Jasper Place Area Redevelopment Plan Transportation and Mobility Assessment

Transportation and Mobility Assessment in Relation to First Draft of the Area Redevelopment Plan

Prepared for:
The City of Edmonton – Sustainable Development

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October 9, 2014

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1.0 INTRODUCTION

The study area of the Jasper Place Area Redevelopment Plan (ARP) includes the four neighbourhoods of Britannia Youngstown, Canora, Glenwood, and West Jasper Place. These established neighbourhoods in west Edmonton are primarily residential with commercial components adjacent to Stony Plain Road. The ARP process underway will provide a tool to help manage growth and change over the next 15 to 20 years.

The implementation of the west portion of the Valley Line LRT project will create three new LRT stations in Jasper Place and is expected to be one additional reason for redevelopment to occur in the area. This report was prepared to assess the transportation and mobility characteristics as land uses transition towards the levels proposed in the ARP.

1.1 REPORT ORGANIZATION

With the understanding that the multi-modal assessment conducted in this report is relatively new to the Edmonton context, additional background is included in this report and the appendices to help the reader understand the analysis. The report is organized as follows:

- 2.0 Proposed Redevelopment describes the proposed area redevelopment plan and transportation policy context.
- 3.0 Mobility Assessment Guiding Principles discusses the criteria used for the assessment of each mode. Further details are included in Appendix A.
- 4.0 General Mobility Assessment is the transportation assessment for the entire Jasper Place area and examines the overall multi-modal transportation network in the area.
- Sections 5.0, 6.0, and 7.0 analyze the three typologies of Mixed Use Hub, Transit Oriented Housing, and Active Edge Housing, respectively. Additional details for the analysis methodology and calculations are included in Appendix B.

1.2 CURRENT CONDITIONS

Field observations and a review of current transportation data yielded several key insights that inform the transportation and mobility assessment and resulting recommendations:

- Stony Plain Road and 100 Avenue are important commercial corridors that also carry through traffic between downtown and areas west of Jasper Place that are unrelated to the study area. Both of these roads can be difficult to cross for pedestrians and cyclists.
- The grid structure of Jasper Place's residential areas contributes to a connected network that provides multiple direct routes between destinations for all modes of transportation throughout most of the study area.

- Real and perceived barriers to walking and bicycling exist throughout the study area.
- Pedestrian facilities are well developed in residential areas, with sidewalks on both sides of most streets. The Stony Plain Road Streetscape project is improving the sidewalks and pedestrian crosswalks on Stony Plain Road between 149 Street and 158 Street.
- Bicycle facilities in the area are limited. This poses less of an issue on quieter residential roads, but mobility along high-volume roads such as Stony Plain Road can be inhibited by the lack of dedicated facilities.
- Most arterial intersections within the area operate within capacity; congestion is primarily experienced during the PM Peak Hour at intersections along 149 Street.
- Current parking demand appears to be accommodated by the available on-street and off-street parking, except on streets adjacent to MacEwan University
- Stony Plain Road east of 156 Street, and 156 Street south of Stony Plain Road, are both designated by the City as Transit Avenues with at least 15 minute frequency transit service during weekday peak, and weekday, Saturday and Sunday midday periods.

The four neighbourhoods of Jasper Place and their existing cycling and transit networks are shown in Figure 1.1.

1.3 OBJECTIVES

This assessment was not intended to be a traditional Transportation Impact Assessment with analysis of future background traffic, site generated traffic, and total design traffic during peak hours at specific intersections. Recognizing that the implementation of LRT will reduce vehicular capacity while increasing transit capacity, and policy direction to increase the use of active transportation, a multi-modal assessment was seen as being a more appropriate way to examine overall mobility within the area.

The objectives of this Transportation and Mobility Assessment included:

- Conducting a multi-modal assessment of the general land use plan for pedestrian, bicycle, transit, and motor vehicle trips throughout Jasper Place.
- Analyzing three specific land use typologies: Mixed Use Hub, Transit Oriented Housing, and Active Edge Housing, which represent areas with greater potential for change.
- Assessing changes in vehicular trip generation and the proposed roadway network to identify potential issues and mitigation strategies.
- Considering the effects of LRT on mobility within Jasper Place.
- Reviewing the adequacy of parking for redevelopment and recommending parking policies in redeveloping areas.

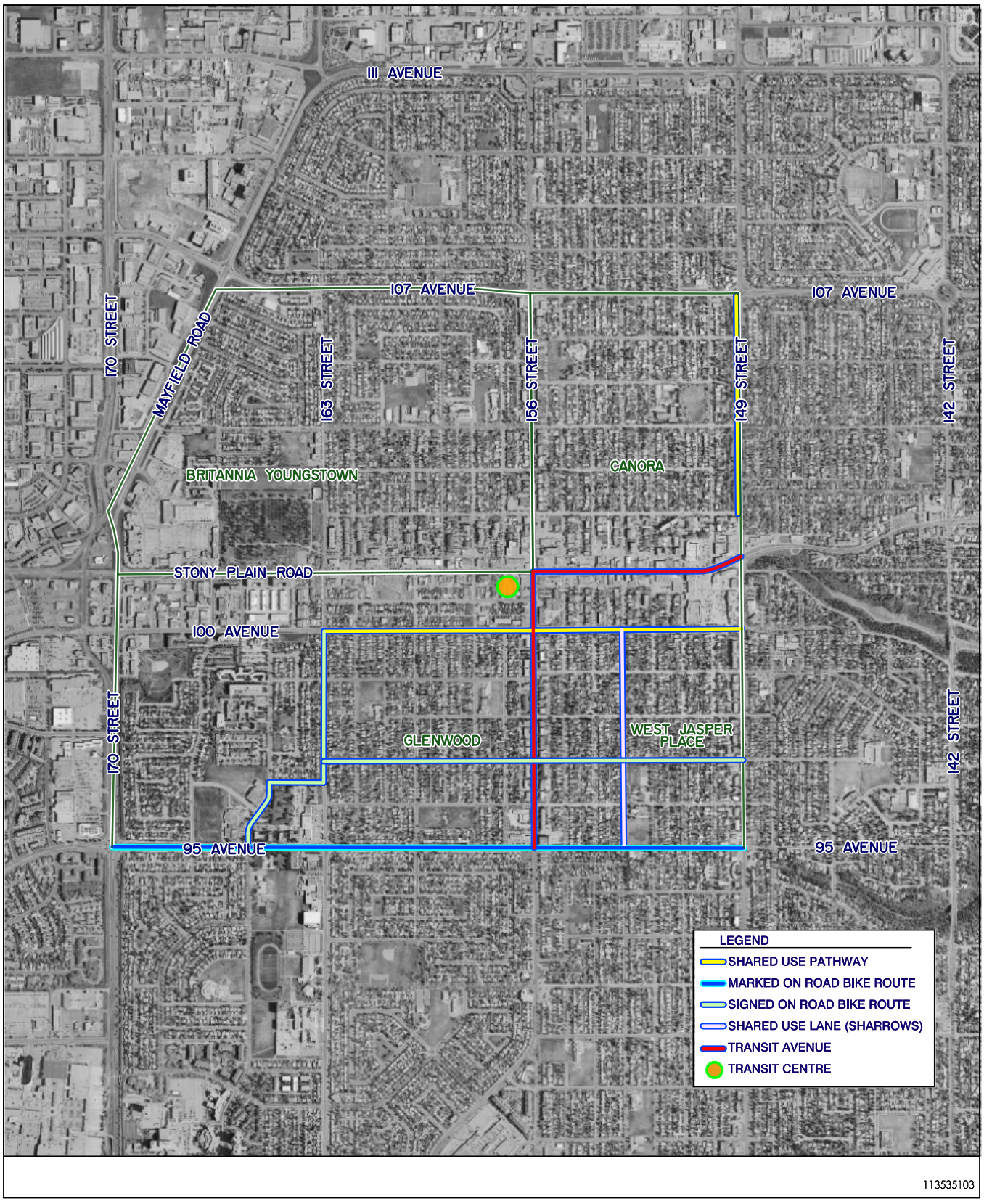

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Figure No.
1.1

Title
EXISTING INFRASTRUCTURE

2.0 PROPOSED REDEVELOPMENT

2.1 JASPER PLACE ARP

The proposed ARP shown in Figure 2.1 seeks to concentrate redevelopment opportunities on Stony Plain Road "to establish a community focal point and to generate a critical mass of positive change". The planned construction of LRT in the center of Stony Plain Road and 156 Street is expected to be a catalyst for redevelopment. The incorporation of LRT will narrow both Stony Plain Road and 156 Street to a single through lane in each direction for vehicular traffic. Three LRT stops are planned within the Study area at: 95 Avenue – 156 Street, Stony Plain Road – 156 Street (MacEwan University), and Stony Plain Road – 151 Street.

The area of redevelopment that this assessment will focus on is shown in Figure 2.2. Three specific land use typologies were analyzed in greater detail as they represent areas where there will be greater opportunity for redevelopment:

- Mixed Use Hub Development is located primarily along Stony Plain Road and is intended to increase the density on the future LRT corridor to two to eight storey buildings with commercial on the ground floor and residential or office uses on upper floors.
- Transit Oriented Housing is intended to increase the density of residential development near future LRT stations to a maximum density of row housing.
- Active Edge Housing is intended to improve the security of parks, open spaces, and major streets by orienting the front entrance of residences towards the park/street. In addition to being aligned with Crime Prevention Through Environmental Design (CPTED), Active Edge Housing encourages additional residential units.

The Small Scale Housing, Multi-family Housing and Commercial land types are expected to see more incremental changes and cumulative are unlikely to significantly change traffic and parking patterns. These areas were included in the analysis for the overall multi-modal transportation network to ensure network integration and connectivity.

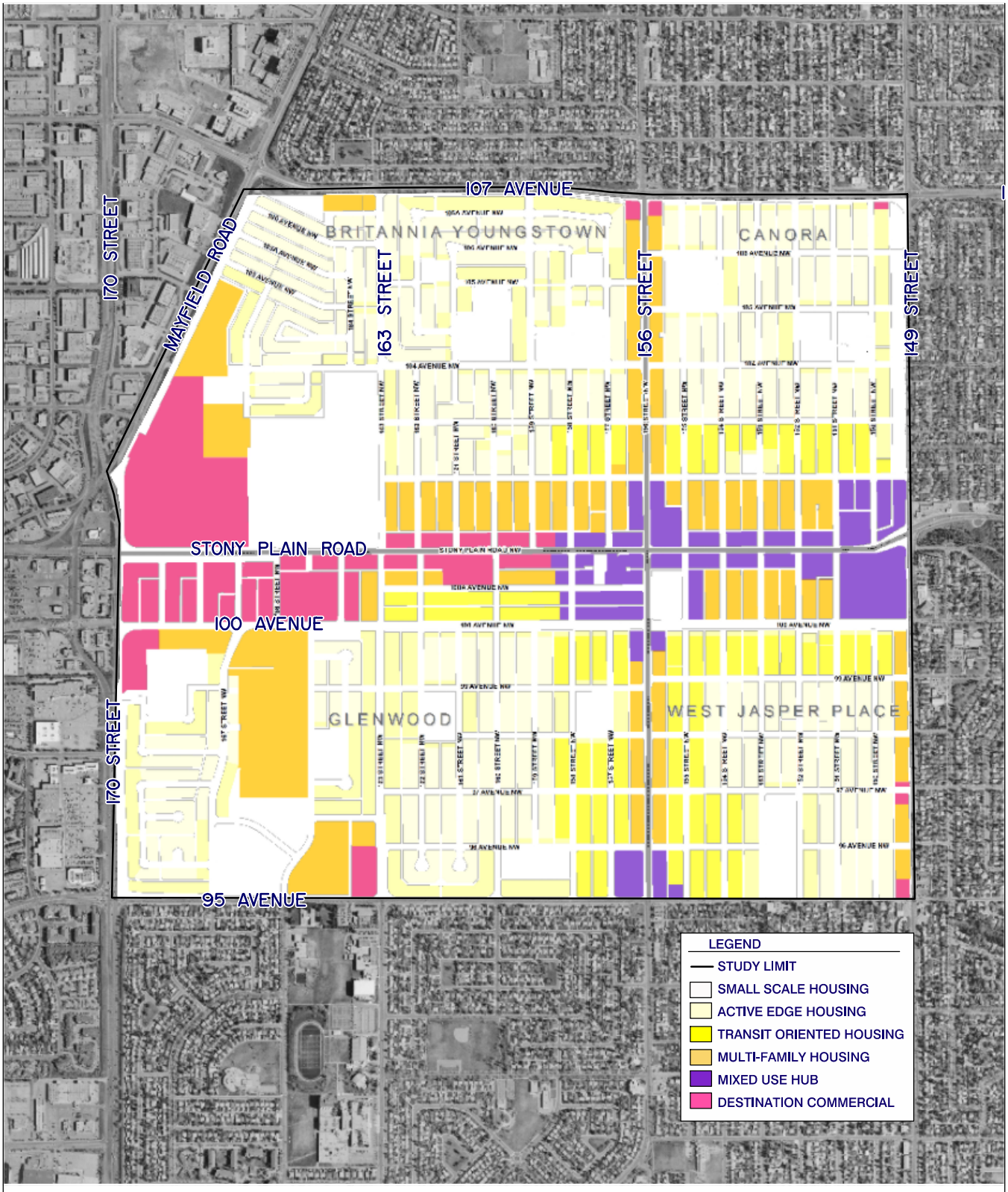

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Figure No.
2.1

Title
LAND USE PLAN

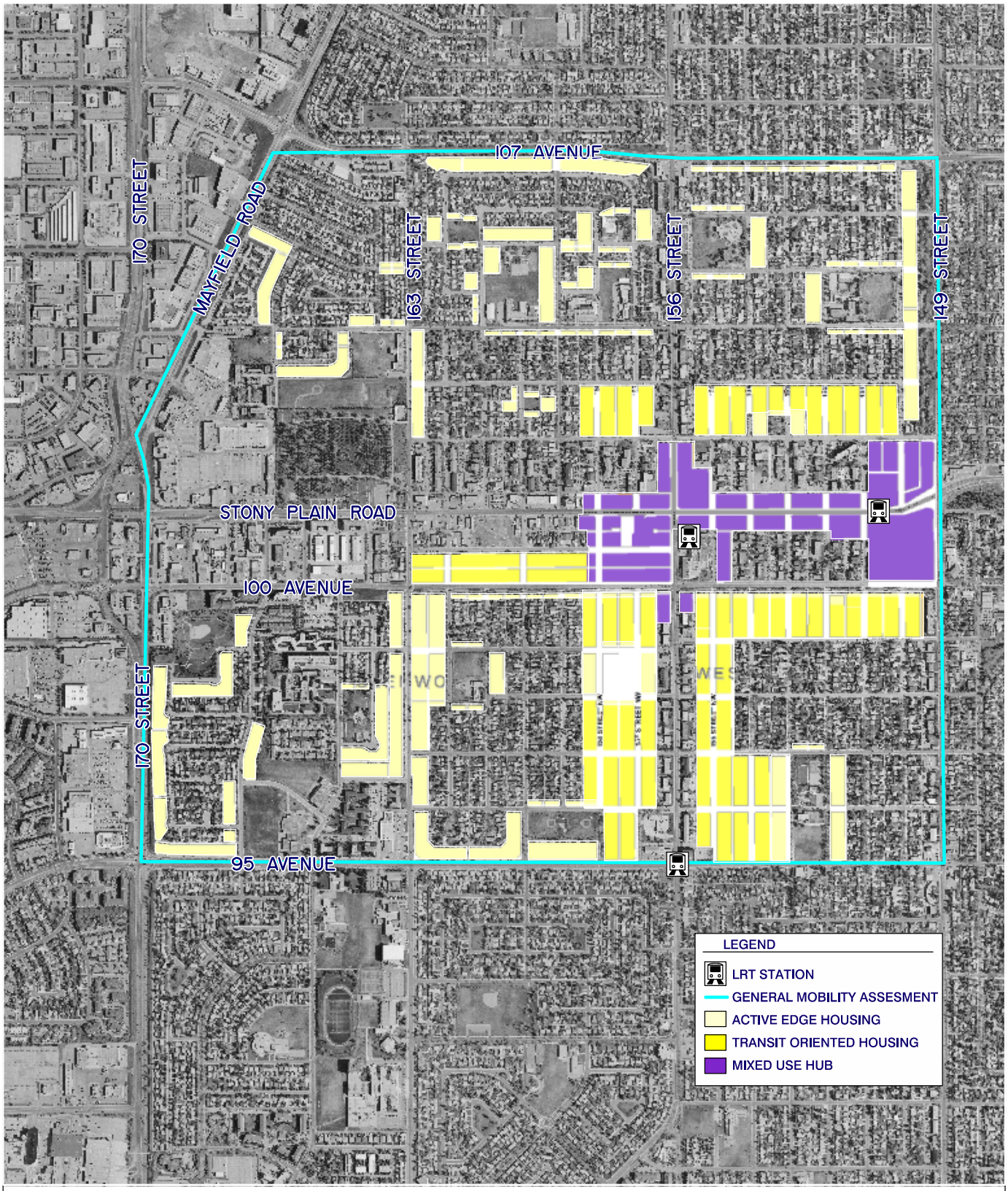

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Figure No.
2.2

Title
PRIMARY ANALYSIS AREAS

2.2 POLICY CONTEXT

When development or redevelopment occurs, most cities throughout North America, including Edmonton, require the completion of a Transportation Impact Assessment. Traditionally, this assessment focuses exclusively on vehicular traffic with conclusions informed by a "predict and provide" philosophy. This philosophy stipulates the construction of whatever improvements are necessary to keep post-development traffic on the adjacent road network operating better than a specified criterion to minimize delay for motor vehicles. Minimal consideration is typically given in these types of studies to pedestrians, cyclists, transit and the overall transportation network further from the development.

This "Transportation and Mobility Assessment" is not intended to be a typical traffic impact assessment. The redevelopment plan proposes a combination of increased density with transit oriented development and the introduction of a reliable LRT line, all of which would result in a transportation outcome that is not sufficiently explained through conventional transportation planning and engineering methods. The following analysis gives equal consideration to travel via transit, walking, cycling, and motor vehicle, balancing the level of service provided for all modes.

The proposed approach is consistent with *The Way We Move*, Edmonton's Transportation Master Plan, which:

- Seeks to create "more livable complete communities where jobs, retail, medical, recreational, cultural, and entertainment services are integrated within residential areas" to minimize travel distances and traffic volumes.
- Understands that car dependence leads to increasing congestion and the perceived need to build more roadways, which is "a fiscally and environmentally unsustainable cycle".
- Aims to enhance use of public transit and active modes of transportation.
- Recognizes that congestion will increase as Edmonton grows and "Physical, financial and community constraints in many areas make it unfeasible or even undesirable to build or expand roads to alleviate congestion".

These policies informed the analysis and recommendations contained in this report.

3.0 MOBILITY ASSESSMENT GUIDING PRINCIPLES

This mobility assessment includes a multi-modal assessment of the level of service provided for each of the four modes: walking, biking, transit, and motor vehicles (traffic and parking). Each of the modes has different requirements. The guiding principles discussed below were applied in this assessment to provide recommendations and identify areas for improvement. Appendix A includes further discussion on the rationale and analysis criteria used for the analysis of each mode.

The City of Edmonton modeled several learning scenarios to support the Jasper Place ARP[1]. These learning scenarios represent several hypothetical development scenarios under low and high change cases for a 20 year horizon. A high change case was defined as redevelopment of 30% of the parcels in Jasper Place. This report similarly assumed 30% redevelopment in the study area for the assessment. This is because the 100% build out typically analyzed in greenfield conditions is not realistic in redevelopment conditions, and 30% was seen as high enough to capture the maximum potential outcome of the land use opportunities provided in the ARP.

The construction of LRT will likely be a catalyst for redevelopment; however, the implications of redevelopment without provision of LRT have also been considered.

3.1 WALKING

A walkable area is typically one that has an attractive environment for pedestrians, provides a high level of connectivity for pedestrian trips, and has a sense of "place" that makes it a destination in its own right. The typical elements of a walkable environment that have been considered in this study are summarized in the following Table 3.1.

[1] City of Edmonton. *Jasper Place Area Redevelopment Plan Learning Scenarios.* October 2013.

Table 3.1 – Elements of a Walkable Environment

Attribute	Description of Attribute
Space	There is appropriate space provided along a street for pedestrians. 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 pedestrians.
Crossings	Pedestrian crossings are conveniently located along desired travel paths and are comfortable and safe.
Security	Pedestrians feel comfortable walking alone at all times of the day and areas are overlooked by other land uses.
Connectivity	Direct routes with minimal deviation exist between destinations that reduce travel times.

The City of Edmonton's *Complete Streets Guidelines*[2] also offer guidance on several of these elements.

3.2 CYCLING

Three key elements were identified when evaluating the bicycle transportation network in the study area: Connectivity, Cycling Infrastructure (e.g. bike lanes), and End-of-Trip Facilities. Connectivity and infrastructure are global concepts that only apply over the entire study area. 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. The typical elements of creating a positive environment for cyclists that have been considered in this study are included in Table 3.2.

Table 3.2 – Elements of a Cycling Environment

Element	Description of Attribute
Space	Comfortable and safe cycling infrastructure that separates cyclists from motor vehicles encourages less experienced cyclists and improves safety.
Facilities	End of trip facilities, including secure bicycle parking, lockers, and showers, are provided.
Connectivity	Direct routes with minimal deviation exist between destinations that reduce travel times.

These elements will be further discussed in the assessment.

[2] City of Edmonton. *Complete Streets Guidelines.* 2013.

3.3 TRANSIT

Successful transit service can be characterized by seven User Expectations[3] as summarized in Table 3.3. Some expectations, such as cost, are usually assessed on a network wide basis, whereas others may be influenced by local development.

Table 3.3 – Transit User Expectations

	User Expectation	Description of User Expectation
1.	*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.
2.	*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.
3.	*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.
4.	*It is a good use of my* money.	Cost of travel is reasonable.
5.	*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.
6.	*I can* trust *it.*	Transit service is reliable, actual travel times match schedules.
7.	*It gives me* freedom *to change my plans.*	Service is flexible enough to allow for spontaneous unscheduled trips.

The seven User Expectations above were evaluated for the proposed Jasper Place ARP for both the existing transit service and to qualify the effects of LRT.

[3] See Walker, Jarrett. *Human Transit*. Island Press, Washington, DC: 2012.

3.4 MOTOR VEHICLES AND PARKING

Motor vehicle traffic is being approached differently in this Transportation and Mobility Assessment compared to a typical Transportation Impact Assessment, as described earlier. 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, motor vehicle traffic was assessed with an understanding that some delay is acceptable because of balancing service for other modes.

Traffic analysis was completed at key arterial – arterial intersections in the study area. For congested intersections, the extent to which intersections are overcapacity was considered. If intersections were found to be considerably overcapacity, an increase in vehicular capacity was 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 was also considered.

Traffic calming refers to various measures that are used to manage motor vehicle volumes and speeds in residential areas. With increased delay on arterial roads, vehicles may shortcut through local and collector roadways. Traffic calming measures should be implemented carefully as they can also inconvenience local residents and be of concern to emergency response providers. As discussed with Transportation Services, our analysis does not explicitly recommend particular Traffic Calming measures at specific locations. However, potential problem areas and solutions were identified.

Existing parking supply was also assessed relative to the change in parking demand caused by redevelopment. The applicability of various policies to moderate parking demand was also assessed, including:

- Transit Incentive Programs.
- Parking Design to support transit and active modes.
- Carsharing.
- Parking Requirements for redevelopment and unbundled parking.
- Shared Parking between different developments and users.
- On-Street Parking management and pricing.
- Parking Management Program.
- Parking locations (e.g. behind developments rather than street-fronting)

4.0 GENERAL MOBILITY ASSESSMENT

Walking, cycling, transit trips, and automobile travel were first assessed relative to the entire Jasper Place area. For a number of these travel modes (cycling and transit) it is important to ensure that there is a connected network throughout the study area that also connects to larger regional nodes. Alternatively, other modes such as walking and driving need to be analyzed at both study area-wide and site-specific levels. An assessment of each travel mode at this overall scale is provided in the subsequent sections.

4.1 WALKING

As described in Section 3.0, a walkable community is one that offers pedestrians a safe and comfortable way of traversing the street network while also providing an interesting travel environment. In the design of walkable communities, several factors need to be considered, such as connectivity, safety, crossing treatments, and pedestrian comfort. These factors were considered when generating recommendations for the proposed redevelopment plan.

4.1.1 Existing Conditions Summary

Sidewalks exist on both sides of most streets in the study area and the sidewalks in Canora and West Jasper Place were recently rehabilitated and widened as part of the neighbourhood renewal program. On the busier arterials, however, existing sidewalks may not provide adequate separation from traffic for pedestrians to feel comfortable and safe. To address this issue, the Stony Plain Road Streetscape project is currently installing wider sidewalks on Stony Plain Road between 149 Street and 158 Street.

The grid network that forms the majority of the road network in this area provides for high connectivity. A connected network has a high number of intersections, shorter links between intersections, and fewer dead ends (cul-de-sacs). By dividing the number of links by the number of intersections, a connectivity index can be calculated for a given area. The connectivity of Jasper Place is relatively high, scoring an average of 2.0, which is typical for a grid neighborhood. For comparison, a Connectivity Index in excess of 1.9 is considered the ideal level of connectivity for walking and biking in a high activity area.

Pedestrians may legally cross a road at every intersection unless otherwise signed. These crosswalks may be uncontrolled, or controlled with one of several types of pedestrian control devices in order of increasing protection for pedestrians:

- Marked crosswalks (pavement markings and signage).
- Pedestrian actuated amber flashers.
- Pedestrian actuated half signals that only stop traffic on the main street for pedestrians.

- Full traffic signals.

Mid-block crosswalks not associated with an intersection are always controlled. Pedestrians may not feel comfortable crossing a busy road at an uncontrolled crosswalk so that although a crossing is legal, the road may act as a barrier to pedestrian movement.

Connectivity to destinations outside of the study area requires the crossing of an arterial roadway in most cases, which can be a barrier to walking trips. To the south, east, and north, controlled crosswalks on 95 Avenue, 149 Street, and 107 Avenue are generally available every two to three blocks and development continues to conform to the grid pattern of Jasper Place. To the west, pedestrian movement is somewhat more challenging with controlled crosswalks on Mayfield Road and 170 Street occurring at wider spacing.

Some pedestrian facilities are also discontinuous. One type of discontinuity occurs where controlled crosswalks at an intersection lack connecting sidewalks. An example of this occurs at the intersections of 103 Avenue and 170 Street / Mayfield Road, which impedes pedestrian connectivity between the study area and destinations to the west and north. A second type of discontinuity occurs where sidewalks lead to a pedestrian crossing that has been prohibited. For example, due to the use of a half signal at a 4-way intersection, pedestrians wishing to cross the west leg of 107 Avenue - 159 Street must instead use the east leg, necessitating three crossings instead of one.

4.1.2 Analysis

Having meaningful destinations in close proximity is an important factor that people consider when they are deciding whether to walk or bike. There are two main potential destinations within walking distance for residents of Jasper Place including:

- Mayfield Common and commercial areas on Stony Plain Road west of 158 Street.
- Existing commercial and office areas on Stony Plain Road between 158 Street and 149 Street that will intensify with redevelopment.

The three future LRT stations are expected to generate additional pedestrian trips that further strengthen the need for investment in the pedestrian realm along high-use walking routes. Most of the following analysis is also applicable prior to implementation of LRT as the LRT stations on Stony Plain Road coincide with the Mixed Use Hub and both are expected to be significant pedestrian destinations.

4.1.2.1 Primary and Secondary Pedestrian Activity Area

A review of the walking network with respect to the land use plan and future LRT and three LRT stations in the area assisted in the identification of primary and secondary pedestrian activity areas. Stony Plain Road between 158 Street and 149 Street will be a primary pedestrian activity area given the future transit stations and the mixed-use hub offering a number of places for

people to walk to. The streetscape design from 149 Street to 158 Street inclusive has been addressed through the Stony Plain Road Streetscape project. This project is intended to improve the walking environment along Stony Plain Road through measures such as:

- Wider sidewalks to provide space for pedestrian movement and lively street activity.
- Reconstruction of controlled crosswalks to increase visibility for drivers and decrease crossing distances by using curb extensions.
- Trees and street furniture to enhance the boulevard and separate pedestrians from vehicular traffic.

An example of the streetscape treatment for this area is shown in Figure 4.1.

Figure 4.1 – Stony Plain Road Streetscape Improvements

The extents of the streetscape project are from 149 Street to 158 Street, consistent with the mixed use hub area identified in the ARP. It is worth noting that there remain sections of narrow sidewalk after the streetscape project, an example of which is shown in Figure 4.2. These narrow sections are likely constrained by limited right of way, but opportunities to widen should be considered if adjacent properties are redeveloped or when LRT is constructed.

Figure 4.2 – Stony Plain Road Streetscape (Narrow Sidewalk)

Stony Plain Road between 149 Street and 158 Street was identified as a Primary Pedestrian Activity Area. As part of this study, due to the adjacent land uses proposed in the ARP four Secondary Pedestrian Activity Areas were also identified:

- Stony Plain Road, 159 Street to 170 Street
- 156 Street, 95 Avenue to 107 Avenue
- 149 Street, 95 Avenue to Stony Plain Road
- 163 Street, 95 Avenue to Stony Plain Road

The Secondary Pedestrian Activity Areas are the streets in the study area that will have higher pedestrian activity due to the intensity and type of adjacent land uses and the connectivity that the street provides to the Primary Pedestrian Activity Areas. These Secondary Pedestrian Activity Areas typically front multi-family residential and commercial areas. On Secondary Pedestrian Activity Areas it is expected there will be lower pedestrian activity than in the Primary Pedestrian Activity Area; however, sidewalks should still be at least 1.8 metres wide. Sojourning, or staying, activities should be accommodated where appropriate through additional width in the frontage zone and most land uses should be street-fronting and pedestrian scaled. All vehicular design treatments (e.g. small curb radii) should be pedestrian friendly. Loading and parking should be encouraged to occur in the rear of buildings, and landscaping along the corridor should be provided to at least the City's minimum standards.

A standard 1.5 metre wide sidewalk should be sufficient for all other streets. Most streets in Jasper Place already have sidewalks on both sides. Gaps in the sidewalk network, and sidewalks that are less than 1.5 metres wide, should be improved as part of the ongoing neighbourhood renewal program. If space permits, pedestrians may still be separated from traffic with boulevards and vehicular design treatments should be for slow vehicle speeds.

4.1.2.2 Directness and Connectivity

The existing grid network offers relatively good connectivity in most of Jasper Place. Good connectivity is also achieved through the provision of continuous walking infrastructure with sidewalks that continue on either side of a crosswalk, sidewalks on both sides of the street and crossing spacing that offers convenience, comfort, and safety to pedestrians crossing the street.

Glenwood and Britannia-Youngstown have reduced connectivity west of 163 Street compared to the rest of Jasper Place. In Britannia-Youngstown, an irregular grid pattern, the existing Cemetery, and fencing along the perimeter of Mayfield Common reduce pedestrian connectivity. East-west linkages in Glenwood are reduced south of 100 Avenue by several impermeable Multi-Family Housing developments between 165 Street and 167 Street. Additional pedestrian connections should be considered as opportunities arise due to redevelopment, especially for the Multi-Family Housing in Glenwood where connections between 165 Street and 167 Street can be created on 99 Avenue, 98A Avenue, and/or 97 Avenue.

4.1.2.3 Crosswalk Treatments

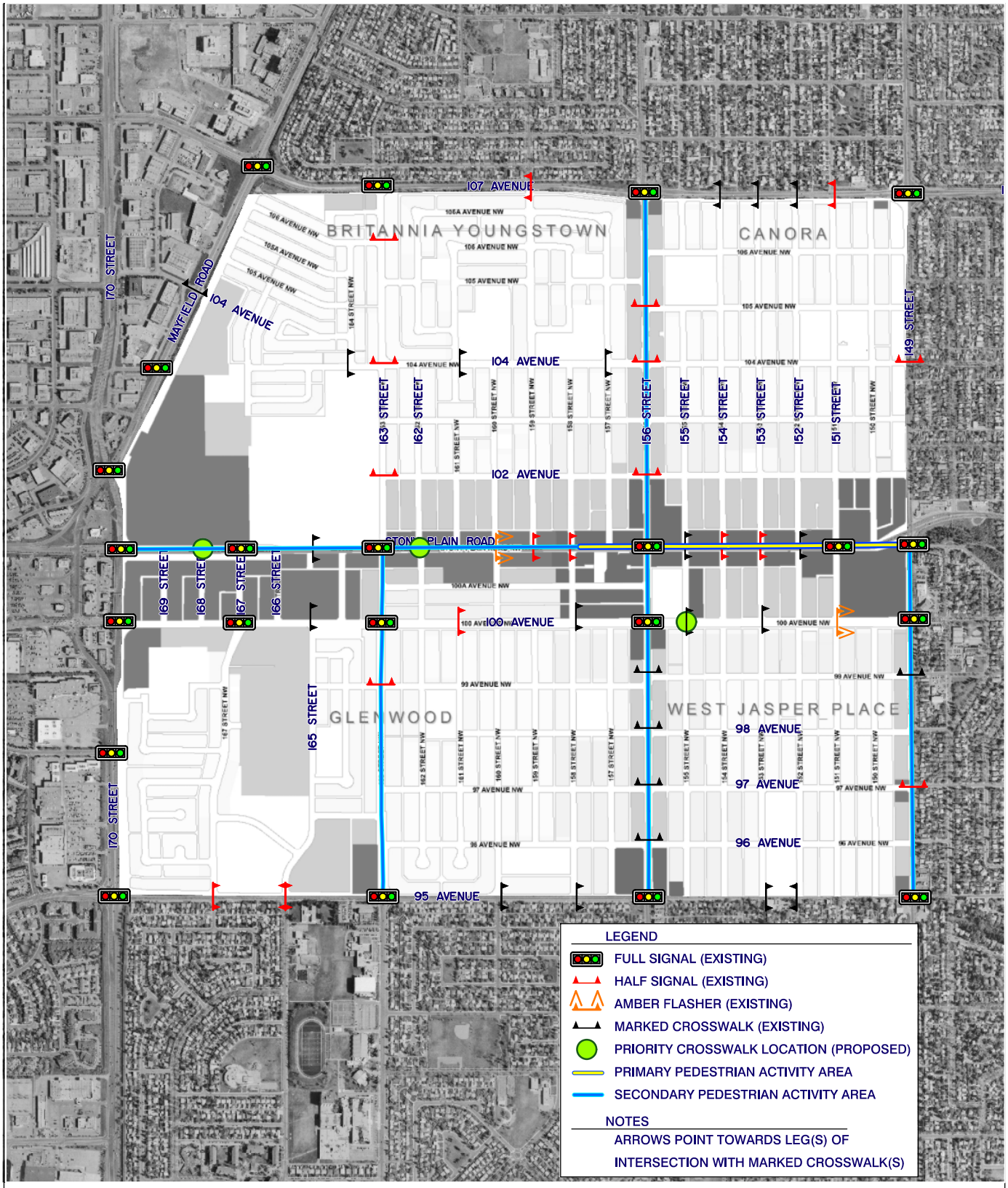
Several types of controlled crosswalks can be considered in the study area. This preliminary identification is based on an understanding of the various land use activities in the area, the Stony Plain Road Streetscape Plan that covers improvements between 149 Street and 158 Street, and the intent to provide more controlled crosswalks to improve walkability, a desirable community asset highlighted through the public engagement activities for the ARP. It should be noted that the changes to the intersections would require detailed analysis to determine the appropriate type of pedestrian control.

West of 158 Street, intersections on Stony Plain Road are spaced at about 100 m. While a controlled crosswalk can be installed at every intersection, we suggest that the following locations be analyzed further to determine the appropriate control:

- A controlled crosswalk at Stony Plain Road - 168 Street is recommended to facilitate access to Mayfield Common from areas south of Stony Plain Road.
- Controlled crosswalks should be located at four-way intersections, which contribute more to connectivity than T-intersections.
- A controlled crosswalk at 162 Street will improve overall connectivity and provide a direct route to the health centre.

The locations of existing controlled crosswalks on 100 Avenue and 149 Street appear to be appropriate. Uncontrolled and marked crosswalks may be uncomfortable for pedestrians who feel there is insufficient visibility or find that vehicles fail to yield. Existing marked crosswalks that consist of only signage and pavement markings should be reviewed with redevelopment to determine if upgrading to amber flashers or half signals is appropriate. The review should focus on crosswalks connecting to the Mixed Use Hub and LRT, which are expected to be significant pedestrian traffic generators, such as 100 Avenue at 155 Street. Additional analysis in conjunction with feedback from local residents is required to determine the appropriate pedestrian control at the above crosswalks.

Figure 4.3 illustrates the existing controlled crosswalks, potential high-activity pedestrian areas, and priority crosswalk review locations within the study area.



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4.3

Title
EXISTING AND PROPOSED PEDESTRIAN INFRASTRUCTURE

4.2 CYCLING

4.2.1 Existing Conditions Summary

Currently, a wide range of facilities exist in the study area, including on-street bike lanes, shared use lanes, signed bicycle routes, and shared use paths. During the morning rush hours (7:00 AM to 9:00 AM) there is a reserved eastbound bus / taxi / bike lane on Stony Plain Road east of 158 Street. On 95 Avenue, there are bike lanes along the study area boundary. Shared use paths are available for cyclists running parallel to 100 Avenue and on 149 Street between 102 Avenue and 107 Avenue.

The City has installed bicycle racks at several intersections on Stony Plain Road on the east side of the study area in conjunction with new curb extensions, but the provision of on-street bicycle parking within the area is not significant.

4.2.2 Analysis

4.2.2.1 Bicycle Facilities

As described in Appendix A, Edmontonians can be divided into several different categories based on their propensity for cycling. The single largest group are the 'Interested but Concerned' who could be persuaded to cycle more if safer routes/facilities are available.

Based on the context of the area, bicycle facilities will likely consist of:

- Shared use pathways (Figure 4.4): off-road paths open to pedestrians and cyclists.
- Shared use lanes (Figure 4.5): typically lower traffic roads marked with sharrow pavement markings and signage to remind motorists to share the road with cyclists.
- Bike lanes (Figure 4.6): marked on-road lanes exclusively dedicated for cyclists.

Low traffic volumes and wide carriageways on local residential streets in the remainder of the study area should be comfortable enough for cyclists to provide the necessary coverage in the remainder of the study area.

Figure 4.4 – Shared Use Pathway

Figure 4.5 – Shared Use Lane

Figure 4.6 – Bike Lane

The Bicycle Transportation Plan[4] identifies two 'Connector System' corridors within the study area. One corridor along 154 Street provides north-south connections past the extents of the study area, and the second on 104 Avenue provides east-west connectivity in the area. The City has designated 153 Street as a signed bicycle route. If the preferred cycling corridor is moved one block east from 154 Street to 153 Street, this would allow both corridors to make use of the traffic calming effect provided by the diagonal diverter at 104 Avenue – 153 Street.

Based on the proposed redevelopment along Stony Plain Road and the future transit-oriented development, a network of bicycle facilities is proposed. The proposed network shown in Figure 4.7 is based on the guiding principles of providing connectivity to the region and local activity centres, increasing safety for people who choose to use a bicycle for their travel, and providing intuitive wayfinding.

[4] City of Edmonton. *Cycle Edmonton: Bicycle Transportation Plan.* 2009.

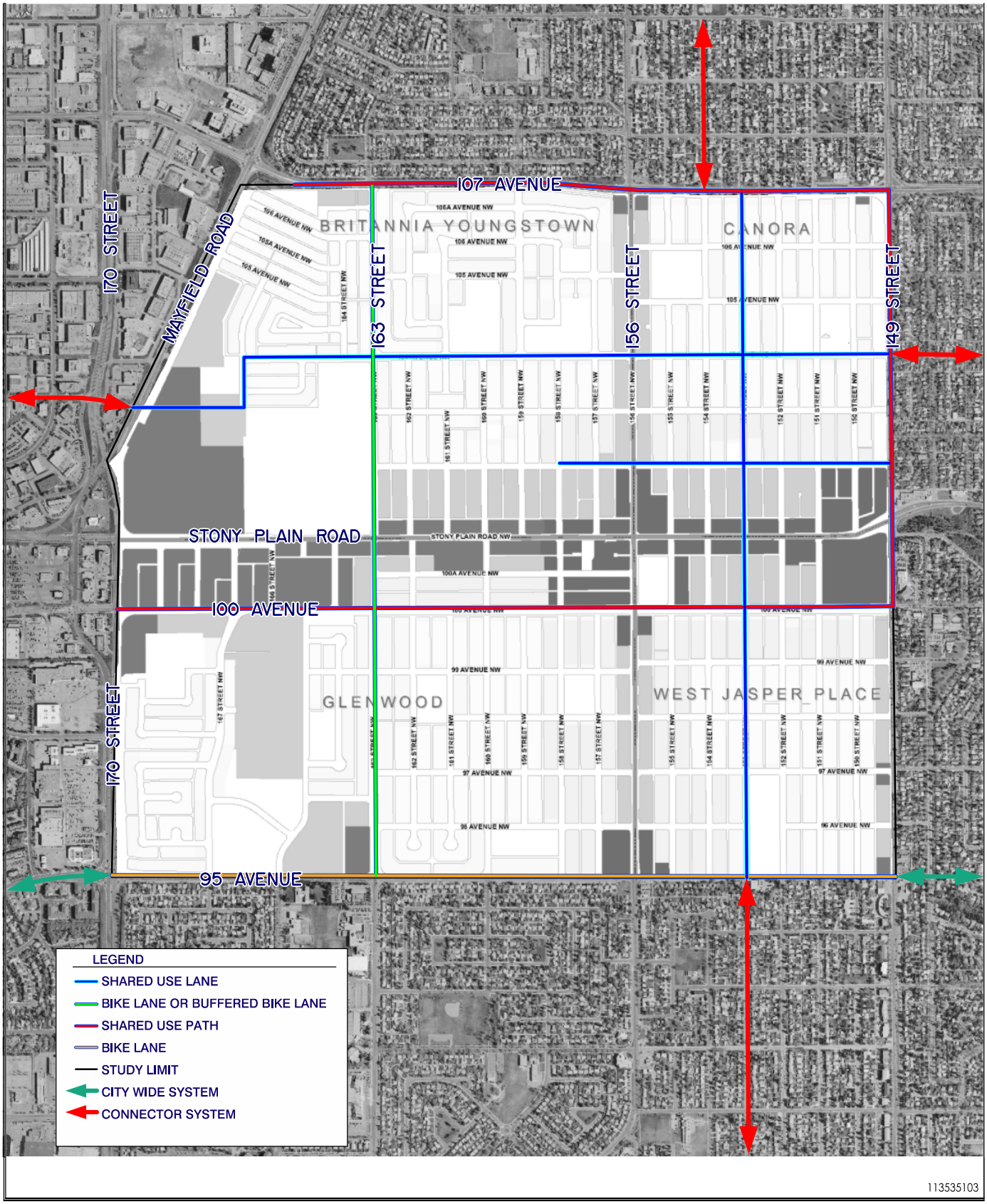

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Figure No.
4.7

Title
PROPOSED CYCLING NETWORK

As shown, a variety of bicycle treatments are proposed within the study area. Some of these are existing routes, some are new routes, and others represent new bicycle facilities on planned or existing routes. The existing signed on road bike route (97 Avenue, 96A Avenue, and 165 Street) was found to possibly be redundant if quality cycling facilities are provided on 100 Avenue and 95 Avenue. Like most local roads within the study area, the on road bike route will continue to provide a comfortable environment for cyclists, but does not need to be part of the formal cycling network. The type of bicycle facility recommended and the rationale for their inclusion in the area is provided in Table 4.1.

Similar to the pedestrian network, the cycling network will provide connections to LRT but is not dependent on implementation of LRT. Routes that support the existing commercial development and proposed Mixed Use Hub redevelopment on Stony Plain Road are logical even without LRT on Stony Plain Road.

Table 4.1 - Proposed Bicycle Network

Bicycle Facility	Potential Facility Treatment	Rationale
163 Street *95 Avenue to 107 Avenue*	Bike Lanes or Buffered Bike Lanes	This four-lane street currently carries less than 10,000 vehicles per day and is a candidate for alternative cross-sections that better accommodate cyclists.
153 Street *95 Avenue to 107 Avenue*	Shared Use Lane	Provides north-south connectivity for the east portion of the study area and access to the Mixed Use Hub. Following the existing signed bicycle route, this replaced the 154 Street connection in the Bicycle Transportation Plan. As part of the City's overall network this route will connect to industrial areas north of 114 Avenue.
149 Street *107 Avenue to 100 Avenue*	Shared Use Path	107 Avenue to 102 Avenue is being constructed by the City and will provide access to the Mixed Use Hub. A potential extension from 102 Avenue to 100 Avenue should be considered in coordination with LRT design.
107 Avenue *149 Street to Mayfield Road*	Shared Use Path	Facility proposed by the City when 107 Avenue is upgraded in advance of LRT being constructed. Will provide east-west connectivity in the north of the plan with potential for extending into downtown.
104 Avenue *Mayfield Rd to 149 Street*	Shared Use Lane	Provides east-west connectivity for the north portion of the study area. Part of the City's overall bike network that will connect to industrial areas west of 170 Street. The crossing of Mayfield Common and 170 Street / Mayfield Road will require further review.
102 Avenue *158 Street to 149 Street*	Shared Use Lanes	Provides parallel east-west connectivity for access to commercial area on Stony Plain Road from the north.
100 Avenue *149 Street to 170 Street*	Shared-Use Path	Existing shared use path east of 163 Street provides parallel east-west connectivity for access to Mixed Use Hub from the south. Extending to the west will provide access to commercial area with possibility of crossing 170 Street.
95 Avenue *149 Street to 170 Street*	Bike Lane	Existing bike lane provides regional east-west connectivity to the south portion of the study area. This lane continues west to 189 Street.

The bicycle facilities proposed for the area include buffered bike lanes, bike lanes, shared use lanes and shared use pathways. The description of each facility type from the *Complete Streets Guidelines* is provided in Appendix A. These facilities will improve the safety and comfort of potential riders. It should be noted that these bike facilities not only support the proposed redevelopment in the area, but also support the existing land uses and destinations, such as schools, religious institutions, and commercial nodes.

4.2.2.2 Connectivity and Directness

Connectivity and directness were two elements that were important in the development of the proposed bicycle network. Directness is a concept relating the quality of a route's alignment by comparing the distance to a destination using a bicycle facility compared to the straight line distance. To determine whether the proposed network has appropriate connectivity or directness, the ratio between the straight line and actual distance, called the Detour Factor, is calculated.

The Dutch *Design Manual for Bicycle Traffic*[5] recommends the lowering of detour factors in order to enhance the quality of a network and notes that good networks typically range between values of 1.24 to 1.5. In order to obtain this measure for Jasper Place, 20 potential origins and 18 potential destinations were located creating 360 potential trips for analysis. The various start and end points were an average of 1.2 kilometres apart using a straight line distance. When taking into account the use of the proposed bicycle facilities and existing local roads, the average trip length was 1.6 kilometres, giving a detour factor of 1.3.

The detour factor of 1.3 for the proposed bike network falls in the lower end of the range identified by the CROW manual and suggests that the proposed bicycle network would provide a high level of service to users. It should be noted that the low detour factor is partially a result of the evenly spaced grid layout of the bicycle network, which provides a measure of flexibility for trip planning and enables direct routes to destinations across the area.

4.2.2.3 End-of-Trip Bike Facilities

End-of-trip bike facilities can be seamlessly integrated into the overall study area. End-of-trip bicycle facilities should be focused at the numerous destinations throughout the study area. In particular, the transit stations and mixed use hub along Stony Plain Road will require end-of-trip bike facilities to allow users that have travelled there on the proposed on- and off-street bicycle facilities to park their bicycles in a safe and secure location. The amount of parking and the specific location and design would be addressed at the development permit stage.

[5] CROW. *Design Manual for Bicycle Traffic.* 2007.

4.3 TRANSIT

The proposed ARP concentrates redevelopment opportunities on Stony Plain Road to take advantage of existing transit service and future LRT.

4.3.1 Existing Conditions Summary

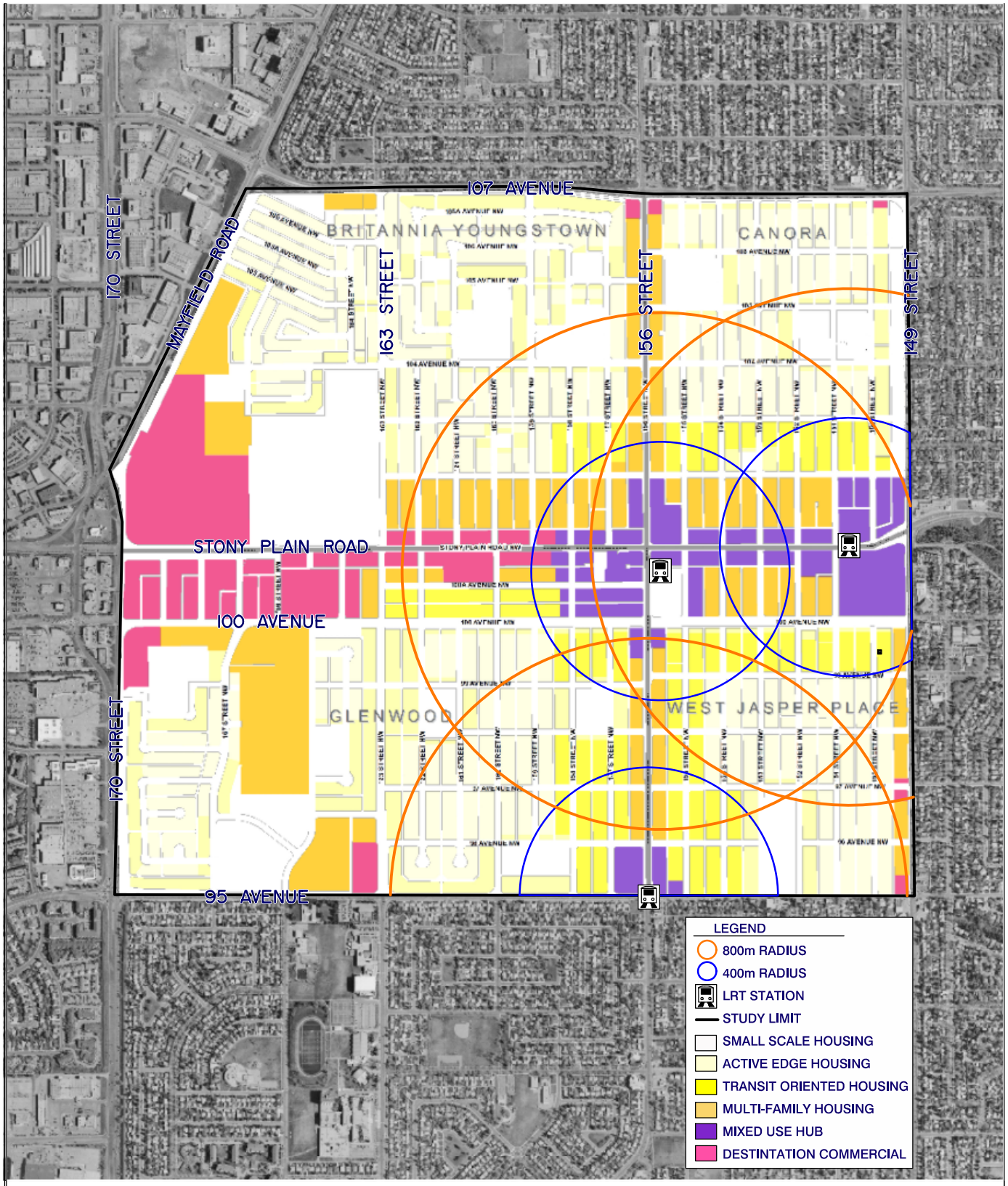
Stony Plain Road east of 156 Street, and 156 Street south of Stony Plain Road, are both designated by the City as Transit Avenues with at least 15 minute service frequency during weekday peak, and weekday, Saturday and Sunday midday periods. The existing environment is also walkable and encourages pedestrian connections to transit. As a result, the City of Edmonton's 2012 census indicates that 20% of residents commute to work via transit, which is significantly higher than the Edmonton average of 14%.

4.3.2 Analysis

Until the west leg of the Valley LRT Line is constructed, the existing Transit Avenue will still provide a high level of service to the Mixed Use Hub and most of the Transit Oriented Housing will be within 400 metres of a transit stop. The existing above average transit mode share would be expected to continue.

The implementation of LRT along Stony Plain Road and 156 Street includes three LRT stops within the study area at: 95 Avenue – 156 Street, Stony Plain Road – 156 Street, and Stony Plain Road – 151 Street. The City of Edmonton aims to provide transit service within 400 metre of all households; however, studies recognize that LRT has the ability to attract riders from a larger catchment area[6]. As such, a distance of 800 metre is commonly used to identify the catchment area for LRT stations. Figure 4.8 shows 400-metre and 800-metre catchment areas of the proposed LRT stations.

[6] O'Sullivan, Sean and John Morrall. *Walking Distance to and from Light-Rail Transit Stations.* Transportation Research Record, 1538, 19-26.



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4.8

Title
LRT CATCHMENT AREAS

As shown, all of the Mixed Use Hub and most of the Transit Oriented Housing is located within 400 metres of an LRT station and will be well supported by the future transit service. Although some of the Transit Oriented Housing falls outside of the 400-metre catchment, the entirety of this development type is within the 800-metre catchment area. The majority of existing Multi-Family Housing is also located within 800 metres of future LRT stations. Thus, higher density land uses will be well served by the proposed LRT.

Construction of LRT and redevelopment is expected to improve upon the Transit User Expectations described earlier. Our analysis assumed that the addition of LRT will replace some bus service, but much of the existing service in Jasper Place outside of the LRT's influence will be retained. A description of how the Transit User Expectations will be affected in the study area as a result of the implementation of LRT is provided below:

1. **Service coverage** will increase as riders are willing to walk further to connect to LRT than they are to bus service so that each stop has a larger effective catchment area. At the same time, some local users may find accessing transit to be less convenient because LRT stations are spaced further apart than bus stops.
2. **Service frequency** will likely not change significantly as the LRT will replace an existing Transit Avenue that already has 15 minute or better service frequency during most time periods. LRT is only expected to operate at a 10 to 15 minute frequency during off-peak hours similar to the existing Capital Line.
3. **Travel time** will decrease for most riders, especially during peak hours, because the LRT will bypass roadway congestion. However, some residents further from the LRT line that are currently served by direct bus service may be required to make a transfer to LRT.
4. The **cost of service** is beyond the scope of this study.
5. **Stops and the associated pedestrian environment** will improve as redevelopment creates a more interesting streetscape and higher pedestrian volumes contribute to a feeling of security.
6. **Service reliability and travel time consistency** will improve due to the LRT's ability to bypass congestion.
7. **Service flexibility** may increase due to faster travel times, especially in the peak. However, only modest improvements are expected as existing service on the Transit Avenue is frequent enough to provide a high level of flexibility.

The *Transit Capacity and Quality of Service Manual*[7] includes research on the effect of service improvements on ridership. It suggests that "Ridership is less responsive [to increases in service frequency] when service was already relatively frequent". The effect of increased travel time

[7] Transportation Research Board. *Transit Capacity and Quality of Service Manual. Third ed.* Washington, D.C., National Academy of Sciences: 2013.

reliability on ridership was found to be mixed and mostly anecdotal. However, a package of improvements, such as would occur in Jasper Place with both implementation of LRT and redevelopment of adjacent areas, was found to have a greater effect on ridership than would be expected from isolated service improvements.

The improved service offered by LRT will likely attract riders from an expanded catchment area. However, because Jasper Place already has access to above average transit service, which is reflected in the above average transit mode share, the impact of LRT is expected to be modest. Further increase in ridership may also be difficult because remaining non-transit users may have destinations that are not well served by existing or future transit, such as the industrial areas west of Mayfield Road. By increasing the intensity of land uses near the existing Transit Avenue and future LRT, the ARP locates redevelopment to take full advantage of transit service and maximizes potential ridership.

It is also important to remember that only about half of Jasper Place is within 800 metre of a proposed LRT station and supporting transit routes to other areas will need to be maintained.

4.4 DRIVING

The effects of redevelopment on the road network are discussed in the following section. No additional roadways are proposed as part of the ARP.

4.4.1 Existing Conditions Summary

The existing conditions analysis indicates that several arterial – arterial intersections within the study area are operating at an Intersection Capacity Utilization (ICU) of greater than 82%, and motorists will experience some delay at these intersections. During the PM peak hour, two intersections operate at ICU > 91% indicating that they will be over-capacity for part of the peak hour. Figure 4.9 and Figure 4.10 show the ICU for existing traffic volumes and geometry during the AM and PM peak hours, respectively.

Figure 4.9 – Existing AM Peak Hour ICU Percentages

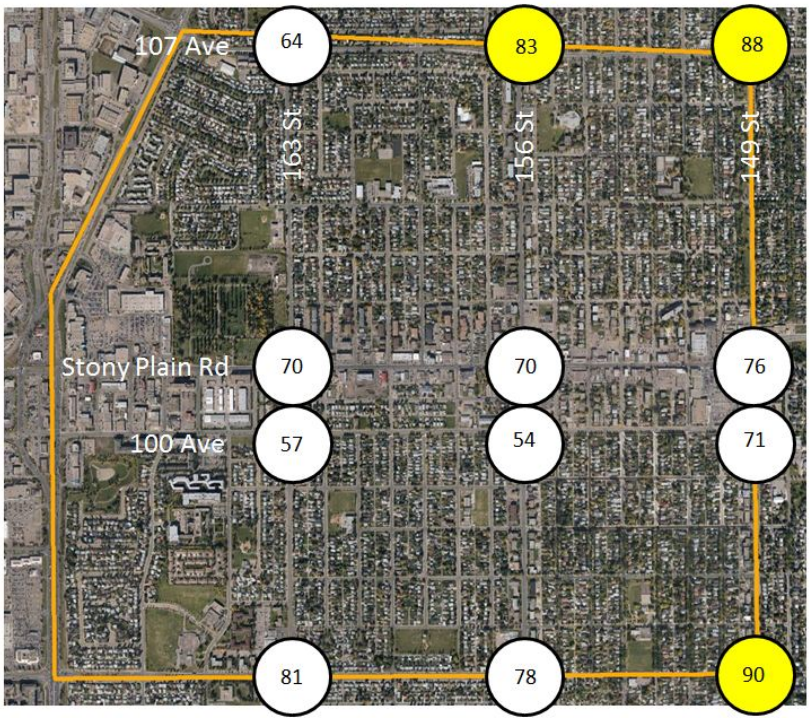
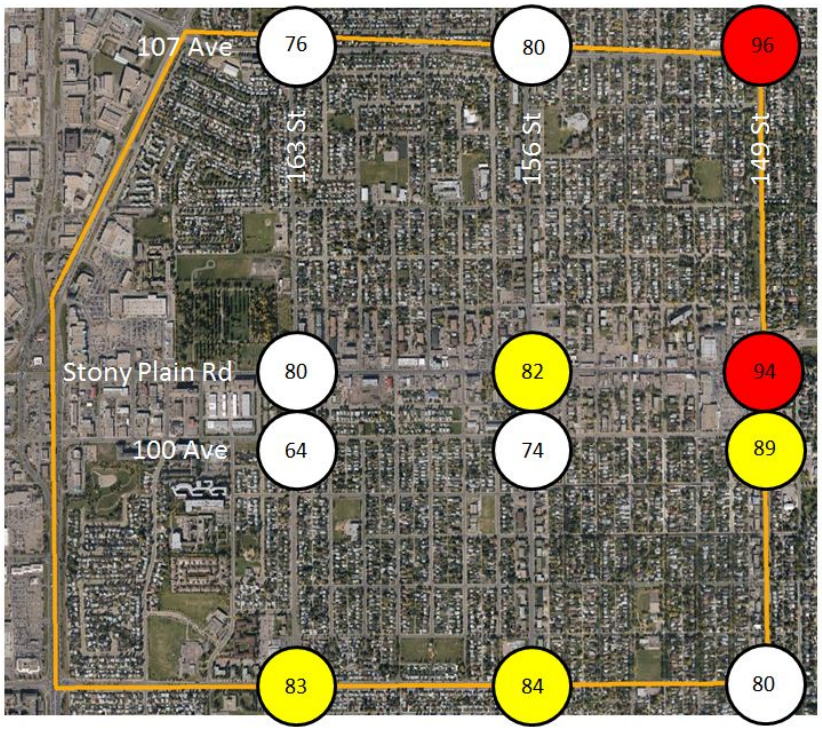


Figure 4.10 – Existing PM Peak Hour ICU Percentages



4.4.2 Analysis

4.4.2.1 Traffic Analysis

Even without redevelopment in the study area, traffic operations on Stony Plain Road and 156 Street will be impacted by the implementation of the West LRT that will reduce vehicular travel lanes from four lanes to two lanes, and restrict left turns at several intersections.

A Vissim model[8] of the LRT corridor including Stony Plain Road and 156 Street within the study area was created for the City by the ConnectEd Transit Partnership to analyze impacts at the 2044 horizon. The modeling work remains in progress at the time of writing; however, we reviewed a draft *Traffic Operations and Modeling Report* dated December 16, 2013. The analysis results from the City's Vissim model of the LRT corridor is shown in Table 4.2.

Table 4.2 – Vissim Intersection Analysis Results

Intersection	Existing AM		Existing PM		2044 AM		2044 PM	
	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)
156 St - 95 Ave	B	17.2	B	18.5	F	158.3	F	213.3
156 St - 97 Ave	A	2.3	A	1.7	F	81.6	F	94.5
156 St - 100 Ave	C	22.6	C	21.1	E	59.0	F	145.7
156 St - 100A Ave	A	2.1	A	1.0	B	19.9	C	24.0
Stony Plain Road - 155 St	A	1.6	A	3.5	C	23.2	D	47.5
Stony Plain Road - 153 St	A	0.9	A	2.2	A	6.7	C	27.9
Stony Plain Road - 151 St	A	6.5	B	10.9	C	33.1	F	89.5
Stony Plain Road - 149 St	C	27.3	D	52.0	D	50.4	F	91.2

As shown in the analysis made available by the City of Edmonton, delay is expected to increase at all intersections in the study area during the 2044 horizon peak hours.

Existing traffic volumes on Stony Plain Road and 156 Street likely include regional traffic that is not generated by developments within Jasper Place. Stony Plain Road and 107 Avenue are the most direct routes between downtown Edmonton and developing neighbourhoods to the west as well as Spruce Grove. These external volumes may divert to other routes as Stony Plain Road becomes congested. Delay to motor vehicles is also expected to be mitigated as travelers choose to make journeys outside of the peak hour (peak spreading) or use alternative modes, especially transit.

[8] Vissim is a micro simulation software that is used to analyze traffic flow.

4.4.2.2 Traffic Calming

The increase in delay may result in motorists seeking short-cuts through the residential local roads. Of particular concern is the speed that these vehicles may be travelling at. As such, traffic volumes and speeds should be monitored after construction of LRT, with the potential for traffic calming measures being implemented.

The implementation of specific measures is outside the scope of this assessment, but the following measures can be considered in order of effectiveness and inconvenience to local residents:

1. Median Islands and Curb Extensions.
2. Speed Humps, Speed Tables, and Two Lane Chicanes.
3. One Lane Chicanes.
4. Median Diverters and Diagonal Diverters.
5. Road Closure (cul-de-sac).

Future shortcutting induced by changes in the road network are difficult to predict. Shortcutting commonly occurs when congestion on arterials encourages drivers to use an alternate route through less congested local and collector roadways. With implementation of LRT, drivers will seek alternate routes to 156 Street and Stony Plain Road. These diverted vehicles will be inclined to stay on the arterial road network unless those roads are congested.

No specific shortcutting concerns were identified as part of this assessment. In the future, traffic calming measures may be implemented in close consultation with local residents in specific areas where speed and volume problems are observed.

4.4.2.3 Parking

The City's zoning bylaw sets minimum off-street parking requirements for various residential uses. Multifamily developments within 400 metre of LRT stations and transit centres, or 100 metre of a Transit Avenue, are considered to be transit oriented development (TOD) subject to both maximum and minimum parking requirements as shown in Table 4.3. Parking requirements for commercial uses are generally based on the floor area of the development and vary according to specific uses.

Table 4.3 – Multi-Unit Residential Parking Requirements (Bylaw 12800[9])

	Minimum	Maximum	TOD minimum	TOD maximum
Bed Sitting Room	1	N/A	0.7	1
Bachelor Suite	1	N/A	0.7	1
1 Bedroom Dwelling	1	N/A	0.8	1
2 Bedroom Dwelling	1.5	N/A	1	1.5
3 or more Bedroom Dwelling	1.7	N/A	1.25	1.75
Visitor Parking	1 per 7 Dwellings	N/A	1 per 7 Dwellings	N/A

On-street parking is generally available on both sides of local roads. Except for streets adjacent to MacEwan University, our survey observed a moderate to high availability of on-street parking throughout Jasper Place. The learning scenarios described in section 3.0 found that Jasper Place currently has 1.6 parking stalls per person when both on-street and residential off-street parking is included. On average, Edmontonians own 0.74 vehicles per person[10], meaning that there is currently more than twice as much parking available in Jasper Place as there are vehicles. Moreover, the lower vehicle mode share in Jasper Place suggests that vehicle ownership and demand for parking is likely lower than the Edmonton average. As such, the total parking provision is expected to be sufficient to accommodate the modest densification proposed by the redevelopment.

If LRT is constructed, a parking management program may be sought for several blocks around stations to maintain parking availability for residents. Such a program should also manage parking demand generated by the MacEwan building and reduce shortcutting traffic through residential streets as traffic volumes decrease in response to parking restrictions.

A pilot program will be implemented in West Jasper Place on November 1, 2014 to remove on-street parking on one side of residential roads to assist with snow clearing. As this is a pilot program only and may not be continued, it was not considered in the analysis. It is worth noting that our analysis and the field observations both indicate that there should still be sufficient on-street even if half of the parking is lost.

4.5 RECOMMENDATIONS

The recommendations made in the previous sections for each travel mode are summarized in this section.

[9] As of August 2014
[10] Edmonton population from 2012 civic census. Vehicle ownership from Alberta Transportation (see http://www.transportation.alberta.ca/Content/docType47/Production/vehreg2012.pdf)

The existing grid network with sidewalks on both sides of most streets provides a strong framework for pedestrian trips. Destinations along Stony Plain Road are within walking distance of most existing and future residents. The following measures can enhance pedestrian mobility:

Table 4.4 – General Walking Recommendations

Challenges and Opportunities	Recommendations
Facilities along the Secondary Pedestrian Activity Areas need to be improved.	Focus sidewalk widening and rehabilitation on the Secondary Pedestrian Activity Areas, ideally to provide wider sidewalks with a boulevard.
Arterial roadways impede pedestrian movement within study area.	Analyze locations to prioritize the addition of crosswalks as identified in this report. Prioritize crosswalks that connect to the mixed use hub and future LRT stations.

Many local roads can comfortably serve cyclists and the existing grid network facilitates cyclist trips. The lack of safe crossings and dedicated facilities on arterials, and shortage of bicycle parking, can impede cyclists, especially for longer distance travel to external destinations outside Jasper Place. The following measures can enhance bicycle mobility:

Table 4.5 – General Cycling Recommendations

Challenges and Opportunities	Recommendations
Existing bicycle network is sparse and arterials can impede travel.	Install bicycle facilities in accordance with the proposed bicycle network described in this report.
Traffic volumes on 163 Street are low for a four-lane roadway.	Consider alternate cross-section that may better accommodate bicycles on 163 Street.
End of trip facilities are required at destinations.	Ensure that end of trip facilities, including bicycle parking, are provided at major destinations along Stony Plain Road and at LRT stations.
Poor bicycle integration with transit.	Provide end of trip facilities (bike racks) at or close to future LRT stations.

Transit service to Jasper Place is above average in the Edmonton context and will further improve with implementation of LRT. Future LRT is expected to primarily influence the existing and proposed higher density developments along Stony Plain Road and 156 Street. The following measures are recommended to maximize the impact of LRT.

Table 4.6 - General Transit Recommendations

Challenges and Opportunities	Recommendations
Not all areas of Jasper Place are within walking distance (800 m) of LRT.	Maintain supporting transit routes to connect areas further than 800 metres from LRT to stations.
Security is important on transit infrastructure and is a concern of Jasper Place residents.	Redevelopment near transit facilities should incorporate CPTED principles to ensure good overlook from adjacent developments.
Pedestrian barriers can impede access to transit.	Ensure that pedestrian crossings facilitate convenient access to transit and install controlled crosswalks where necessary. Prioritize crosswalks within 800 metres of future LRT stations.
Cyclist barriers can impede access to transit.	Implement the proposed bicycle network to provide connections to transit. Provide end of trip facilities (bike racks) at or close to future LRT stations.

Vehicular traffic in Jasper Place is expected to experience higher delays with construction of LRT and redevelopment. The following measures are recommended to mitigate traffic impacts.

Table 4.7 – General Driving Recommendations

Challenges and Opportunities	Recommendations
Several roads (especially 156 Street and Stony Plain Road) within Jasper Place are expected to have delays and queuing after LRT is constructed.	Maximize effectiveness of existing infrastructure, potential measures include additional resources to optimize signal timings.
Congestion can cause through traffic to divert onto local roads.	Monitor future traffic patterns and consider implementing traffic calming measures to reduce shortcutting and speed.
On-street parking close to LRT stations may be used as an unofficial park and ride, which will also increase traffic volumes on local roads.	Consider implementing a parking management program system to control parking near LRT stations.

5.0 MIXED USE HUB AND STONY PLAIN ROAD MOBILITY ASSESSMENT

The proposed Mixed Use Hub will include retail, residential, and office developments fronting onto Stony Plain Road, which is envisioned as a pedestrian and transit oriented high street.

5.1 BACKGROUND

5.1.1 Current Context

Stony Plain Road adjacent to the proposed Mixed Use Hub is currently a four-lane undivided arterial with pockets of on-street parking on the north side and one of the eastbound lanes acting as a bus/right-turn only lane during the AM peak hour. Several sites have direct access onto the roadway. The Average Annual Daily Traffic volumes (AADT) of 18 000 vehicles/day between 149 Street and 156 Street has decreased in recent years. East of 149 Street, AADT increases to 30 000 vehicles/day and the intersection of Stony Plain Road – 149 Street is congested during the PM peak hour. Overall, the corridor remains under capacity. As the most direct route from many parts of west Edmonton to the downtown, some of this volume is likely through traffic unrelated to Jasper Place.

The Jasper Place Transit Centre is located at the west end of the Mixed Use Hub and multiple bus routes traverse Stony Plain Road. As mentioned before, Stony Plain Road is designated as a Transit Avenue in recognition of the high level of transit service provided along the corridor.

The approximately 16.5 hectare Mixed Use Hub is currently comprised of a mixture of big box stores near 149 Street and smaller scale strip mall and pedestrian oriented businesses towards 158 Street with some offices. For the analysis, the baseline indicators in the learning scenarios for the Canora and West Jasper Place neighbourhoods, in which the majority of the mixed use hub is located, provide estimates of existing Floor Area Ratio (FAR) and uses. As such, a FAR = 0.57 has been used for existing developments with a split between retail and non-retail uses (assumed office) of 85% to 15%. The existing land uses within the Mixed Use Hub are shown in Table 5.1.

Table 5.1 – Existing Mixed Use Hub Analysis Units

Land Use	Proportion	Area (1,000 ft^2)
Commercial	85%	928
Office	15%	164
Total	100%	1,092

This current context information was considered in the subsequent analysis for the area.

5.2 FUTURE CONTEXT AND REDEVELOPMENT

There are two major construction projects that will have an influence on the study area: Stony Plain Road Streetscape Improvement project and the Valley Line LRT. For the Stony Plain Road Streetscape Improvements, work began in 2013 that will widen the existing sidewalk, close 152 Street to vehicular traffic, and remove existing on-street parking. Construction is expected to be complete by 2015.

The Valley Line LRT will be constructed as a centre running LRT on Stony Plain Road that will reduce the corridor to one lane in each direction between 156 Street and 149 Street. Several intersections will be reduced to right-in/right-out movements. LRT stations are proposed at 151 Street and 156 Street; the latter station will also include a transit centre for transfers to buses.

The proposed redevelopment of the Mixed Use Hub area will align with these two projects. The mixed use hub is expected to redevelop as two to eight storey buildings with commercial uses on the ground floor, medium density residential (MDR) uses on the upper floors, with the possibility of some office uses. For analysis purposes we assumed that the Mixed Use Hub area would be covered with five storey buildings. Floors will be used with a ratio of 1 office : 2 commercial : 7 residential. The analysis completed assumed 75% site coverage for buildings with residential units of 1,200 gross square feet in size. The post-redevelopment land uses for a 1 hectare parcel are summarized in Table 5.2.

Table 5.2 – Mixed Use Hub: 1 hectare Redevelopment

Land Use	Analysis Units	
Commercial	80.7	(1,000 ft^2)
Office	40.4	(1,000 ft^2)
MDR	235	Dwelling units

Three land uses were considered separately based on the proposed plan: commercial, residential (MDR), and office. Internal trips within the Mixed Use Hub area were not explicitly considered, but are implicitly included in the active modes share.

5.3 ANALYSIS

5.3.1 Walking

Redevelopment of the area to include more mixed-use destinations will increase the opportunity for non-work trips, primarily home based shopping, social/recreation, and other, to be made within a distance that allows for walking.

This assessment recommends that Stony Plain Road from 149 Street to 158 Street be identified as a Primary Pedestrian Activity Area and the Stony Plain Road Streetscape project will sufficiently address this recognition.

5.3.2 Cycling

Increases in cycling trips are expected to occur as a result of the redevelopment in the area. Using the bike network recommended in Section 4.2, residents in adjacent neighbourhoods can bike to the Mixed Use Hub using low traffic local streets. The installation of bicycle parking in the furniture zone along Stony Plain Road or on the north-south side streets would further encourage cycling trips to the Mixed Use Hub.

5.3.3 Transit

Census results indicate that residents of Jasper Place are more likely than the average Edmontonian to use transit for commuter trips from home to work. As Stony Plain Road is already a Transit Avenue with frequent transit service, the addition of LRT is expected to have a modest impact on trips within the Mixed Use Hub. That said, the construction of LRT is expected to improve transit travel time and reliability for users within the Mixed Use Hub, especially during the peak hours.

Security is an important consideration on transit infrastructure and is a concern of Jasper Place residents. Redevelopment should increase pedestrian activity on Stony Plain Road to improve safety and overlook.

5.3.4 Driving

Vehicular trip generation is traditionally performed using the Institute of Transportation Engineers (ITE) *Trip Generation Manual*[11]. The data in the Manual "were primarily collected at suburban locations having little or no transit service, nearby pedestrian amenities, or travel demand management". It is commonly recognized that these rates are not representative of a walkable urban context with frequent transit service, such as Jasper Place.

Various methods have been proposed for deriving a multi-modal trip generation rate. A multi-modal rate would explicitly account for transit and pedestrian/cyclist trips, which are expected to be significant in Jasper Place, with a corresponding decrease in vehicular trip generation. NCHRP Report 758 is a document published by the US Transportation Research Board that provides guidance on how to account for trips made by transit, vehicles, and active modes. The following analysis is based on a simplified application of the methodology described in NCHRP Report 758:

1. Convert vehicular trip rates (from ITE or local Edmonton rates) to person trips using an appropriate vehicle occupancy and mode share for the source data of trip rates.

[11] Institute of Transportation Engineers. *Trip Generation Manual, 9th ed.* Washington, DC.: 2012.

2. Estimate the mode shares for existing Jasper Place, recognizing that the area currently has lower vehicular trip generation than the Edmonton average, and for a post-LRT scenario.
3. Conduct person trip generation for each mode with the estimated mode splits.
4. To calculate motor vehicle trips, use assumed vehicle occupancy values to convert the person vehicle mode trips to vehicular trips.

Vehicular trip generation was completed for the PM peak hour as the trip rate for this time period is higher than the other analysis periods (e.g. AM). Further details on the trip rate derivation are included in Appendix B. Assuming a 30% redevelopment of the area, the expected additional trip generation is summarized in Table 5.3.

Table 5.3 – PM Peak Hour Vehicular Traffic Projection

Land Use	Analysis Units	Trip Rate	In%	Out%	Trips In	Trips Out	Total
Existing Trip Generation							
Commercial	258 (1,000 ft²)	1.60	44%	56%	182	231	413
Office	46 (1,000 ft²)	1.24	17%	83%	10	47	57
Total					191	278	469
Future Trip Generation - No LRT							
Commercial	399 (1,000 ft²)	1.60	44%	56%	281	358	639
Residential	1165 Dwelling Unit	0.27	63%	37%	197	116	313
Office	200 (1,000 ft²)	1.24	17%	83%	42	206	248
Total					520	679	1200
Difference from Existing					**329**	**401**	**730**
Future Trip Generation - With LRT							
Commercial	399 (1,000 ft²)	1.42	44%	56%	250	319	569
Residential	1165 Dwelling Unit	0.24	63%	37%	178	105	283
Office	200 (1,000 ft²)	1.16	17%	83%	39	193	232
Total					468	616	1084
Difference from Existing					**277**	**338**	**615**

As shown, it is expected that in the PM peak hour the Mixed Use Hub is expected to generate 730 new vehicular trips if LRT is not implemented, and 615 new vehicular trips when a mode shift to LRT is accounted for. A review of traffic impacts for the ARP is included in Section 8.0.

5.3.4.1 Parking

Outside of the downtown, the Pedestrian Commercial/Shopping Street Overlay[12] provides for a further reduction beyond TOD minimum parking requirements for office and commercial uses along streets such as Whyte Avenue. Developments adjacent to Stony Plain Road are not

[12] Edmonton Zoning Bylaw 12800, section 819

currently included in this overlay. Considering the goals of the Transportation Master Plan and ARP to encourage active modes and transit, and the reduced vehicular trip generation compared to the Edmonton average, the extension of this overlay (or a similar overlay) to the Mixed Use Hub is recommended. In addition, the City should consider having on-street parking within the Mixed Use Hub require payment to reduce any long-stay parking associated with the LRT stations, thereby increasing short-stay parking availability for the local businesses.

The ARP strongly encourages underground parking and stipulates that "any surface car parking or underground parking entrances shall be located at the back of buildings." Additional parking design guidelines are included in the City's *Residential Infill Guidelines*.

To reduce car ownership among residents who may only occasionally need a car, the City should consider supporting a car sharing program with vehicles parked within the Mixed Use Hub. Additionally, allowing residential units to be sold without parking stalls or providing subsidized transit for residents in new buildings, even if only for a few months, may encourage reductions in car ownership or the switching of transportation modes.

5.4 RECOMMENDATIONS

The recommendations made in the previous sections for each travel mode are summarized in this section.

Stony Plain Road will have an attractive pedestrian environment that will complement the mixed use hub and integrate with future LRT once streetscape improvements are complete.

Table 5.4 – Mixed Use Hub Walking Recommendations

Challenges and Opportunities	Recommendations
Some sidewalk segments remain narrow after streetscape improvements.	Consider further widening to sidewalks adjacent to the Mixed Use Hub when redevelopment or LRT construction yields additional right of way.

The Mixed Use Housing is expected to be accessible to cyclists from Jasper Place and beyond and improvements to the cycling network described in Section 4.0 should be implemented to improve cyclist connectivity.

Table 5.5 - Mixed Use Hub Cycling Recommendations

Challenges and Opportunities	Recommendations
A lack of end of trip facilities at key destinations.	Provision should be made for bicycle parking along Stony Plain Road to support trips to local businesses and transfers to LRT.

The construction of LRT is expected to improve transit travel time and reliability for users within the Mixed Use Hub, especially during the peak hours. The following measures are recommended to maximize the impact of LRT.

Table 5.6 – Mixed Use Hub Transit Recommendations

Challenges and Opportunities	Recommendations
Security is important on transit infrastructure and is a concern of Jasper Place residents.	Redevelopment should increase pedestrian activity on Stony Plain Road to improve safety and overlook.
Travelers may not be aware of the travel time and reliability improvements that LRT will bring.	Once LRT is constructed, encourage local residents and employees to reconsider transit through an awareness campaign. Consider providing free or subsidized transit passes for a limited time.

Vehicular traffic on Stony Plain Road is expected to experience increasing delays with construction of LRT and redevelopment. The following measures are recommended to mitigate traffic impacts.

Table 5.7 - Mixed Use Hub Driving Recommendations

Challenges and Opportunities	Recommendations
Stony Plain Road is expected to be over capacity during peak periods when LRT is constructed.	Maximize effectiveness of existing infrastructure, examples of potential measures include intelligent transportation systems measures to optimize green time allocation and more frequent retiming of signals. Allow reduced parking requirements to discourage automobile use.
Long-stay parking activity may result in difficulty finding short-stay parking in the area.	Meter all City owned parking to increase turnover and availability of stalls. Support a car sharing program to reduce the need for vehicle ownership within the ARP. Separate the cost of parking stalls from dwelling units for residential developments to make explicit the costs of vehicle ownership.

6.0 TRANSIT ORIENTED HOUSING MOBILITY ASSESSMENT

Several blocks in proximity to the proposed LRT stations have been designated as Transit Oriented Housing. This section reviews the transportation implications of the Transit Oriented Housing typology.

6.1 EXISTING CONDITIONS SUMMARY

The areas designated as Transit Oriented Housing consist primarily of single family residential developed at a density of about 15 units per hectare. Most residences have entrances onto a local street with an alley in the rear. Local streets typically include sidewalks without boulevard on either side. The carriageway on many local streets is wider than current City of Edmonton standards.

6.1.1 Single Detached Residential Trip Rate Survey

A trip rate survey was completed for a total of 66 existing low density residential (LDR) units between 100 Avenue and 99 Avenue on February 26, 2014 during the AM and PM Peak Hours. This was completed in order to baseline the existing trip generation rates.

6.2 FUTURE CONTEXT AND REDEVELOPMENT

Transit Oriented Housing is intended to increase the residential density adjacent to the future LRT line. This analysis assumes that they will redevelop as row houses, which is the highest density permitted by the ARP.

6.3 ANALYSIS

6.3.1 Walking

Increasing density adjacent to the shopping, social, and recreational activities along Stony Plain Road should increase the opportunity for non-work trips to be made via walking. The existing highly connected street network, with sidewalks on both sides of most streets, is well suited to encourage and accommodate these additional trips.

6.3.1 Cycling

Transit Oriented Housing areas front onto local roads that should be comfortable for cyclists and facilitate connections to the proposed bicycle network. Connections to the commercial and Mixed Use Hub areas can be conveniently made along bicycle facilities or via local roads, encouraging cyclists who may not feel confident riding with traffic.

6.3.2 Transit

Most of the proposed Transit Oriented Housing areas are close to the existing Stony Plain Road and 156 Street Transit Avenues and probably already exhibit above average transit usage. Redevelopment as Transit Oriented Housing will increase the density close to these Transit Avenues and the proposed LRT to allow more residents to take advantage of transit. The change in user expectations with addition of LRT is expected to be similar to that experienced by the Mixed Use Hub areas, but with a lesser effect because these residences are further from the proposed LRT stations.

6.3.3 Driving

6.3.3.1 Traffic Generation

The observed trip generation rates and density of 15 du/ha was used to estimate existing trip generation during the AM and PM peak hours. Since the block sizes within the four neighbourhoods are approximately the same, a 155 metre by 50 metre half-block (0.78 hectare) was used as the basis of analysis. Each half-block is typically bounded by three local roads and an alley.

The typical Edmonton RF5 trip rate was reduced based on the observed local travel characteristics within Jasper Place as detailed in Appendix B. The trip generation per half-block is summarized in the following Table 6.1.

Table 6.1 – Transit Oriented Housing Redevelopment Trip Generation by Half-Block

Peak Hour	Analysis Units	Trip Rate	Total Trips
Existing Trip Generation			
AM	11.6 dwelling units	0.46	5.4
PM	11.6 dwelling units	0.53	6.2
Redevelopment Trip Generation			
AM	34.9 dwelling units	0.31	10.8
PM	34.9 dwelling units	0.39	13.6

A review of traffic impacts for the ARP including those generated by the Transit Oriented Housing is included in Section 8.0.

6.3.3.2 Parking

The parking survey indicated that on-street parking was available on most streets except within one block of Stony Plain Road. Since Transit Oriented Housing redevelopment will likely be evenly dispersed throughout the Transit Oriented Housing area and includes a mix of row houses with less dense redevelopment, on-street parking demand is not expected to be constrained. For example, if 30% of a block redevelops as row housing, increasing the number of dwelling units

from 12 to 19, the measured parking demand rate of 0.41 per unit indicates that there will be an additional on-street parking demand of 3 stalls. As each half-block is about 150 metres long with space for 18 vehicles, the additional parking demand can be accommodated.

The zoning bylaw only allows for reduced parking within 100 metres of a Transit Avenue and within 400 metres of transit centres and LRT stations. The surveyed residences within the Jasper Place area have trip rates that are significantly lower than the Edmonton average even though they are located about 300 metres from a Transit Avenue (Stony Plain Road or 156 Street). The City of Edmonton Household Travel Survey (HHTS) found that trip generation is positively correlated with vehicle ownership. As such, both vehicle ownership and parking demand rates within Jasper Place are likely to be lower than the Edmonton average.

Therefore, it is recommended that TOD parking maximums and minimums in the zoning bylaw be applied to the proposed Transit Oriented Housing areas even if they are greater than 400 metres from the proposed LRT stations or greater than 100 metres from a Transit Avenue.

6.4 FINDINGS AND RECOMMENDATIONS

The transportation recommendations made for the Transit Oriented Housing are minor in nature. This is largely due to the existing grid road network and proximity to transit. Table 6.2 shows the recommendations for the Transit Oriented Housing area.

Table 6.2 - Transit Oriented Housing Findings and Recommendations

Mode	Findings and Recommendation
Walking	The connected street network will help facilitate walking trips from the Transit Oriented Housing.
Biking	Transit Oriented Housing fronts onto local roads that should be comfortable for cyclists and facilitate connections to the bicycle network.
Transit	Transit Oriented Housing is close to an existing Transit Avenue and future LRT line. Redeveloping units are expected to maintain or exceed the existing high transit mode share.
Driving and Parking	Traffic impacts from redevelopment of Transit Oriented Housing areas are expected to be minimal as traffic will be dispersed throughout the grid network. With minimal to moderate densification, traffic volumes will not significantly increase on any road. Assuming 30% redevelopment as row housing, the highest density permitted, each residential half-block of 155 metres by 50 metres is estimated to generate an additional 5 trips in the AM peak hour and 7 trips in the PM peak hour.

Existing residential units located in the Transit Oriented Housing area exhibit trip generation below the Edmonton average; therefore, it is recommended that Transit Oriented Housing areas be allowed to conform to TOD parking requirements even if they are slightly more than 400 metres from proposed LRT stations.

7.0 ACTIVE EDGE HOUSING MOBILITY ASSESSMENT

Active Edge Housing fronts onto neighbourhood edges along arterial and collector routes including 107 Avenue and 95 Avenue, as well as parks and pedestrian routes to provide overlook for these areas. Most areas designated as Active Edge Housing currently consist of single family residential developed at a density of about 15 units per hectare and are very similar to the existing condition of Transit Oriented Housing areas.

In addition to the requirement for a street-fronting orientation of the buildings, densities in Active Edge Housing areas are permitted to vary from row houses to single detached houses. However, it is expected that areas further from the LRT and Mixed Use Hub will likely redevelop to a lower density. The results of the analysis completed for the Active Edge Housing areas are summarized in Table 7.1.

Table 7.1 - Active Edge Housing Findings and Recommendations

Mode	Findings and Recommendation
Walking	The connected street network will help facilitate walking trips from the Active Edge Housing.
Biking	Active Edge Housing areas front onto local roads that should be comfortable for cyclists and facilitate connections to the bicycle network.
Transit	Active Edge Housing will generally benefit from the high level of transit service in Jasper Place. Except for sites closer to the future LRT, mode shares are expected to be similar to the Edmonton average.
Driving and Parking	Traffic impacts from redevelopment of Active Edge Housing areas are expected to be minimal as Active Edge Housing is either adjacent to an arterial, or widely dispersed throughout the neighbourhoods at various park sites. With minimal to moderate densification, traffic volumes will not significantly increase on any road. Many Active Edge Housing areas are expected to front onto park sites. Since parks typically generate minimal parking demand, it is expected that there will be ample on-street parking.

8.0 STONY PLAIN ROAD TRAFFIC IMPACTS

Redevelopment is expected to increase traffic volumes generated by Jasper Place. A high level analysis was completed to quantify the effect of the change in traffic volumes.

8.1 TRIP GENERATION

Row houses are the highest density redevelopment permitted in Transit Oriented Housing and Active Edge Housing areas. Assuming the worst case scenario that all redevelopment in these areas will be row houses, the existing PM peak hour trip generation is shown in Table 8.1, and the expected PM peak hour trip generation after 30% redevelopment is shown in Table 8.2.

Table 8.1 – Transit Oriented Housing Area Trip Generation (No Redevelopment)

Neighbourhood	Existing Low Density Residential		Redeveloped Row Housing		Total Traffic
	Half-blocks	Vehicle Traffic	Half-blocks	Vehicle Traffic	
Canora	19	117	0	0	117
West Jasper Place	30	185	0	0	185
Britannia Youngstown	18	111	0	0	111
Glenwood	47	290	0	0	290
Total	114	702	0	0	702

Table 8.2 - Transit Oriented Housing Area Trip Generation (Redevelopment)

Neighbourhood	Existing Low Density Residential		Redeveloped Row Housing		Total Traffic
	Half-blocks	Vehicle Traffic	Half-blocks	Vehicle Traffic	
Canora	13.3	82	5.7	77	159
West Jasper Place	21	129	9	122	252
Britannia Youngstown	12.6	78	5.4	73	151
Glenwood	32.9	203	14.1	191	394
Total	79.8	492	34.2	464	956

Redevelopment of the Transit Oriented Housing and Active Edge Housing areas is expected to result in a maximum increase of 254 trips in the PM peak hour.

The trip generation for the mixed use hub was described in Table 5.3. The following Table 8.3 summarizes the changes to trip generation expected due to redevelopment.

Table 8.3 – Change in PM Peak Hour Trip Generation due to Redevelopment

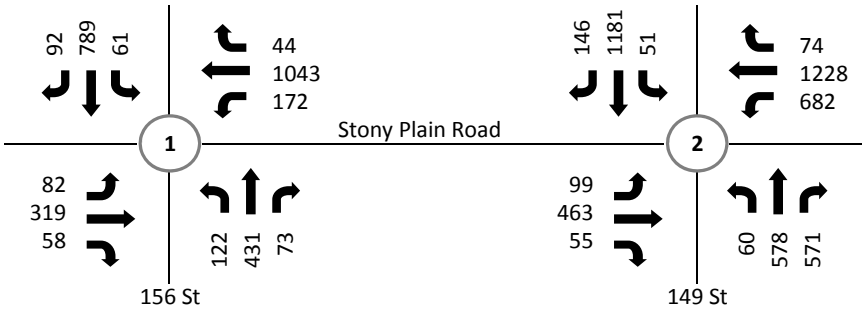
	Trips In	Trips Out	Total
Row Housing	165	89	253
Mixed Used Hub - No LRT	355	433	788
Total Trips - No LRT	520	522	1041
Row Housing	165	89	253
Mixed Used Hub - With LRT	298	365	663
Total Trips - With LRT	463	453	916

8.2 TRAFFIC IMPACTS

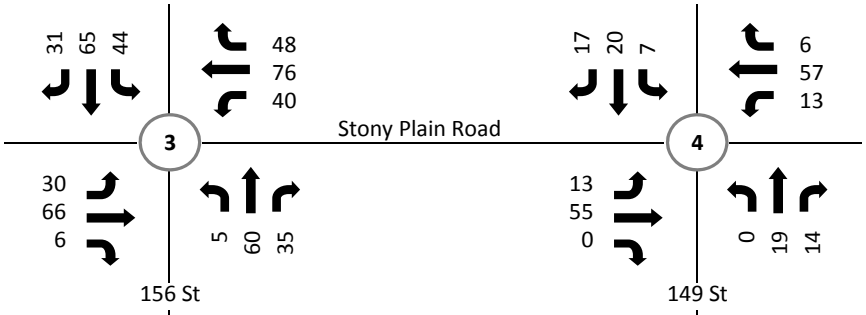
Traffic from the Transit Oriented Housing and Active Edge Housing will be diffused throughout the local road network and minimal impacts are expected. For example, West Jasper Place has one of the higher concentrations of potential row housing redevelopment, but additional traffic will be spread out across 10 local roads (4 avenues and 6 streets). Thus, the additional 67 vehicular trips generated by row housing redevelopment will result in an average of 7 additional vehicular trips during the PM peak hour on each road. Even if some roads carry twice the average trips, 14 additional vehicles per hour is a minor impact that should not create safety or noise concerns.

The additional vehicle trips generated by redevelopment were quantified on Stony Plain Road to provide a high level analysis of potential impacts. Vehicle trips were distributed based on origin-destination matrices from the City of Edmonton's Regional Travel Model. Trips were assigned to the road network and the additional site generated traffic was added to the existing traffic to derive the total traffic. The estimated traffic volumes after redevelopment occurs are shown in Figure 8.1. As Stony Plain Road is a mature corridor and traffic volumes have decreased in recent years, no background growth was considered.

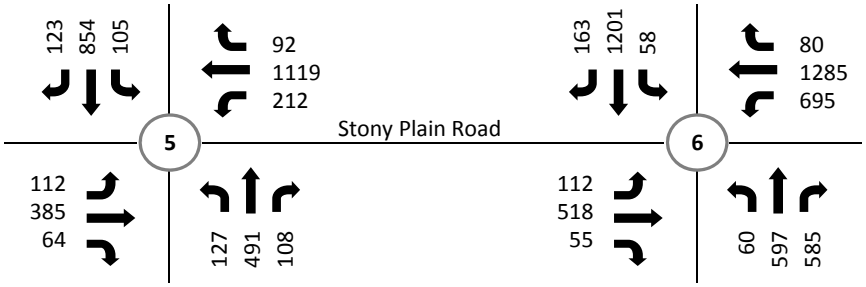
Background (Existing Traffic)



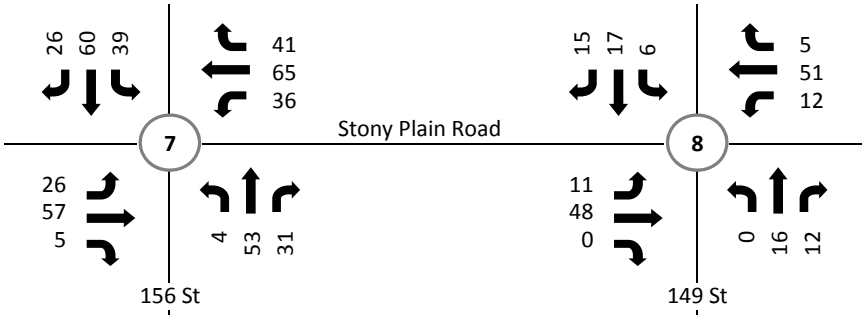
No-LRT Redevelopment Traffic



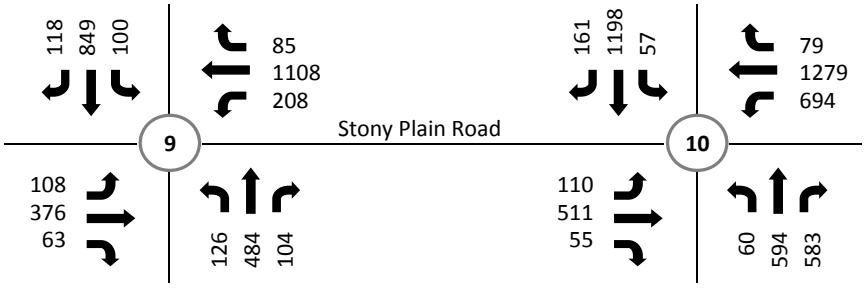
No-LRT Total Traffic



Post-LRT Redevelopment Traffic



Post-LRT Total Traffic



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Stantec

10160 - 112th Street
Edmonton AB

Client/Project
City of Edmonton
Jasper Place ARP
Mobility Assessment

Figure No.
8.1

Title
Redevelopment Traffic
PM Peak Hour

8.2.1.1 Vehicular Capacity Analysis

The PM peak hour Intersection Capacity Utilization (ICU) is shown in the following . ICU analysis considers the traffic volumes and geometry of an intersection, but is independent of signal timings. The ICU method is used to determine the reserve capacity of an intersection and provides an overview of traffic operations without attempting to predict delays on individual movements.

Table 8.4 – Intersection Capacity Utilization

Intersection	Scenario	ICU
Stony Plain Road - 149 Street	Existing Condition	94%
	Existing Traffic with LRT	126%
	Redevelopment Traffic, no LRT	97%
	Redevelopment Traffic with LRT	130%
Stony Plain Road - 156 Street	Existing Condition	82%
	Existing Traffic with LRT	102%
	Redevelopment Traffic, no LRT	89%
	Redevelopment Traffic with LRT	110%

Without implementation of LRT, both intersections are expected to operate at ICU > 80% regardless of redevelopment. This indicates that the intersections are expected to be over capacity for part of the peak hour and may experience some delay.

With implementation of LRT, traffic volumes were analyzed using the proposed intersection configurations shown in the City's LRT plans. Irrespective of redevelopment, the ICU is expected to exceed 100% at both intersections indicating that they will be over capacity for an hour or more. This agrees with the LRT corridor analysis conducted for the City.

Under the LRT scenario, it is expected that there will be some peak spreading of traffic volumes as drivers seek to avoid delays. In addition, some of the traffic currently on Stony Plain Road is through traffic between West Edmonton and Downtown Edmonton and these vehicles will likely use a different route once the LRT is constructed. A diversion of these trips in the area would aid in mitigating congestion for local residents.

Compared to the daily traffic that can be accommodated on two vehicular lanes, repurposing two of the current four lanes on Stony Plain Road for LRT is an efficient use of transportation right of way. Long range ridership forecasts for the West LRT anticipate 45,000 to 50,000 daily riders, which is significantly greater than the number of vehicles that can be accommodated on the two lanes being lost. The increased mobility for residents of West Edmonton, including Jasper Place, supports tolerating a moderate amount of overcapacity for vehicles due to changes in the road network caused by LRT.

9.0 CONCLUSION

The Jasper Place Area Redevelopment Plan (ARP) aims to densify residential areas along the LRT line through the use of transit oriented housing, provide greater oversight on public areas through the use of active edge housing, and create a mixed use hub with residential, commercial, and office uses in close proximity on Stony Plain Road. Jasper Place already has a strong multi-modal transportation network that will be further improved when LRT is implemented.

Modeling conducted by the City of Edmonton for LRT planning indicates that multiple intersections on Stony Plain Road and 156 Street will be overcapacity after two travel lanes are repurposed for LRT. Redevelopment of 30% of Jasper Place is not expected to significantly worsen the situation. The analysis completed in this Transportation and Mobility Assessment recognized that providing additional vehicular capacity is not the solution, but seeks instead to mitigate the issue by encouraging travel via other modes.

Detailed recommendations for different areas of the ARP are included in the report. Key ideas can be summarized as follows:

- The ARP's explicit intent to develop so as to provide overlook for high pedestrian areas will encourage both walking and transit trips and will respond to residents' expressed concerns for security.
- Wider sidewalks are recommended in Primary and Secondary Pedestrian Activity Areas to accommodate pedestrian travel.
- Bicycle facilities should be installed based on the proposed cycling network to facilitate bicycle travel within and beyond the study area.
- Installation of controlled crosswalks or upgrading of marked crosswalks to provide additional pedestrian protection is recommended on Stony Plain Road and 100 Avenue to improve connections to commercial areas and future LRT.
- After construction of LRT, bus transit service should be maintained to connect areas further than 800 metres to the LRT, especially in the western parts of Jasper Place.
- Reduced parking requirements should be considered for residences and businesses on Stony Plain Road or close to the LRT.
- Consider a residential parking management program and traffic calming measures, especially in close proximity to transit stations. Review the potential for a City supported car sharing program.

- Intelligent Transportation Systems[13] to reduce delay to motorists could be considered for arterials within Jasper Place.

[13] Potential measures include advanced signal controllers that dynamically allocate green time in response to changes in traffic flow and preemption by LRT trains.

A. MULTI-MODAL TRANSPORTATION PLANNING

This section provides additional discussion on the key elements associated with each travel mode that contributes to their attractiveness. The information provided below was used to aid in the assessment and recommendations provided in the main report.

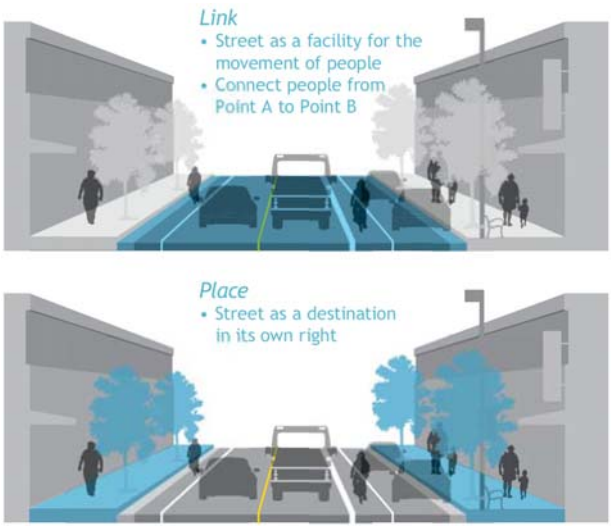
A.1 WALKING

The following five important attributes for pedestrian facilities were considered when assessing the walking environment:

- Place
- Space
- Crossings
- Security
- Connectivity

A.1.1 Place

The *Edmonton Complete streets Guidelines*[1] uses the notion of 'Link and Place' to classify roads. A "link" acts as a connector between two places, where as a "place" is a destination in its own right. Greater value is derived by pedestrians and other street users when a street is designed with recognition of both functions. Contributing to the "place" aspect of a street is the building orientation with respect to the street. Having buildings that are oriented towards the street enliven the public realm, contribute to a sense of human scale, and support ease of accessibility to buildings. Building orientation is a fundamental element that needs to be considered when any of the streets in the area are being considered for redesign.

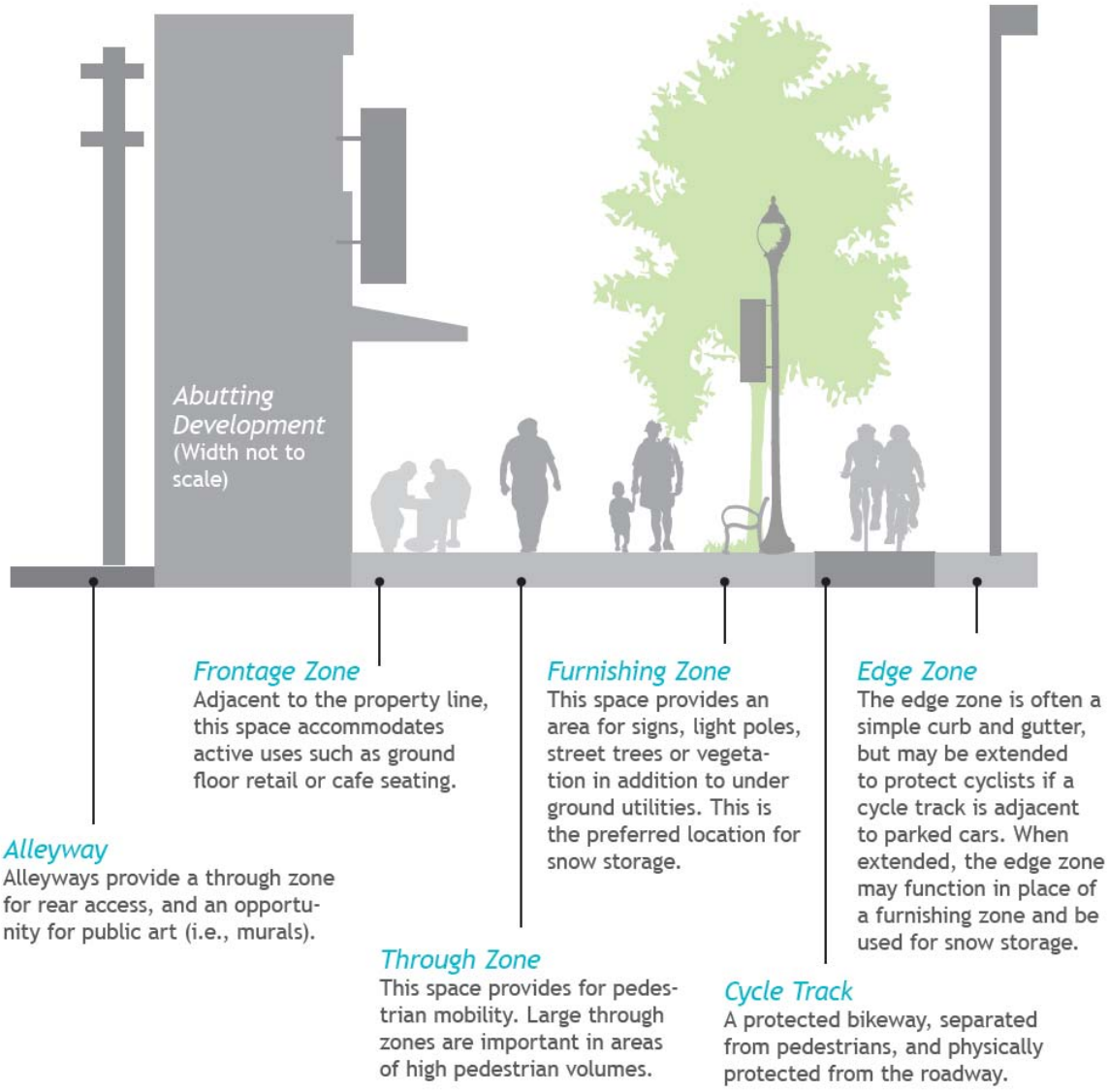


[1] City of Edmonton. *Complete Streets Guidelines.* 2013.

A.1.2 Space

Pedestrians require adequate space on the sidewalk to move efficiently. The amount of space required depends on the function of the street and pedestrian volumes. Where a street acts as a "place", the sidewalk can be divided into four zones: frontage, through, furnishing, and edge. The through zone, which provides for pedestrian mobility, may only be a fraction of the paved boulevard. Other parts of the boulevard can be used for café seating, light poles and furnishings, or to provide a buffer from motor vehicles. Figure A.1 from the *Edmonton Complete Streets Guidelines* depicts the various sidewalk zones.

Figure A.1 - Sidewalk Zones



A.1.3 Safe and comfortable crossings

Controlled pedestrian crosswalks are typically provided with several goals in mind[2]:

1. Appropriately locate controlled crosswalks in response to the anticipated traffic flow and convenience of the pedestrian
2. Provide for pedestrian safety and comfort

[2] See Los Angeles Walkability Guide

3. Increase the level of caution of pedestrians and motorists
4. Create a link between the two sides of the street or mark a block's mid-point or end-point

These principles were used to identify new controlled crosswalk locations and upgrades to existing controlled crosswalks to improve pedestrian protection. A number of factors need to be considered when determining the most appropriate crosswalk type, which include: accident history, pedestrian volume, local demographics, roadway width, vehicle volume, vehicle speed, visibility conditions, and proximity of adjacent pavement markings and signs or signals.

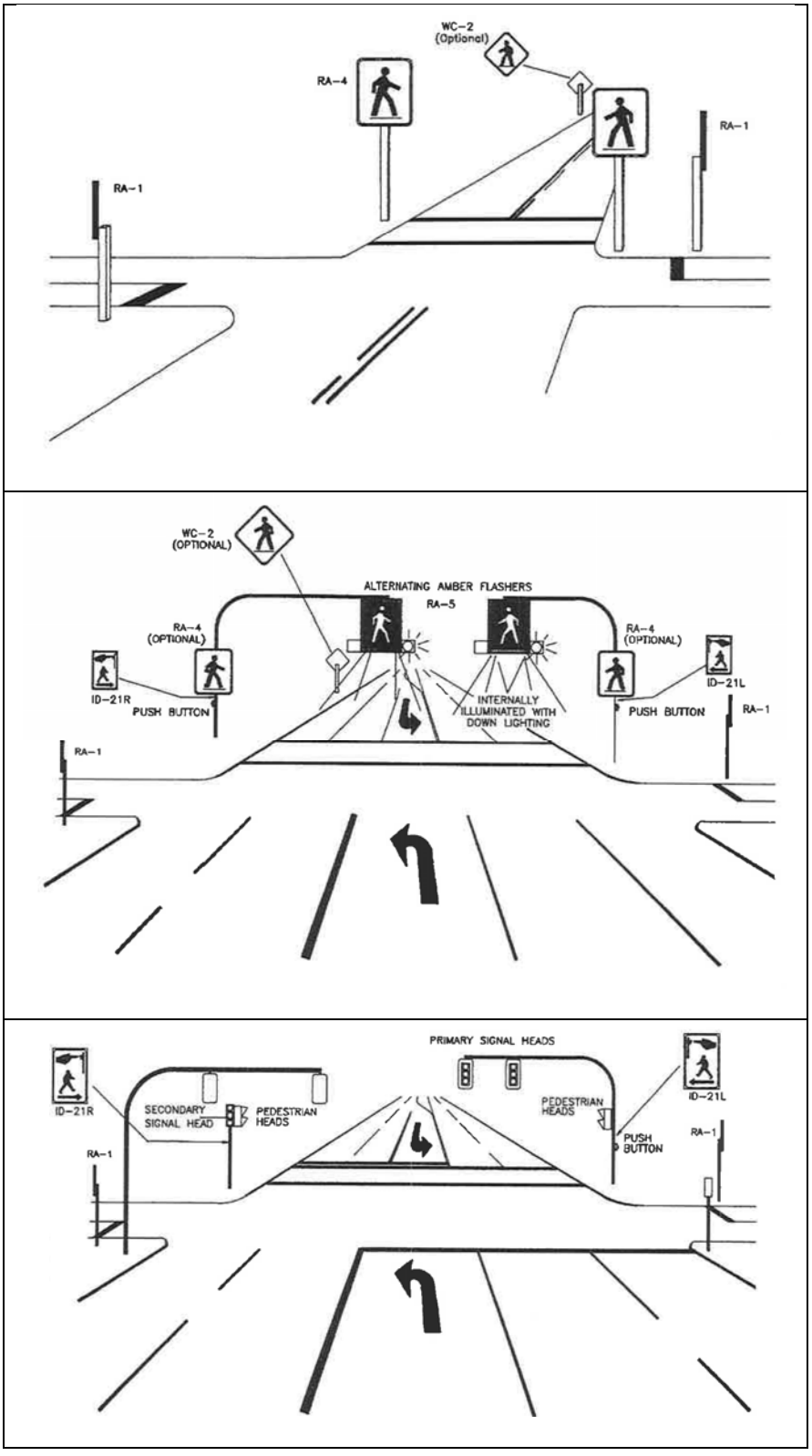
The Transportation Association of Canada (TAC) has developed a hierarchical system[3] for crossings as shown in Figure A.2 including:

1. Marked crosswalks with pavement marking and signage.
2. Special crosswalks including amber flashers.
3. Pedestrian actuated signals. These signals only control traffic on the main street, with traffic on the side street typically stop controlled. The signal displays red only in response to actuation by pedestrians crossing the main street and does not respond to traffic on the side street.

Pedestrian controls have both safety and connectivity implications and should be determined at each recommended crossing through additional engineering analysis. Research has found that providing safe and attractive crossings is "an essential element of having an attractive overall [non-motorized transportation] system."[4]

[3] Transportation Association of Canada. *Pedestrian Crossing Control Guide.* Second ed. 2012.
[4] Transportation Research Board. *TCRP Report 95, Chapter 16: Pedestrian and Bicycle Facilities.* Washington, D.C., National Academy of Sciences: 2012.

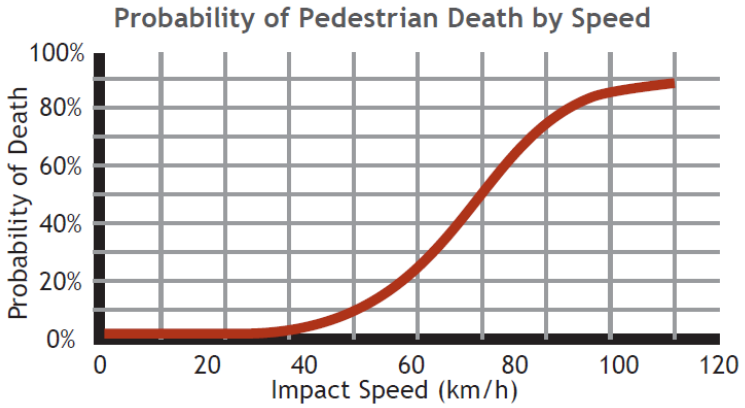
Figure A.2 – Pedestrian Control Devices (TAC)



A.1.4 Safety, Security, and Comfort

The physical separation of pedestrians and moving vehicles is important for comfort and also for safety. This is especially true when vehicle speeds are greater than 50 km/h, at which point the probability that a pedestrian will die when struck by a vehicle significantly increases. The relationship between motor vehicle impact speed and probability of a pedestrian death is shown in Figure A.3.

Figure A.3 - Relation between Pedestrian Deaths and Motor Vehicle Impact Speed



To ensure pedestrian safety and comfort, vehicle speeds in the study area need to be managed. This can be done by incorporating the *Edmonton Complete Streets Guidelines* in future planning and design work for the streets, which would also include traffic management measures.

Pedestrians also tend to use the street network more when they feel secure walking alone. Crime Prevention Through Environmental Design (CPTED) principles can ensure that pedestrians feel like they are not isolated, are visible to others, and are able to access help quickly if the need arises. Elements such as adequate lighting, removal of barriers to visibility, and using building orientation to provide 'eyes on the street' could aid in having people travelling in the neighbourhood feel more secure.

A.1.5 Directness and Connectivity

Connectivity is a measure of the variety of routes available for any given trip between points in an area. Connectivity can vary between different modes of transportation (pedestrian versus automobile) and different parts of the city. The connectivity of an area is related to the

directness of the travel desire lines in an area. For pedestrians, there is a strong desire for a route to be direct. TCRP Report 95 (Chapter 16)[5] found that:

> *"Directness of sidewalk routing is sought by pedestrians. Local deviations producing as little as 12 percent extra walking distance have been observed to engender short-cutting by most pedestrians, while 6 percent local indirectness may be tolerable. At a larger scale, route directness has been shown to be an indicator of higher walking activity. "*

As shown, people travelling on foot are sensitive to deviations in their route that increase travel distance. As such, barriers to pedestrian travel, both physical and psychological (such as high vehicle traffic volumes or speeds) were considered in the assessment.

A.1.6 Limits of this Evaluation

The degree of comfort felt by people walking in a neighbourhood is not limited to the physical elements of the street that are present. As mentioned earlier, having a sense of 'place' is also important in creating a vibrant urban environment. As such, it should not be forgotten that the community should be involved in creating these special places throughout the area. Experts[6] on this subject have suggested that there are four basic characteristics that make a good place: good places promote sociability; good places offer lots of things to do; good places are comfortable and attractive, and; good places are accessible.

Having strong community involvement in developing these places was not included in the assessment completed for the study area, but it is recognized to be a very important element of creating a walkable environment. Other community-based programs, such as Safe Routes to School, would also contribute to the walkability of the area, but have not been included in this assessment.

A.2 CYCLING

Three key concepts were used to evaluate bicycle transportation network: Comfortable and Safe Cycling Facilities, End-of-Trip Facilities, and Connectivity. Connectivity and Comfortable and Safe Facility Types are global concepts that only apply over the entire study area. End-of-

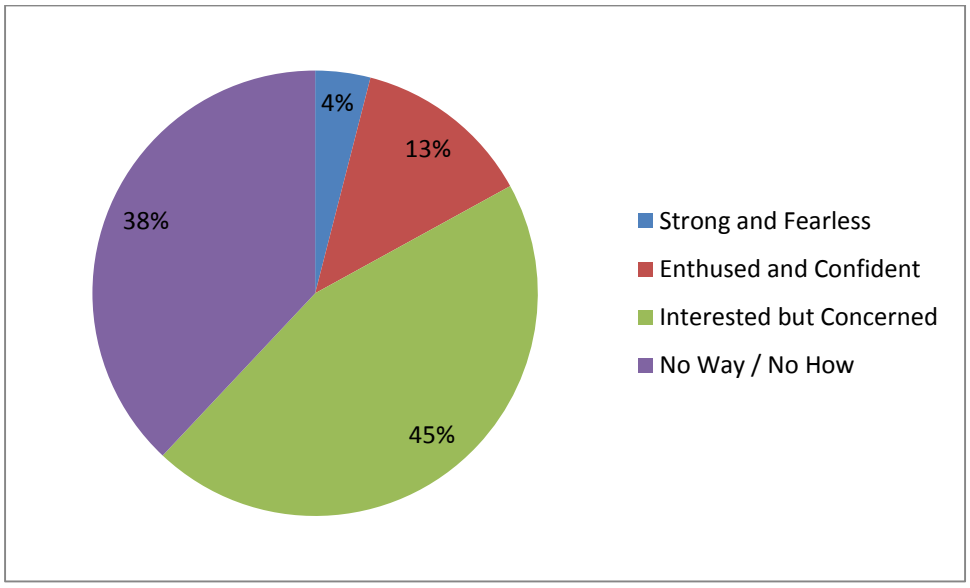
[5] This Transit Cooperative Research Program (TCRP) report can be found at: http://www.trb.org/Publications/TCRPReport95.aspx [accessed April, 2014]
[6] Jay Walljasper, "The Great Neighbourhood Book"

Trip Facilities are appropriate to discuss at a high level for the entirety of the study area, but will be implemented at a very local and site specific level.

A.2.1 Cycling Facilities

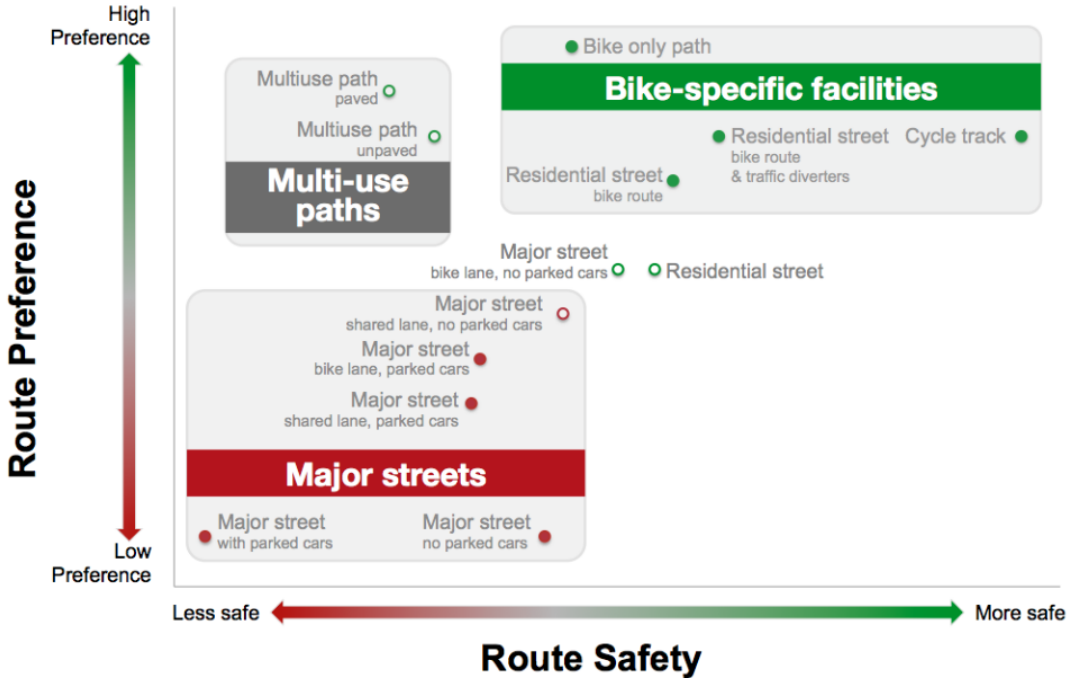
The attitudes of Edmontonians towards cycling can be divided into the four categories summarized in Figure A.4. Separation from vehicles is required in order to encourage "Interested but Concerned" cyclists, which forms the largest category.

Figure A.4 – Cycling Attitudes in Edmonton



A UBC study compared studies on route safety to studies on route preferences for cyclists. The results of the study are shown in Figure A.5.

Figure A.5 - Route safety and route preference for bicycle facility types[7]



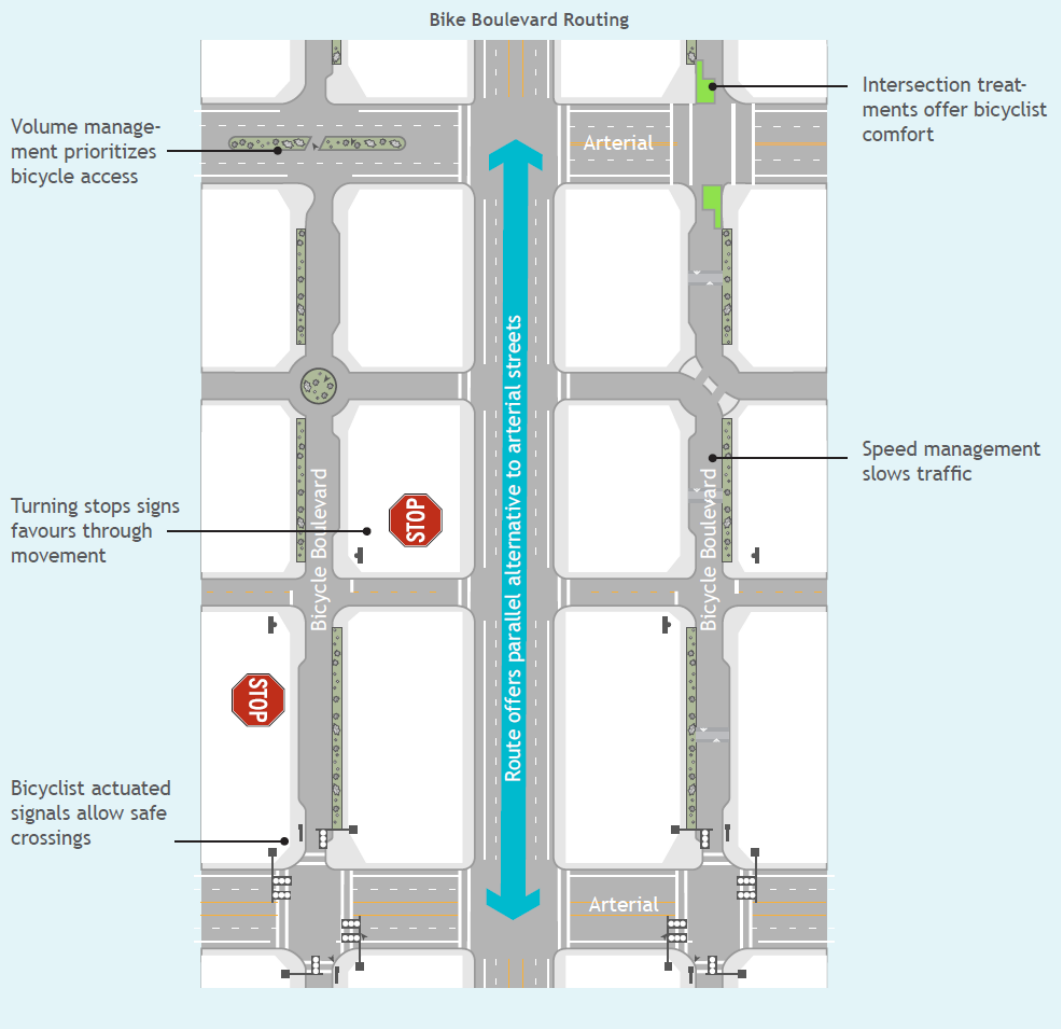
Potential bicycle infrastructure measures were identified using the above information. As shown, the bike-specific facilities of Residential Street – Bike Route, Residential Street – Bike Route & Traffic Diverters, Bike-only Path, and Cycle Track are appropriate to provide safety and comfort to people who are 'Interested but Concerned' about choosing to ride a bicycle as their travel mode. In addition, Major Street – Bike lane, No Parked Cars and Residential Street would also be appropriate facilities.

[7] See http://cyclingincities.spph.ubc.ca/injuries/the-bice-study/

Bike Boulevard

Low-volume, low-speed streets modified to enhance conditions by using treatments such as signage, pavement markings, traffic calming and/or traffic reduction, and intersection modifications. These treatments allow through movements of bicyclists while discouraging similar through trips by non-local motorized traffic.

Source: City of Edmonton Complete Streets Guidelines

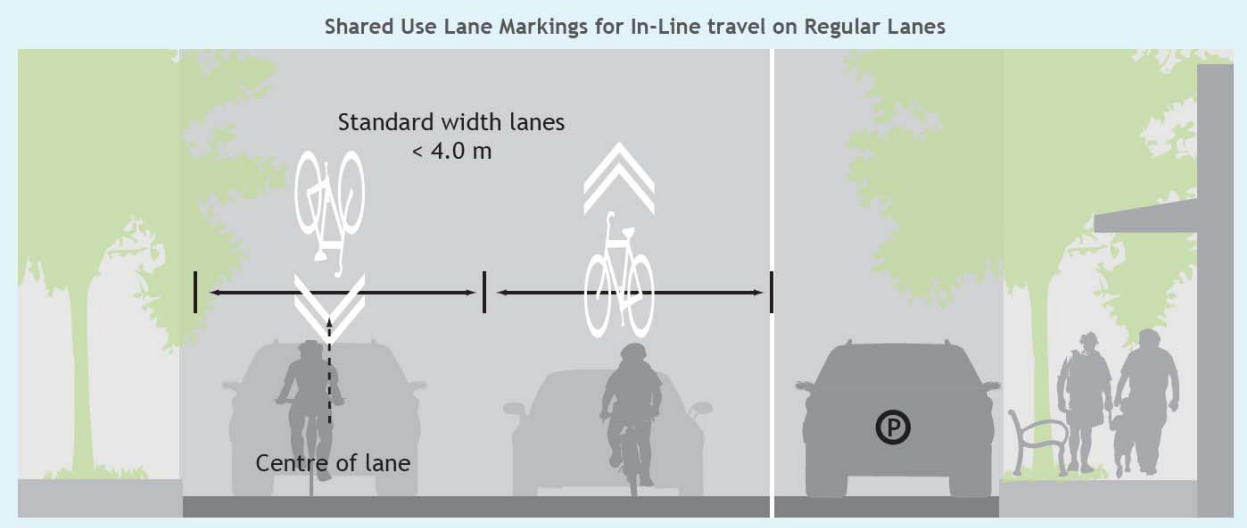


Shared Use Lane

General purpose travel lanes marked with shared use lane markings (sharrows). These facilities encourage bicycle travel and proper positioning within the lane and increase awareness of motorists to expect bicycles along the road.

Different than a Bicycle Boulevard due to a lack of traffic calming and other enhancements designed to provide a higher level of comfort for a broad spectrum of users.

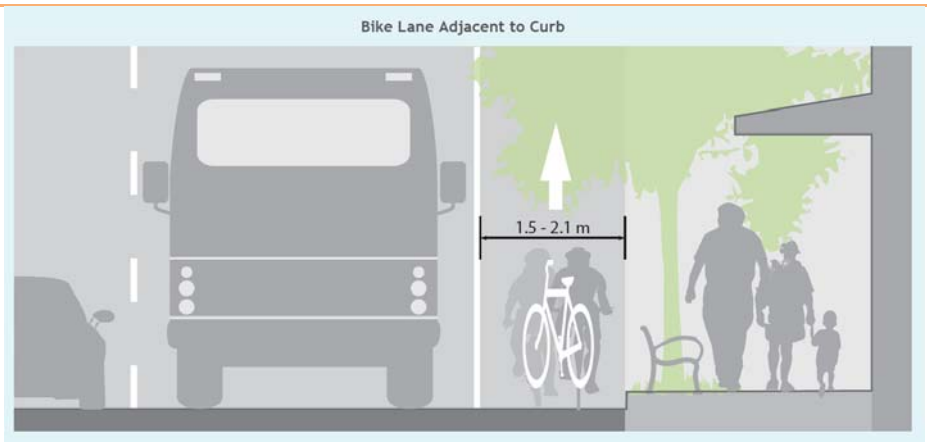
Source: City of Edmonton Complete Streets Guidelines



Bike Lanes

Designate an exclusive space for bicyclists through the use of pavement markings and signage. The bike lne is typically located on the right side of the street, between the adjacent travel lane and curb or parking, and is used in the same direction as motor vehicle traffic.

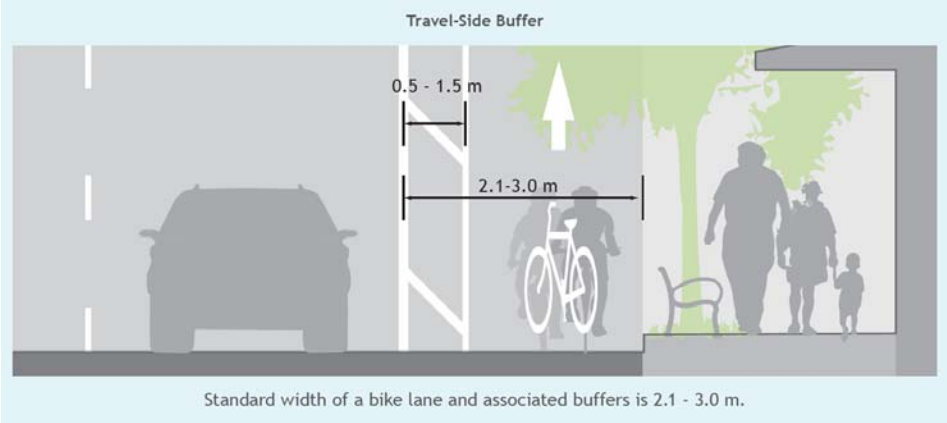
Source: City of Edmonton Complete Streets Guidelines



Buffered Bike Lanes

Enhancement to Bike Lanes, adding a designated buffer space to separate the bicyclle lane form the adjacent motor vehicle travel lane and/or parking lane.

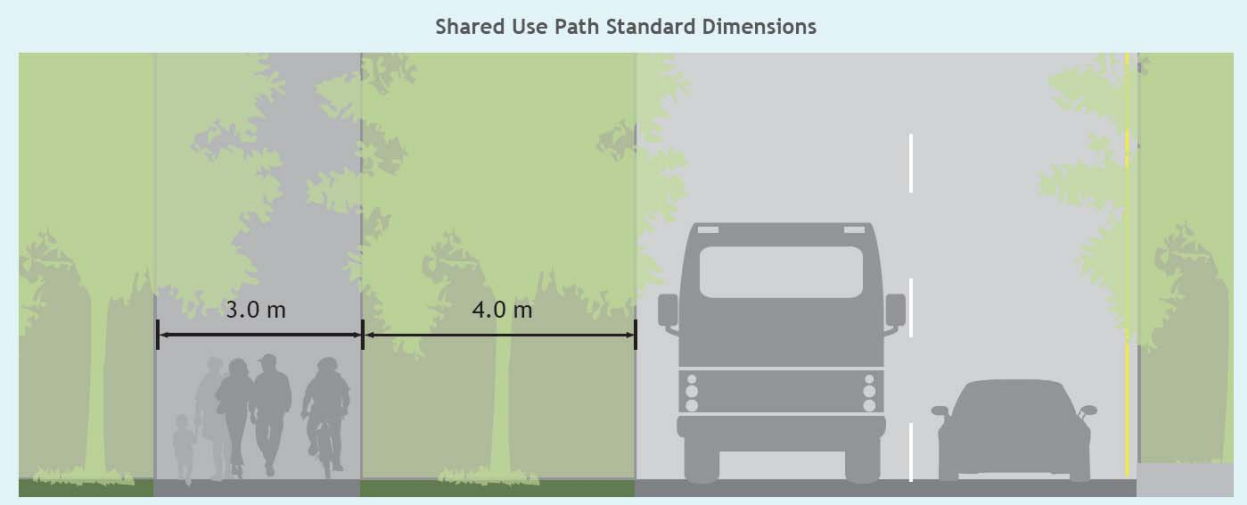
Source: City of Edmonton Complete Streets Guidelines



Shared use Path

Provide for two-way travel for bicyclists and pedestrians separated from motor vehicle traffic. Shared use paths adjacent to roadways are appropriate where there are very few conflicts, low bicyclist volumes, and recreational uses are high.

Source: City of Edmonton Complete Streets Guidelines



A.2.2 End of Trip Facilities

End-of-trip facilities for bicycles include various forms of bicycle parking (stands and racks, enclosures) and complementary infrastructure (lockers, changes rooms, showers). End of trip facilities encourage cycling trips, especially for non-recreational purposes for which cyclists may need to leave their bicycles unattended for longer periods and must change into non-athletic clothing while at work. In addition, provision of bicycle end-of-trip facilities at transit centres and LRT stations promotes trip-chaining of these two modes and increases both cycling and transit usage. Additionally, the use of a bicycle to access transit increases the effective coverage area that transit has compared to accessing transit on foot[8].

Table A.1 summarizes the bicycle parking requirements in the Land Use Bylaw.

[8] Transportation Association of Canada, Bicycle End-of-Trip Facilities: A guide for Canadian municipalities

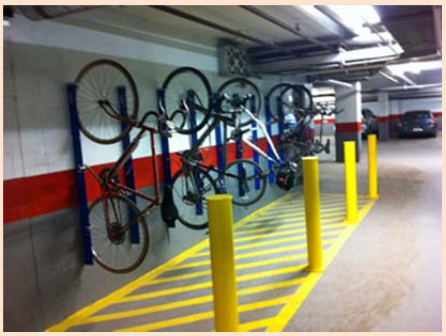
Table A.1 – Bicycle Parking Requirements (Bylaw 12800[9])

Use of Building or Site	Minimum Number of Bicycle Parking Spaces
1. All Residential and Residential-Related Use Classes of 20 Dwellings or more, and all Non-residential Use Classes outside the boundaries of the Downtown Area Redevelopment Plan.	5% of the number of vehicular parking spaces required under Schedule 1 to a maximum of 50 Bicycle Parking spaces with 5 Bicycle Parking spaces being the minimum to be provided.
2. Administration Use and Educational Facilities	10% of the number of vehicular parking spaces required under Schedule 1, with 5 Bicycle Parking spaces being the minimum number of spaces to be provided.
3. All Residential and Residential-Related Use Classes of 20 Dwellings or more, and all Non-residential Use Classes within the boundaries of the Downtown Area Redevelopment Plan	20% of the number of vehicular parking spaces required under Schedule 1 to a maximum of 50 Bicycle Parking spaces, with 5 Bicycle Parking spaces being the minimum to be provided.

As shown, a number of land-uses require bicycle parking and the amount is typically a percentage of what is required for vehicular parking. It is noted that the parking required in the bylaw is assumed to be Short-Term Bicycle Parking, rather than Long-Term Bicycle Parking. A description of these two types of bicycle parking is provided in Table A.2. The images for short-term parking illustrate two examples, one utilizing two on-street parking stalls for 16 bicycle parking spaces and the other using available sidewalk space to provide two types of bicycle parking types (red 'coat hangers' and black 'bike arc').

[9] As of August 2014

Table A.2 - Short-Term versus Long-Term Bicycle Parking

Characteristic	Short-Term Bicycle Parking	Long-Term Bicycle Parking
Visibility	Placed in highly visible locations outdoors	Can be placed indoors or outdoors, not necessarily in a highly visible location
Level of Service	Low level of service • No weather protection • Limited protection against vandalism or theft • Limited complementary infrastructure	Higher level of service • Higher level of weather protection • Higher level of vandalism and theft protection • Can include complementary infrastructure
Users	For use by the general public	For use by designated users or paying users
Payment	Free of charge	Fees for use are common
Examples	 	 

Source: Transportation Association of Canada. Bicycle End-of-Trip Facilities: A guide for Canadian municipalities and employers

Other potential end of trip facilities include tools for minor repairs on bikes and carriers as shown Figure A.6. These could be integrated at bike parking locations and at transit stations or within private developments throughout the study area.

Figure A.6 - Basic Tools for Bike Repairs

A.2.3 Connectivity and Directness

The connectivity of a bicycle network can be evaluated by the mesh width of the network[10]. The mesh width refers to the distance between parallel bicycle routes. For some jurisdictions, this network mesh width is between 250 - 300 m in built-up areas; however, larger mesh widths are possible where there is a lower cycling potential. For example, TransLink (Metro Vancouver) recommends a network of cycling routes that are spaced at 800 metres for 'General Urban' areas such as Jasper Place. The mesh width used for the study area recognizes the land use context in the surrounding area and provides adequate options for people who choose to travel by bicycle for some or all of their travel requirements.

The recommended cycling routes also seek to connect Jasper Place to the rest of Edmonton, including West Edmonton Mall and the downtown.

A.3 TRANSIT

Transit is a unique mode combining elements of vehicular travel with walking/cycling, which are required to access stops and stations, and needs specific to transit. A transit trip has several steps including:

1. Understanding the journey: whether it can be made on transit, when can it be made, what it will cost, and the travel time, routes, and transfers required.

[10] CROW. *Design Manual for Bicycle Traffic.* 2007.

2. Accessing the transit stop or station, typically via walking or cycling.
3. Waiting for the transit vehicle.
4. Embarking on the transit vehicle and travelling on the vehicle, including making transfers if necessary.
5. Disembarking and travelling to the destination, typically via walking or cycling.

Within the study area, the quality of the walking and cycling environments is important for facilitating transit usage. Having direct routes between transit stops/stations and residences or businesses will reduce travel times for accessing transit. A safe and attractive pedestrian environment also makes waiting for transit vehicles more pleasant. End of trip facilities will help cyclists continue via transit and increase its catchment area. A high quality of service for walking and cycling contributes to a high quality of service for transit.

The City of Edmonton seeks to provide transit service within a 400 m walking distance of all residential developments. Light rail transit typically has a larger catchment area, which is commonly estimated as an 800 m walking distance to LRT stations.

Transit is different from other modes because journey start and end times are constrained by a transit timetable created by the transit agency. Unlike walking, biking, or driving trips when travelers leave at their discretion, transit users must adapt their journeys to the transit timetable or spend more time waiting at stops. Higher frequency service decreases overall transit travel times by reducing wait times (or the degree to travelers must adapt their schedules to the transit timetable) and transfer times. Reducing travel times is important for transit, but unlike other modes travel time is depends on time spent waiting for a vehicle time in addition to time spent travelling. Frequencies of 15 minutes or less between transit vehicles start to allow for spontaneous trips that do not require users to plan their journeys around the transit timetable.

The transit timetable also defines when service is offered. An ideal timetable will offer service starting early in the morning and ending late at night to accommodate all potential trips. Most transit users need to make at least two daily trips, one leaving home and the other returning home. If transit service starts late or ends early, or if frequency during the start and end of service is poor, so that transit service is poor for either trip, the service as a whole will become considerably less attractive.

The actual transit travel time for residents of Jasper Place is difficult to determine as destinations and the time of day when journeys take place will vary among the residents. However, by reviewing stop locations, walking and cycling environments, travel times to major destinations such as downtown, and frequency of service, as well as the transit mode share recorded in various surveys, the quality of transit service within Jasper Place can be assessed.

A.4 MOTOR VEHICLES

A.4.1 Traffic Calming

Traffic Calming refers to various measures that are used to manage motor vehicles volumes and speeds in residential areas. Traffic Calming measures can be divided into four general categories[11] as shown in Table A.3.

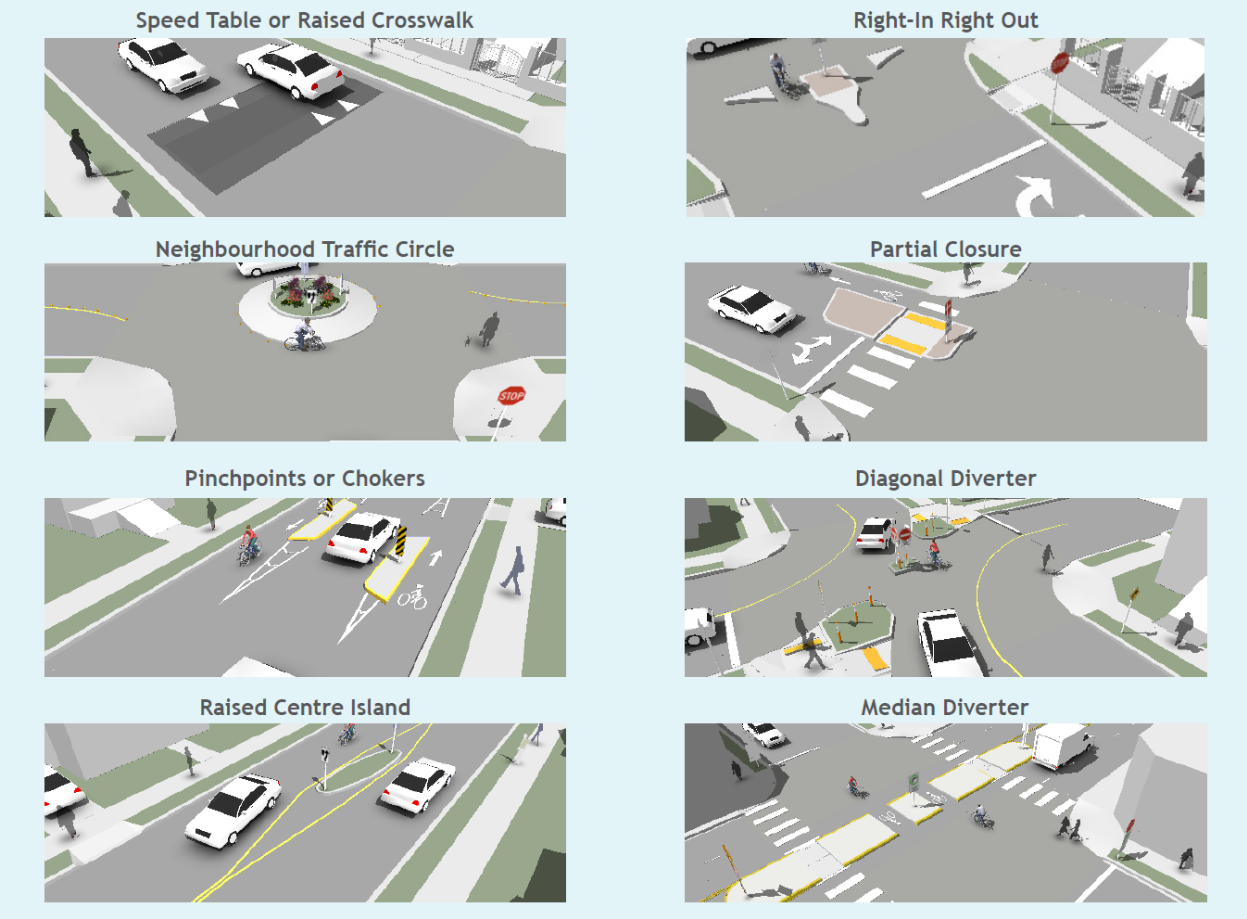
Table A.3 – Summary of Traffic Calming Measures

Category	Potential Measures	Potential Benefits
Vertical Deflection	Speed Hump Speed Table Raised Crosswalk	Most effective at speed reduction, with minor effects on volumes.
Horizontal Deflection	Chicane (one or two lane) Curb Extension Median Island. Neighbourhood Traffic Circle	Most effective at speed reduction, with minor effects on volumes.
Obstruction	Partial Closure Median Diverter Diagonal Diverter Full Closure	Most effective at reducing volumes.
Signing	Speed Signage One-way Stop and Yield	Not primarily intended for traffic calming but may have some effect on volumes.

Several of the above measures are specifically recommended in the Edmonton context in the *Complete Streets Guidelines* as shown in Figure A.7. Some of these measures have already been implemented in Jasper Place including closures on the south legs of intersections with 100 Avenue, a median diverter on 102 Avenue, and a diagonal diverter at 104 Avenue – 153 Street. Traffic calming measures should be applied judiciously as they may also inconvenience local residents, potentially increase emergency response times, create an impediment for other travel modes (e.g. ETS), or have increased maintenance costs depending on the treatment and design identified.

[11] TAC and CITE. *Canadian Guide to Neighbourhood Traffic Calming.* Transportation Association of Canada, Ottawa, ON: 1998.

Figure A.7 – Traffic Calming Measures



Source: Edmonton Complete Streets Guidelines

B. MULTI-MODAL TRIP GENERATION AND ANALYSIS

Vehicular trip generation is traditionally performed using the Institute of Transportation Engineers (ITE) *Trip Generation Manual*[1]. The data in the Manual "were primarily collected at suburban locations having little or no transit service, nearby pedestrian amenities, or travel demand management". It is commonly recognized that these rates are not representative of infill development in a walkable urban context with frequent transit service, such as Jasper Place. The Manual suggests that users "may wish to modify trip generation rates presented in this document to reflect the presence of public transportation service…[or] enhanced pedestrian and bicycle trip-making opportunities".

As such, various methods have been proposed for adjusting trip generation rates for infill developments, such as NCHRP Report 758: *Trip Generation Rates for Transportation Impact Analyses of Infill Developments*[2]. The following analysis is based on a simplified application of this methodology:

1. Identify baseline (vehicular) trip rates for relevant developments. Baseline trips rates are the available (vehicular) trip generation data and were taken from the ITE Manual and City of Edmonton recommended rates. [Section A.1]
2. Convert baseline (vehicular) trip rates to person trips using a baseline vehicle occupancy and mode share that reflects the context in which trip rates were surveyed (typically suburban). [Section A.2]
3. Estimate the local vehicular mode share for Jasper Place, before and after implementation of LRT. [Section A.3]
4. Use the local vehicular mode split and vehicle occupancy to estimate the local vehicular trip generation. [Section A.4]
5. Estimate vehicular trip generation with implementation of LRT using a modified mode split. [Section A.5]

NCHRP 758 further notes that "The use of person trips as the common denominator between baseline ITE data and infill data underscores an important assumption in this research study: that land uses in single-use suburban environments (baseline sites) generate approximately the same quantity of person trips as land uses in dense urban environments (infill sites)." Validation conducted as part of the research indicates that this approach produces vehicular trip generation estimates that are 33% to 50% lower than estimates produced using conventional trip generation, which is consistent with other research and appears reasonable in the Jasper Place context.

[1] Institute of Transportation Engineers. *Trip Generation Manual, 9th ed.* Washington, DC.: 2012.
[2] Transportation Research Board. *NCHRP Report 758: Trip Generation Rates for Transportation Impact Analyses of Infill Developments.* Washington, D.C., National Academy of Sciences: 2013.

Trip generation was only conducted during the weekday PM peak hour, which is generally acknowledged as the time of peak transportation activity and potential travel delay.

B.1 BASELINE TRIP RATES

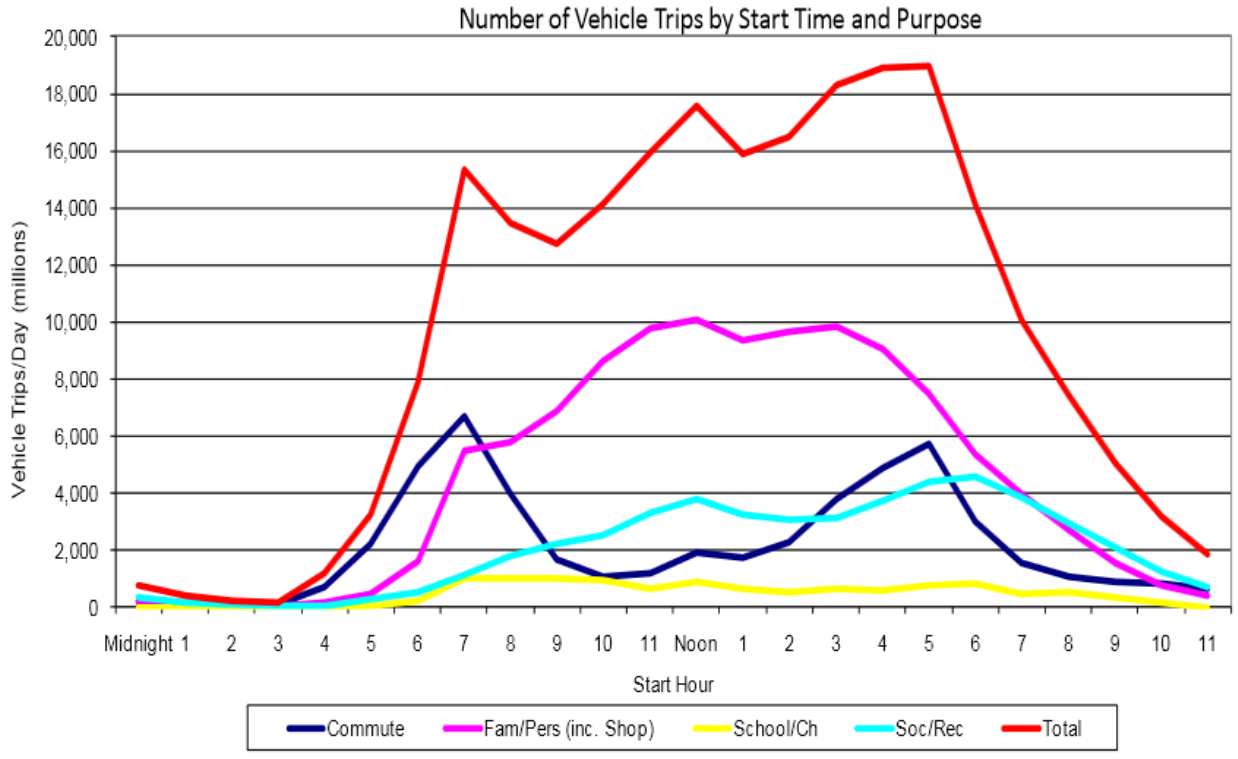
The following vehicular trip generation rates from the ITE *Trip Generation Manual* and standard City of Edmonton rates were used for baseline trip rates:

1. Commercial: ITE 826 (Specialty Retail Centre) – 2.71 trips/1000 ft^2.
2. Residential: Edmonton recommended trip rates – 0.4 trips/dwelling unit for medium density residential (MDR); 0.79 trips/dwelling unit for low density residential (LDR).
3. Office: ITE 710 (General Office Building) – 1.49 trips/1000^2..

B.2 BASELINE PERSON TRIP RATE

Baseline mode shares and vehicle occupancies that reflect the context in which the trip rates were measured were then used to convert vehicular trips to person trips. The majority of surveyed sites in the ITE Manual are from the US; therefore, vehicle occupancies were derived from the US National Household Travel Survey (NHTS). The NHTS indicates that during the PM peak hour most trips are taken for either commuting to work, family/personal activities including shopping, and social/recreational activities as shown in Figure B.1.

Figure B.1 – Distribution of Vehicle Trips by Trip Purpose and Start Time (2009 US NHTS)



Based on the above figure, the average vehicle occupancy in the US NHTS for shopping/errands and social/recreational activities was used for the commercial trip generation. Since ITE data is typically from suburban and exurban sites with limited pedestrian, bicycle, and transit activity, all trips were assumed to be vehicular. This conservative assumption is recommended by NCHRP 758 if specific mode share data is not available.

For residential trips, as the baseline trip rate is the City of Edmonton's recommended rate, the weighted average for home based activities from the *1994 City of Edmonton Household Travel Survey* was used for baseline vehicle occupancy. The average mode share for all trips from the *2006 Edmonton Household Travel Survey* was used for the baseline mode share.

Most office trips are assumed to be work related in the PM peak hour. The vehicle occupancy for work trips in the US NHTS was used as the baseline vehicle occupancy. Similar to the commercial land use, all trips are assumed to be vehicular. The baseline trip rates are shown in the following Table B.1.

Table B.1 – Baseline Trip Generation

	(A)	(B)	(C)	(D)
Land Use	Vehicle Trip Rate*	Vehicle Occupancy	Vehicle Mode Share	Person Trip Rate*
Commercial	2.71	1.98	100%	5.37
Residential (MDR)	0.4	1.41	78%	0.73
Residential (LDR)	0.79	1.41	78%	1.44
Office	1.49	1.15	100%	1.71

*Trip Rates expressed per 1000 ft^2 for commercial and office, per dwelling unit for residential.
(D)=(A)*(B)/(C)

The person trip rates shown in the above table are intended to include trips generated by all modes, including pedestrians, cyclists, transit and motor vehicles.

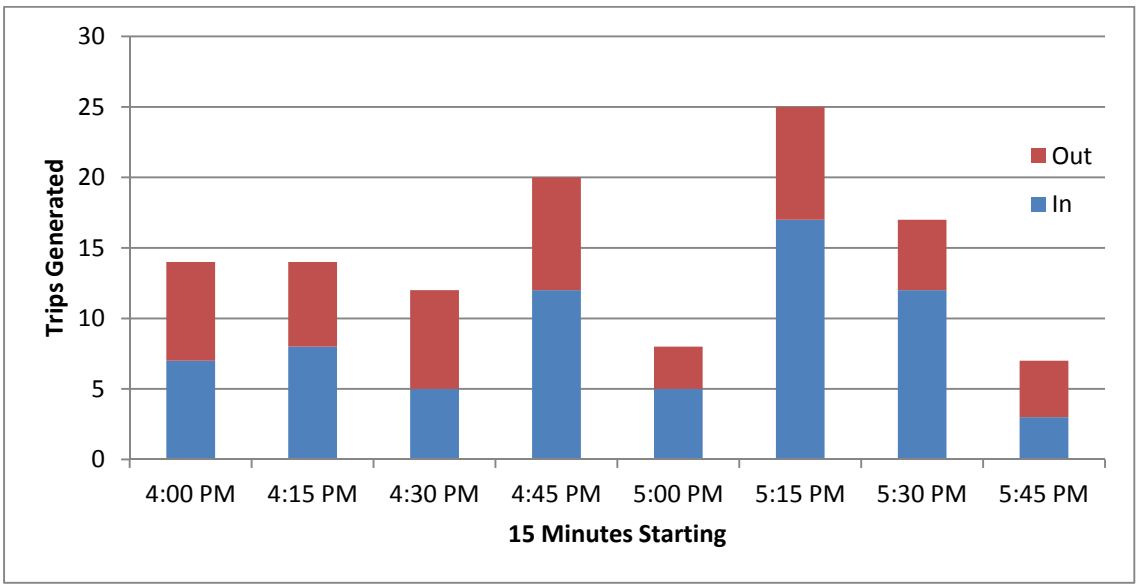
B.3 LOCAL MODE SHARES

Traffic counts at existing commercial and residential developments were conducted to assist with estimating a local mode split within the Jasper Place context.

B.3.1 Stony Plain Road Commercial Trip Generation

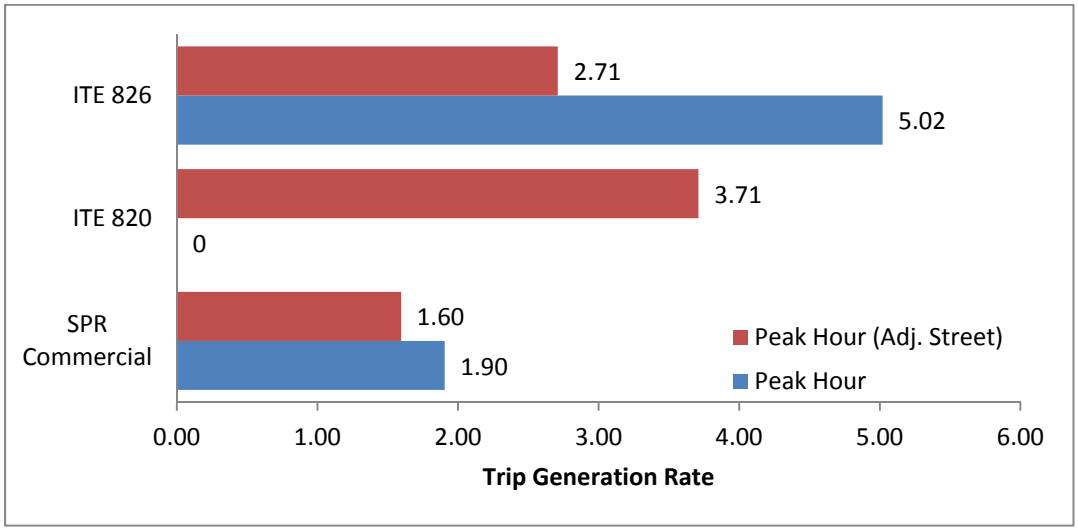
To determine a local commercial mode split, a strip mall commercial development located south of Stony Plain Road between 152 Street and 151 Street was surveyed from 4:00 PM to 6:00 PM on March 27, 2014. The site is currently zoned as Low Intensity Business (CB1) and includes a mixture of retail, service, and eating establishments in a strip mall with a footprint of 42 000 ft^2. Figure B.2 summarizes the results of the survey; it should be noted that a yoga class starting at 5:30 PM appears to have caused a spike in traffic during the 15 minutes prior.

Figure B.2 – Commercial Trip Generation Survey



As the available parking was reduced by snow storage in some of the stalls, the parking lot reached capacity briefly and some patrons were observed parking on 152 Street. To ensure that vehicles parking on-street after the parking lot reached capacity were accounted for, an additional ten vehicles was added to the observed trip generation. As summarized in the following Figure B.3, the calculated commercial trip rate remains considerably lower than both the ITE 820 (Shopping Centre) and ITE 826 (Specialty Retail Centre, "small strip shopping centers") land uses from ITE's *Trip Generation Manual*.

Figure B.3 – PM Peak Hour Commercial Trip Generation Rates (per 1000 ft²)

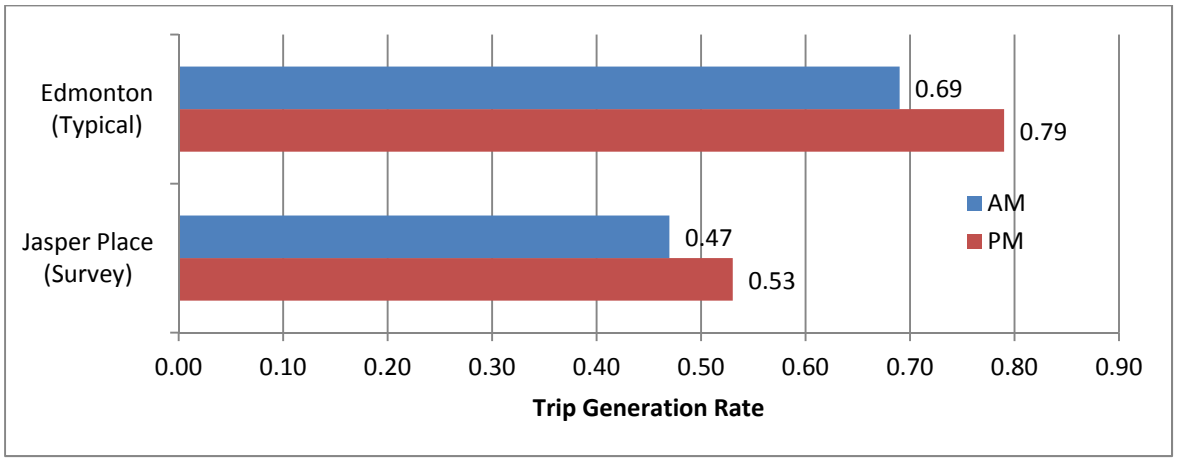


Assuming that there were no non-vehicular trips at developments surveyed for ITE 826, the survey indicates a 41% decrease in vehicular trip generation in Jasper Place (from 2.71 to 1.60 trips per 1000 ft²). As previously mentioned, this is based on the assumption that all strip mall developments like the one surveyed have the same person trip generation rate though the vehicular trip generation can differ depending on local mode splits.

B.3.2 Low Density Residential Trip Generation

Local mode share for residential developments was also derived through a survey. A total of 66 low density residential (LDR) units south of 100 Avenue were surveyed on February 26, 2014 during the AM and PM Peak Hours. The average density of the surveyed area was approximately 15 dwelling units per net residential hectare (du/ha), which appears to be a typical density for LDR developments in Jasper Place. Observed trip rates of 0.47 and 0.53 in the AM and PM peak hours, respectively, are lower than typical Edmonton rates as shown in Figure B.4.

Figure B.4 – LDR Trip Generation Rates



As shown in Figure B.4, the observed trip rates are 32% and 33% lower than typical Edmonton trip rates for LDR in the AM and PM peak hours, respectively.

On-street parking adjacent to these residential units was also surveyed to help understand the effect of intensifying residential development in the Transit Oriented Housing and Active Edge Housing areas. The survey indicated a parking demand of 0.41 on-street parked vehicles per dwelling unit.

B.3.3 Mode Share Literature Review

A literature review was conducted to guide the estimation of future mode shares in Jasper Place for the post-LRT scenario.

Research conducted by the City of Portland based on a 1994 travel survey found that while the presence of high frequency transit helped to reduce the auto mode split, pairing transit with

mixed use development was considerably more effective as shown in Table B.2. The latter scenario is similar to Jasper Place.

Table B.2 – Mode Splits in the City of Portland

Land Use Type	Mode Split: Auto	Mode Split: Walk	Mode Split: Transit	Mode Split: Bike	Mode Split: Other	Daily Vehicle Miles per Capita	Auto Ownership per Household
High Frequency Transit/Mixed Use	58.1%	27.0%	11.5%	1.9%	1.5%	9.8	0.9
High Frequency Transit Only	74.4%	15.2%	7.9%	1.4%	1.1%	12.4	1.5
Remainder of Multnomah Co.	81.5%	9.7%	3.5%	1.6%	3.7%	17.3	1.7
Remainder of Region	87.3%	6.1%	1.2%	0.8%	4.5%	21.8	1.9

Source: Metro 1994 Travel Survey

This table shows data derived from the Metro 1994 Travel Behavior Survey that compares auto and non-auto mode shares. The data was analyzed by small geographic units that allowed for a comparison of areas with good transit and a high mix of uses with other parts of the region.

TCRP Report 95 (chapter 17): *Transit Oriented Development*[3] cites the following mode shares from a study of 26 California sites adjacent to rail transit shown in Table B.3. The mode share for work trips shows a noticeable decrease, but the effect of rail transit on other trip purposes is minimal. The surveyed sites included residential, office, and commercial land uses, in both urban and suburban areas. It is not clear to what extent land uses varied at individual sites, but the higher vehicular mode shares compared to the Portland study likely reflect a lack of mixed use development at many sites.

Table B.3 – Travel Mode at 26 California Rail Transit Stations

Travel Mode	Work	Shopping	Meal or Snack	Pick up, Drop off Children	Other Errands	Social, Recreation
Drove (alone)	66.4%	55.6%	55.6%	58.3%	72.8%	62.6%
Carpool	5.3	29.0	33.3	31.7	22.8	18.6
Rail Transit	24.3	4.1	2.8	0.0	1.8	10.1
Bus Transit	2.2	3.6	3.7	6.7	0.9	2.5
Bicycled	0.6	0.0	0.9	0.0	0.0	1.5
Walked	1.3	7.7	3.7	3.3	1.8	2.5
Took Taxi	0.0	0.0	0.0	0.0	0.0	2.0
Number of trips	877	169	108	60	114	198

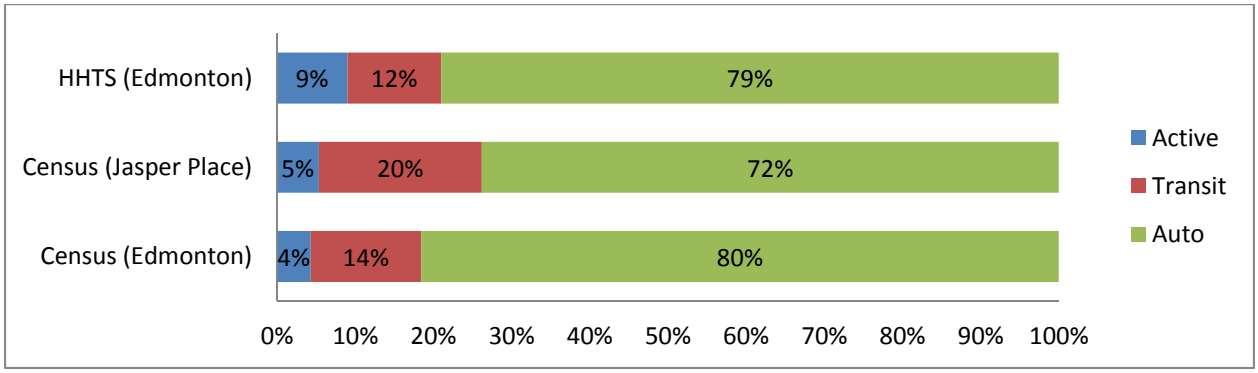
As shown above, only 71.7% of work trips are made by vehicle when in close proximity to a rail transit station. However, the mode share for vehicles remains much higher for other trip purposes:

[3] Transportation Research Board. *TCRP Report 95, Chapter 17: Transit Oriented Development.* Washington, D.C., National Academy of Sciences: 2010.

84.6% for shopping, 88.9% for meal or snack, 95.6% for other errands, and 81.2% for social/recreation trips.

Two local data sources were reviewed. The City of Edmonton`s 2012 census includes mode share data for individual neighbourhoods, but only for home to work trips. The City's 2006 Household Travel Survey (HHTS) has mode share data for both work trips and all trip purposes, but data is not broken down by neighbourhood. A comparison of mode share data is shown below in Table B.4 for home to work trips from the census and the 2006 Household Travel Survey (HHTS). Active modes refer to both walking and cycling.

Table B.4 – Local Mode Share Data for Home to Work Trips



As shown above, Jasper Place already exhibits a vehicular travel to work mode split of 72%, which is lower than the Edmonton average and comparable to the 71.7% surveyed at the California rail transit stations. Compared to the Portland study, which reported a vehicular mode split of 58.1% for all trips (not just work trips), Jasper Place has the potential for further decreases in vehicular mode share.

B.4 JASPER PLACE EXISTING TRIP GENERATION RATES

Vehicular trip generation rates for Jasper Place developments are based on the local mode share and vehicle occupancy. The *1994 City of Edmonton Household Travel Survey* includes information on the vehicle occupancy for different trip purposes, for example, home based work, or home based shopping. The vehicle occupancy rates from the 1994 Survey were used as follows:

1. The vehicle occupancy for the commercial land uses is the weighted average of home based shopping, home based social/recreation, home based other, and non-home based other trip purposes.
2. The vehicle occupancy for residential land uses is the weighted average of all home based activities.
3. The vehicle occupancy for office is based on home based work trips.

For commercial and residential land uses, the local trip rate and local vehicle occupancy are then used to calculate a person vehicle trip rate. All other trips are then assumed to be made by non-vehicular modes. Although only low density residential was surveyed, it was assumed that all residential developments will exhibit a similar lower vehicle mode share. The calculated local vehicle mode share is show in Table B.5.

Table B.5 – Local Vehicle Mode Share in Jasper Place

	(A)	(B)	(C)	(D)	(E)
Land Use	Vehicle Trip Rate*	Vehicle Occupancy	Vehicle Person Trip Rate	Person Trip Rate*	Vehicle Mode Share
Commercial	1.60	1.53	2.448	5.37	46%
Residential (LDR)	0.53	1.41	0.7473	1.44	52%

*Trip Rates expressed per 1000 ft^2 for commercial and office, per dwelling unit for residential.
(C)=(A)*(B); (E)=(C)/(D)

Using the above mode shares, local vehicle trip rates were calculated as shown in Table B.6. No office trip surveys were completed and the vehicle mode share of 80% from the *2006 Edmonton Household Travel Survey* for home to work trips was conservatively assumed to apply to Jasper Place. The calculated trip rates represent a reduction from typical City of Edmonton and ITE *Trip Generation Manual* rates.

Table B.6 – Jasper Place no-LRT Trip Generation

	(A)	(B)	(C)	(D)
Land Use	Person Trip Rate*	Vehicle Mode Share	Vehicle Occupancy	**Vehicle Trip Rate***
Commercial	5.37	46%	1.53	**1.60**
Residential (MDR)	0.73	52%	1.41	**0.27**
Residential (LDR)	1.44	52%	1.41	**0.53**
Office	1.71	79%	1.09	**1.24**

*Trip Rates expressed per 1000 ft^2 for commercial and office, per dwelling unit for residential.
(D)=(A)*(B)/(C)

The above trip rates and vehicle mode shares without LRT already represent a lower than average vehicle trip generation compared to the Edmonton average, and even compared to the literature review of mode shares in Portland and California. These numbers likely reflect the current condition in Jasper Place: a walkable mixed use community with high quality transit service. Therefore, we think the calculated vehicle trip rates are appropriate for the study context.

B.5 JASPER PLACE POST-LRT TRIP GENERATION RATES

Due to the quality of current conditions, the effects of LRT are expected to be modest, but a further reduction of 5% to the vehicle mode share was used for a sensitivity analysis as shown in Table B.7.

Table B.7 – Jasper Place post-LRT Trip Generation

	(A)	(B)	(C)	(D)
Land Use	Person Trip Rate*	Vehicle Mode Share (5% decrease)	Vehicle Occupancy	**Vehicle Trip Rate***
Commercial	5.37	41%	1.53	**1.42**
Residential (MDR)	0.73	47%	1.41	**0.24**
Residential (LDR)	1.44	47%	1.41	**0.48**
Office	1.71	74%	1.09	**1.16**

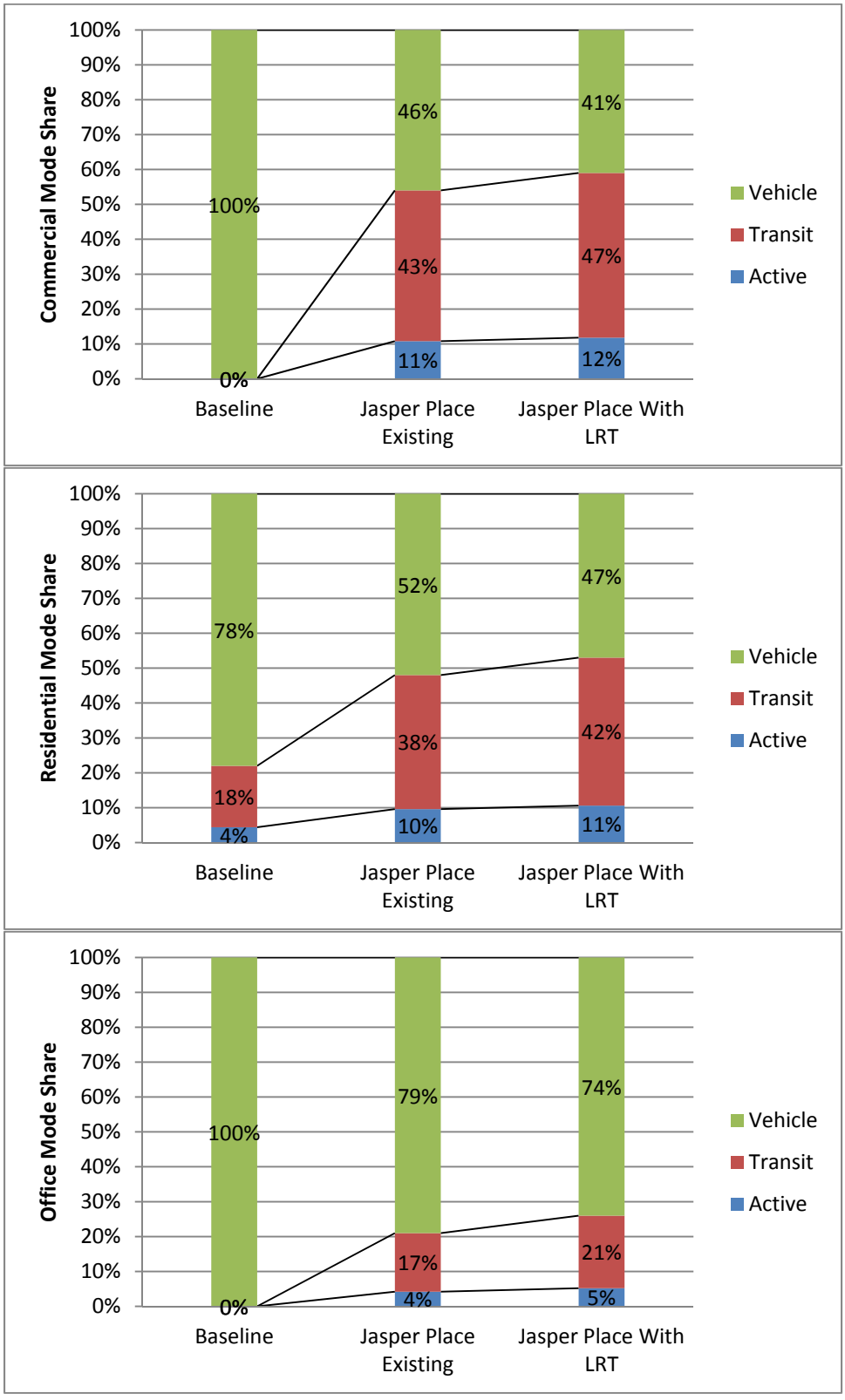
*Trip Rates expressed per 1000 ft^2 for commercial and office, per dwelling unit for residential.
(D)=(A)*(B)/(C)

As shown above, a 5% decrease in vehicular mode share results in decreases to vehicular trip generation of 11% for commercial, 9.6% for residential, and 6.3% for office, respectively.

B.6 MODE SHARE SUMMARY

The City of Edmonton's *2006 Household Travel Survey* indicates that about 20% of non-vehicular home to work trips are made using active modes (walking or cycling) and 80% are made using transit. Assuming the above mode splits, the following Figure B.5 summarizes the change in person trip mode split between the baseline mode split, which represents typical trip rates used for suburban development, local Jasper Place mode split, and post-LRT mode split.

Figure B.5 Person Trip Mode Share Comparison



B.7 MIXED USE HUB TRIP GENERATION

The approximately 16.5 hectare mixed use hub is expected to redevelop as two to eight storey buildings with commercial uses on the ground floor and residential/office uses on the upper floors. For analysis purposes we assumed that the Mixed Use Hub area would be covered with five storey buildings. Floors will be used with a ratio of 1 office : 2 commercial : 7 residential. The analysis completed assumed 75% site coverage for buildings with residential units of 1,200 gross square feet in size. The average post-redevelopment land uses for a 1 hectare parcel are summarized in Table B.8.

Table B.8 – Mixed Use Hub: 1 hectare of redevelopment

Land Use	Analysis Units	
Commercial	80.7	(1000 ft^2)
Office	40.4	(1000 ft^2)
Residential (MDR)	235	Dwelling unit

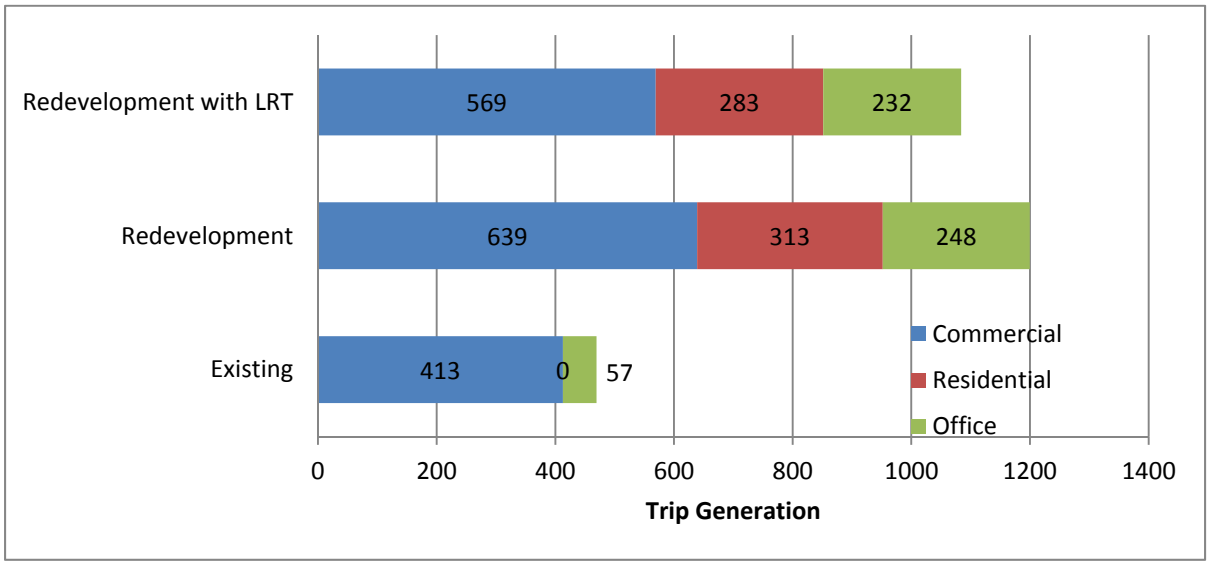
The Learning Scenarios Report includes data on existing developments within Jasper Place for each of the four neighbourhoods. Most of the proposed Mixed Use Hub is located in Canora and West Jasper Place. The floor area ratio of commercial/industrial developments for the two west neighbourhoods is 0.57, and retail floor area makes up 85% of total commercial/industrial floor area. These values were used to calculate the square footage and existing trip generation of areas that were redeveloped in the analysis. Table B.9 summarizes the expected change in trip generation during the PM peak hour assuming 30% of parcels redevelop.

Table B.9 – PM Peak Hour Vehicular Traffic Projection

Land Use	Analysis Units	Trip Rate	In%	Out%	Trips In	Trips Out	Total
Existing Trip Generation							
Commercial	258 (1,000 ft^2)	1.60	44%	56%	182	231	413
Office	46 (1,000 ft^2)	1.24	17%	83%	10	47	57
Total					191	278	469
Future Trip Generation - No LRT							
Commercial	399 (1,000 ft^2)	1.60	44%	56%	281	358	639
Residential	1165 Dwelling Unit	0.27	63%	37%	197	116	313
Office	200 (1,000 ft^2)	1.24	17%	83%	42	206	248
Total					520	679	1200
Difference from Existing					**329**	**401**	**730**
Future Trip Generation - With LRT							
Commercial	399 (1,000 ft^2)	1.42	44%	56%	250	319	569
Residential	1165 Dwelling Unit	0.24	63%	37%	178	105	283
Office	200 (1,000 ft^2)	1.16	17%	83%	39	193	232
Total					468	616	1084
Difference from Existing					**277**	**338**	**615**

The PM peak hour trip generation is also shown graphically in Figure B.6. With redevelopment, vehicular trip generation within the existing Mixed Use Hub area is expected to increase by 104%. With the implementation of LRT, the increase in vehicular trip generation will be limited to 84%.

Figure B.6 - PM Peak Hour Vehicular Traffic Projection



B.8 TRANSIT ORIENTED HOUSING TRIP GENERATION

The observed trip generation rates and density of 15 du/ha was used to estimate existing trip generation during the AM and PM peak hours. Since the blocks within the four neighbourhoods are approximately the same size, a 155 m by 50 m half-block (0.78 ha) was used as the basis of analysis. Each half-block is typically bounded by three roads and an alley.

A local trip rate for transit oriented housing was calculated using the Edmonton recommended trip rate for RF5 (Row Housing) of 0.46 and 0.58 trips/dwelling unit in the AM and PM peak hours, respectively. The mode share and vehicle occupancy from the mixed use hub analysis were used to derive a person trip rate shown in Table B.10, and vehicular trip rate shown in Table B.11, using the same calculation methodology.

Table B.10 – Baseline Row Housing Trip Generation

	Vehicle Trip Rate*	Vehicle Occupancy	Vehicle Mode Share	Person Trip Rate*
AM peak hour	0.46	1.41	78%	0.84
PM peak hour	0.58	1.41	78%	1.06

*Trip Rates expressed per dwelling unit.

Table B.11 – Jasper Place Row Housing Trip Generation

	Person Trip Rate*	Vehicle Mode Share	Vehicle Occupancy	Vehicle Trip Rate*
AM peak hour	0.84	52%	1.41	0.31
PM peak hour	1.06	52%	1.41	0.39

*Trip Rates expressed per dwelling unit.

Using the above vehicle trip rates, the trip generation for a typical half-block before, and after, redevelopment is shown in Table B.12. Without redevelopment, the existing area is assumed to be developed as low density residential at 15 du/ha. Redevelopment is assumed to increase densities to 45 du/ha of row housing.

Table B.12 – Transit Oriented Housing Trip Generation per Half-Block

Peak Hour	Analysis Units	Trip Rate	Total Trips
Existing Trip Generation			
AM	11.6 dwelling units	0.46	5.4
PM	11.6 dwelling units	0.53	6.2
Redevelopment Trip Generation			
AM	34.9 dwelling units	0.31	10.8
PM	34.9 dwelling units	0.39	13.6