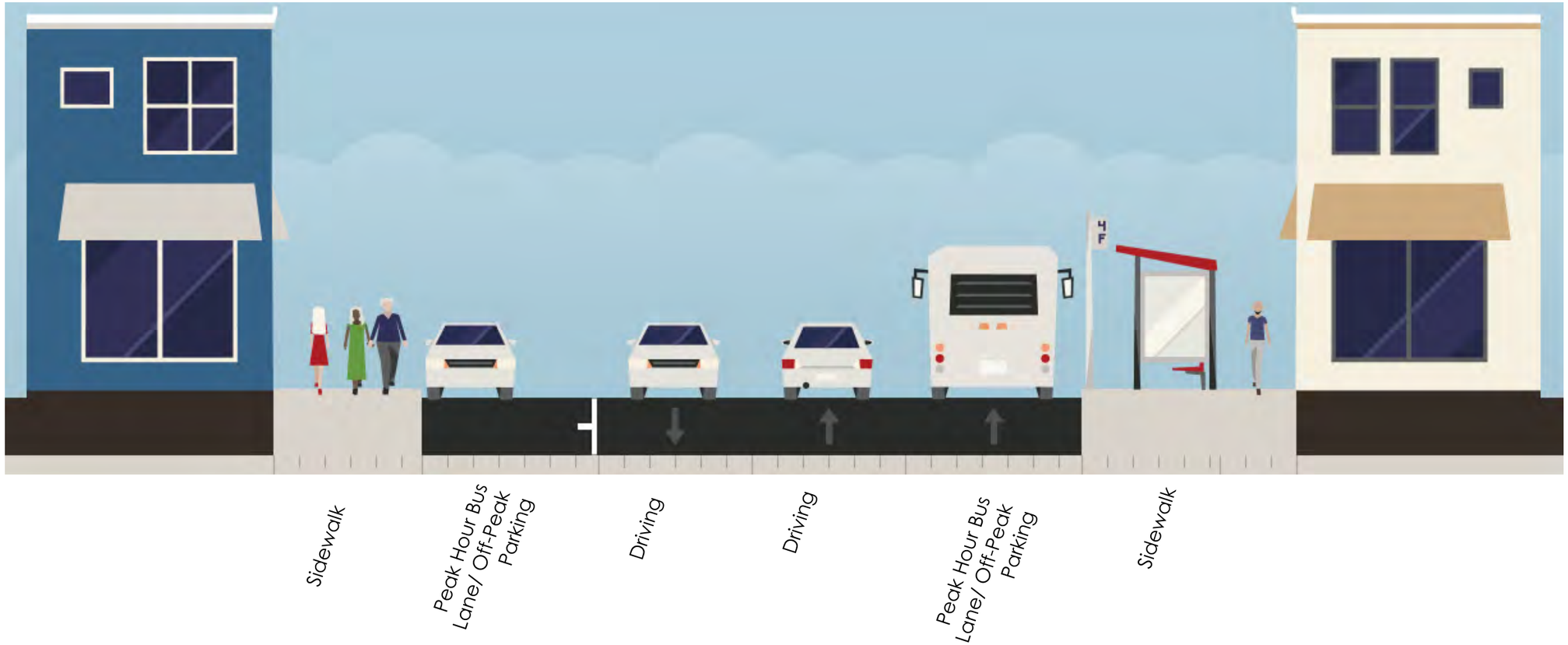
Sidewalk | *Protected Bike Lane* | *Driving* | *Driving* | *Parking (All Day)* | *Sidewalk*

Description
- Eliminate two through lanes of traffic from existing street
- All day parking on north side of street
- Protected bidirectional bike lane on south side of street
- Widened sidewalks and street tress

Advantages	Disadvantages
• Wide sidewalks prioritizes people walking • All day on street parking on north side of street provides parking for businesses and acts as a buffer from traffic for people walking • All day parking space can be used by businesses for parklets • Protected cycling facilities provide safe location for people biking	• No prioritized transit facilities • Less space for street trees • Require consideration for how cycling facilities will fit into greater network and operate bus stops

Norwood Boulevard - between 94 Street and 93 Street
Option 3

South Side of Norwood



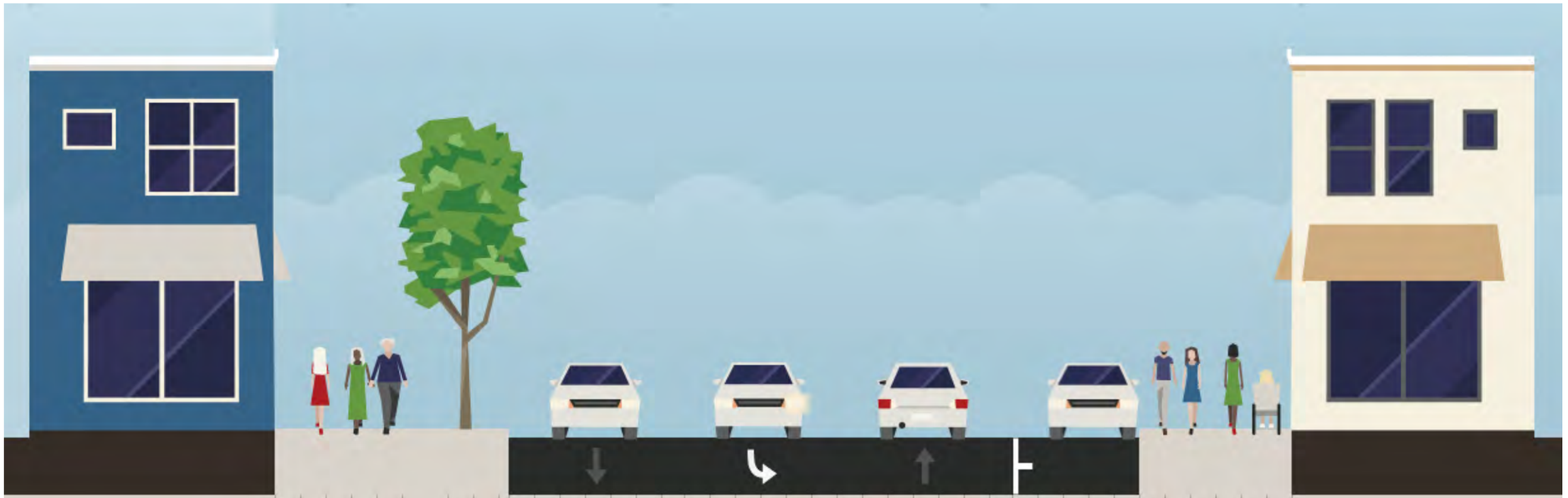
North Side of Norwood

Description
- Eliminate two through lanes of traffic from existing street
- Peak hour bus priority lanes on north and south side of street
- Off-peak parking lanes
- Wider sidewalks than current street (restricted at bus stops)

Advantages	Disadvantages
• Prioritized transit space (only really needed if transit reliability is a challenge in this area) • Off peak parking on both sides of the street provides parking during the day and evening, and provides buffer from roadway for people walking	• No cycling facilities (provided on parallel street) • Less space for street trees and other amenities than other options • Less space than other options for people walking • Wide crossing distance for people at crosswalks crossing Norwood Boulevard

Norwood Boulevard - between 94 Street and 93 Street
Option 4

South Side of Norwood



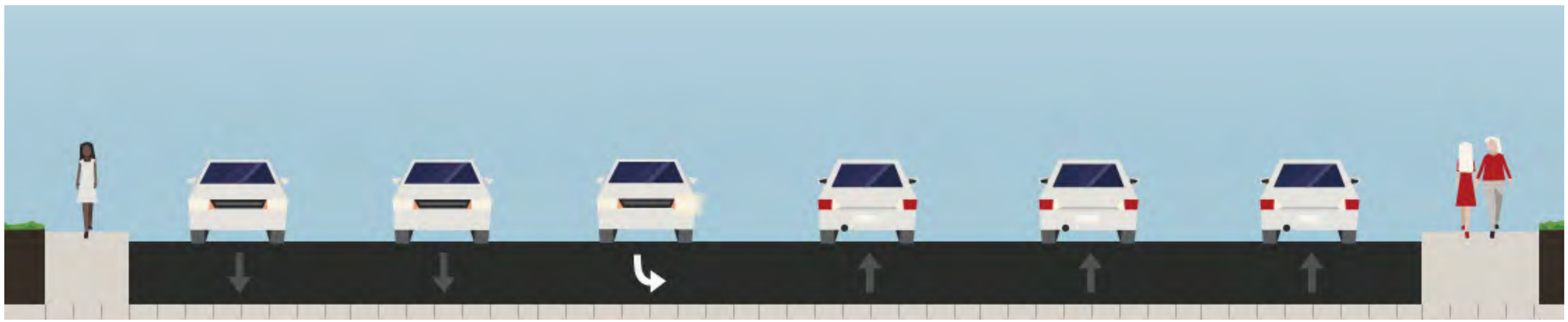
North Side of Norwood

Description
- Eliminate two through lanes of traffic from current street
- All day parking on north side of street
- Turning lane for eastbound left turning traffic
- Widened sidewalk space

Advantages	Disadvantages
• All day on street parking on north side of street • All day parking space can be used by businesses for parklets • Additional capacity for turning vehicles	• No prioritized transit facilities • Less space for street trees • Less sidewalk space than some other options • Wider travelled way with more priority for people driving, and longer crossings for people walking • No parking on the south side of the street, people walking near moving traffic • No cycling facilities (provided on parallel street)

Norwood Boulevard - between 95a Street and 95 Street

South Side of Norwood



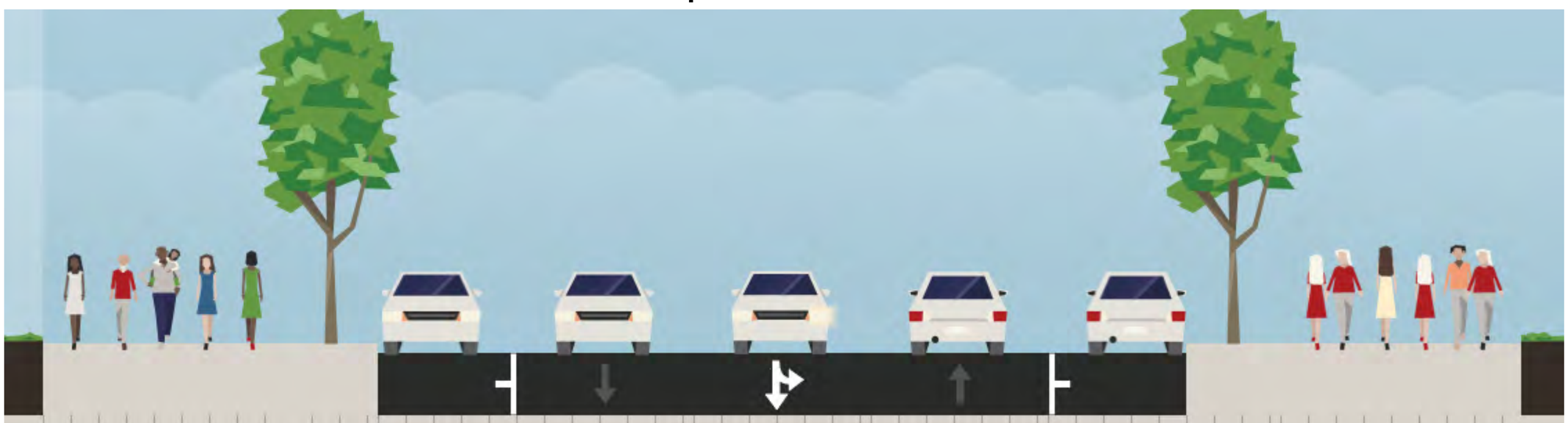
North Side of Norwood

Sidewalk *Driving* *Driving* *Turn Lane* *Driving* *Driving* *Driving* *Sidewalk*

Description
- Wide travelled way, prioritizing people driving
- Narrow space for people walking and wide crossings
- No space for people biking
- No transit priorities lanes or bus shelters

Norwood Boulevard - between 95a Street and 95 Street
Option 1

South Side of Norwood



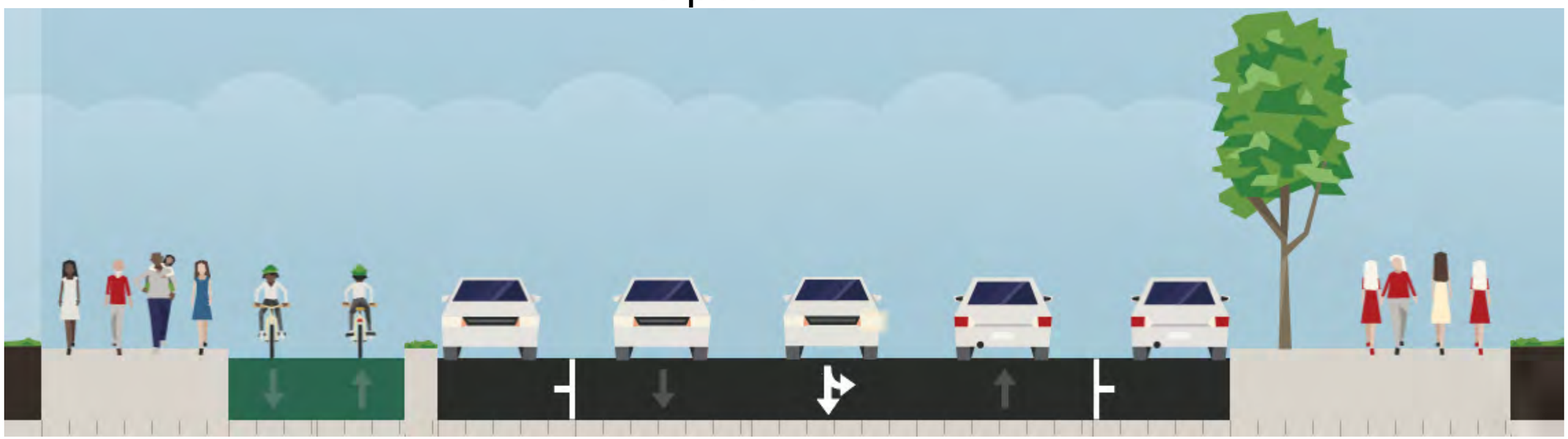
North Side of Norwood

Description
- Eliminate two lanes from the travelled way
- Adds all day parking on the north and south side of the street
- Ample space for street trees, furniture and sidewalk space including space for sidewalk activities

Advantages	Disadvantages
• All day on street parking on both sides of street • Widened space for people walking, street trees, and other street furniture. • Parking provides buffer from moving vehicles for people walking • All day parking space can be used by businesses for parklets • Space available to provide enhanced bus stops • Reduced street crossing distance for people walking	• No prioritized transit facilities • No cycling facilities (provided on parallel street)

Norwood Boulevard - between 95a Street and 95 Street
Option 2

South Side of Norwood



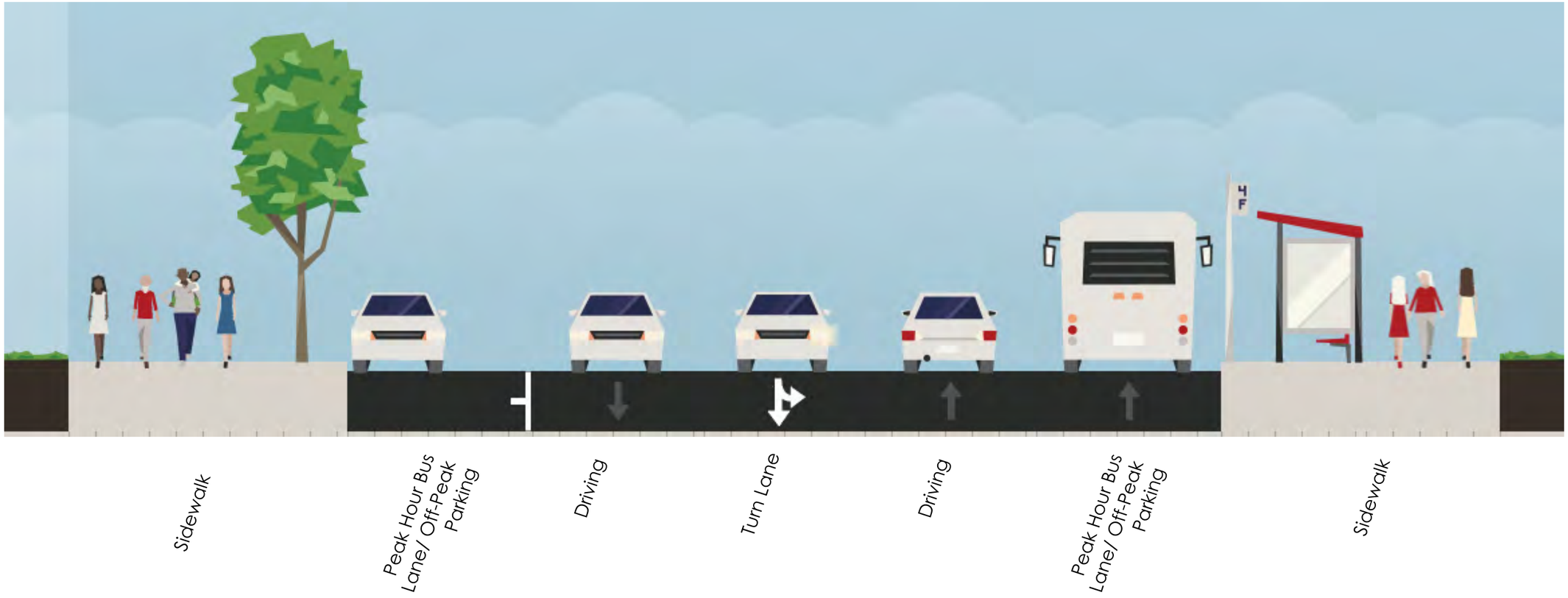
North Side of Norwood

Description
- Eliminate two lanes from the travelled way
- Adds all day parking on the north and south side of the street
- Adds a bidirectional protected bike lane on south side of street

Advantages	Disadvantages
• All day on street parking on both sides of street • Protected cycling facilities provide safer connections for people biking and buffer from moving vehicles for people walking • Widened sidewalks • All day parking space can be used by businesses for parklets • Reduced street crossing distance for people walking • Space for street trees and other amenities	• No prioritized transit facilities • Less sidewalk space than Option 1 • Consideration required for how cycling facilities fit into greater network and access to schools

Norwood Boulevard - between 95a Street and 95 Street
Option 3

South Side of Norwood



North Side of Norwood

Description
- Eliminate two lanes from the travelled way
- Adds peak hour transit priority lanes on both sides of street
- Off peak parking on both sides of street
- Widened pedestrian facilities

Advantages	Disadvantages
• Transit priority during peak hour • On street parking during off peak hours can act as buffer from moving vehicles for people walking and reduce driving speeds	• No cycling facilities (provided on parallel streets) • Less space for street trees • Less space than other options for people walking

https://www.google.ca/maps/@53.5626708,-113.4839073,1873m/data=!3m1!1e3!5m1!1e3?hl=en

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Option 1 – Cycling Route Paralleling Norwood

Not to scale

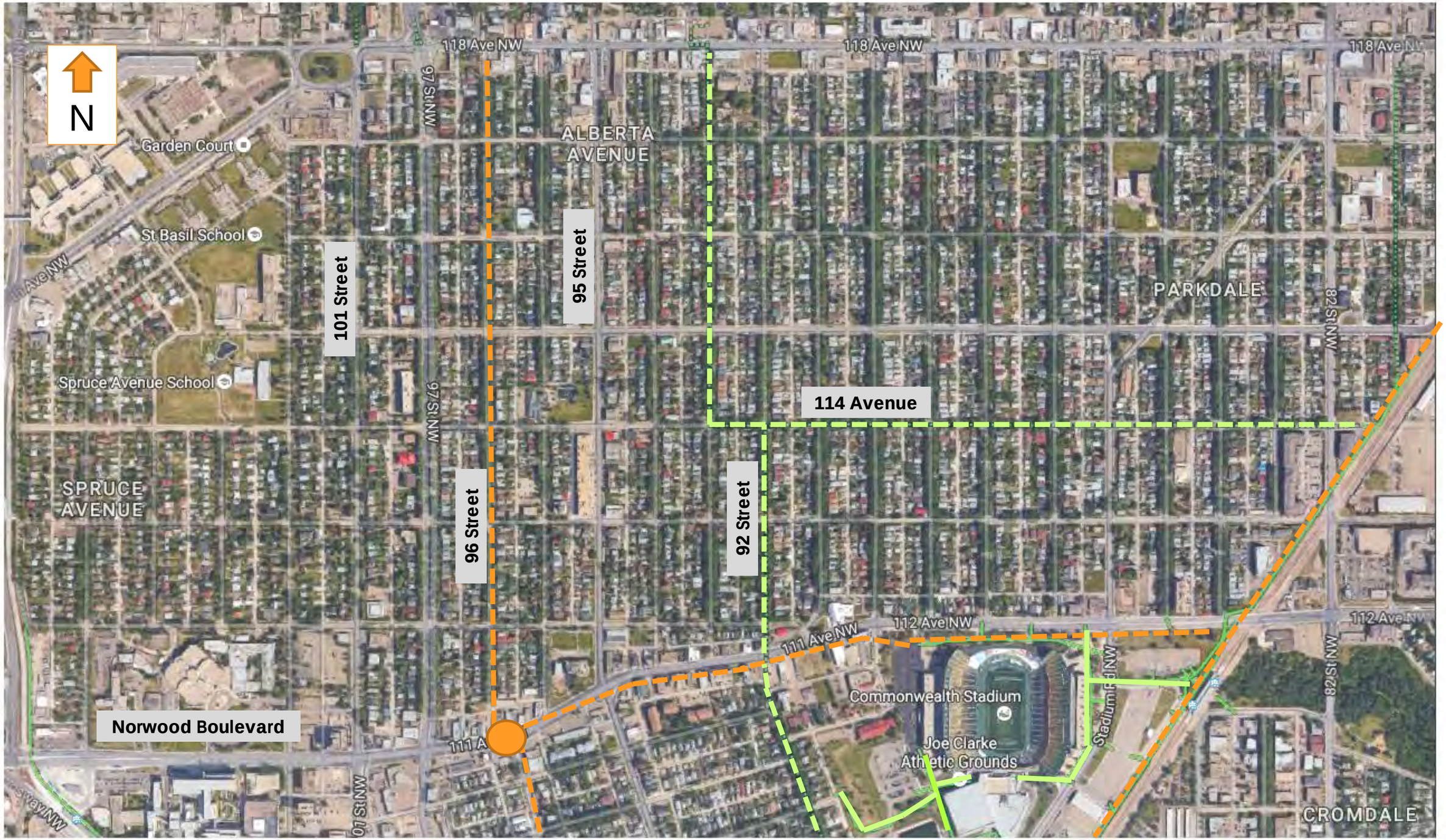
COE Trail

COE Bicycle Friendly Road

Upgraded Intersections

Upgraded Cycling Route

Bike Parking



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2/3

Option 2 – Cycling Route on Norwood Blvd

Not to scale

- COE Trail
- COE Bicycle Friendly Road
- Upgraded Intersections
- Upgraded Cycling Route

Appendix B Future Trip Generation

The trip generation, distribution, and assignment for the proposed infill development in the Norwood Boulevard study area was completed to identify the potential capacity of the roadway corridor.

B.1 Land use

The *Norwood Boulevard Corridor Study Real Estate Development Market Assessment Edmonton, Alberta* (November 2016) was prepared by Site Economics for the City of Edmonton. The study reviews the market potential for the study area to identify the anticipated land use development along the corridor, looking at a study horizon of 10 years (development to 2026). Key points which impact the potential trip generation and assignment are as follows.

- Residential growth will include an additional 1,300 households by 2026, at a rate of 130 units/year.
    - Residential development will be mostly in the form of 4 storey strata-title condominium apartment buildings, with an average density of 20-40 units per building (referred to hereafter as medium density residential (MDR))
    - Some development will include smaller infill projects in the form of duplexes, triplexes, townhouses or quadplexes (referred to hereafter as low density residential (LDR))
- The market assessment does not indicate what proportion of the development will be MDR vs. LDR. The Mobility Assessment analysis assumes that 80% of development will be found in four-level condominium style buildings (MDR) and 20% will be LDR.
- Commercial growth will include 25,000 to 35,000 sq ft of retail, primarily on the ground floor of mixed use low-rise residential buildings. The tenant mix will be dominated by small shops and stores designed to serve the local market, including food retail and food service.

Though the Real Estate Development assumes this development will occur in a 10 year horizon, it is likely that it will be more spread out, representing a relatively "longer term" growth horizon. The Mobility Assessment will also evaluate a future horizon that uses volumes identified in the City of Edmonton 2047 EMME model as an "ultimate" scenario reference. These volumes are reflective of additional growth in the City of Edmonton Quarter's and Downtown areas.

To evaluate the impact of the development on the street network, the land uses were placed along the corridor assuming the MDR as nodes on the east and west ends of the study area, with commercial/mixed use development and LDR spread along the corridor. Development distribution is illustrated in Figure 22.

Figure 22 Land Use Distribution

B.2 Trip Rates

Typically, new development trips are established using the Institute of Transportation Engineers (ITE) trip rates from the *Trip Generation Manual*. However, the data in the ITE *Trip Generation Manual* was generated from data collected at primarily suburban locations, in locations with little or no transit, and poor pedestrian connectivity. These rates tend to inflate vehicle trip generation for infill sites in urban locations. The Norwood Boulevard study area is an urban infill location that is well served by public transit, is located close to the urban core, and is projected to have growing residential density. To that end, the typical vehicle trip generation rates will be reviewed and modified to reflect the more multi-modal nature of the corridor, based on the findings of the area's travel behaviour. Trip generation rates will be converted into person-trip rates using the following process:

- Identify a baseline trip generation rate using either an ITE Trip Rate or City of Edmonton Trip Rate.
- Convert that trip rate into a person trip rate using the mode split associated with that rate and the vehicle occupancy rate.
- Use local mode splits for the study area to generate trips for all modes.

B.2.1 Baseline Trip Rate

Two sources were identified to develop trip rates, the ITE *Trip Generation Manual* and the City of Edmonton 2013 Recommended Trip Generation Rates. The identified rates are summarized as follow:

- Commercial – according to the Market Assessment, the retail development in the area is expected to be dominated by small shops and stores designed to serve the local market. The ITE land use best associated with this description is Specialty Retail Centre (Land Use 826), which the ITE *Manual* describes as "generally small strip shopping centres that contain a variety of retail shops and specialize in quality apparel, hard goods and services, such as real estate offices, dance studios, florists and small restaurants."
    - AM Peak – there is no AM Peak hour trip generation rate for a specialty retail centre during the peak hour of the adjacent street. However, there is an AM peak hour of the adjacent street traffic for a similar land use, ITE 830 Shopping Centre. To identify an appropriate trip generation rate for the Specialty Retail Centre a AM Peak hour rate has been generated by taking the proportion of AM Peak Hour Trips to PM Peak Hour Trips for the Shopping Centre (830) land use, and applying this proportion to the PM Peak hour trips for the Specialty Retail Centre (826). The AM Peak hour rate is therefore 0.70 trips/1000 sq ft.
    - PM Peak – 2.71 trips/1000 sq ft.
- Residential (MDR) – The 4 storey residential rate is taken from the City of Edmonton RA7/RA8 Apartment Housing Rate.
    - AM Peak – 0.34 trips/dwelling unit (du)
    - PM Peak – 0.40 trips/dwelling unit (du)
- Residential (LDR) – The rate for lower density infill will be an average of City of Edmonton Low Density Residential and RF 5 Row Housing.
    - AM Peak – 0.58 trips/du
    - PM Peak – 0.69 trips/du

The resulting trip rates are summarized in Table 14.

Table 14 Baseline Trip Generation Rates

Land Use	AM Peak Hour Rate	PM Peak Hour Rate
Commercial	0.70 trips/1,000 sq ft	2.71 trips/1,000 sq ft
MDR	0.34 trips/du	0.40 trips/du
LDR	0.58 trips/du	0.69 trips/du

B.2.2 Person Trip Rates

To identify person trip rates from the vehicle trip rates shown in Table 12, the baseline trip generation will be modified using adjustments for vehicle occupancy and mode share.

To convert the vehicle trip rate to person trips, first the vehicle occupancy rate of those trips must be adjusted to account for the fact that some driving trips have more than one person per vehicle.

- Commercial – The commercial land use trip rate was obtained from the ITE manual, which is an American source. To identify the vehicle occupancy for the commercial trip rates data from the 2009 National Household Travel Survey was reviewed. The commercial trips best reflect the trip type identified as “Shopping,” which, according to Table 16 of the “Summary of Travel Trends – 2009 National Household Travel Survey report, has 1.78 person trips per vehicle mile. This will be used for vehicle occupancy for trips to commercial land uses.

- Residential – The residential trip rates were obtained from the City of Edmonton, and therefore vehicle occupancy rates should also align with City of Edmonton Data. According to the 2005 City of Edmonton Household Travel Survey, for commute to work (which should reflect the majority of AM and PM Peak residential travel), approximately 72% of trips are made by a car driver, and 8% of trips are as a car passenger. This converts to a rate of 1.11 persons per vehicle.

The mode share is used to identify the final person trip rate. Since ITE data is typically from suburban and exurban sites with limited walking, cycling, and transit activity, all trips identified using ITE rates were assumed to be vehicular

(i.e., 100% driving mode share). This conservative assumption is recommended by NCHRP Report 758 if mode share data is not available.

The average mode share for all trips from the 2005 Edmonton Household Travel Survey was used for the baseline mode share for residential trips (i.e., 77% mode share to driving trips).

The person trip rates are therefore summarized in Table 15. The calculation of the person trip rate is equal to the vehicle trip rate (column A) multiplied by the vehicle occupancy (column B) divided by the vehicle mode share (column C).

Table 15 – Person Trip Rates

Land Use	AM Peak Hour				PM Peak Hour			
	*Vehicle Trip Rate (A)	Vehicle Occupancy (B)	Vehicle Mode Share (C)	***Person Trip Rate (D)**	*Vehicle Trip Rate (A)	Vehicle Occupancy (B)	Vehicle Mode Share (C)	***Person Trip Rate (D)**
Commercial	0.7	1.78	100%	**1.25**	2.71	1.78	100%	**4.82**
Residential (MDR)	0.34	1.11	77%	**0.49**	0.4	1.11	77%	**0.58**
Residential (LDR)	0.58	1.11	77%	**0.84**	0.69	1.11	77%	**0.99**

*Trip Rates expressed per 1000 sq ft for commercial and per dwelling unit for residential.

B.3 Trip Generation, Assignment and Distribution

B.3.1 Trip Generation

The total number of new person trips generated from the new development is summarized in Table 16.

Table 16 - Trip Generation Summary

Peak Hour Period	Land Use	Units	Person Trip Rate	Splits		Total New Person Trips	
				In	Out	In	Out
AM Peak Hour	Commercial	35,000 sq ft	1.25/1000 sq ft	0.62	0.38	27	17
	LDR	260 units	0.84/unit	0.20	0.80	44	174
	MDR	1040 units	0.49/unit	0.17	0.83	87	423
	Total New Person Trips					**158**	**614**
PM Peak Hour	Commercial	35,000 sq ft	4.82/1000 sq ft	0.44	0.56	74	95
	LDR	260 units	0.99/unit	0.66	0.34	169	88
	MDR	1040 units	0.58/unit	0.63	0.37	380	223
	Total New Person Trips					**623**	**406**

Internal Trip Capture/Pass-by Trips

Trips to commercial land uses are typically composed of trips from residential uses within the area (i.e., internal capture trips), trips that are from people already travelling along the street (i.e., pass-by trips), and new trips to the network that attract additional trips to the street.

The commercial development in this corridor is targeting local traffic. As such, some of the commercial trips will come from the local residential traffic. To capture this impact, 40% of the commercial traffic is considered “internal trips.” The commercial trips will be added to the corridor, but the corresponding residential trips will be removed from the medium density residential trips.

In addition to the internal trips, some of the commercial trips will also come from existing traffic already on the corridor. To account for this impact, 30% of the total commercial trips will also be removed from the trip generation.

Revised Trip Generation

The revised total person trip generation is summarized in Table 17.

Table 17 - Revised Total New Trips

Peak Hour Period	Land Use	Units	Person Trip Rate	Splits		Total New Person Trips	
				In	Out	In	Out
AM Peak Hour	Commercial	35,000 sq ft	1.25/1000 sq ft	0.62	0.38	19	12
	LDR	260 units	0.84/unit	0.20	0.80	44	174
	MDR	1040 units	0.49/unit	0.17	0.83	76	417
					Total New Trips	**139**	**603**
						742	
PM Peak Hour	Commercial	35,000 sq ft	4.82/1000 sq ft	0.44	0.56	52	67
	LDR	260 units	0.99/unit	0.66	0.34	169	88
	MDR	1040 units	0.58/unit	0.63	0.37	350	185
					Total New Trips	**571**	**340**
						911	

Mode Split & Generation of Trips by Mode

The City of Edmonton mode split for 'Main Mode of Transportation from Home' to work for key neighbourhoods surrounding the study area were identified in the 2005 Household Travel Survey. These rates, and their average compared the overall City of Edmonton mode split average, are identified in Table 18.

Table 18 - Neighbourhood Mode Split

Mode	Alberta Avenue	Parkdale	Spruce Avenue	McCauley	Average	COE Average
Vehicle (driver or passenger)	68%	66%	62%	55%	**63%**	77%
Transit	21%	23%	20%	24%	**22%**	13%
Walk	4%	4%	15%	9%	**8%**	4%
Bike	3%	2%	1%	2%	**2%**	5%
Other	4%	5%	2%	10%	**5%**	5%

As expected from the lower income nature of the study area, the average vehicle and transit mode shares are lower and higher, respectively, than the overall city average.

The average mode share rates from the study area neighbourhoods will be used for trip generation from the proposed development identified in the Market Assessment. "Other" trips will be assigned as walking trips. Total trips by mode are summarized in Table 19.

Table 19 - Total Trips by Mode

Peak Hour	Mode	Mode Share	Total Trips by Mode
AM Peak Hour	Vehicle	63%	467
	Transit	22%	163
	Walk	13%	96
	Bike	2%	15
		Total	**741**
PM Peak Hour	Vehicle	63%	574
	Transit	22%	200
	Walk	13%	118
	Bike	2%	18
		Total	**910**

B.3.2 Trip Distribution & Assignment of Vehicle Trips

Driving trips will leave the study area via the following streets:

- 111 Avenue to the West
- 112 Avenue to the East
- 97 Street to the North
- 97 Street to the South
- 95 Street to the North
- 95 Street to the South
- 101 Street to the South

Assigning driving trips exclusively to these streets creates a conservative estimate by putting more trips on busier arterial streets, which means the turning movements at those intersections will be higher. In actual practice, some trips will end prior to intersection because they will park on the street or they will access businesses off of one of the minor intersecting streets.

To identify the assignment, the results from the 2005 City of Edmonton Household Survey were reviewed to identify travel patterns between different regions. Using the City of Edmonton Household Travel Survey, general travel patterns between city regions can be identified. The regions are illustrated in Figure 23 and trip assignment is summarized in Table 20.

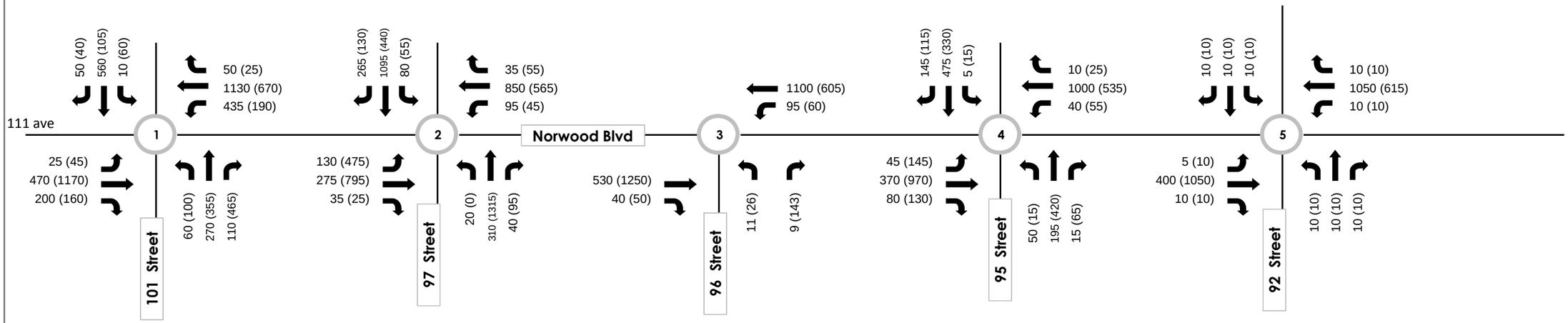
Figure 23 - HTS Regions

Table 20 - Trip Assignment to/from Study Area

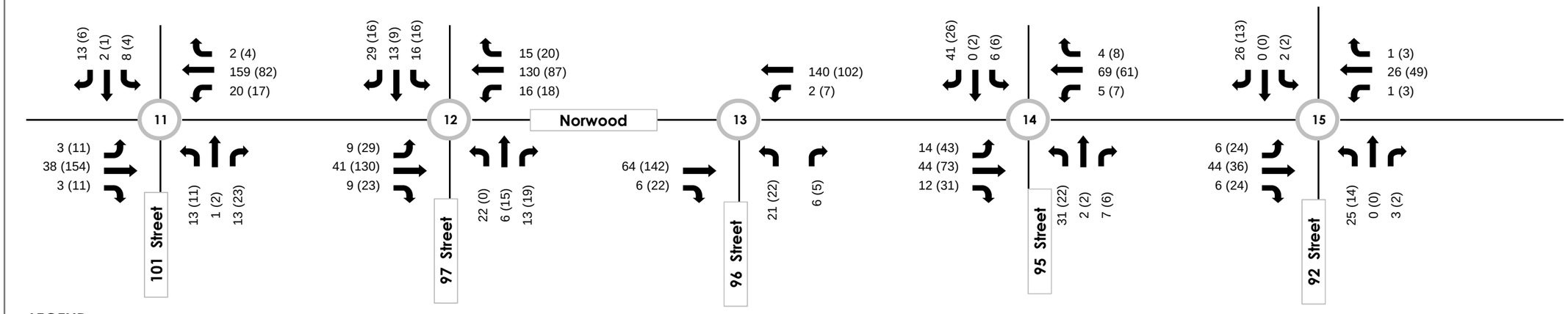
Origin / Destination Region	Distribution %	Percent assigned to given roads in the study network						
		111 Ave West	112 Av East	97 St North	97 St South	101 St South	95 St North	95 St South
Central	**26%**	40%			20%	30%		10%
NW	**14%**	75%		15%			10%	
NE	**10%**		60%	30%			10%	
SE	**14%**		60%		30%			10%
SW	**13%**	100%						
W	**11%**	100%						
Regional	**12%**	25%	25%	15%	15%		10%	10%
Summary Assignment		**47.9%**	**17.4%**	**6.9%**	**11.2%**	**7.8%**	**3.6%**	**5.2%**

Using Table 18, vehicle trips generated by the proposed infill development within the study area were assigned to the network as illustrated in Figure 24. This Figure also illustrates the current motor vehicle traffic volumes within the study area.

Existing Traffic on Norwood Boulevard



Market Assessment Trip Generation



LEGEND
AM Peak Hour Volume
(##) PM Peak Hour Volume

2017-03-28

Stantec

10160 - 112th Street
Edmonton AB

Client/Project
Norwood Boulevard

Figure No.
24

Title
Site Generated Trips

March 2017
1135300005

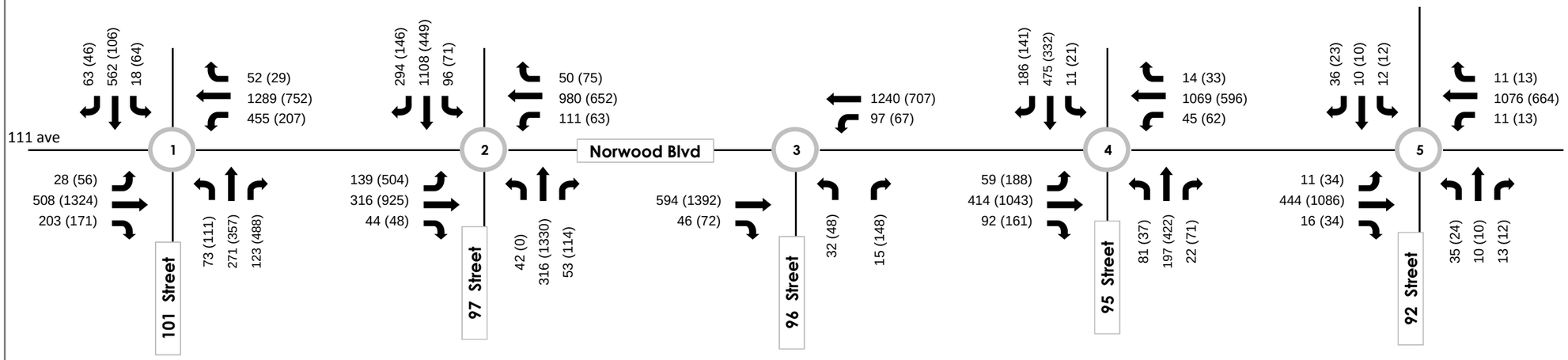
B.4 Evaluation Horizons

The analysis of the driving network was completed for two development horizons:

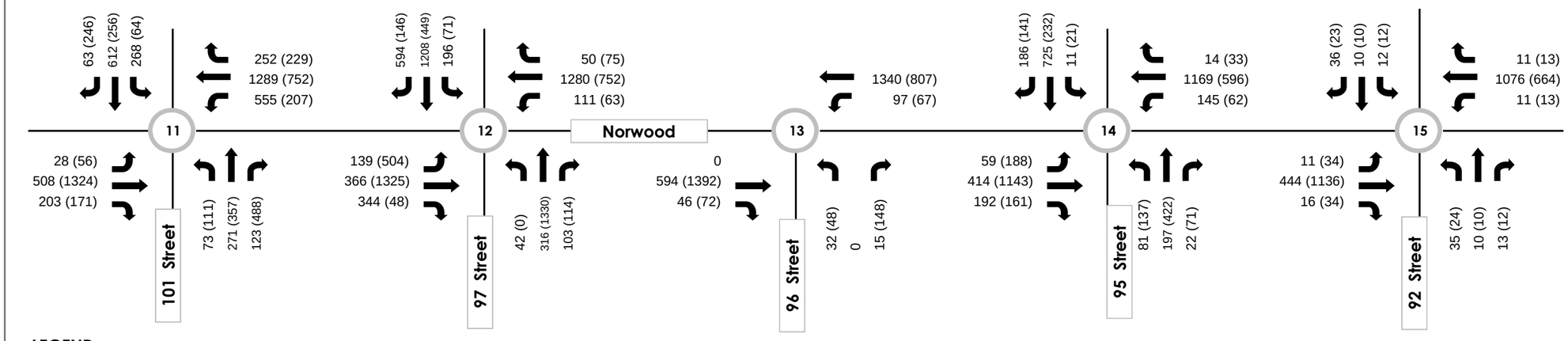
- Full build out of the Market Assessment with existing traffic volumes plus the traffic generated by the infill development for:
  - The existing street network
  - A redesigned street network
- Ultimate horizon which includes generated traffic from the full build out of the Market Assessment and projected traffic volumes based on the City of Edmonton's 2047 EMME Travel Model for:
  - A redesigned street network

Figures 25 illustrates the motor vehicle traffic volumes used for each of the future evaluation horizons.

Market Assessment Build out



Future Build Out Adjusted with City of Edmonton 2047 Volumes



LEGEND
AM Peak Hour Volume
(##) PM Peak Hour Volume

2017-03-28

Stantec

10160 - 112th Street
Edmonton AB

Client/Project
Norwood Boulevard

Figure No.
25

Title
Market Assessment Build Out Volumes

March 2017
113530005

Appendix C Synchro Analysis

Appendix C summarizes the methodology and results of the traffic analysis completed using Synchro 9 software.

C.1 Volume to Capacity Ratio

The volume to capacity ratio (v/c) is a measure that compares the lane volume to the theoretical capacity of that street. Volume to capacity ratio is generally reported at intersections, because that is where capacity is most constrained. A v/c ratio of less than 0.85 is a movement with excess capacity. A v/c ratio between 0.85 and 1.0 may experience some congestion. A v/c ratio of greater than 1.0 represents a movement that is operating beyond the design capacity and queues will be anticipated with some drivers requiring more than one green phase to travel through the intersection.

C.2 Existing Conditions

The existing conditions were evaluated using Synchro files and volumes provided by the City of Edmonton. No changes were made to those files, representing a planning horizon used by the City of Edmonton that represents existing conditions along the corridor.

The motor vehicle volumes used for the existing conditions are summarized in Figure 24.

The lane configurations and resulting v/c ratios for the existing conditions at the signalized intersections are summarized in the following tables. Where cells are greyed-out, those movements are not allowed. The PM Peak period is typically busier than the AM Peak period and operates with higher v/c ratios. All movements under existing conditions in the AM and PM Peak periods have v/c ratios less than 0.85.

101 Street	EB			WB			NB			SB		
Approach	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**
Existing Lane Config												
AM V/C Ratio	0.17	0.39		0.77	0.39		0.32		0.17	0.61		0.10
PM V/C Ratio	0.15	0.58		0.61	0.22		0.48		0.64	0.56		0.08

97 Street	EB			WB			NB			SB		
Approach	L	T	R	L	T	R	L	T	R	L	T	R
Existing Lane Config							(AM Only)	(PM Only)				
AM V/C Ratio	0.23	0.22		0.57	0.45		0.28			0.20	0.71	0.29
PM V/C Ratio	0.57	0.59		0.37	0.39		0.84			0.80	0.26	0.17

96 Street	EB			WB			NB			SB		
Approach	L	T	R	L	T	R	L	T	R	L	T	R
Existing Lane Config												
AM V/C Ratio		0.12		0.29			0.09		0.09			
PM V/C Ratio		0.26		0.18			0.09		0.10			

95 Street	EB			WB			NB			SB		
Approach	L	T	R	L	T	R	L	T	R	L	T	R
Existing Lane Config												
AM V/C Ratio	0.21	0.23		0.08	0.51	0.01	0.23			0.46		
PM V/C Ratio	0.26	0.52		0.28	0.37	0.04	0.41			0.38		

92 Street	EB			WB			NB			SB		
Approach	L	T	R	L	T	R	L	T	R	L	T	R
Existing Lane Config												
AM V/C Ratio	0.15			0.38			0.13			0.13		
PM V/C Ratio	0.38			0.23			0.13			0.13		

C.3 Market Analysis Development Horizon

The first development horizon identified for the Norwood Boulevard corridor is based on the 2016 Market Assessment report, which identifies full build out of the proposed infill development by 2026.

The existing conditions analysis identified that there is additional motor vehicle capacity in the street network. At the same time, the existing conditions assessment identified a lack of service for walking, cycling, and transit along the corridor, and infrastructure provided does not align with the Main Streets principles. To that end, the traffic volumes related to the Market Assessment infill development were applied to both the existing network and a redesigned network that eliminates one through motor vehicle traffic lane in each direction along the corridor.

The traffic volumes for the development horizon are summarized in Figure 25. Where cells are greyed-out, those movements are not allowed. Note that nominal volumes were added to movements that did not have identified volumes in the City's Synchro network.

The following tables show the volume to capacity analysis results for the study intersections with the existing configurations/timings and redesigned intersection configurations/timings.

101 Street Existing Configuration	**EB**			**WB**			**NB**			**SB**		
Approach	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**
Existing Lane Configuration												
AM V/C Ratio	0.23	0.42		0.83	0.44		0.35		0.19	0.62		0.13
PM V/C Ratio	0.20	0.65		0.73	0.25		0.42		0.67	0.24		0.09

101 Street Redesigned Configuration	**EB**			**WB**			**NB**			**SB**		
Approach	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**
Redesigned Lane Configuration												
AM V/C Ratio	0.27	0.73		0.72	0.60		0.42		0.21	0.69		0.14
PM V/C Ratio	0.18	0.88		0.81	0.35		0.48		0.74	0.27		0.10

97 Street Existing Configuration	EB			WB			NB			SB		
Approach	L	T	R	L	T	R	L	T	R	L	T	R
Existing Lane Configuration							(AM Only)	(PM Only)				
AM V/C Ratio	0.27	0.25		0.66	0.52		0.38			0.26	0.71	0.32
PM V/C Ratio	0.83	0.83		0.52	0.46		0.77			0.95	0.24	0.17

97 Street Redesigned Configuration	EB			WB			NB			SB		
Approach	L	T	R	L	T	R	L	T	R	L	T	R
Redesigned Lane Configuration							(AM Only)	(PM Only)				
AM V/C Ratio	0.42	0.33		0.55	0.77		0.37			0.25	0.70	0.32
PM V/C Ratio	0.98	1.0		0.52	0.68		0.97			0.50	0.26	0.18

96 Street Existing Configuration	EB			WB			NB			SB		
Approach	L	T	R	L	T	R	L	T	R	L	T	R
Existing Lane Configuration												
AM V/C Ratio		0.14		0.35			0.20		0.10			
PM V/C Ratio		0.34		0.24			0.30		0.53			

96 Street Redesigned Configuration	EB			WB			NB			SB		
Approach	L	T	R	L	T	R	L	T	R	L	T	R
Redesigned Lane Configuration												
AM V/C Ratio		0.21		0.52			0.22		0.10			
PM V/C Ratio		0.51		0.38			0.30		0.53			

95 Street Existing Configuration	EB			WB			NB			SB		
Approach	L	T	R	L	T	R	L	T	R	L	T	R
Existing Lane Configuration												
AM V/C Ratio	0.30	0.26		0.10	0.54	0.02	0.32			0.50		
PM V/C Ratio	0.36	0.57		0.35	0.41	0.05	0.46			0.41		

95 Street Redesigned Configuration	EB			WB			NB			SB		
Approach	L	T	R	L	T	R	L	T	R	L	T	R
Redesigned Lane Configuration												
AM V/C Ratio	0.39			0.61			0.40	0.32		0.52		
PM V/C Ratio	0.88			0.52			0.18	0.88		0.56		

92 Street Existing Configuration	EB			WB			NB			SB		
Approach	L	T	R	L	T	R	L	T	R	L	T	R
Existing Lane Configuration												
AM V/C Ratio	0.19			0.43			0.20		0.04	0.09		0.12
PM V/C Ratio	0.43			0.25			0.12		0.04	0.09		0.07

92 Street Redesigned Configuration	EB			WB			NB			SB		
Approach	L	T	R	L	T	R	L	T	R	L	T	R
Redesigned Lane Configuration												
AM V/C Ratio	0.34			0.77			0.23			0.22		
PM V/C Ratio	0.77			0.46			0.18			0.17		

This analysis shows that the existing road network will continue to have excess capacity, even with the added vehicle traffic from the growth associated with the Market Assessment. Because engagement indicated that making the

corridor safer and more accessible for people walking and taking transit, the analysis was repeated on a constrained road network.

For this analysis, one westbound through lane and one eastbound through lane was eliminated along the entire corridor. One additional revision made was to reassign the lane configuration for northbound traffic at 95th Street. This revised network allows additional space in the right-of-way to reassign to sidewalks, parking, furnishing zones, and other modes in general.

With this constrained corridor, most of the intersection movements continue to operate at v/c ratios less than 0.85. At 97 Street and 95 Street, some movements exceed 0.85, but no individual movement exceeds a v/c ratio of 1.0. This analysis indicates that certain vehicle movements at these two intersections may experience delays during the AM and PM peak hours, but will continue to function at an acceptable level even during peak periods.

C.4 Ultimate Build Out

The Synchro analysis was repeated on the ultimate horizon. The traffic volumes for this horizon are based on those identified in the Market Assessment and the 2047 City of Edmonton EMME model volumes. These volumes were shown in Figure 25.

These volumes, especially along the western portion of the corridor are quite a bit higher than the current volumes. While the entirety of the model was unavailable for review, the growth in traffic volumes seems to be related to the growth in the Quarters and Downtown areas, and is likely primarily traffic passing through the Norwood Boulevard study area.

Traffic volumes for the ultimate horizon are illustrated in Figure 16. The Synchro analysis results are summarized in the following tables. Where cells are greyed-out, those movements are not allowed.

101 Street Redesigned Configuration	**EB**			**WB**			**NB**			**SB**		
Approach	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**
Redesigned Lane Configuration												
AM V/C Ratio	0.45	0.89		1.02	0.82		0.36		0.17	0.98		0.11
PM V/C Ratio	0.20	0.83		0.79	0.43		0.58		0.78	0.50		0.45

97 Street Redesigned Configuration	EB			WB			NB			SB		
Approach	L	T	R	L	T	R	L	T	R	L	T	R
Redesigned Lane Configuration							(AM Only)	(PM Only)				
AM V/C Ratio	0.41	0.51		0.56	0.92		0.56			0.69	0.89	0.67
PM V/C Ratio	1.06	1.09		0.57	0.87		1.07			0.20	0.29	0.55

96 Street Redesigned Configuration	EB			WB			NB			SB		
Approach	L	T	R	L	T	R	L	T	R	L	T	R
Redesigned Lane Configuration												
AM V/C Ratio		0.20		0.54			0.24		0.11			
PM V/C Ratio		0.50		0.42			0.32		0.55			

95 Street Redesigned Configuration	EB			WB			NB			SB		
Approach	L	T	R	L	T	R	L	T	R	L	T	R
Redesigned Lane Configuration												
AM V/C Ratio	0.46			0.83			0.91	0.35		0.78		
PM V/C Ratio	0.90			0.45			0.56	0.90		0.47		

92 Street Redesigned Configuration	EB			WB			NB			SB		
Approach	L	T	R	L	T	R	L	T	R	L	T	R
Redesigned Lane Configuration												
AM V/C Ratio	0.33			0.76			0.37			0.36		
PM V/C Ratio	0.85			0.46			0.32			0.28		

The Synchro results indicate that some intersection movements along the corridor could exceed capacity if traffic volumes align with the long term projection.

The volumes in this analysis are based the total AM and PM peak volumes identified along the corridor in the City of Edmonton's 2047 Peak Hour Travel Demand EMME model. Travel demand model results are based on a set of assumptions, which include the location and density of population and employment growth, as well as the capacity in the road network. Reducing the capacity of part of a road network and rerunning a traffic assignment with the same land use and employment assumptions will cause the volumes to adjust: some may take an alternate route, others may shift to an alternate mode that becomes more favourable because of the increasing congestion, others may choose to take the intended trip outside of the peak hour.

By redesigning Norwood Boulevard to be a "Main Street" with less vehicle capacity but more capacity for people walking, some of that excess traffic volume would likely disappear. This concept of "traffic evaporation" is discussed in more detail in Section 3.5. As such, the movements in the analysis shown as operating with a v/c ratio > 1.0 in the 2047 scenario would likely see driving demand reduce due to the reasons outlined above, and a more likely traffic operation that matches the capacity of the intersection.