TRANSPORTATION PLANNERS AND ENGINEERS

Holyrood DC2

Transportation Impact Assessment

Final Report

Prepared for

Regency Developments

Date

July 31, 2017

Project No.

3459.03

CORPORATE AUTHORIZATION

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The Association of Professional Engineers
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EXHIBITS

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1. INTRODUCTION

1.1 Background

Stantec, on behalf of Regency Developments, is currently preparing a new Site Specific Development Control Provision (DC2) to accommodate the redevelopment of an existing medium density residential site located in the Holyrood neighbourhood in southeast Edmonton. The proposed DC2 includes the development of seven residential apartment buildings accommodating a maximum of 1,200 dwelling units with up to 1,200 m^2 (12,917 SF) of non-residential land uses integrated within the main floor of the residential buildings.

1.2 Study Purpose

The proposed Holyrood DC2 development is anticipated to result in an increase in traffic as compared to the existing development; therefore, Bunt & Associates was retained to complete a Transportation Impact Assessment (TIA) to document the existing and anticipated future activity on the adjacent transportation network.

It is anticipated that the contents of this report are of sufficient detail to provide the client group and the City of Edmonton with a clear appreciation for the transportation characteristics of the proposed development and the resulting impacts on the overall adjacent transportation network. Submission of this report to the City of Edmonton will aid in the review of the redistricting application and subsequent development permit applications.

1.3 Study Methodology

The traffic review was completed using the following methodology:

- An examination of the development area with respect to existing conditions including land use, roadways, walkways, bicycle routes, and traffic conditions;
- A review of the transit service network, specifically the accessibility to the future Valley Line LRT;
- An estimate of future vehicular trip patterns generated to and from the development area;
- The completion of an overall analysis and assessment of the estimated roadway volumes in the vicinity of the proposed development to identify lane requirements, capacity restrictions, and traffic impacts associated with the proposed development; and
- The identification of roadway improvements and traffic control mitigation measures, if required, to ensure that safe and reasonable levels of traffic service are maintained.

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2. SITE CONTEXT –AREA CONDITIONS

2.1 Site Location

The Holyrood DC2 site is located within the Holyrood neighbourhood in southeast Edmonton and is bounded by 90 Avenue to the south, 95 Avenue to the north, 85 Street to the west, and a north-south alley to the east, as shown in **Exhibit 2-1**.

2.2 Existing Conditions

2.2.1 Land Use

The development site is currently zoned as Site Specific Development Control Provision (DC2). The two apartment buildings located at the north end of the site accommodate a total of 96 dwelling units and are not planned for redevelopment. The remaining site includes a series of two-storey medium density residential buildings that accommodate a total of 160 townhouses, which are planned for redevelopment. All of the apartment and townhouse units are currently fully occupied.

The lands to the north, east, and west of the site can be best described as low density residential neighbourhoods. The Vimy Ridge Academy and the Dermott District Park are located south of 90 Avenue and east of 83 Street, and Bonnie Doon Mall is located south of 90 Avenue west of 83 Street.

2.2.2 Adjacent Roadways and Intersections

The following roadways are currently developed in the vicinity of the site:

- ***90 Avenue*** is a four-lane undivided arterial roadway that runs east-west along the south boundary of the site. A boulevard sidewalk, which transitions into a paved shared use path, is provided along the north side of the roadway, and a monowalk is provided along the south side of the roadway. The posted speed limit is 60 km/hr.

- ***93 Avenue*** is an east-west collector roadway through the redevelopment site. At 82 Street, the roadway transitions to a northeastern/southwestern alignment (82 Street) then transitions back to an east-west alignment (94 Avenue) and extends east to 75 Street. East of 79 Street, 94 Avenue is designated as a local road. The width of 93 Avenue/82 Street/94 Avenue ranges from 10.9m east of 85 Street to 10.5m east of 82 Street. On street parking is permitted along both sides of the roadway and transit routes 307 and 302 operate along the segment between 85 Street and 79 Street. Boulevard sidewalks are provided along both sides of the roadway and the assumed speed limit is 50 km/hr. A school is located on the northwest corner of the 94 Avenue/79 Street intersection and a school zone is in place along 82 Street/94 Avenue in the vicinity of the school.

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Exhibit 2-1

Site Location and Existing Conditions

- ***95 Avenue*** is a collector roadway that runs east-west along the north boundary of the site. Between 83 Street and 85 Street, 95 Avenue is developed as a 13.3m two-lane roadway with parking along both sides. East of 83 Street, 95 Avenue is developed as an 11.0m collector, which continues to accommodate two travel lanes and two parking lanes. Monowalks are provided along both sides of the roadway and the assumed speed limit is 50 km/hr.

- ***79 Street*** is an 11.5m wide collector roadway that runs north-south through the Holyrood neighbourhood and accommodates two travel lanes and two parking lanes. Boulevard sidewalks are provided along both sides of the roadway and the assumed speed limit is 50 km/hr. A school zone is located along 79 Street adjacent to Holyrood Elementary School.

- ***85 Street*** is an arterial roadway that runs north-south along the west boundary of the site. 85 Street is developed as a four-lane undivided roadway with service roads running parallel along the east and west sides of the roadway. Monowalks are developed along the service roads and the posted speed limit is 50 km/hr. Parking is available along the service roads.

- The ***85 Street East Service Road*** is part of the arterial roadway network that allows for access to the existing multi-family site. The service road is 6.5m wide and accommodates one, two-way travel lane and one parking lane. The north end of the 85 Street East Service Road was reconstructed to tie into 85 Street south of 95 Avenue with the development of the apartment buildings at the north end of the site. The south end of the 85 Street East Service Road curves east and follows the 90 Avenue alignment to tie into the existing 90 Avenue right in/right out access. A 4.0m wide alley is constructed east of the 90 Avenue right in/right out access. A monowalk is developed along the east side of the service road.

- The ***North-South Alley*** east of 85 Street borders the east edge of the site. The alley includes a 4.0m paved lane with an assumed speed limit of 20 km/hr.

The following existing intersections are anticipated to accommodate the majority of site generated traffic.

- The intersection of ***90 Avenue and 79 Street*** is a signalized four-legged intersection with crosswalks located on all four approaches. The intersection geometry includes one left turn bay, one shared through/right lane on the north and south approaches and one shared left/through lane and one shared through/right lane on the east and west approaches. All four approaches include an additional receiving bay which serves as a transit stop.

- The ***90 Avenue right in/right out*** intersection is located approximately 125m east of 85 Street and provides access to the 85 Street East Service Road and the east-west alley that parallels 90 Avenue. The intersection is currently uncontrolled; although, convention would suggest it operates as stop controlled on the north approach, and includes two through lanes on the west approach, one through lane and one shared through/right lane on the east approach, and one right turn lane on the north approach.

- The intersection of ***90 Avenue/Connors Road/83 Street/85 Street*** currently operates as a five-legged two-lane roundabout with yield control on all approaches. Crosswalks are located on all five approaches.

- The intersection of ***93 Avenue and 85 Street*** is an unsignalized T-intersection with stop control on the east approach. A signed and painted crosswalk is located on the north approach. The intersection geometry includes one shared left/through lane and one through lane on the north approach, one through lane and one shared through/right lane on the south approach; and one shared left/right lane on the east approach.

- The intersection of ***93 Avenue and the North-South Alley*** is an uncontrolled four-legged intersection. All approaches include one lane for all movements.

- The intersection of ***95 Avenue and 85 Street*** is a signalized four-legged intersection with crosswalks located on all four approaches. The intersection geometry includes one shared left/through lane and one shared through/right lane on the north and south approaches and one shared left/through/right lane on the east and west approaches; although, there is sufficient width to allow eastbound and westbound right turns to bypass one to two queued vehicles at the intersection.

- The intersection of ***95 Avenue and the North-South Alley*** is an uncontrolled T-intersection. All approaches include one lane for all movements.

- The intersection of the ***85 Street East Service Road and the North-South Alley*** is an uncontrolled T-intersection. All approaches include one lane for all movements.

2.2.3 Bicycle and Pedestrian Accommodation

The proposed development site is well located to take advantage of pedestrian corridors located in the vicinity of the site with all roadways abutting the development parcel having either monolithic or boulevard sidewalks on one or both sides of the street. All arterial/arterial and arterial/collector roadways within the study area include painted crosswalks and curb ramps to facilitate pedestrian crossings. Two signed and painted pedestrian cross-walks are provided for pedestrians crossing 85 Street between 90 Avenue and 95 Avenue and one pedestrian signal and one signed and painted crosswalk are provided for pedestrians crossing 90 Avenue between 79 Street and 85 Street.

On-street bike routes are identified along 79 Street providing a connection from Argyll Park to Forest Heights Park and connecting to the river valley trail system. A paved shared use path is developed along the north side of 90 Avenue connecting the 85 Street East Service Road to the 79 Street bike route via the east-west alley; however, this is not identified as an official bike route on the City's Bike Map.

2.2.4 Transit Routes

Transit routes along the immediately adjacent roadways provide access to neighbourhood amenities and major transit centres such as West Edmonton Mall, Bonnie Doon, and Southgate. **Table 2-1** summarizes the available routes that operate along 90 Avenue, 93 Avenue, 95 Avenue, and 85 Street. Additional transit routes can be accessed via ETS stops along 83 Street, Connors Road, and 79 Street.

Table 2-1: Existing Transit Routes

ROUTE	DESTINATION	DESCRIPTION
80	Southgate - Capilano	Weekdays only
85	Downtown – Eastgate Industrial - Capilano	Weekdays and Saturdays only. Eastgate industrial peak hours only
112	West Edmonton Mall – Downtown - Capilano	Weekdays and Saturday only
307	Bonnie Doon – Capilano – Gold Bar	Small bus route
322	Bonnie Doon – Strathearn - Holyrood	Small bus route, midday only

2.2.5 Traffic Volumes

Intersection turning movement counts were obtained from the City of Edmonton Traffic Data website for the 90 Avenue/79 Street (Wednesday, April 9, 2014) and 95 Avenue/85 Street (February 25, 2014) intersections and daily link volumes were obtained for Connors Road west of 85 Street. Bunt and Associates also completed a series of intersection turning movement and link volume counts to gain a better understanding of existing traffic characteristics in the vicinity of the development site. The following locations were counted by Bunt & Associates in February 2017. Road surfaces were in good winter driving condition and the daily high temperatures were around -5˚C to 0˚C when the counts were completed.

AM and PM Peak Hour Intersection Turning Movement Counts

- 85 Street East Service Road/90 Avenue Service Road/North-South Alley – Tuesday, February 28, 2017
- 93 Avenue/85 Street – Wednesday, February 22, 2017
- 93 Avenue/North-South Alley – Wednesday, February 22, 2017
- 95 Avenue/North-South Alley – Tuesday, February 28, 2017

24-hour Link Volume Counts

- 93 Avenue east of North-South Alley – February 23, 2017
- North-South Alley south of 93 Avenue – February 23, 2017
- North-South Alley north of 93 Avenue – February 23, 2017
- 95 Avenue east of North-South Alley – February 28, 2017
- North-South Alley south of 95 Avenue – February 28, 2017
- 85 Street East Service Road west of North-South Alley – February 28, 2017
- East-West Alley north of 90 Avenue east of North-South Alley – February 28, 2017
- North-South Alley north of 85 Street Service Road – February 28, 2017

Exhibit 2-2 summarizes the AM and PM peak hour turning movement volumes at key study intersections and daily two-way link volumes on key roadways in the vicinity of the study area. The existing volumes presented in Exhibit 2-2 represent the peak measured volumes at each location, i.e. an overall peak was not determined and volumes were not balanced along the corridor. Detailed turning movement counts are included in **Appendix A**.

2.3 Future Conditions

2.3.1 Horizon Year

Through discussions with the City of Edmonton, a 2047 horizon was used as the basis for the transportation assessment. It is anticipated that the Holyrood DC2 site will be fully developed and occupied within the 2047 horizon.

2.3.2 Land Use

The residential neighbourhoods in the immediate vicinity of the site are mature and well developed. Considering the age of the neighbourhoods and the LRT expansion through the area, infill projects are anticipated over time. A major infill project is planned in Strathearn, on the existing Strathearn Heights medium density site, and the City has identified the potential for medium density infill on the southwest corner of the 95 Avenue/83 Street intersection. The development of the subject site is anticipated to represent the largest single development project within Holyrood.

2.3.3 Valley Line LRT

Phase 1 of the Valley Line LRT between Mill Woods and Lewis Estates is currently under construction and includes the 13 km segment between Mill Woods and Downtown. A portion of the line will run along 85 Street adjacent to the site and includes an LRT at the 93 Avenue/85 Street intersection. Phase 1 construction is expected to be completed by the end of 2020.

The Valley Line is anticipated to replace the majority of bus service along 85 Street. While it is anticipated that the site will continue to have access to bus service, the routing and service levels are yet to be determined.

2.3.4 Adjacent Roadways and Intersections

With the development of the Valley Line LRT, numerous changes to the roadway network are anticipated. The Connors Road/90 Avenue/83 Street/85 Street roundabout will be converted into a signalized four-legged intersection including the reconfiguration of the 85 Street South connection to Connors Road. Additionally, the 93 Avenue/85 Street intersection near the LRT platform will be signalized and the intersection geometry will be re-configured to include one left-turn lane and one right-turn lane on the east approach; one left-turn bay and one through lane on the north approach and one right-turn bay and one through lane on the south approach. On-street parking will not be accommodated along 93 Avenue immediately east of 85 Street.

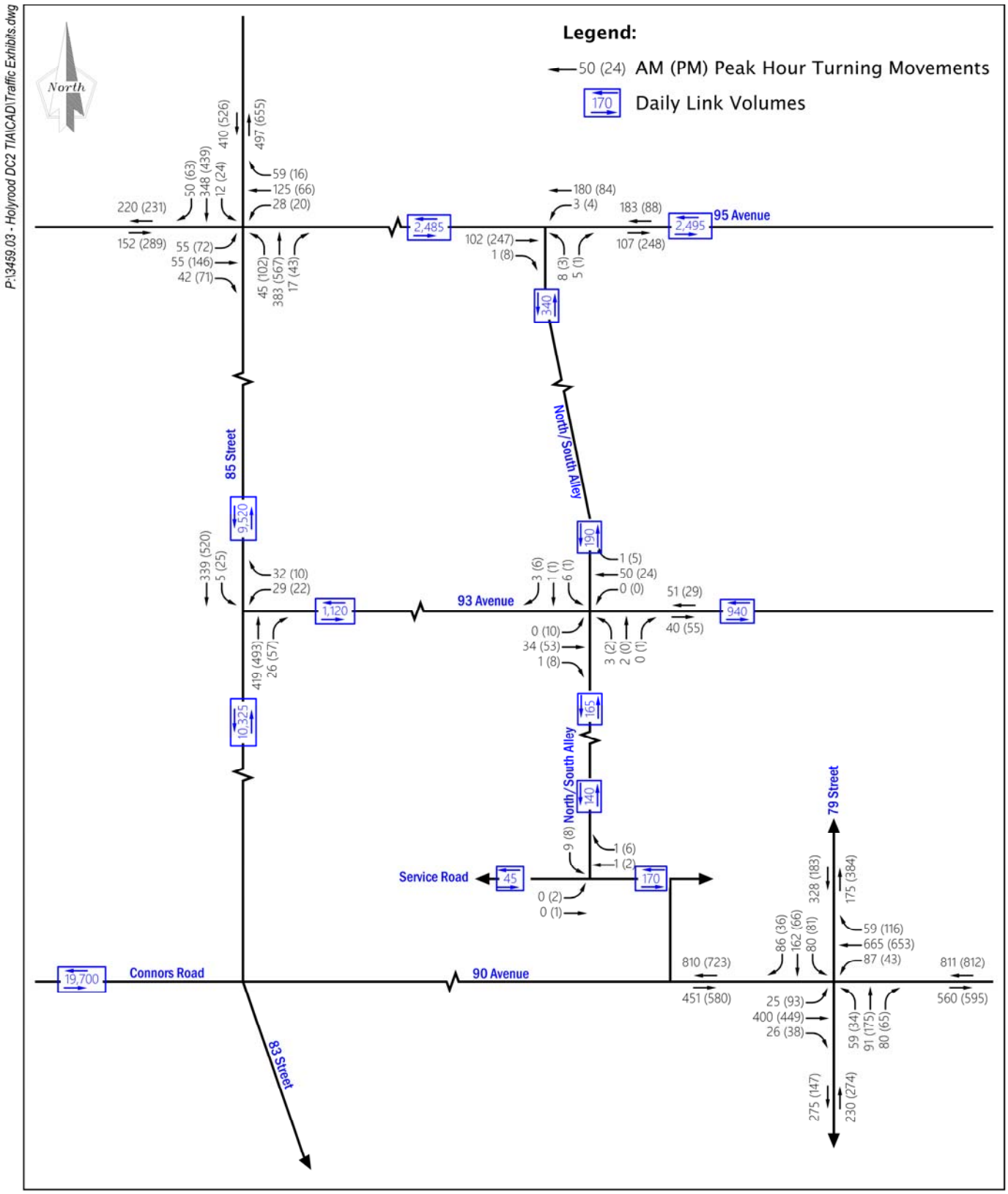

Exhibit 2-2

Existing Traffic
AM (PM) Peak Hour Intersection and Daily Link Volumes

The majority of the 85 Street East Service Road will be closed as a public roadway with the construction of the LRT and portions of the service road right-of-way will be incorporated into the site. The service road intersection with 93 Avenue east of 85 Street will be permanently closed to vehicle traffic (except emergency vehicles) both north and south of 93 Avenue.

At the north end of the site, a portion of the 85 Street East Service Road could be maintained for access between the existing parkade ramp for the north apartment buildings and 95 Avenue; however, current site plans include full closure of the 85 Street East Service Road. In order to accommodate traffic activity associated with existing apartment buildings, an on-site east west drive aisle has been constructed between the 85 Street East Service Road and the north-south alley.

At the south end of the site, the portion of the 85 Street East Service Road that extends between the north-south alley and the 90 Avenue right in/right out access will be maintained as a public roadway.

Additional details regarding the site access strategy are discussed in Section 3.4.

2.3.5 Bicycle and Pedestrian Accommodation

Based on a review of the City of Edmonton's Bicycle Network Plan Map, no major changes to the existing bicycle facilities along 79 Street are anticipated in the 2047 horizon. No additional shared use paths are proposed in the vicinity of Holyrood as part of the Valley Line construction.

2.3.6 Background Traffic Volumes

The City of Edmonton provided 2047 model information for use in the development of background traffic volumes. While the City's 2047 model includes population growth within the Holyrood and Strathearn neighbourhoods in the order of 46% and 93% respectively, the allocation of traffic volumes to the network is based on a limited number of source node connections, making it difficult to determine the potential changes over time that may be associated with the population increases in combination with the improved transit accessibility. Therefore, existing volumes were primarily used to account for turning movements at the study area intersections, with the model link volumes providing an order of magnitude confirmation to account for growth and increased transit use on the network. The following steps were generally used to develop the AM peak hour and PM peak hour background traffic volume estimates:

- Turning movement volumes at the study area arterial/collector intersections and collector/alley access intersections were used in the assessment;
- Turning movements at the Connors Road/83 Street intersection were estimated based on the 2047 model;
- Through volumes along the study arterial roadways were adjusted to reflect the 2047 link volumes;
- Existing turning movement volumes at the 93 Avenue/85 Street East Service Road intersection were removed from the network;

- Traffic associated with the existing Holyrood apartments that will be maintained was added back to the network based on the revised access strategy; and
- Site generated traffic associated with the Strathearn re-development was added to the network.

Daily volumes along the study area arterials were estimated by applying a factor of 4.5 to the sum of the AM and PM peak hour volumes. The factor was derived based on a review of the 2047 link volumes on 85 Street south of 93 Avenue. Where measured volumes are available and are projected to remain relatively stable, the measured daily volumes were used as the basis for the assessment, adjusted as noted above to account for the closure of the service road and the re-assignment of the Holyrood apartment traffic.

Exhibit 2-3 illustrates the 2047 background traffic volume estimates. These estimates are anticipated to be conservative as they include the addition of traffic over and above the 2047 model volumes, which account for growth in Strathearn and Holyrood. As the neighbourhood level model network is different from the existing network, two key points of comparison were identified to confirm that adjusted background volumes continue to reflect a similar order of magnitude along the arterial roadways: 85 Street north of 90 Avenue and Connors Road west of 83 Street. As shown in **Table 2-2**, the 2047 background traffic volumes developed for use in the study are equal to or greater than the link volumes identified in the City's 2047 model.

Table 2-2: 2047 Background Traffic Volume Comparison

LOCATION	TIME PERIOD	2047 MODEL		2047 BACKGROUND	
		EB/NB	WB/SB	EB/NB	WB/SB
85 Street north of 90 Avenue	AM Peak Hour	490 vph	570 vph	549 vph	604 vph
	PM Peak Hour	630 vph	340 vph	746 vph	378 vph
	Daily	9,200 vpd		10,350 vpd	
Connors Road west of 83 Street	AM Peak Hour	750 vph	1,410 vph	800 vph	1,410 vph
	PM Peak Hour	1,180 vph	840 vph	1,220 vph	840 vph
	Daily	17,800 vpd		19,350 vpd	

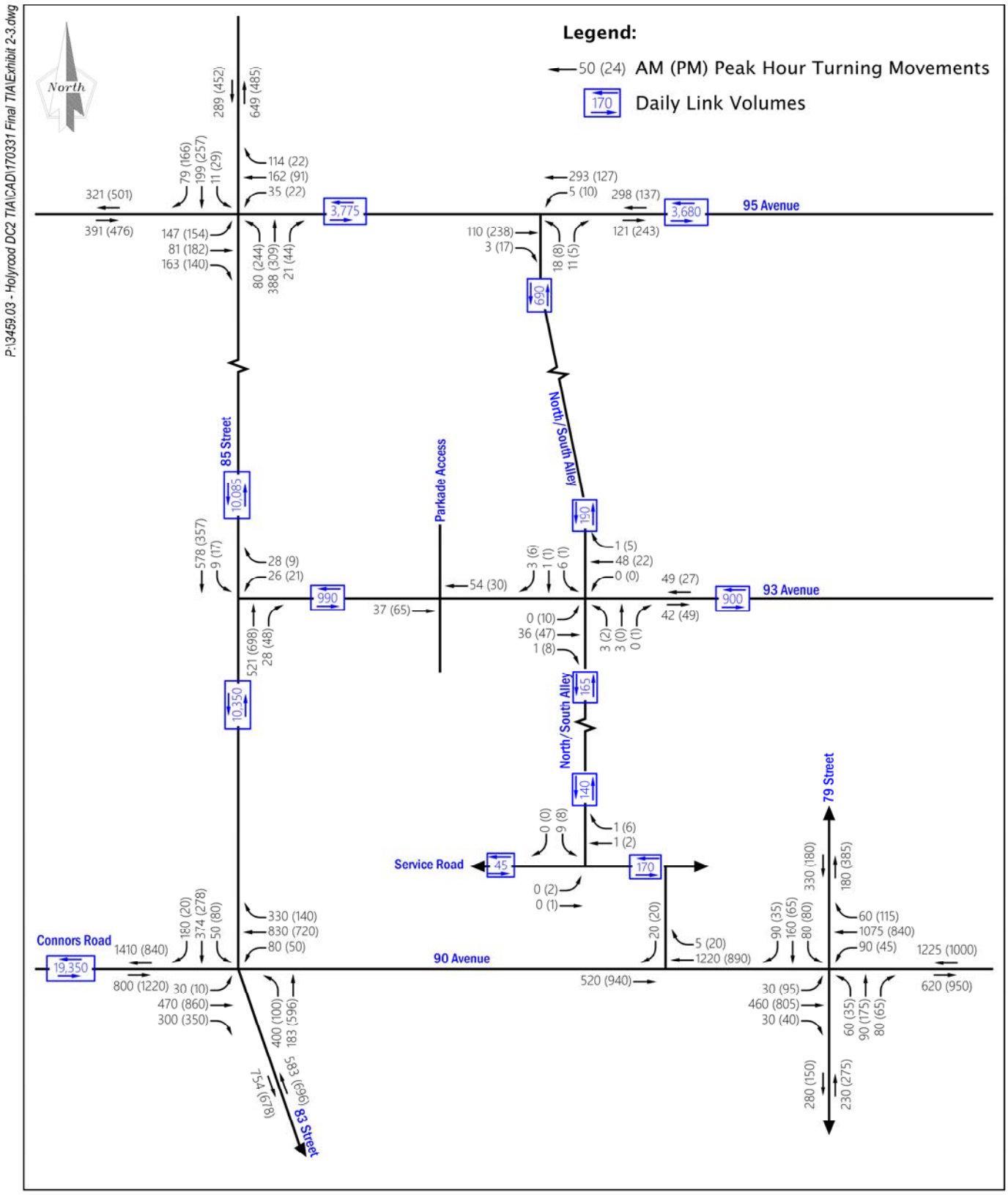

Exhibit 2-3

2047 Background Traffic Estimates AM (PM) Peak Hour Intersection and Daily Link Volumes

3. PROPOSED DEVELOPMENT CHARACTERISTICS

3.1 Proposed Development Area

Exhibit 3-1 illustrates the proposed Holyrood DC2 site plan. The proposed rezoning applies to Area 2 only; the existing apartment buildings will be maintained within Area 1.

3.2 Land Use Schedule

The proposed development includes the construction of seven apartment buildings on the site; three south of 93 Avenue and four north of 93 Avenue. The DC2 includes a number of development regulations and plans that will guide the redevelopment of the site over time. Based on a review of the proposed DC2, the maximum development potential includes 1,200 dwelling units and 1,200m^2 (12,917 SF) of non-residential land uses.

The trip generation characteristics of the residential and non-residential land uses are dependent on the type of development that ultimately occurs. The non-residential uses listed in the DC2 text include a combination of convenience retail and service uses such as restaurants, convenience stores, and health services uses. In order to establish the potential trip generating characteristics of the non-residential land uses, a sample land use schedule was developed that includes uses with a range of trip generating characteristics that are often included within neighbourhood commercial sites in Edmonton. **Table 3-1** summarizes the land uses assumed for the completion of the TIA.

Table 3-1: Assumed Land Use Schedule

CATEGORY	LAND USE	INTENSITY
Residential	Apartment Units	1,200 du
Non-Residential	Restaurant	3,000 SF
	Coffee Shop	2,000 SF
	Medical/Dental	5,000 SF
	Convenience Store	3,000 SF
TOTAL		1,200 DU/13,000 SF

3.3 Parking

The majority of on-site parking will be provided within underground parkades; however, approximately 20 convenience at-grade parking stalls have been identified along the north-south alley to accommodate short duration parking associated with taxis, food deliveries, couriers, and other passenger loading activities. The stalls may be time restricted to 30 minutes and may also be signed as no overnight parking.

3.4 Site Access Strategy

As noted previously, the majority of the 85 Street East Service Road will be closed to traffic and portions of the existing right-of-way will be incorporated into the development site with the construction of the LRT. As shown on Exhibit 3-1, the remainder of the 85 Street East Service Road between 93 Avenue and 95 Avenue will also be closed with the proposed development. On-site private roads are proposed to be constructed east of the existing service road locations, in a similar configuration. These revised private roads will operate as northbound one-ways and be restricted to emergency service vehicles. At this time, the use of bollards and/or electronic gate arms are proposed to restrict public access while continuing to accommodate emergency service vehicles.

The redevelopment of the site will include the construction of underground parkades north and south of 93 Avenue. The primary access to the underground parkades is proposed to be located on 93 Avenue approximately 75m east of 85 Street (centreline to centreline). A secondary exit from the north parkade is proposed to be developed to the east-west drive aisle that runs parallel to the south side of Area 1. Vehicles exiting at this location would be able to access 95 Avenue via the north-south alley. A secondary access from the south parkade is proposed along the south side of the property, immediately west of the north-south alley. This access will utilize the remaining portion of the 85 Street East Service Road, which will be maintained between the access and the 90 Avenue right in/right out access.

Exhibit 3-1

N.T.S.

Site Plan

Holyrood DC2 TIA
bunt & associates | Project No. 3459.03

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4. SITE GENERATED TRAFFIC CHARACTERISTICS

4.1 Transit Oriented Development

The redevelopment initiative is proposed to provide a mix of residential and non-residential land uses adjacent to the Holyrood LRT stop. Therefore, the development of site generated traffic volumes considers the context of the project as a mixed use, Transit Oriented Development (TOD).

4.2 Trip Generation Assumptions

The trip generation rates used in the assessment include a combination of City of Edmonton measured rates and rates published within the Institution of Transportation Engineers (ITE) Trip Generation Manual, 9th Edition[1]. These rates were generally measured in suburban, vehicle oriented contexts; therefore, further refinement of the potential trip generating characteristics of the site to reflect the urban, transit oriented nature of the proposed development are required as discussed in subsequent sections.

4.2.1 Residential

Trip generation estimates for the residential portion of the proposed development were calculated based on the City of Edmonton's measured rates for RA7 & RA8 apartment housing. In order to estimate the potential effect of transit on the trip generation characteristics of the site, mode splits based on transit accessibility and trip distribution were estimated. The distribution of trips generated by the site reflects the City of Edmonton's Origin-Destination Car Driver Trips spreadsheets for the 2047 horizon while existing and future transit accessibility was considered in terms of mode split.

In the 2047 horizon, the Valley Line LRT will provide excellent direct transit access to downtown, the southeast, and the west end, and the ability to transfer between the Valley Line and the Capital and Metro lines at Churchill Station expands LRT access from the site to other locations within Edmonton. As well, the LRT is anticipated to be supported by a revised network of buses that will continue to provide access to areas that are not directly served by the LRT.

Based on the future transit access, the following mode splits to transit or active modes by destination were assumed for the residential land uses within the Holyrood site:

- Downtown and Downtown Fringe – 70%
- University, NW Inner, NE Inner, SE Inner, West Inner – 50%
- SW Inner – 40%
- SE Suburb, SW Suburb – 30%
- NW Suburb, NE Suburb, West Suburb – 20%

[1] [ITE] Institute of Transportation Engineers. 2012. Trip generation. 9th ed. Washington, DC. ITE.

- Sherwood Park, St. Albert, County of Strathcona, County of Leduc, County of Parkland, MD of Sturgeon – 0%

Table 4-1 summarizes the aggregate mode splits to transit or active modes based on the assumed mode splits by origin-destination pair.

Table 4-1: Residential Mode Split to Transit and Active Modes

AM PEAK HOUR		PM PEAK HOUR		DAILY	
In	Out	In	Out	In	Out
33.3%	39.3%	38.6%	36.5%	38.0%	38.4%

Based on a review of available 2016 Municipal Census information, about 22% of Holyrood residents currently take transit, walk, or cycle to work. The development of residential uses in close proximity to transit stops is expected to result in higher mode splits for these units as residents interested in traveling by transit select locations that provide transit services that meet their needs.

4.2.2 Non-Residential

The commercial component of the site is relatively small and is intended to provide day to day retail services to residents on the site and the surrounding communities, and the location of the commercial businesses close to the LRT platform provides ease of access for people using the LRT.

The commercial Gross Floor Area (GFA) is lower than the minimum threshold identified for the use of the City of Edmonton's CNC trip generation rate; therefore, a range of rates for commercial land uses from the ITE Trip Generation Manual, 9th Edition were used in the assessment as follows:

- Restaurant – ITE Land Use Code (LUC) 932 – High Turnover (Sit-Down) Restaurant;
- Coffee Shop – ITE LUC 936 – Coffee/Donut Shop without Drive-Through Window;
- Medical/Dental Offices – ITE LUC 720 – Medical-Dental Office Building; and
- Convenience Store – ITE LUC 852 – Convenience Market (Open 15-16 Hours).

Trip generation estimates were calculated based on the individual trip characteristics for the assumed land use mix. Where daily rate information wasn't available, daily volumes were estimated by multiplying the sum of the AM and PM rates by a factor of six. The development of trip generate estimates for a commercial site based on the application of rates for individual land uses typically results in higher site generated estimates than estimates for the site as whole because the rates provided in ITE are for stand-alone land uses. When businesses are grouped together, the interaction between them allows patrons to visit more than one business without generating another trip. Therefore, a 20% synergy factor was applied to estimate the aggregate trip generation.

As the commercial land uses are proposed within a TOD context, mode split factors were applied based on the potential operational characteristics of each land use. For example, the development of a convenience store in this location is anticipated to cater to adjacent residents and pedestrians accessing the LRT stop; therefore, a high mode split to alternate modes was assumed. While there is also the potential for the restaurants and medical/dental offices to attract visitors that walk or cycle to the site, trips to these uses may come from further afield, and a lower mode split to alternate modes was assumed. Overall, the aggregate mode split to transit was estimated to be in the order of 70%. This reflects the higher patron turnover for convenience land uses, which are also most likely to be influenced by the transit orientation of the project.

The remaining vehicle based non-residential trips were separated into primary and non-primary trips. A non-primary trip represents an intermediate stop along the way from an origin to a primary destination, while a primary trip represents the primary purpose of the trip. Convenience stores typically have a high percentage of non-primary traffic while sit-down restaurants and medical-dental offices have fewer or no non-primary traffic. Aggregate non-primary rates of 40%, 30%, and 35% were used in the assessment for the AM peak hour, PM peak hour, and Daily scenarios respectively. These rates reflect a high percentage of non-primary trips for the high turnover land uses (coffee shop and convenience store) and low or no non-primary trips for low turnover land uses (restaurant and medical/dental).

The remaining primary non-residential trips are anticipated to have an origin or destination in the adjacent communities of Holyrood, Strathearn, Bonnie Doon, Ottewell, Kenilworth, and Idylwylde.

4.3 Net Trip Generation Estimates

Table 4-2 summarizes the net external trip generation estimates for the proposed mixed-use development. It is noted that the non-primary trips are assumed to represent visits with a short turnover; therefore, the inbound and outbound non-primary trips were balanced based on the lowest calculated number of non-primary trips. Detailed trip generation calculations are included in **Appendix B**.

Table 4-2: Net Trip Generation

TRIP COMPONENT	AM PEAK HOUR		PM PEAK HOUR		DAILY	
	In	Out	In	Out	In	Out
Residential						
Gross Trips	69	339	302	178	3,486	3,486
Transit and Active Modes Trips	23	133	117	65	1,326	1,340
Net Vehicle Trips	**46**	**206**	**185**	**113**	**2,160**	**2,146**
Non-Residential						
Gross Trips	148	137	92	95	1,413	1,413
Transit and Active Modes Trips	104	96	64	67	989	989
Non-Primary Trips	16	16	8	8	148	148
Net Vehicle Trips	**28**	**25**	**20**	**20**	**276**	**276**
TOTAL NET NEW VEHICLE TRIPS	74	231	205	133	2,436	2,422

4.4 Trip Assignment and Total Traffic Estimates

The assignment of site generated traffic reflects the site access locations, the configuration and traffic control provided at the study intersections, and the above noted distribution and mode splits. **Exhibit 4-1** illustrates the site generated traffic volume estimates for the 2047 horizon.

The site generated traffic volumes were superimposed on the background traffic volumes to generate total traffic volumes for use in the assessment. **Exhibit 4-2** illustrates the total traffic volume estimates for the 2047 horizon.

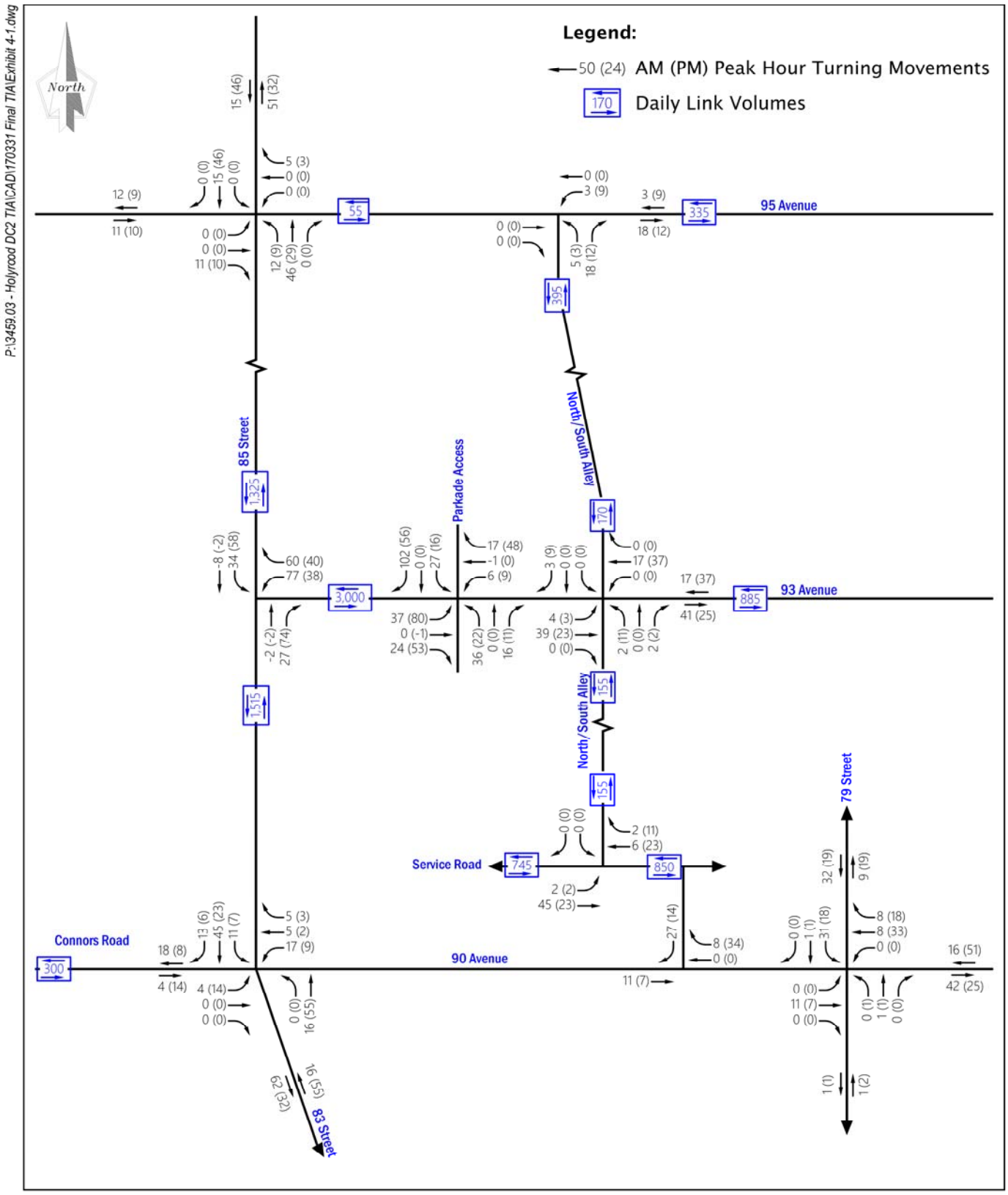

Exhibit 4-1

Site Generated Traffic Volume Estimares
AM (PM) Peak Hours

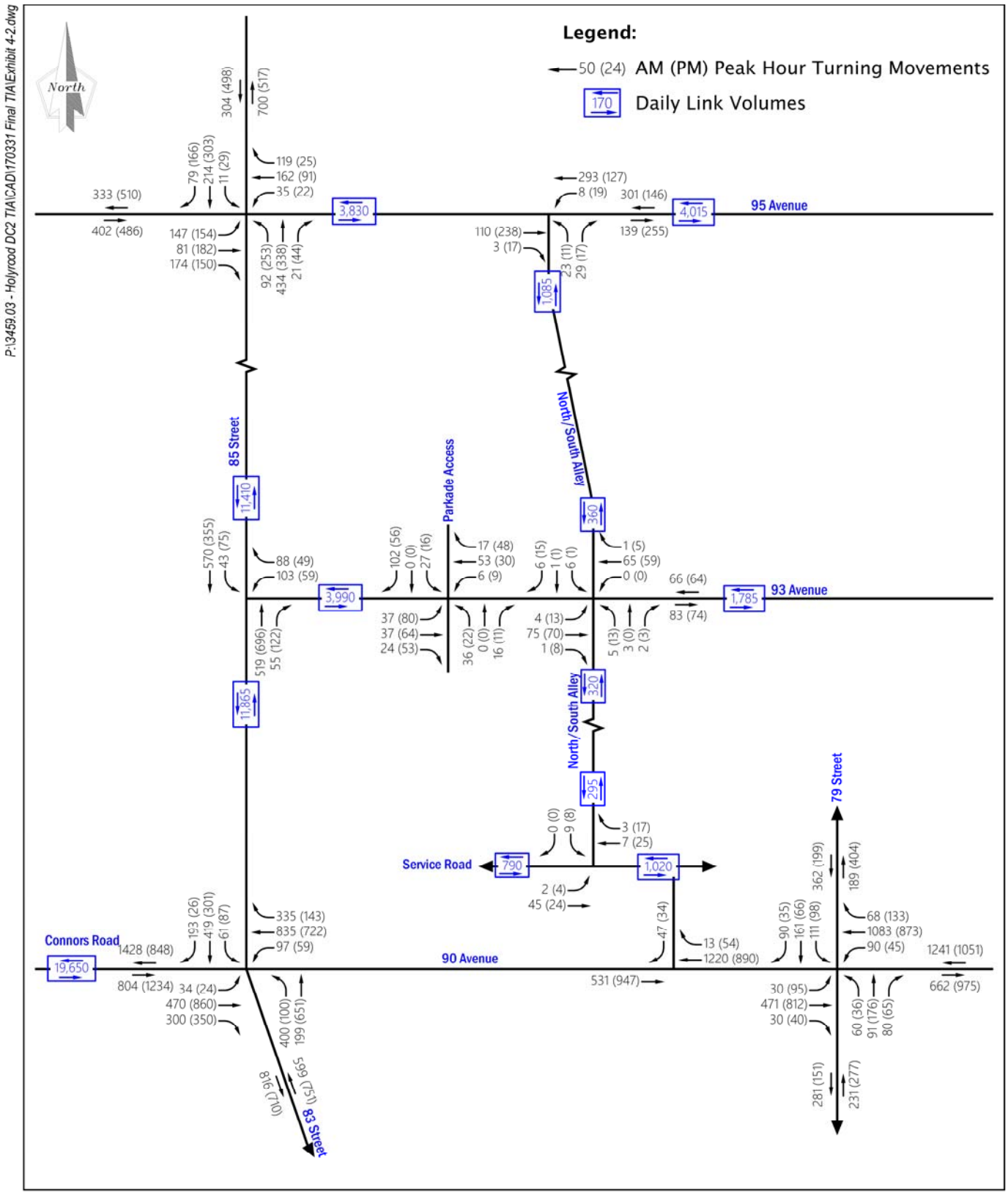

Exhibit 4-2

2047 Total Traffic Volume Estimates
AM (PM) Peak Hours

5. TRANSPORTATION ASSESSMENT

5.1 Bicycle and Pedestrian Facilities

The proposed re-development will maintain boulevard sidewalks along 93 Avenue and monowalks along the north-south private road that parallels 85 Street. In addition, a network of sidewalks is planned through the development providing a meandering north-south connection between 90 Avenue and 93 Avenue and again from 93 Avenue to the private road at the northwest corner of the development site. East-west connections will be provided between the private road and the meandering north-south sidewalk between each of the buildings developed on-site. As well, individual front walks will connect from main floor units to the sidewalk along the private road.

Based on the configuration of on-site sidewalks currently being considered, it is recommended that a cross-walk be installed on the west side of the 93 Avenue/North-South Alley intersection and that the on-site north-south walkways tie in at the southwest and northwest corners of this intersection. This would formalize the legal crossing point and provide the potential for a longer recreational walking loop through the combined site.

No additional bicycle facilities are planned as part of the re-development program; although, bicycle parking will be provided on-site as per the City's Zoning Bylaw.

5.2 Daily Volume Review

The daily volumes projections on the adjacent roadway network were reviewed in the context of the roadway classifications and existing cross-sections. The following general volume thresholds for local and collector roads from the City of Edmonton's Transportation Impact Assessment Guidelines were used as the basis for the assessment of roadways within Holyrood:

- 9.0m Local Road – up to 1,000 vpd; and
- Two-Lane Collector – 5,000 vpd typical.

The above noted thresholds reflect typical standard roadway cross-sections used in Edmonton. However, the roadways within Holyrood include variations that may impact the volume of traffic that can be accommodated. For example, the City's two-lane collector standard currently includes an 11.5m roadway, which accommodates two standard travel lanes and two standard parking lanes; however, the width of 93 Avenue varies between 10.5m and 10.9m between 79 Street and 85 Street. The roadway is designated a collector roadway and accommodates travel in both directions, parking on both sides of the street, and transit routes; however, given the slightly reduced width as compared to current standards, reduced operations, such as slower speeds and caution when passing buses along segments where vehicles are parked on both sides, may be experienced. It is also noted that where on-street parking is restricted on one or both sides of the street, daily volumes greater than 5,000 vpd could be accommodated.

In addition to the above, the analysis includes a review of volume projections along the north-south alley that runs along the east boundary of the site. Residential alleys typically include a 4.0m paved surface within a 6.0m right-of-way. As parallel parking is not permitted within the alley right-of-way, the 4.0m paved surface is generally consistent with the travel lane width provided by a local roadway. The on-street parking along a local road typically provides additional space for vehicles to pull over when meeting an oncoming vehicle. In an alley, the full 6.0m right-of-way is clear (between power poles), which allows typical vehicle traffic to pass one another. These maneuvers are typically completed at low speeds, which is consistent with the City's 20 km/hr speed limit in alleys. Based on the above, a threshold of 1,000 vpd has been established for the existing alley configurations.

5.2.1 93 Avenue

Existing daily traffic volumes along 93 Avenue ranged from 940 vpd east of the north-south alley to 1,120 vpd east of 85 Street. With the development of the Valley Line LRT, on-street parking along the east approach of the 93 Avenue/85 Street intersection will be banned and the geometry will be re-configured to include one left-turn lane and one right-turn lane. As the primary parkade accesses are located between the north-south alley and 85 Street, the majority of site generated traffic will use this corridor. Daily volumes along 93 Avenue between the parkade accesses and 85 Street are projected to be in the order of 3,990 vpd, which can be accommodated by the existing roadway cross-section.

East of the parkade accesses, daily volumes are projected to be in the order of 1,785 vpd in the 2047 horizon. While this is a substantial increase as compared to existing volumes, this magnitude of traffic can be accommodated by the existing cross-section with the on-street parking retained.

5.2.2 95 Avenue

Daily volumes along 95 Avenue between 85 Street and the north-south alley are projected to be in the order of 3,830 vpd in the 2047 horizon. This volume of traffic can be accommodated by the existing cross-section, which includes two travel lanes and two parking lanes. It is also noted that parking may be banned on one-side of the street to accommodate two westbound lanes as shown in available LRT concept plans.

Daily volumes along 95 Avenue east of the north-south alley are projected to increase from 2,495 vpd measured in 2017 to about 4,015 in 2047. Approximately 335 vpd are projected to be generated by the proposed re-development project, while the remaining increase is anticipated as a result of changes in traffic patterns in the community as result of the implementation of the Valley Line LRT. Based on the existing roadway classification and design (min 10.9m cross-section), 95 Avenue is anticipated to accommodate the projected volumes; however, speeds may be reduced in areas where parking is utilized on both sides of the street.

5.2.3 North-South Alley

Existing and future daily volumes were evaluated at four locations along the north-south alley: north of the east-west alley north of 90 Avenue, south of 93 Avenue, north of 93 Avenue, and south of 95 Avenue. **Table 5-1** summarizes the existing volumes, 2047 background volumes, and 2047 total volumes for these four segments.

Table 5-1: North-South Alley Daily Volumes

LOCATION	EXISTING VOLUME	2047 BACKGROUND VOLUMES	2047 TOTAL VOLUMES
North-South Alley North of East-West Alley North of 90 Avenue	140 vpd	140 vpd	295 vpd
North-South Alley South of 93 Avenue	165 vpd	165 vpd	320 vpd
North-South Alley North of 93 Avenue	190 vpd	190 vpd	360 vpd
North-South Alley South of 95 Avenue	340 vpd	690 vpd	1,085 vpd

As noted in Table 5-1, the north-south alley between 90 Avenue and 93 Avenue and the segment of the north-south alley north of 93 Avenue are projected to operate within the 1,000 vpd threshold in the 2047 horizon; however, the segment south of 95 Avenue generally adjacent to Area 1 is anticipated to exceed the threshold. The increased volume along the north portion of the alley reflects the change in access for the existing apartments as well as the provision of an exit from the north parkade. Based on the volume projections, the provision of additional passing opportunities in the north-south alley between the east-west drive aisle and 95 Avenue are recommended. This can be accomplished through widening of the existing pavement to the full 6.0m right-of-way width. At the north end, existing grades and utilities may make it challenging to widen the pavement to the full right-of-way width, therefore, a passing layby could be developed by widening into Area 1, south of the utility box. As well, sight lines at the 95 Avenue/North-South Alley intersection should be reviewed to ensure drivers can see approaching vehicles before entering the alley. Details regarding alley upgrades adjacent to Area 1 will be confirmed at the development permit stage for the north underground parkade.

It should be noted that the above assessment is conservative as the alley traffic associated with the existing 160 townhouse units was not removed from the network. As well, the garbage loading aprons and at-grade parking stalls associated with the existing and proposed buildings provide locations with additional space for passing if required.

5.2.4 85 Street East Service Road

The majority of the 85 Street East Service Road south of 93 Avenue will be closed to vehicular traffic; however, a connection will continue to be available between the south parkade access and the 90 Avenue right in/right out access at the south end of the site. Based on the traffic assignment, it is estimated that

the portion of the 85 Street East Service Road proposed to be maintained could accommodate daily volumes in the order of 1,020 vpd, which can be accommodated by the current design and classification with the removal of the parking lane. No-parking signs should be installed along the remaining portion of the service road between the south parkade access and the 90 Avenue right in/right out access to allow the full road with to be used for traffic.

5.2.5 Alternate Community Routes

While there is the potential for site generated traffic to utilize other roadways within Holyrood, site generated traffic is not anticipated to overwhelm any one facility based on the orientation of trips and the number of routes available. No roadway improvements, cross-section revisions, or roadway closures are recommended as a result of the proposed development.

5.3 Intersection Operational Assessments

5.3.1 Intersection Analysis Assumptions

The capacity analysis was completed using Synchro 9.1. Intersection operations are typically rated by two measures. The volume-to-capacity (V/C) ratio describes the extent to which the traffic volumes can be accommodated by the physical capacity of the road configuration and signal control. A value (measured during the peak hour) less than 0.90 indicates that generally, there is sufficient capacity and projected traffic volumes can be accommodated at the intersection. A value between 0.90 and 1.0 suggests unstable operations may occur and volumes are nearing capacity conditions. A calculated value over 1.0 indicates that traffic volumes are theoretically exceeding capacity. The second measure of performance, Level of Service (LOS), is based on the estimated average delay per vehicle among all traffic passing through the intersection. A low average delay merits a LOS A rating. Average delays greater than 80 seconds per vehicle generally produce a LOS F rating for signalized intersections, while average delays greater than 50 seconds per vehicle generally produce a LOS F rating for unsignalized intersections.

The anticipated 95th percentile queue length has also been included in the following assessment summaries. The queues provided may include a footnote that relates to the ability of the program to estimate the queue accurately. The 'm' footnote indicates that the volume entering the intersection is being metered by an upstream intersection. The Synchro help file also provides the following regarding the '#' footnote:

"The # footnote indicates that the volume for the 95th percentile cycle exceeds capacity. This traffic was simulated for two complete cycles of 95th percentile traffic to account for the effects of spillover between cycles. If the reported v/c <1 for this movement, the methods used represent a valid method for estimating the 95th percentile queue. In practice, 95th percentile queue shown will rarely be exceeded and the queues shown with the # footnote are acceptable for the design of storage bays."[2]

[2] Trafficware LLC., Synchro Studio 9 User Guide, Chapter 10 – Timing/Signing Settings, Queue Lengths, pg. 10-19.

The City of Edmonton's TIA Guidelines identify peak hour level of service objectives of LOS ≤ D and v/c ≤ 0.85 for the short term (10 to 15 years) and LOS ≤ E and v/c ≤ 0.95 for the longer term (30 to 40 years) for greenfield developments. Currently, the document does not include thresholds for mature neighbourhoods; however, previously, the City of Edmonton's Roadway Planning and Design Objectives document (February 2005 Edition) identified the Peak Hour LOS Design Objectives for Signalized Arterials at LOS E for inner city areas in the medium and long terms. For this assessment, efforts were taken to meet the City's long term design objectives; however, in the 2047 horizon, the intersection operations are anticipated to also be impacted by LRT operations, which generally reduce the capacity for passenger vehicle traffic. While the typical thresholds may not be met for passenger vehicle traffic under the 2047 horizon, the implementation of LRT will improve the overall transportation network and increase the capacity for moving people throughout the City. Therefore, the analysis focuses on the potential incremental change in intersection operations as a result of the proposed development proceeding.

The methodology includes a number of assumptions that relate to the operating conditions present at the intersections. The following assumptions were used in the analysis.

- Saturation Flow Rate – 1,750 vphg
- Lost Time Adjustment Factor – 0.5 seconds
- Peak Hour Factor – 1.00
- Lane Utilization Factor – 1.0 or as noted below
- % Heavy Vehicles –Existing or 2% where unknown, 2047 – 2%.

In addition to the above, the saturation flow rate was reduced by 25% for all intersection turning movements that cross the LRT tracks.

Unsignalized intersection assessments were completed using the HCM2010 methodology within Synchro 9.1. As per the HCM2010 methodology, assessment results are reported for critical movements only. As well, the HCM2010 95th percentile queue is reported as vehicles; therefore, a distance in metres was calculated assuming an average of 7.5m per vehicle.

The following intersections were included in the assessment:

- 90 Avenue and 79 Street;
- 90 Avenue/Connors Road/83 Street/85 Street;
- 93 Avenue and 85 Street;
- 95 Avenue and 85 Street;
- 90 Avenue right in/right out;
- 85 Street East Service Road and the North-South Alley;
- 93 Avenue and the North-South Alley;
- 95 Avenue and the North-South Alley; and
- 93 Avenue Parkade Access.

The signalized intersections were evaluated under the 2047 background and the 2047 total traffic scenarios. The remaining intersections were evaluated under the 2047 total traffic scenario only.

The geometry assumed for each intersection is included in the assessment tables. Left turn movements, through movements, and right turn movements are represented by "L", "T", and "R" respectively in the assessment tables, and lanes are separated by a "/". For example, an approach whose geometry is described as LT/R features two lanes: one lane accommodating shared left/through movements and a second lane accommodating right turning movements. Traffic control information is also included in the assessment tables. Key signal phasing is identified in the tables, with protected/permitted left turn phasing identified by "Pm+Pt", protected only phasing identified by "Prot", and overlap right turns identified by "Over".

5.3.2 90 Avenue and 79 Street

The 90 Avenue/79 Street intersection is an existing signalized four-legged intersection with crosswalks located on all four approaches. The intersection currently operates with side street vehicle and pedestrian actuation, which is anticipated to be maintained in the future. No changes to the existing intersection geometry are proposed; therefore, the following geometry was included in the assessment:

- ***West Approach*** – one shared left/through lane, one shared through/right lane;
- ***East Approach*** – one shared left/through lane, one shared through/right lane;
- ***South Approach*** – one left turn bay, one shared through/right lane; and
- ***North Approach*** – one left turn bay, one shared through/right lane.

Tables 5-2 and **5-3** summarize the results of the intersection assessment completed for the 90 Avenue/79 Street intersection for the AM and PM peak hours respectively.

Table 5-2: 90 Avenue and 79 Street – AM Peak Hour

DIRECTION	EASTBOUND			WESTBOUND			NORTHBOUND			SOUTHBOUND		
MOVEMENT	L	T	R	L	T	R	L	T	R	L	T	R
2047 Background – Actuated (75s cycle)												
Geometry	LT/TR			LT/TR			L/TR			L/TR		
Volume (vph)	30	460	30	90	1075	60	60	90	80	80	160	90
v/c	0.27			0.63			0.41	0.47		0.38	0.71	
Delay (s)	1.1			10.1			33.3	20.6		30.0	34.7	
LOS	A			B			C	C		C	C	
95th Queue (m)	m0			77			17	28		20	47	
Intersection Delay:						12.8	Intersection LOS:					B
2047 Total – Actuated (75s cycle)												
Geometry	LT/TR			LT/TR			L/TR			L/TR		
Volume (vph)	30	471	30	90	1083	68	60	91	80	111	161	90
v/c	0.28			0.64			0.41	0.47		0.53	0.71	
Delay (s)	1.3			10.3			33.3	20.8		35.4	34.8	
LOS	A			B			C	C		D	C	
95" Queue (m)	m0			79			17	28		27	47	
Intersection Delay:						13.4	Intersection LOS:					B

Table 5-3: 90 Avenue and 79 Street – PM Peak Hour

DIRECTION	EASTBOUND			WESTBOUND			NORTHBOUND			SOUTHBOUND		
MOVEMENT	L	T	R	L	T	R	L	T	R	L	T	R
2047 Background – Actuated (75s cycle)												
Geometry	LT/TR			LT/TR			L/TR			L/TR		
Volume (vph)	95	805	40	45	840	115	35	175	65	80	65	35
v/c	0.55			0.51			0.15	0.70		0.52	0.29	
Delay (s)	21.9			8.2			24.4	35.4		38.0	18.5	
LOS	C			A			C	D		D	B	
95th Queue (m)	m51			54			10	46		21	18	
Intersection Delay:						18.0	Intersection LOS:					B
2047 Total – Actuated (75s cycle)												
Geometry	LT/TR			LT/TR			L/TR			L/TR		
Volume (vph)	95	812	40	45	873	133	36	176	65	98	66	35
v/c	0.57			0.54			0.15	0.70		0.64	0.29	
Delay (s)	22.3			8.5			24.4	35.5		45.7	18.5	
LOS	C			A			C	D		D	B	
95" Queue (m)	m51			58			11	46		26	18	
Intersection Delay:						18.5	Intersection LOS:					B

As shown in Tables 5-2 and 5-3, the intersection is anticipated to operate well as a signalized intersection in the 2047 horizon. The existing signal timings include a 70s cycle length. This was increased to 75s, which is half the cycle length assumed for the signalized intersections that accommodate LRT movements. This does not allow for full coordination along the corridor, but some coordination is achievable.

5.3.3 90 Avenue/Connors Road/83 Street/85 Street (Connors Road/85 Street)

The Connors Road/85 Street intersection is currently a five-legged roundabout but will be converted to a four-legged signalized intersection with the construction of the Valley Line LRT. Based on a review of the City of Edmonton's Valley Line LRT Stage 1 Between Downtown and Mill Woods brochure (September 2016), the intersection is anticipated to include the following geometry:

- ***West Approach*** – one left turn bay, two through lanes, one free flow right turn bay;
- ***East Approach*** – one left turn bay, two through lanes, one right turn bay;
- ***South Approach*** – two left turn bays, one through lane; and
- ***North Approach*** – one left turn bay, one through lane, one right turn bay.

The LRT alignment runs north-south through the intersection along the east side of 83 Street/85 Street. Based on the figures included in the brochure, it appears the northbound right turn movement will be banned at the intersection.

The traffic assessment assumes the northbound and southbound left turns will operate under protected phasing and that the east and west approaches will operate independently of one another. **Tables 5-4** and **5-5** summarize the results of the intersection assessments completed for the AM and PM peak hours respectively.

Table 5-4: Connors Road and 85 Street – AM Peak Hour

DIRECTION	EASTBOUND			WESTBOUND			NORTHBOUND		SOUTHBOUND		
MOVEMENT	L	T	R	L	T	R	L	T	L	T	R
2047 Background – Pre-timed (150s cycle, NB & SB Prot L, E/W Split Phasing, Free EB R)											
Geometry	L/T/T/R			L/T/T/R			L/L/T		L/T/R		
Volume (vph)	30	470	300	80	830	330	400	183	50	374	180
v/c	0.14	1.06	0.18	0.20	1.05	0.99	1.08	0.36	0.64	0.89	0.39
Delay (s)	54.9	118.4	0.2	40.0	90.6	89.6	130.9	44.8	90.2	70.8	12.9
LOS	D	F	A	D	F	F	F	D	F	E	B
95th Queue (m)	24	#148	0	m42	#228	#212	#99	66	#46	#167	39
					Intersection Delay:	80.3			Intersection LOS:		F
2047 Total – Pre-timed (150s cycle, NB & SB Prot L, E/W Split Phasing, Free EB R)											
Geometry	L/T/T/R			L/T/T/R			L/L/T		L/T/R		
Volume (vph)	34	470	300	97	835	335	400	199	61	419	193
v/c	0.15	1.06	0.18	0.25	1.06	1.00	1.08	0.40	0.78	0.99	0.42
Delay (s)	55.3	118.4	0.2	40.8	92.5	93.3	130.9	45.6	115.7	89.1	12.0
LOS	E	F	A	D	F	F	F	D	F	F	B
95" Queue (m)	26	#148	0	m51	#231	#218	#99	72	#59	#198	32
					Intersection Delay:	83.2			Intersection LOS:		F

Table 5-5: Connors Road and 85 Street – PM Peak Hour

DIRECTION	EASTBOUND			WESTBOUND			NORTHBOUND		SOUTHBOUND		
MOVEMENT	L	T	R	L	T	R	L	T	L	T	R
2047 Background – Pre-timed (150s cycle, NB & SB Prot L, E/W Split Phasing, Free EB R)											
Geometry	L/T/T/R			L/T/T/R			L/L/T		L/T/R		
Volume (vph)	10	860	350	50	720	140	100	596	80	278	20
v/c	0.03	1.32	0.20	0.18	1.28	0.59	0.54	1.11	1.33	0.53	0.04
Delay (s)	43.1	199.1	0.3	44.4	180.2	56.6	80.5	119.5	266.5	46.2	2.0
LOS	D	F	A	D	F	E	F	F	F	D	A
95th Queue (m)	10	#272	0	27	#228	69	25	#275	#87	111	2
					Intersection Delay:	132.7			Intersection LOS:		F
2047 Total – Pre-timed (150s cycle, NB & SB Prot L, E/W Split Phasing, Free EB R)											
Geometry	L/T/T/R			L/T/T/R			L/L/T		L/T/R		
Volume (vph)	24	860	350	59	722	143	100	651	87	301	26
v/c	0.07	1.32	0.20	0.21	1.28	0.60	0.54	1.21	1.45	0.57	0.05
Delay (s)	44.0	199.1	0.3	45.5	181.6	57.6	80.5	155.6	307.8	47.4	2.7
LOS	D	F	A	D	F	E	F	F	F	D	A
95" Queue (m)	18	#272	0	31	#229	73	25	#310	#93	121	4
					Intersection Delay:	139.9			Intersection LOS:		F

As shown in Tables 5-4 and 5-5, the intersection is projected to be over capacity during peak hours under the 2047 background traffic scenario based on the planned intersection geometry and assumed signal phasing. The addition of site generated traffic compounds congestion for some movements; however, overall operations are similar between the 2047 background and 2047 total traffic scenarios.

An alternate scenario was completed assuming that a hold phase could be implemented to allow the LRT to move through the intersection. During this phase it is assumed that all vehicle traffic would be stopped while the LRT moves through the intersection. When the LRT has cleared the intersection, vehicle movements can once again proceed.

The hold phase represents 25% of the cycle length, in this case 38 seconds, and is assumed to occur every cycle. In conjunction with the hold phase, the signal phasing for vehicle traffic was simplified to include an east-west main phase, a north-south main phase, and a northbound protected only phase (required because of the dual left turns). As the impact of the LRT is represented with a dedicated phase, the saturation flow rate adjustment factors were removed.

As shown in **Table 5-6**, the intersection is anticipated to operate at or below capacity in the AM peak hour. In the PM peak hour, the westbound left and southbound left movements are projected to be over-capacity; although, these are relatively low volume movements within the intersection.

While there are a number of movements that could operate when the LRT is moving through the intersection, the requirement for separate phases for each movement decreases the efficiency of the signal within the analysis.

Table 5-6: Connors Road and 85 Street – Alternate Signal Phasing

DIRECTION	EASTBOUND			WESTBOUND			NORTHBOUND		SOUTHBOUND		
MOVEMENT	L	T	R	L	T	R	L	T	L	T	R
AM Peak Hour - 2047 Total – Pre-timed (150s cycle, NB Prot L, Free EB R, Hold Phase)											
Geometry	L/T/T/R			L/T/T/R			L/L/T		L/T/R		
Volume (vph)	34	470	300	97	835	335	400	199	61	419	193
v/c	0.74	0.56	0.18	0.66	0.99	0.99	0.96	0.28	0.23	0.97	0.44
Delay (s)	124.9	52.6	0.2	65.3	76.7	93.9	100.3	30.2	39.8	77.4	16.1
LOS	F	D	A	E	E	F	F	C	D	E	B
95th Queue (m)	#31	79	0	m#49	#164	#163	#92	58	24	#188	32
					Intersection Delay:	64.3			Intersection LOS:		E
PM Peak Hour - 2047 Total – Pre-timed (150s cycle, NB Prot L, Free EB R, Hold Phase)											
Geometry	L/T/T/R			L/T/T/R			L/L/T		L/T/R		
Volume (vph)	24	860	350	59	722	143	100	651	87	301	26
v/c	0.29	0.94	0.20	1.28	0.79	0.39	0.54	0.95	1.24	0.59	0.05
Delay (s)	55.6	72.6	0.3	265.9	64.6	54.2	80.5	67.2	232.7	56.4	2.8
LOS	E	E	A	F	E	D	F	E	F	E	A
95" Queue (m)	15	#163	0	#53	131	63	25	#263	#70	124	4
					Intersection Delay:	67.1			Intersection LOS:		E

Based on the assessments completed, the Connors Road/85 Street intersection is anticipated to represent a congestion point along the network. Based on a review of the City's model, the 2047 horizon identifies a shift in traffic from the 83 Street corridor to the 90 Avenue corridor as the connection to Connors Road. When the LRT becomes operational, a further shift away from the 85 Street corridor may occur, or people choosing to continue to drive through the area may choose to alter their travel times to minimize their personal delays. Based on the above assessment, shifting 20 southbound left turn vehicles and 15 westbound left turn vehicles either away from the intersection or to an alternate movement at the intersection would result in PM peak hour operations below capacity for all movements.

5.3.4 93 Avenue and 85 Street

The intersection of 93 Avenue and 85 Street is planned to operate as a signalized T-intersection once the Valley Line LRT is operational. Based on a review of the City's concept brochure, the intersection is assumed to include the following geometry:

- ***East Approach*** – one left turn bay, one right turn bay;
- ***South Approach*** – one through lane, one right turn bay; and
- ***North Approach*** – one left turn bay, one through lane.

As shown in **Tables 5-7** and **5-8**, the intersection is anticipated to operate at acceptable levels of service in the 2047 horizon.

Table 5-7: 93 Avenue and 85 Street – AM Peak Hour

DIRECTION	WESTBOUND		NORTHBOUND		SOUTHBOUND	
MOVEMENT	L	R	T	R	L	T
2047 Background – Actuated (150s cycle, Prot SB L)						
Geometry	L/R		T/R		L/T	
Volume (vph)	26	28	521	28	9	578
v/c	0.36	0.46	0.39	0.04	0.18	0.39
Delay (s)	80.6	90.5	3.1	1.4	72.1	7.8
LOS	F	F	A	A	E	A
95th Queue (m)	23	25	m62	m2	m8	108
Intersection Delay:	9.6		Intersection LOS:		A	
2047 Total – Actuated (150s cycle, Prot SB L)						
Geometry	L/R		T/R		L/T	
Volume (vph)	103	88	519	55	43	570
v/c	0.73	0.73	0.43	0.08	0.54	0.41
Delay (s)	90.8	95.4	9.5	5.8	81.3	12.7
LOS	F	F	A	A	F	B
95" Queue (m)	65	58	m111	m13	m28	143
Intersection Delay	24.5		Intersection LOS:		C	

Table 5-8: 93 Avenue and 85 Street – PM Peak Hour

DIRECTION	WESTBOUND		NORTHBOUND		SOUTHBOUND	
MOVEMENT	L	R	T	R	L	T
2047 Background – Actuated (150s cycle, Prot SB L)						
Geometry	L/R		T/R		L/T	
Volume (vph)	21	9	698	48	17	357
v/c	0.35	0.18	0.52	0.06	0.30	0.24
Delay (s)	83.7	75.0	5.0	0.4	85.8	3.2
LOS	F	E	A	A	F	A
95th Queue (m)	20	12	m3	m0	m10	m34
Intersection Delay:	7.4		Intersection LOS:		A	
2047 Total – Actuated (150s cycle, Prot SB L)						
Geometry	L/R		T/R		L/T	
Volume (vph)	59	49	696	122	75	355
v/c	0.61	0.60	0.57	0.17	0.68	0.25
Delay (s)	91.2	93.9	6.9	1.2	77.2	5.3
LOS	F	F	A	A	E	A
95" Queue (m)	43	37	m11	m2	m31	m50
Intersection Delay	16.7		Intersection LOS:		B	

The 95th percentile westbound queues are projected to be in the order of 37m to 65m. The provision of three travel lanes between 85 Street and the alley as previously identified will accommodate the projected queues at the signalized intersection. Laybys could be constructed to provide on-street parking or loading zones in this area if required.

5.3.5 95 Avenue and 85 Street

The 95 Avenue/85 Street intersection is an existing signalized intersection that currently operates with the same signal timings during all times of the day. The Valley Line LRT alignment curves through the intersection from the east side of 85 Street south of 95 Avenue to the centre of 95 Avenue west of 85 Street. The intersection geometry will be revised as part of the LRT construction and is anticipated to include the following:

- ***West Approach*** –one shared left/through lane, one right turn bay;
- ***East Approach*** – one left turn bay, one shared through/right lane;
- ***South Approach*** – one left turn bay, one through lane, one shared through/right lane; and
- ***North Approach*** – one left turn bay, one shared through/right lane.

Tables 5-9 and **5-10** respectively summarize the AM and PM peak hour assessments completed for the 95 Avenue/85 Street intersection under the 2047 background and 2047 total traffic scenarios.

Table 5-9: 95 Avenue and 85 Street – AM Peak Hour

DIRECTION	EASTBOUND			WESTBOUND			NORTHBOUND			SOUTHBOUND		
MOVEMENT	L	T	R	L	T	R	L	T	R	L	T	R
2047 Background – Actuated (150s cycle, NB & SB Prot L, E/W Split)												
Geometry	LT/R			L/TR			L/T/TR			L/TR		
Volume (vph)	147	81	163	35	162	114	80	388	21	11	199	79
v/c	0.90		0.44	0.12	0.93		0.60	0.51		0.10	0.76	
Delay (s)	94.4		22.1	45.6	88.0		68.4	32.2		68.8	60.8	
LOS	F		C	D	F		E	C		E	E	
95th Queue (m)	#150		36	24	#169		#66	78		13	#148	
Intersection Delay:						59.0	Intersection LOS:					E
2047 Total – Actuated (150s cycle, NB & SB Prot L, E/W Split)												
Geometry	LT/R			L/TR			L/T/TR			L/TR		
Volume (vph)	147	81	174	35	162	119	92	434	21	11	214	79
v/c	0.90		0.46	0.11	0.94		0.70	0.57		0.10	0.80	
Delay (s)	94.4		22.8	45.5	89.2		86.7	32.2		69.0	64.5	
LOS	F		C	D	F		F	C		E	E	
95" Queue (m)	#150		38	24	#173		#79	87		13	#165	
Intersection Delay:						60.2	Intersection LOS:					E

As shown in Table 5-9, the 95 Avenue/85 Street intersection is anticipated to operate within the specified thresholds in the AM peak hour under the 2047 total traffic scenario.

Table 5-10: 95 Avenue and 85 Street – PM Peak Hour

DIRECTION	EASTBOUND			WESTBOUND			NORTHBOUND			SOUTHBOUND		
MOVEMENT	L	T	R	L	T	R	L	T	R	L	T	R
2047 Background – Actuated (150s cycle, NB & SB Prot L, E/W Split)												
Geometry	LT/R			L/TR			L/T/TR			L/TR		
Volume (vph)	154	182	140	22	91	22	244	309	44	29	257	166
v/c	1.15		0.32	0.24	1.22		1.10	0.30		0.35	0.95	
Delay (s)	149.8		7.0	73.0	214.0		153.7	12.5		79.8	76.2	
LOS	F		A	E	F		F	B		E	E	
95th Queue (m)	#238		14	21	#107		#188	41		26	#247	
Intersection Delay:						92.5	Intersection LOS:					F
2047 Total – Actuated (150s cycle, NB & SB Prot L, E/W Split)												
Geometry	LT/R			L/TR			L/T/TR			L/TR		
Volume (vph)	154	182	150	22	91	25	253	338	44	29	303	166
v/c	1.15		0.34	0.24	1.23		1.14	0.32		0.35	1.05	
Delay (s)	149.8		8.4	73.0	219.1		163.0	14.7		79.8	101.5	
LOS	F		A	E	F		F	B		E	F	
95" Queue (m)	#238		17	21	#110		#194	47		26	#290	
Intersection Delay:						99.8	Intersection LOS:					F

As shown in Table 5-10, the intersection is projected to be over capacity in the PM peak hour based on the assumed geometry and traffic signal phasing. A supplementary analysis was completed for the PM peak hour 2047 total traffic scenario assuming a hold phase would be implemented at the intersection. Similar to the analysis completed at the Connors Road/85 Street intersection, the hold phase represents 25% of the cycle length (38 seconds) and is assumed to occur every cycle. In conjunction with the hold phase, the signal phasing for vehicle traffic was simplified to include an east-west main phase, a north-south main phase, and a northbound permitted plus protected phase. As the impact of the LRT is represented with a dedicated phase, the saturation flow rate adjustment factors were removed.

As shown in **Table 5-11**, a number of movements are projected to be over capacity with the revised phasing. Based on the assessments completed, the intersection is anticipated to be a congestion point along the network. Once the LRT is operational, drivers that do not have an origin or a destination in the immediate vicinity may shift to an alternate route, shift modes, or adjust their travel time. Based on a review of the projected volumes, a 5% shift in volume, either outside of the peak hour, to an alternate mode, or alternate route would result in the intersection operating below capacity during the PM peak hour.

Table 5-11: 95 Avenue and 85 Street – Alternate Signal Phasing

DIRECTION	EASTBOUND			WESTBOUND			NORTHBOUND			SOUTHBOUND		
MOVEMENT	L	T	R	L	T	R	L	T	R	L	T	R
2047 Total – Pre-timed (150s cycle, NB L Pm+Pt, Hold Phase)												
Geometry	LT/R			L/TR			L/T/TR			L/TR		
Volume (vph)	154	182	150	22	91	25	253	338	44	29	303	166
v/c	1.01		0.34	0.19	0.27		1.12	0.27		0.12	1.07	
Delay (s)	107.3		16.7	49.5	43.8		147.7	36.7		43.9	111.8	
LOS	F		B	D	D		F	D		D	F	
95" Queue (m)	#166		29	14	44		#126	39		15	#219	
Intersection Delay:						85.3	Intersection LOS:					F

5.3.6 90 Avenue Right In/Right Out

The 90 Avenue right in/right out intersection was assessed as a stop controlled intersection with the following geometry:

- ***West Approach*** –two through lanes;
- ***East Approach*** – one through lane, one shared through/right lane;
- ***North Approach*** – one right turn lane.

As shown in **Table 5-12**, the intersection is anticipated to operate at LOS B or better in the AM and PM peak hours under the 2047 total traffic scenario.

Table 5-12: 90 Avenue Right In/Right Out

DIRECTION	EASTBOUND	WESTBOUND		SOUTHBOUND
MOVEMENT	T	T	R	R
AM Peak Hour – 2047 Total – Unsignalized (SB Stop)				
Geometry	T/T	T/TR		R
Volume (vph)	531	1220	13	47
v/c				0.11
Delay (s)				14.9
LOS				B
95th Queue (m)				3
Intersection Delay:	0.4	Intersection LOS:		A
PM Peak Hour – 2047 Total – Unsignalized (SB Stop)				
Geometry	T/T	T/TR		R
Volume (vph)	947	890	54	34
v/c				0.07
Delay (s)				12.5
LOS				B
95" Queue (m)				2
Intersection Delay	0.2	Intersection LOS:		A

5.3.7 85 Street East Service Road and the North-South Alley

The intersection of the 85 Street East Service Road and the North-South Alley is an uncontrolled T-intersection; therefore, the intersection was assessed assuming stop control on the north approach. The assessment also assumed a single lane on each approach.

As shown in **Table 5-13**, the intersection is anticipated to operate at excellent levels of service in the 2047 horizon.

Table 5-13: 85 Street East Service Road and the North-South Alley

DIRECTION	EASTBOUND		WESTBOUND		SOUTHBOUND	
MOVEMENT	L	T	T	R	L	R
AM Peak Hour – 2047 Total – Unsignalized (SB Stop)						
Geometry	LT		TR		LR	
Volume (vph)	2	45	7	3	9	0
v/c	0.00				0.01	
Delay (s)	7.3				9.0	
LOS	A				A	
95th Queue (m)	0				0	
Intersection Delay:	1.4		Intersection LOS:		A	
AM Peak Hour – 2047 Total – Unsignalized (SB Stop)						
Geometry	LT		TR		LR	
Volume (vph)	4	24	25	17	8	0
v/c	0.00				0.01	
Delay (s)	7.3				9.1	
LOS	A				A	
95” Queue (m)	0				0	
Intersection Delay	1.3		Intersection LOS:		A	

5.3.8 93 Avenue and the North-South Alley

The intersection of 93 Avenue and the North-South Alley is an unsignalized four-legged intersection with stop control on the north and south approaches. The intersection is assumed to include the following geometry:

- ***West Approach*** –one shared left/through/right lane;
- ***East Approach*** – one shared left/through/right lane;
- ***South Approach*** – one shared left/through/right lane; and
- ***North Approach*** – one shared left/through/right lane.

As shown in **Table 5-14**, the intersection is anticipated to operate at excellent levels of service in the 2047 horizon.

Table 5-14: 93 Avenue and the North-South Alley

DIRECTION	EASTBOUND			WESTBOUND			NORTHBOUND			SOUTHBOUND		
MOVEMENT	L	T	R	L	T	R	L	T	R	L	T	R
AM Peak Hour – 2047 Total – Unsignalized (N/S Stop)												
Geometry	LTR			LTR			LTR			LTR		
Volume (vph)	4	75	1	0	65	1	5	3	2	6	1	6
v/c	0.00			0.00			0.01			0.02		
Delay (s)	7.4			0.0			9.7			9.4		
LOS	A			A			A			A		
95th Queue (m)	0			0			0			0		
Intersection Delay:						1.5	Intersection LOS:					A
PM Peak Hour – 2047 Total – Unsignalized (N/S Stop)												
Geometry	LTR			LTR			LTR			LTR		
Volume (vph)	13	70	8	0	59	5	13	0	3	1	1	15
v/c	0.01			0.00			0.02			0.02		
Delay (s)	7.4			0.0			9.8			9.0		
LOS	A			A			A			A		
95" Queue (m)	0			0			1			1		
Intersection Delay:						2.2	Intersection LOS:					A

5.3.9 95 Avenue and the North-South Alley

The intersection of 95 Avenue and the north-south alley anticipated to continue to operate as an unsignalized T-intersection with the stop control on the south approach. A single lane is anticipated to be provided on each approach. As shown in **Table 5-15**, the 95 Avenue/North-South Alley intersection is anticipated to operate at LOS B or better in the 2047 horizon.

Table 5-15: 95 Avenue and the North –South Alley

DIRECTION	EASTBOUND		WESTBOUND		NORTHBOUND	
MOVEMENT	T	R	L	T	L	R
AM Peak Hour – 2047 Total – Unsignalized (NB Stop)						
Geometry	TR		LT		LR	
Volume (vph)	110	3	8	293	23	29
v/c			0.01		0.07	
Delay (s)			7.5		10.5	
LOS			A		B	
95th Queue (m)			0		1	
Intersection Delay:	1.3		Intersection LOS:		A	
PM Peak Hour – 2047 Total – Unsignalized (NB Stop)						
Geometry	TR		LT		LR	
Volume (vph)	238	17	19	127	11	17
v/c			0.02		0.04	
Delay (s)			7.8		10.7	
LOS			A		B	
95” Queue (m)			0		1	
Intersection Delay	1.0		Intersection LOS:		A	

5.3.10 93 Avenue Parkade Access

The 93 Avenue parkade access is anticipated to operate as a four-legged unsignalized intersection with stop control on the north and south approaches. The intersection is anticipated to operate with a single lane on each approach; however, two westbound lanes are anticipated to be developed west of the parkade access. As shown in **Table 5-16**, the parkade access is anticipated to operate well during the peak periods.

Table 5-16: 93 Avenue Parkade Access

DIRECTION	EASTBOUND			WESTBOUND			NORTHBOUND			SOUTHBOUND		
MOVEMENT	L	T	R	L	T	R	L	T	R	L	T	R
AM Peak Hour – 2047 Total – Unsignalized (N/S Stop)												
Geometry	LTR			LTR			LTR			LTR		
Volume (vph)	37	37	24	6	53	17	36	0	16	27	0	102
v/c	0.03			0.00			0.08			0.15		
Delay (s)	7.5			7.4			10.8			9.8		
LOS	A			A			B			A		
95th Queue (m)	1			0			2			4		
Intersection Delay:						6.0	Intersection LOS:					A
PM Peak Hour – 2047 Total – Unsignalized (N/S Stop)												
Geometry	LTR			LTR			LTR			LTR		
Volume (vph)	80	64	53	9	30	48	22	0	11	16	0	56
v/c	0.05			0.01			0.06			0.09		
Delay (s)	7.5			7.5			11.3			9.7		
LOS	A			A			B			A		
95" Queue (m)	2			0			2			2		
Intersection Delay:						4.5	Intersection LOS:					A

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6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Study Synopsis

This TIA was completed to assess the potential impacts of the proposed Holyrood DC2 rezoning application, which allows for the intensification of residential uses and the addition of commercial development within an existing Holyrood medium density residential site.

The transportation assessment was completed assuming 1,200 dwelling units would be developed, not including the 96 apartment units already constructed at the north end of the site. In addition, a total of 13,000 SF of non-residential area was accounted for in the assessment.

Based on the trip generation assumptions, the site is estimated to generate 305 new two-way AM peak hour trips, 338 net two-way PM peak hour trips, and 4,858 net two-way daily trips.

6.2 Conclusions

Based on the assessments completed, the Connors Road/85 Street and 95 Avenue/85 Street intersections are anticipated to represent congestion points during peak hours for vehicle travel in the 2047 horizon under both background and total traffic scenarios. The capacity constraints are primarily related to the revised geometry associated with the development of the Valley Line LRT and the potential impact that LRT operations will have on signal phasing and intersection operations; however, it is noted that the existing Connors Road/85 Street intersection currently represents a congestion point within the arterial roadway network within Southeast Edmonton. While at-grade LRT operations present a number of challenges regarding passenger vehicle travel along the same corridor, ultimately, the implementation of LRT will improve the overall transportation network and increase the capacity for moving people throughout the City.

In addition to assessing the arterial roadway network, the potential impact on roadways within Holyrood was identified. Based on the assessments completed, the magnitude of traffic projected to utilize internal neighbourhood roadways can be accommodated by the existing roadway network.

6.3 Recommendations

The following recommendations are advanced:

- a cross-walk should be considered for the west side of the 93 Avenue/North-South Alley intersection with a more direct tie-in between the on-site north-south walkways and the southwest and northwest corners of this intersection.
- The full north-south alley right-of-way width should be paved between the east-west drive aisle and 95 Avenue (adjacent to Area 1) to provide additional passing opportunities. Where existing grades and utilities make it challenging to widen the pavement to the full right-of-way width, a passing layby could be developed by widening into Area 1.
- three travel lanes should be provided along 93 Avenue between 85 Street and the alley. If on-street parking is desired through this section, laybys could be constructed.
- No parking signs should be installed along the remaining portion of the 85 Street East Service Road between the south parkade access and the 90 Avenue right in/right out access.

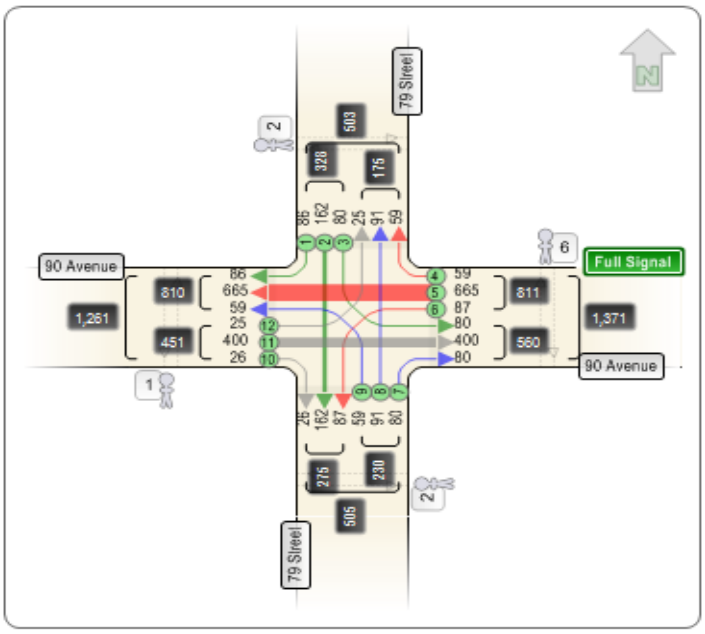
APPENDIX A

Traffic Data

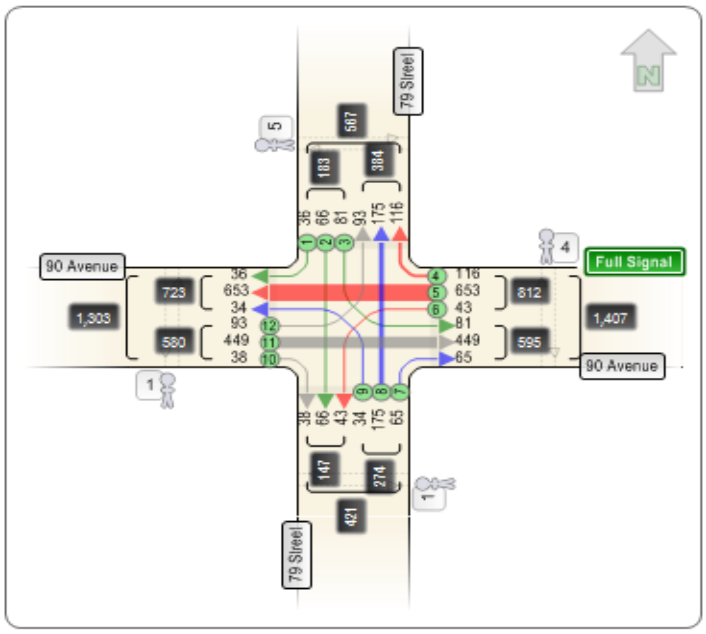
Turning Movement Count

Location	**90 Avenue and 79 Street**
Site Number	**523612**
Date	**2014/Apr/09 6:30:00 AM-2014/Apr/09 6:30:00 PM**
Vehicle Type	**-**
Weather	**-**
County	**South East**

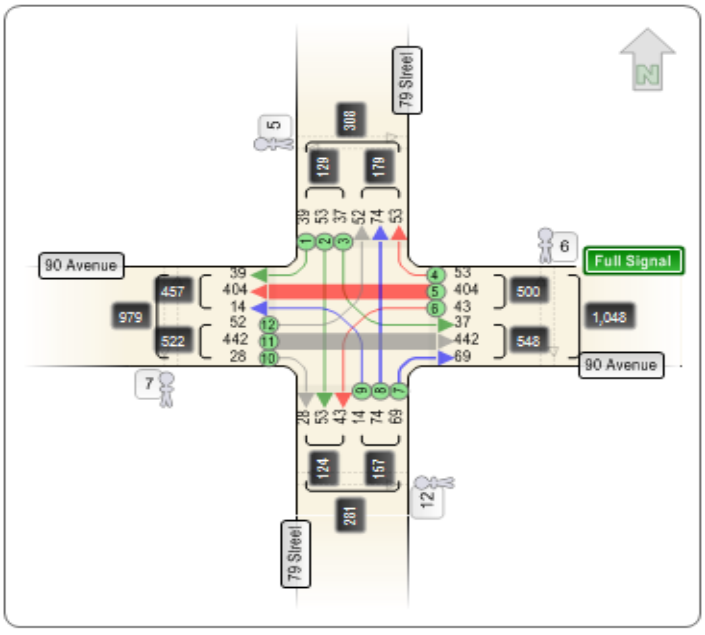
Peak Hour AM
7:40 AM - 8:40 AM



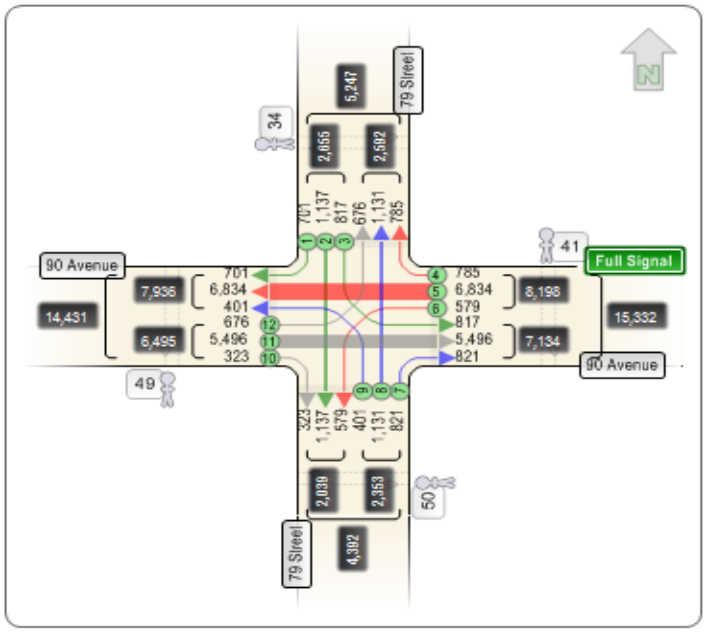
Peak Hour PM
4:35 PM - 5:35 PM



Off Peak Hour
2:30 PM - 3:30 PM



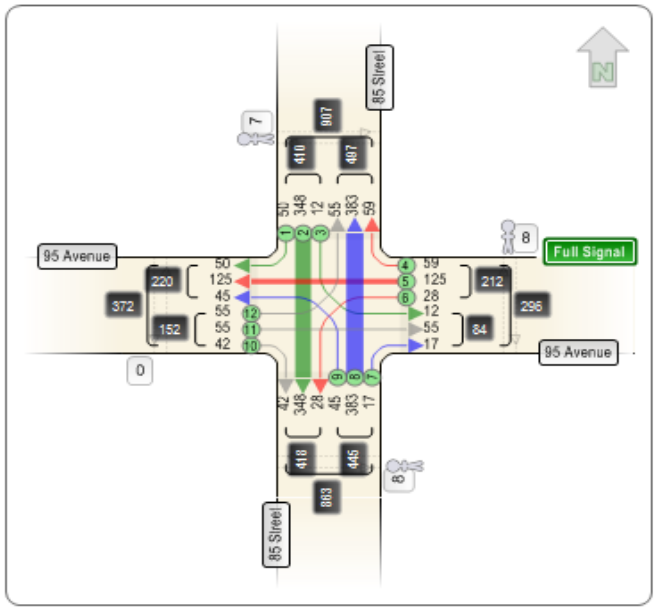
Estimated 24 Hour



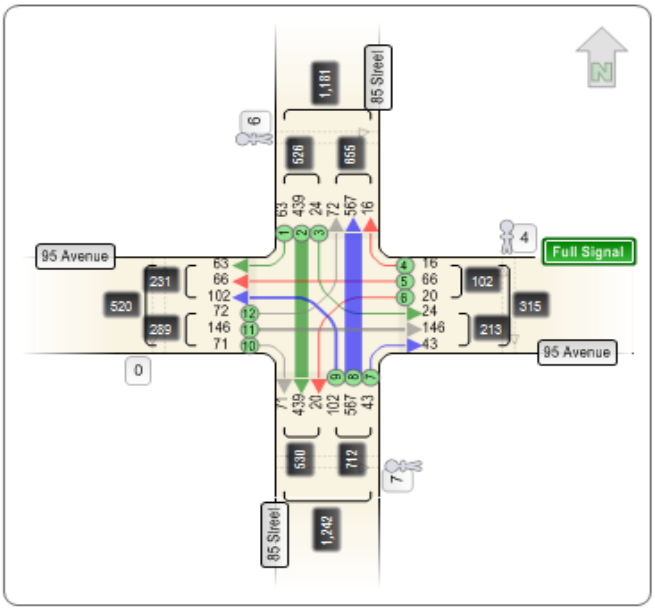
Turning Movement Count

Location	**95 Avenue and 85 Street**
Site Number	**525172**
Date	**2014/Feb/25 6:30:00 AM-2014/Feb/25 6:30:00 PM**
Vehicle Type	**-**
Weather	**-**
County	**South East**

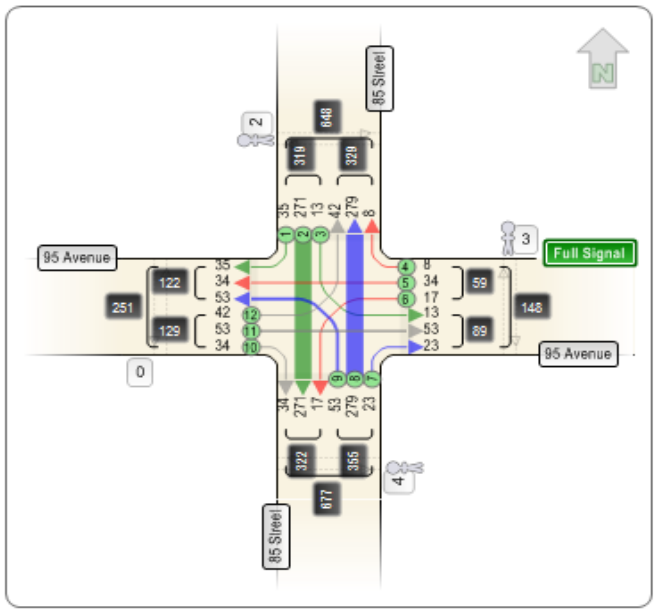
Peak Hour AM
7:40 AM - 8:40 AM



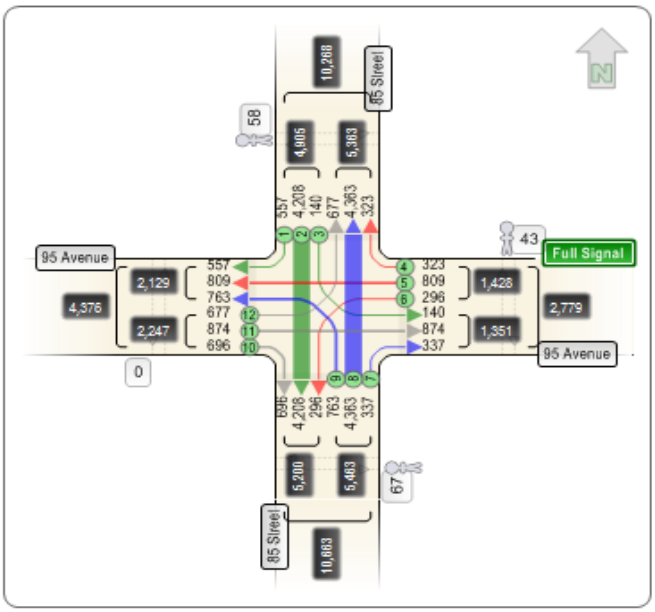
Peak Hour PM
4:35 PM - 5:35 PM



Off Peak Hour
2:30 PM - 3:30 PM



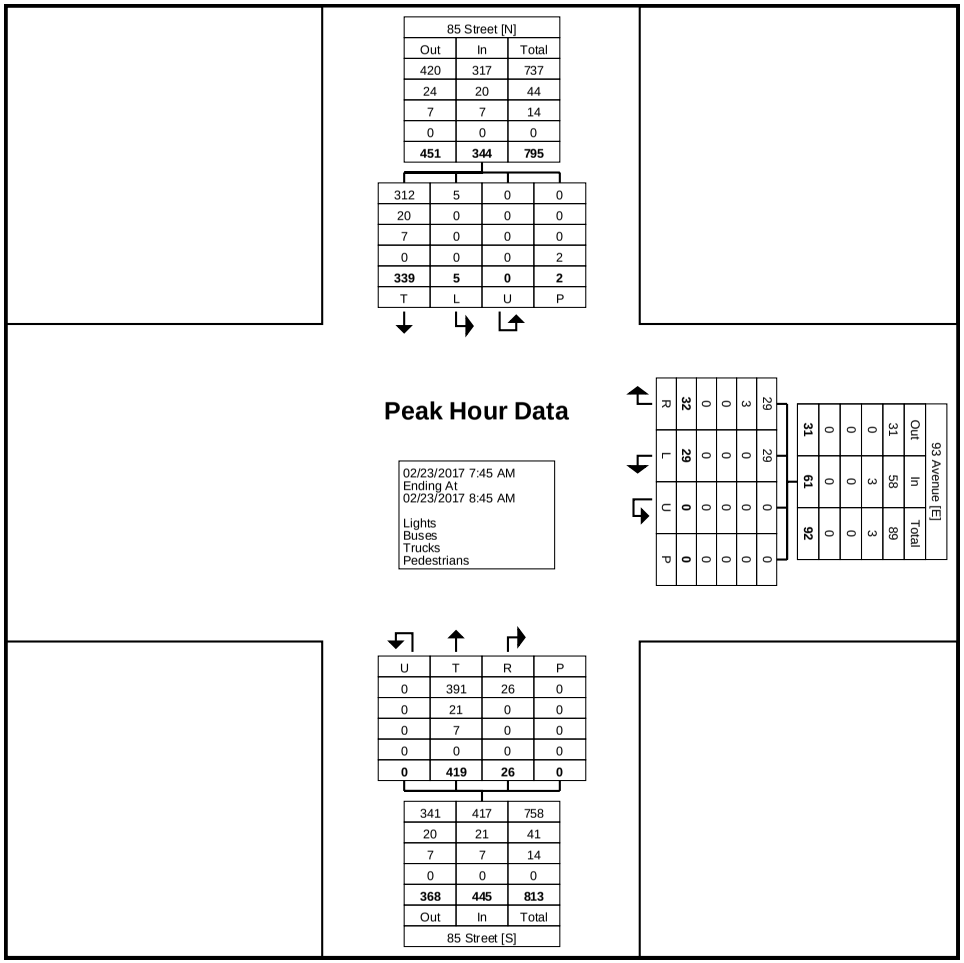
Estimated 24 Hour



Bunt & Associates - Edmonton
10339 124 St NW #504

Edmonton, Alberta, Canada T5N 3W1
(780) 732-5373 gleblanc@bunteng.com

Count Name: 85 Street and 93 Avenue - TMC
Site Code:
Start Date: 02/23/2017

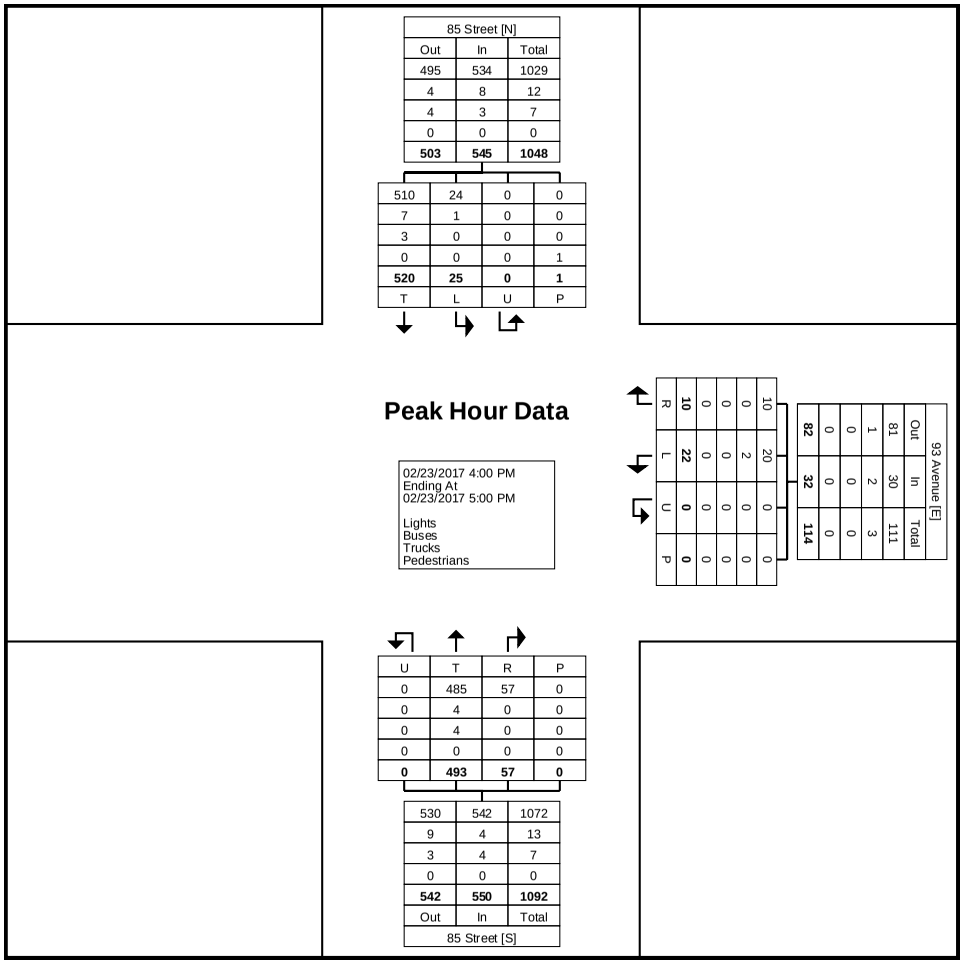


Turning Movement Peak Hour Data Plot (7:45 AM)

Bunt & Associates - Edmonton
10339 124 St NW #504

Edmonton, Alberta, Canada T5N 3W1
(780) 732-5373 gleblanc@bunteng.com

Count Name: 85 Street and 93 Avenue - TMC
Site Code:
Start Date: 02/23/2017

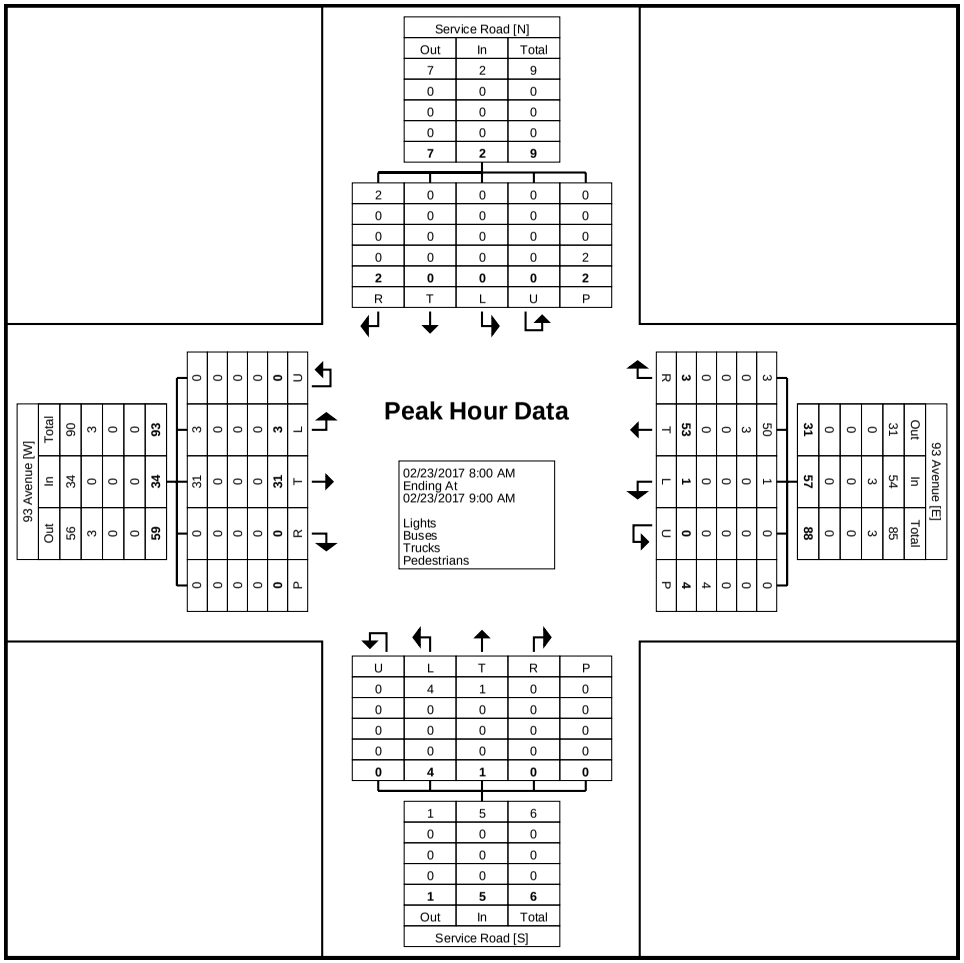


Turning Movement Peak Hour Data Plot (4:00 PM)

Bunt & Associates - Edmonton
10339 124 St NW #504

Edmonton, Alberta, Canada T5N 3W1
(780) 732-5373 gleblanc@bunteng.com

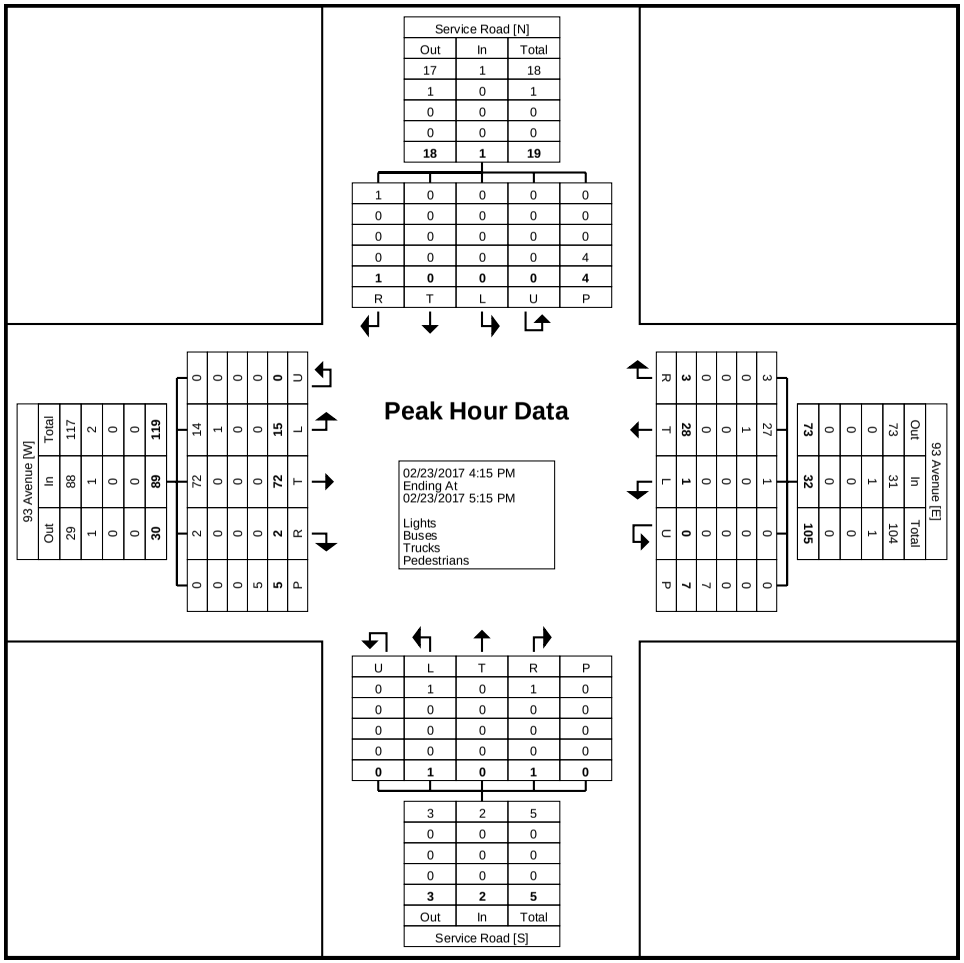
Count Name: 93 Avenue and Service Road
Site Code:
Start Date: 02/23/2017



Turning Movement Peak Hour Data Plot (8:00 AM)

Bunt & Associates - Edmonton
10339 124 St NW #504

Edmonton, Alberta, Canada T5N 3W1
(780) 732-5373 gleblanc@bunteng.com

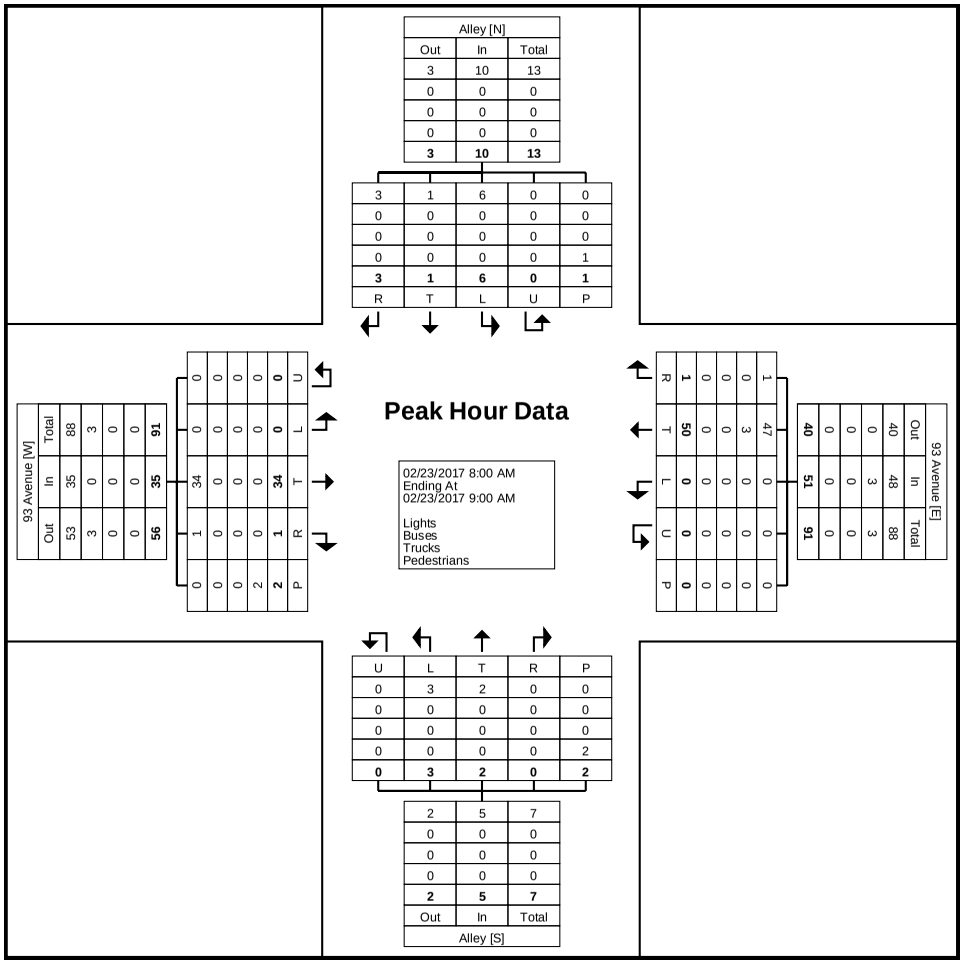


Turning Movement Peak Hour Data Plot (4:15 PM)

Bunt & Associates - Edmonton
10339 124 St NW #504

Edmonton, Alberta, Canada T5N 3W1
(780) 732-5373 gleblanc@bunteng.com

Count Name: 93 Avenue and Alley
Site Code:
Start Date: 02/23/2017

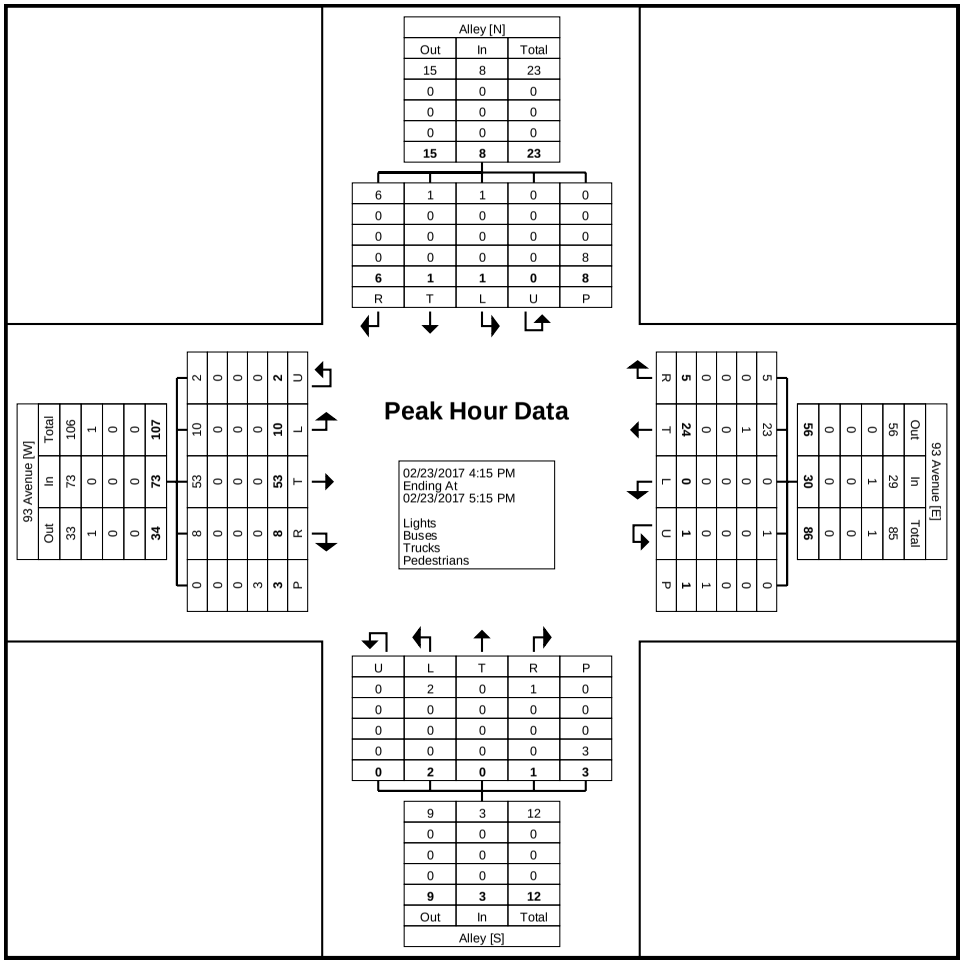


Turning Movement Peak Hour Data Plot (8:00 AM)

Bunt & Associates - Edmonton
10339 124 St NW #504

Edmonton, Alberta, Canada T5N 3W1
(780) 732-5373 gleblanc@bunteng.com

Count Name: 93 Avenue and Alley
Site Code:
Start Date: 02/23/2017

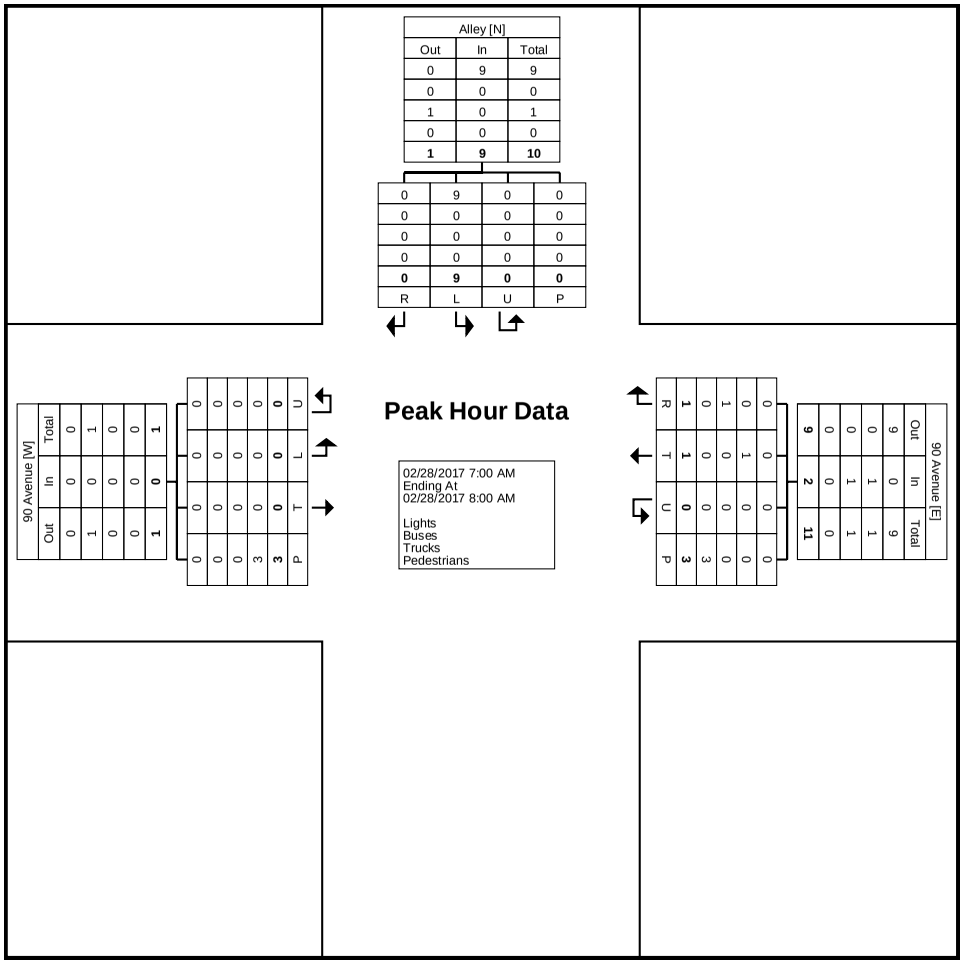


Turning Movement Peak Hour Data Plot (4:15 PM)

Bunt & Associates - Edmonton
10339 124 St NW #504

Edmonton, Alberta, Canada T5N 3W1
(780) 732-5373 gleblanc@bunteng.com

Count Name: 90 Avenue and Alley
Site Code:
Start Date: 02/28/2017

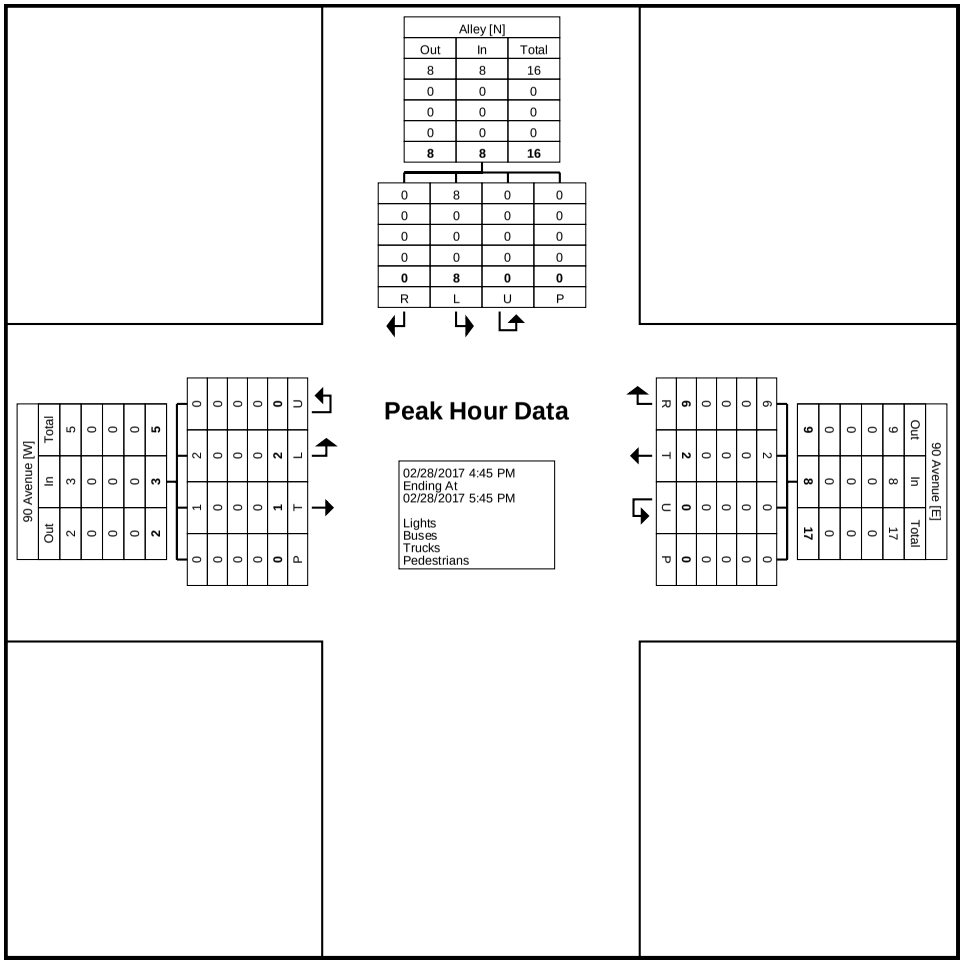


Turning Movement Peak Hour Data Plot (7:00 AM)

Bunt & Associates - Edmonton
10339 124 St NW #504

Edmonton, Alberta, Canada T5N 3W1
(780) 732-5373 gleblanc@bunteng.com

Count Name: 90 Avenue and Alley
Site Code:
Start Date: 02/28/2017

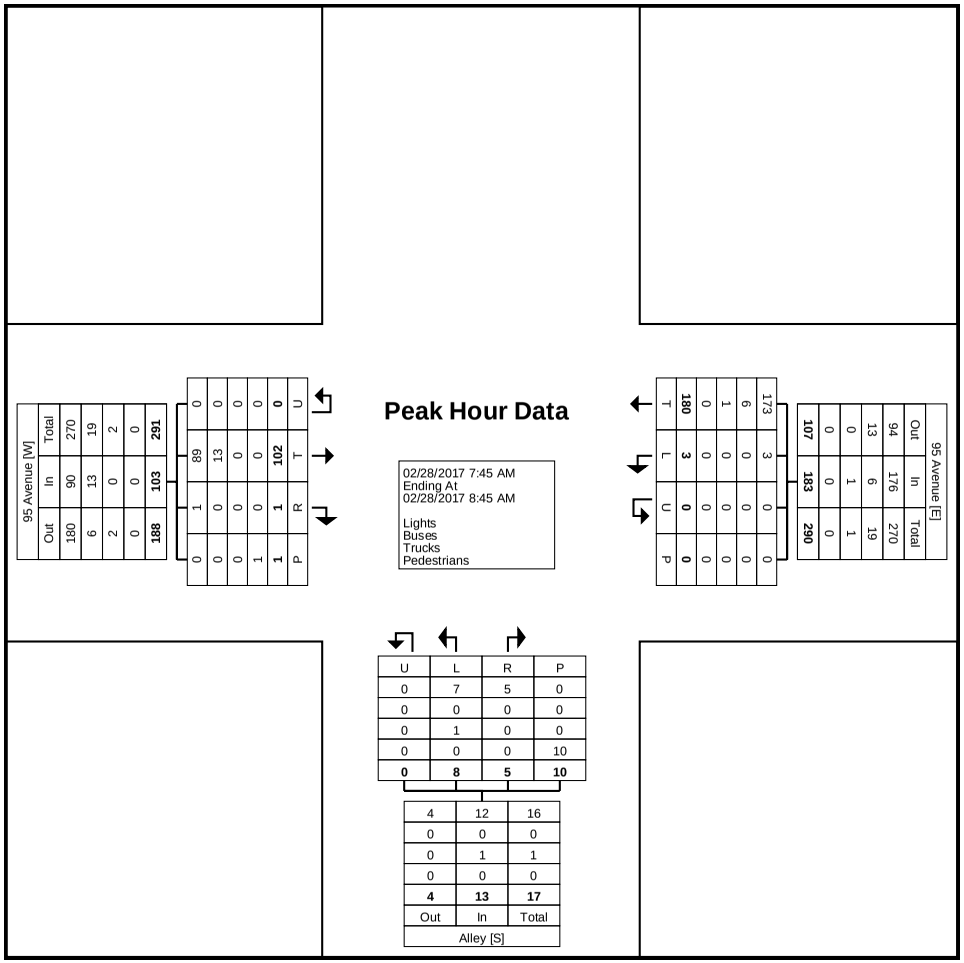


Turning Movement Peak Hour Data Plot (4:45 PM)

Bunt & Associates - Edmonton
10339 124 St NW #504

Edmonton, Alberta, Canada T5N 3W1
(780) 732-5373 gleblanc@bunteng.com

Count Name: 95 Avenue and Alley
Site Code:
Start Date: 02/28/2017

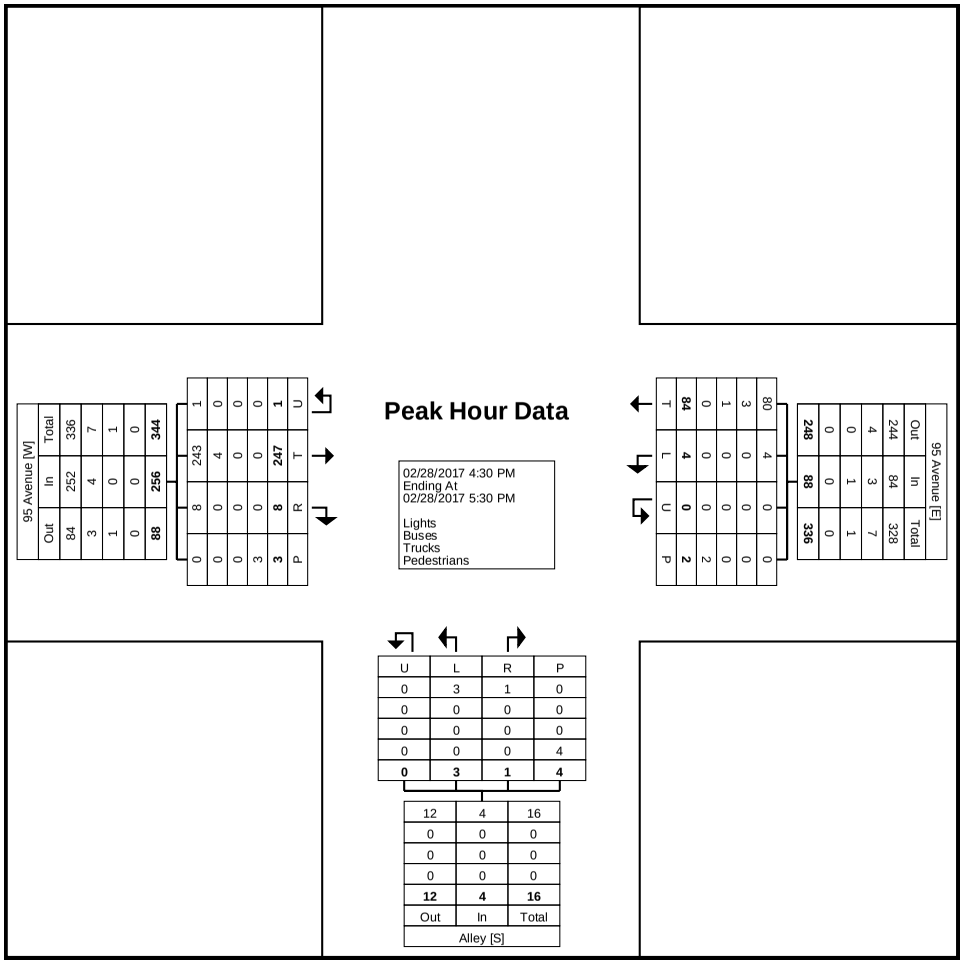


Turning Movement Peak Hour Data Plot (7:45 AM)

Bunt & Associates - Edmonton
10339 124 St NW #504

Edmonton, Alberta, Canada T5N 3W1
(780) 732-5373 gleblanc@bunteng.com

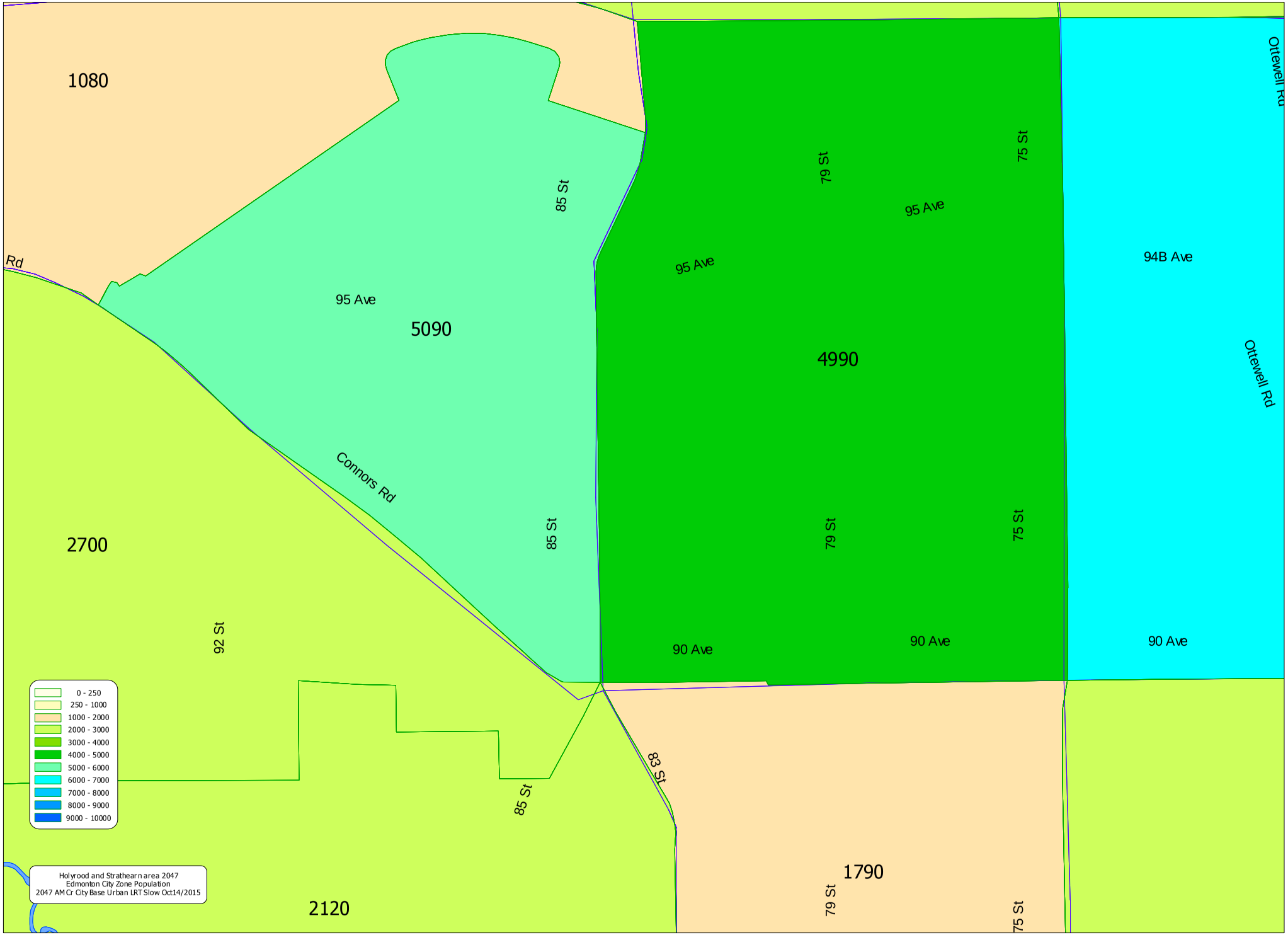
Count Name: 95 Avenue and Alley
Site Code:
Start Date: 02/28/2017

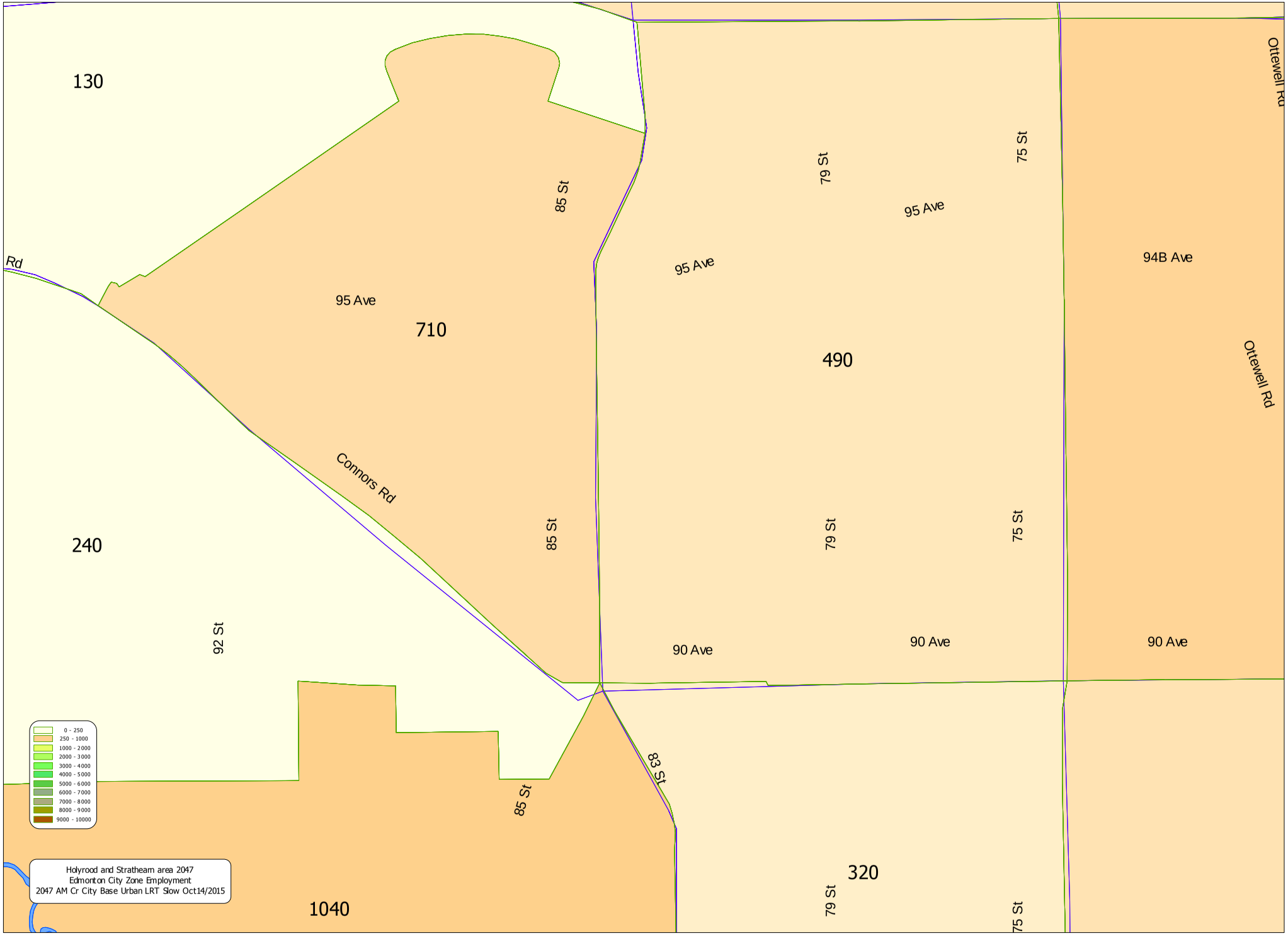


Turning Movement Peak Hour Data Plot (4:30 PM)

APPENDIX B

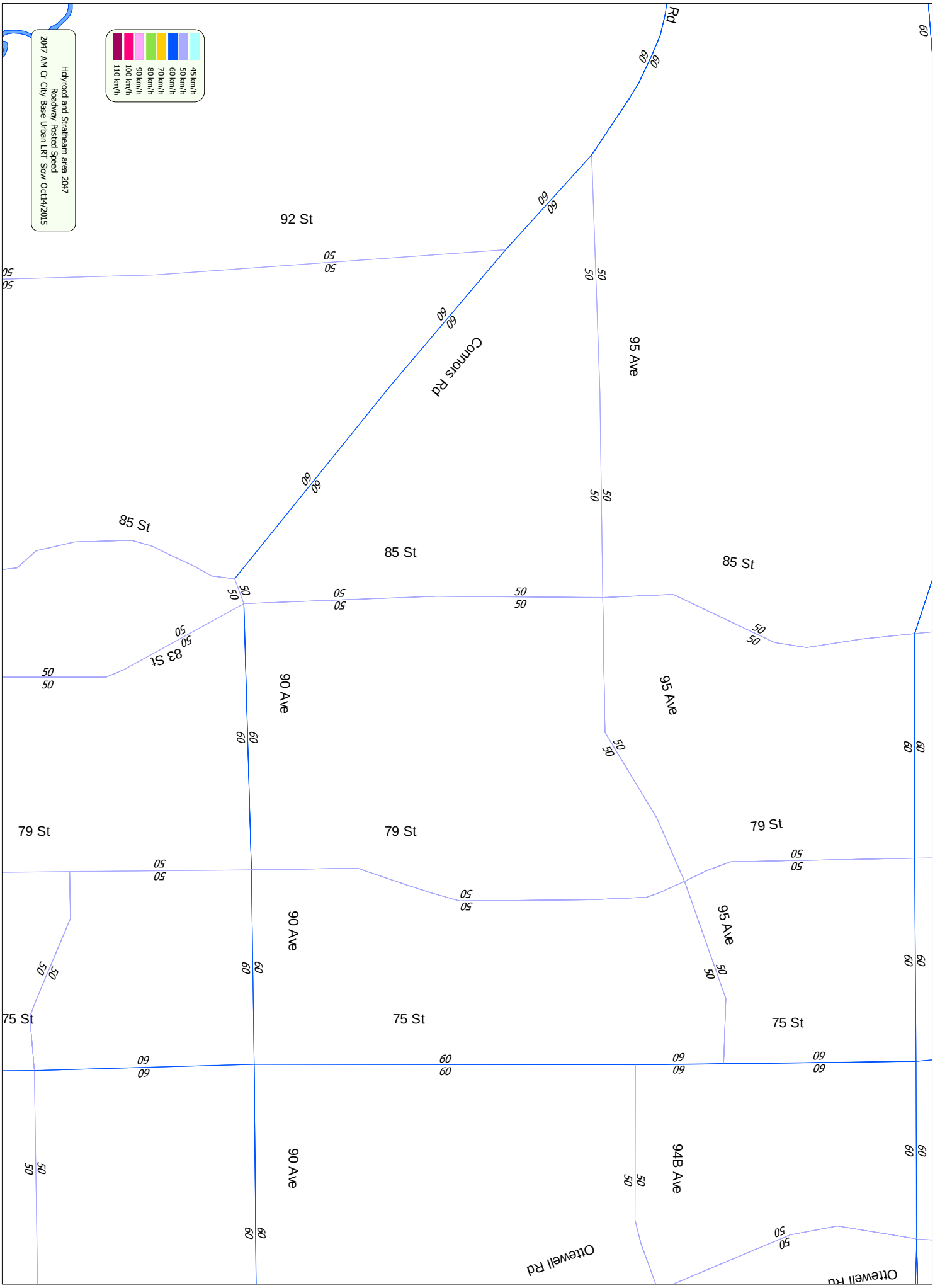
City Model


1080
5090
4990
2700
2120
1790
95 Ave
95 Ave
95 Ave
94B Ave
90 Ave
90 Ave
90 Ave
85 St
85 St
85 St
79 St
79 St
79 St
75 St
75 St
75 St
83 St
92 St
Connors Rd
Rd
Ottewell Rd
Ottewell Rd
0 - 250
250 - 1000
1000 - 2000
2000 - 3000
3000 - 4000
4000 - 5000
5000 - 6000
6000 - 7000
7000 - 8000
8000 - 9000
9000 - 10000
Holyrood and Strathearn area 2047
Edmonton City Zone Population
2047 AM Cr City Base Urban LRT Slow Oct14/2015


130
710
490
240
1040
320
95 Ave
95 Ave
95 Ave
94B Ave
90 Ave
90 Ave
90 Ave
85 St
85 St
85 St
79 St
79 St
79 St
75 St
75 St
75 St
92 St
83 St
Connors Rd
Rd
Ottewell Rd
Ottewell Rd
0 - 250
250 - 1000
1000 - 2000
2000 - 3000
3000 - 4000
4000 - 5000
5000 - 6000
6000 - 7000
7000 - 8000
8000 - 9000
9000 - 10000
Holyrood and Stratheam area 2047
Edmonton City Zone Employment
2047 AM Cr City Base Urban LRT Slow Oct14/2015

Ottewell Rd
Ottewell Rd
94B Ave
90 Ave
75 St
75 St
75 St
95 Ave
90 Ave
79 St
79 St
79 St
95 Ave
90 Ave
85 St
85 St
85 St
95 Ave
Connors Rd
92 St
Rd
1 Lane
2 Lanes
3 Lanes
4 Lanes
5 Lanes
6 Lanes
Holyrood and Strathearn area 2047
Roadway Number of Lanes
2047 AM Cr City Base Urban LRT Stow Oct14/2015

Ottewell Rd
Ottewell Rd
94B Ave
90 Ave
75 St
75 St
75 St
95 Ave
90 Ave
79 St
79 St
79 St
95 Ave
90 Ave
83 St
85 St
85 St
85 St
95 Ave
Connors Rd
92 St
Holyrood and Strathearn area 2047
Roadway Link Capacity
2047 AM Cr City Base Urban LRT Stow Oct14/2015
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0


Holyrood and Strathearn area 2047
Roadway Posted Speed
2047 AM Cr City Base Urban LRT Slow Oct14/2015
45 km/h
50 km/h
60 km/h
70 km/h
80 km/h
90 km/h
100 km/h
110 km/h
92 St
85 St
79 St
75 St
Connors Rd
95 Ave
90 Ave
83 St
94B Ave
Ottewell Rd

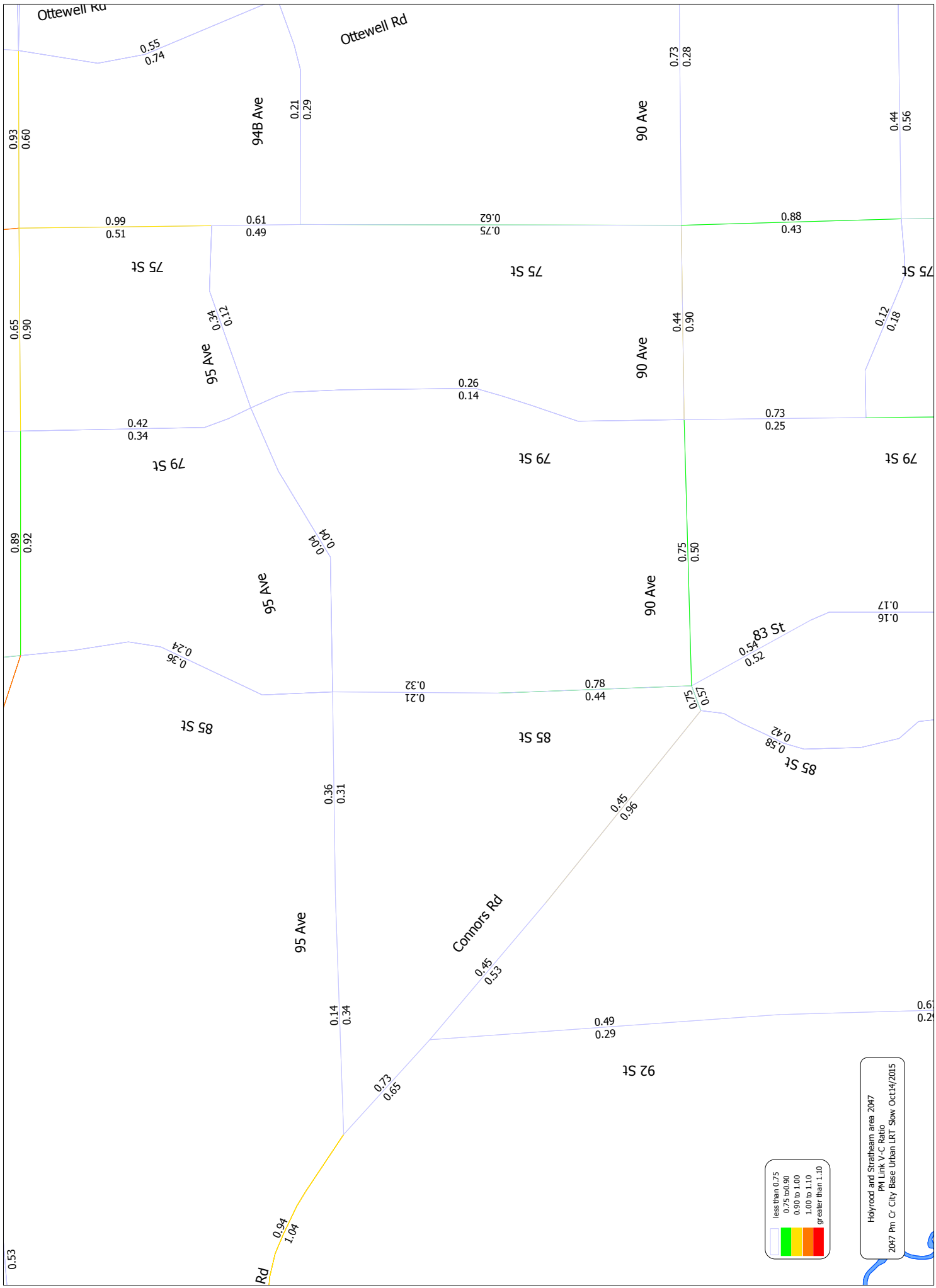
Ottewell Rd
Ottewell Rd
94B Ave
90 Ave
90 Ave
75 St
75 St
75 St
95 Ave
90 Ave
79 St
79 St
79 St
95 Ave
90 Ave
83 St
85 St
85 St
85 St
95 Ave
Connors Rd
92 St
8100
7100
15300
7500
35000
69300
68200
00089
59900
38300
8100
16500
900
1700
3300
6000
40400
1900
18100
5700
6000
11000
17800
2600
9200
6000
4900
19800
3700
18900
5600
6900
21600
25000
40000
140,000 - 150,000+
130,000 - 140,000
120,000 - 130,000
110,000 - 120,000
100,000 - 110,000
90,000 - 100,000
80,000 - 90,000
70,000 - 80,000
60,000 - 70,000
50,000 - 60,000
40,000 - 50,000
30,000 - 40,000
20,000 - 30,000
10,000 - 20,000
0 - 10,000
Holyrood and Strathearn area 2047
Daily Two-Way Vehicle Volumes
Daily VEH, Daily TRUCK, Daily PCU & Transit Volumes Scenario

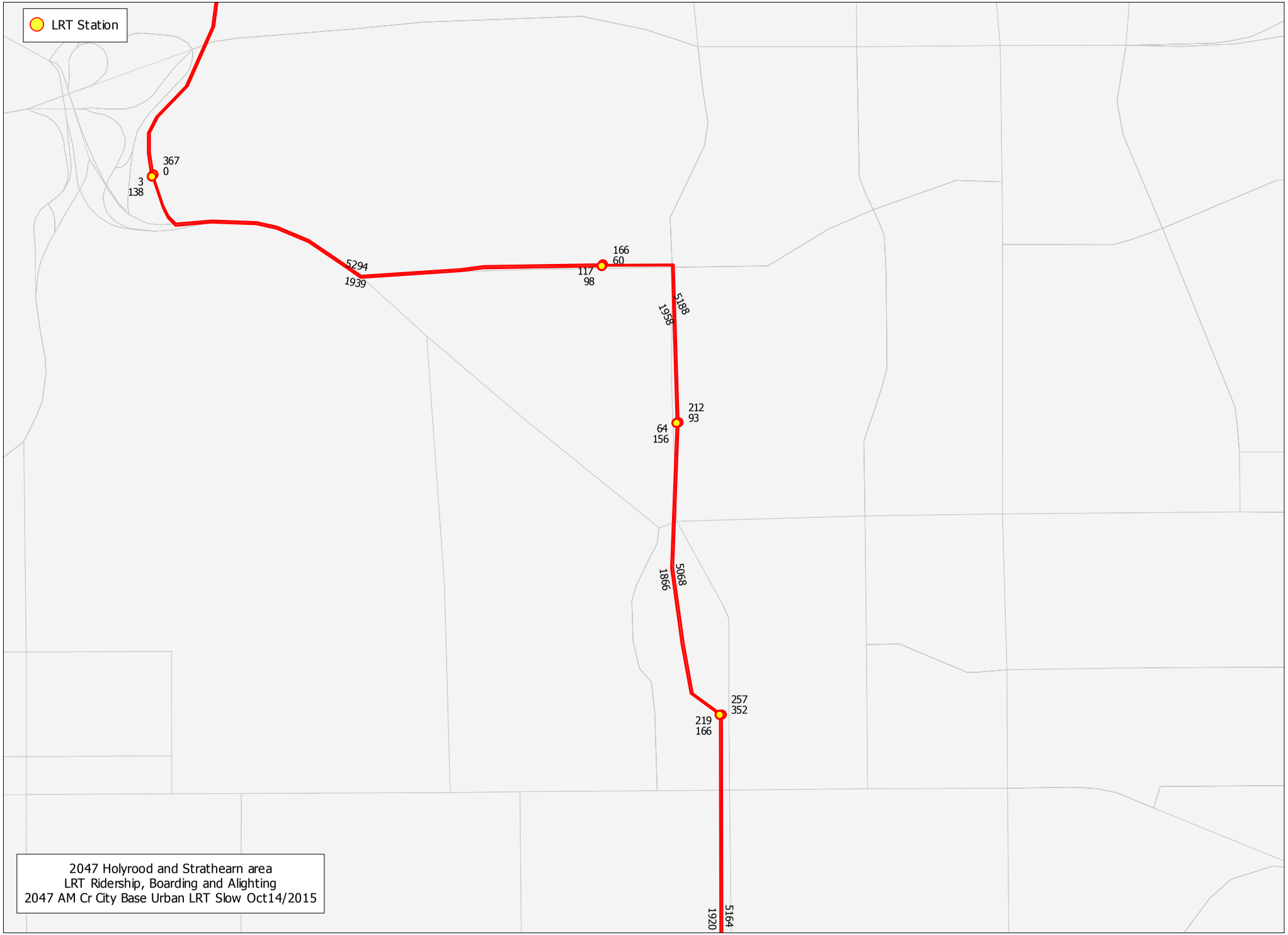
Ottewell Rd
94B Ave
90 Ave
75 St
95 Ave
79 St
85 St
Connors Rd
92 St
Holyrood and Strathearn area 2047
Daily Two-Way Truck Percentage
Daily VEH, Daily TRUCK, Daily PCU & Transit Volumes Scenario
90 - 100
80 - 90
70 - 80
60 - 70
50 - 60
40 - 50
30 - 40
20 - 30
10 - 20
0 - 10

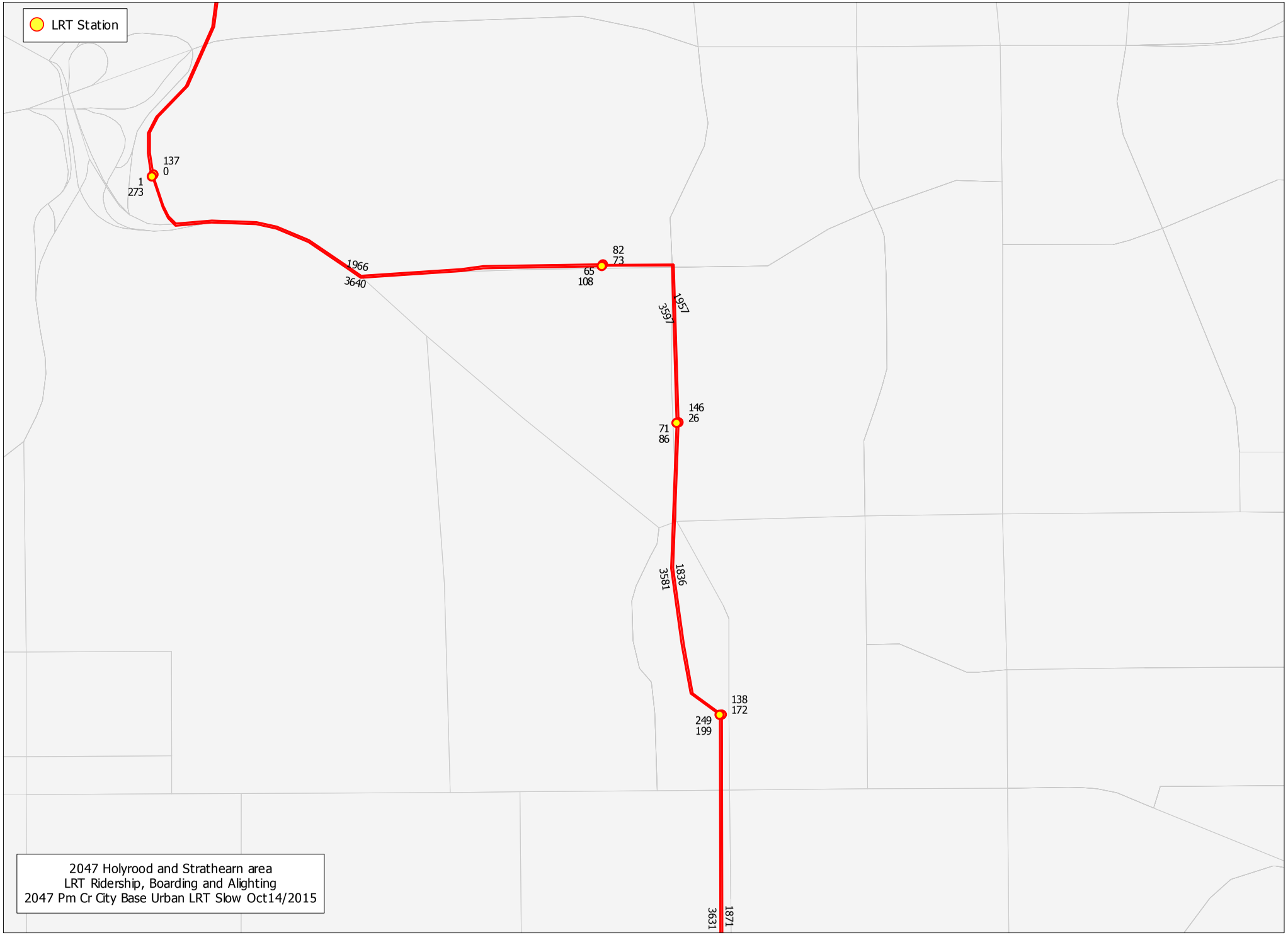
Ottewell Rd
Ottewell Rd
94B Ave
90 Ave
90 Ave
90 Ave
90 Ave
95 Ave
95 Ave
95 Ave
95 Ave
Connors Rd
75 St
75 St
75 St
79 St
79 St
79 St
85 St
85 St
85 St
92 St
Holyrood and Strathearn area 2047
AM Peak Hour Vehicle Volumes
2047 AM Cr City Base Urban LRT Slow Oct14/2015
14,000 - 15,000+
13,000 - 14,000
12,000 - 13,000
11,000 - 12,000
10,000 - 11,000
9,000 - 10,000
8,000 - 9,000
7,000 - 8,000
6,000 - 7,000
5,000 - 6,000
4,000 - 5,000
3,000 - 4,000
2,000 - 3,000
1,000 - 2,000
0 - 1,000

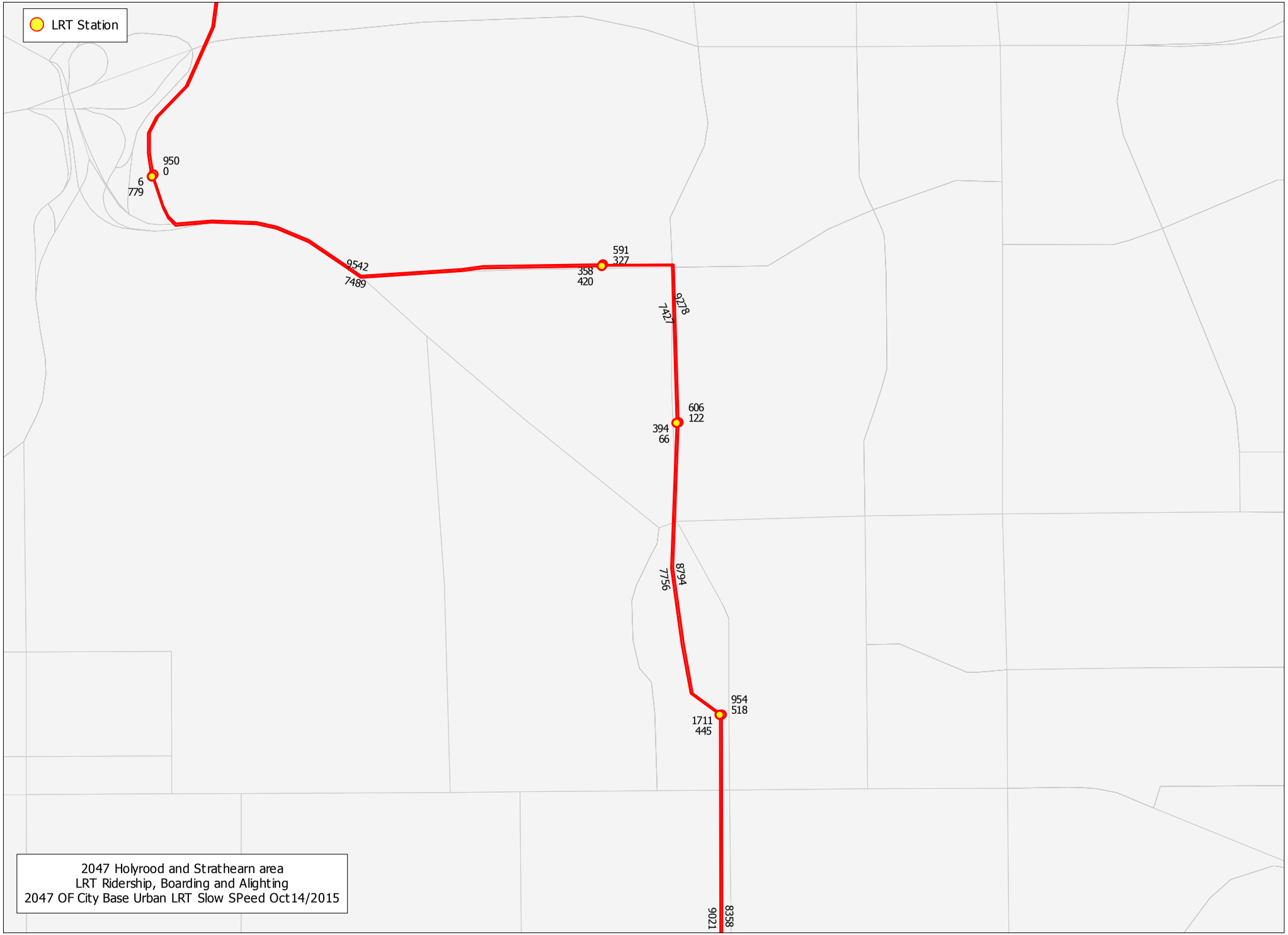
Ottewell Rd
Ottewell Rd
94B Ave
90 Ave
75 St
75 St
75 St
95 Ave
90 Ave
79 St
79 St
79 St
95 Ave
95 Ave
90 Ave
83 St
85 St
85 St
85 St
Connors Rd
92 St
Rd
less than 0.75
0.75 to0.90
0.90 to 1.00
1.00 to 1.10
greater than 1.10
Holyrood and Strathearn area 2047
AM Link V-C Ratio
2047 AM Cr City Base Urban LRT Stow Oct14/2015

Ottewell Rd
Ottewell Rd
94B Ave
90 Ave
90 Ave
90 Ave
95 Ave
95 Ave
95 Ave
Connors Rd
75 St
75 St
75 St
79 St
79 St
79 St
85 St
85 St
85 St
92 St
Holyrood and Strathearn area 2047
PM Peak Hour Vehicle Volumes
2047 Pm Cr City Base Urban LRT Slow Oct14/2015
14,000 - 15,000+
13,000 - 14,000
12,000 - 13,000
11,000 - 12,000
10,000 - 11,000
9,000 - 10,000
8,000 - 9,000
7,000 - 8,000
6,000 - 7,000
5,000 - 6,000
4,000 - 5,000
3,000 - 4,000
2,000 - 3,000
1,000 - 2,000
0 - 1,000


Ottewell Rd
Ottewell Rd
94B Ave
90 Ave
90 Ave
75 St
75 St
75 St
95 Ave
90 Ave
79 St
79 St
79 St
95 Ave
95 Ave
90 Ave
83 St
85 St
85 St
85 St
Connors Rd
92 St
Rd
less than 0.75
0.75 to0.90
0.90 to 1.00
1.00 to 1.10
greater than 1.10
Holyrood and Stratheam area 2047
PM Link V-C Ratio
2047 Pm Cr City Base Urban LRT Stow Oct14/2015


LRT Station
367
0
3
138
5294
1939
166
60
117
98
5188
1955
212
93
64
156
5068
1866
257
352
219
166
5164
1920
2047 Holyrood and Strathearn area
LRT Ridership, Boarding and Alighting
2047 AM Cr City Base Urban LRT Slow Oct14/2015


LRT Station
137
0
1
273
1966
3640
82
73
65
108
1957
3591
146
26
71
86
1836
3581
138
172
249
199
1871
3631
2047 Holyrood and Strathearn area
LRT Ridership, Boarding and Alighting
2047 Pm Cr City Base Urban LRT Slow Oct14/2015


LRT Station
950
0
6
779
9542
7489
591
327
358
420
9278
7427
606
122
394
66
8794
7756
954
518
1711
445
9021
8358
2047 Holyrood and Strathearn area
LRT Ridership, Boarding and Alighting
2047 OF City Base Urban LRT Slow SPeed Oct14/2015

APPENDIX C

Trip Generation

3459.03 - Holyrood DC2
25-Apr-17
Statistics Source: Stantec January 12, 2017 emails
Trip Generation - ITE & City of Edmonton Rates

			AM Peak Hour					PM Peak Hour					Daily				
Land Use	**Units**		**Rate**	**In**		**Out**		**Rate**	**In**		**Out**		**Rate**	**In**		**Out**	
MDR - Apartment	1,200	units	0.34	17%	69	83%	339	0.40	63%	302	37%	178	5.81	50%	3,486	50%	3,486
MDR - Townhouse		units	0.46	21%	0	79%	0	0.58	65%	0	35%	0	6.59	50%	0	50%	0
				69		339			302		178			3,486		3,486	
Total Residential	**1,200**			408					480					6,972			
Restaurant (ITE 932)	3,000	SF	10.81	55%	18	45%	15	9.85	60%	18	40%	12	127.15	50%	191	50%	191
Coffee Shop (ITE 936)	2,000	SF	108.38	51%	111	49%	106	40.75	50%	41	50%	41	894.78	50%	895	50%	895
Medical/Dental (ITE 720)	5,000	SF	2.39	79%	9	21%	3	3.57	28%	5	72%	13	36.13	50%	90	50%	90
Convenience Retail (852)	3,000	SF	31.02	50%	47	50%	47	34.57	49%	51	51%	53	393.54	50%	590	50%	590
Synergy	20%				-37		-34			-23		-24			-353		-353
				148		137			92		95			1,413		1,413	
Total Non-Residential	**13,000**		21.92	285				14.38	187				217.38	2,826			
				217		476			394		273			4,899		4,899	
Total				693					667					9,798			

Estimation of Average Mode Split to Alternate Modes	AM	PM	Daily	AM		PM		Daily	
based on individual land use characteristics	% Mode Split	% Mode Split	% Mode Spli	In	Out	In	Out	In	Out
Restaurant (ITE 932)	20%	20%	20%	4	3	4	2	38	38
Coffee Shop (ITE 936)	80%	80%	80%	89	85	33	33	716	716
Medical/Dental (ITE 720)	20%	20%	20%	2	1	1	3	18	18
Convenience Retail (852)	80%	80%	80%	38	38	41	42	472	472
Aggregate Mode Split	72%	68%	70%	132	126	78	80	1244	1244

Calculation of Average Pass-by Percentage based on	AM	PM	Daily	AM		PM		Daily	
assumed vehicle trips for individual land uses	% Pass-by	% Pass-by	% Pass-by	In	Out	In	Out	In	Out
Restaurant (ITE 932)	10%	10%	10%	1	1	1	1	15	15
Coffee Shop (ITE 936)	60%	60%	60%	13	13	5	5	107	107
Medical/Dental (ITE 720)	0%	0%	0%	0	0	0	0	0	0
Convenience Retail (852)	50%	50%	50%	5	5	5	5	59	59
Aggregate Pass-by	40%	30%	35%	19	19	11	11	182	182

Trip Summary	**Intensity**	**AM Peak Hour**		**PM Peak Hour**		**Daily**	
		In	**Out**	**In**	**Out**	**In**	**Out**
Residential	1,200	69	339	302	178	3,486	3,486
Mode Split		23	133	117	65	1,326	1,340
Pass-by Trips		0	0	0	0	0	0
Net External Trips		**46**	**206**	**185**	**113**	**2,160**	**2,146**
Non-Residential	13,000	148	137	92	95	1,413	1,413
Mode Split (Average)	70%	104	96	64	67	989	989
Pass-by Trips	As Above	16	16	8	8	148	148
Net External Trips		**28**	**25**	**19**	**20**	**276**	**276**
Gross Trips		217	476	394	273	4,899	4,899
Mode Split		127	229	181	131	2,315	2,329
Pass-by Trips		16	16	8	8	148	148
Net External Trips		**74**	**230**	**205**	**133**	**2,436**	**2,422**

Residential Distribution	Downtown	University	Downtown Fringe	NW Inner	NE Inner	SE Inner	SW Inner	West Inner	NW Suburb	NE Suburb	SE Suburb	SW suburb	West Suburb	Sherwood park	St. Albert	County of Strathcona	County of Leduc	County of Parkland	MD of Sturgeon	Total
Mode Split To Auto	**30.0%**	**50.0%**	**30.0%**	**50.0%**	**50.0%**	**50.0%**	**60.0%**	**50.0%**	**80.0%**	**80.0%**	**70.0%**	**70.0%**	**80.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	
AM Peak Hour																				
Original O-D Inbound	2.2%	1.7%	3.6%	4.3%	7.0%	16.7%	3.2%	2.0%	4.6%	8.5%	22.4%	7.0%	3.9%	5.5%	1.7%	1.7%	2.0%	1.4%	0.7%	
Revised O-D Inbound	0.7%	0.9%	1.1%	2.2%	3.5%	8.4%	1.9%	1.0%	3.7%	6.8%	15.7%	4.9%	3.1%	5.5%	1.7%	1.7%	2.0%	1.4%	0.7%	66.7%
Original O-D Outbound	9.7%	5.5%	5.2%	3.5%	4.6%	16.1%	3.5%	1.6%	6.3%	4.1%	29.1%	2.4%	1.4%	2.6%	0.7%	0.5%	2.4%	0.4%	0.4%	
Revised O-D Outbound	2.9%	2.8%	1.6%	1.8%	2.3%	8.1%	2.1%	0.8%	5.0%	3.3%	20.4%	1.7%	1.1%	2.6%	0.7%	0.5%	2.4%	0.4%	0.4%	60.7%
PM Peak Hour																				
Original O-D Inbound	6.5%	4.1%	4.6%	3.9%	4.7%	20.2%	5.0%	1.2%	5.8%	4.4%	28.6%	3.0%	1.4%	3.5%	0.7%	0.5%	1.2%	0.4%	0.3%	
Revised O-D Inbound	2.0%	2.1%	1.4%	2.0%	2.4%	10.1%	3.0%	0.6%	4.6%	3.5%	20.0%	2.1%	1.1%	3.5%	0.7%	0.5%	1.2%	0.4%	0.3%	61.4%
Original O-D Outbound	3.1%	2.6%	4.1%	4.3%	6.8%	22.3%	4.3%	1.9%	3.8%	6.5%	22.5%	4.9%	2.9%	5.2%	1.1%	1.1%	1.4%	0.8%	0.5%	
Revised O-D Outbound	0.9%	1.3%	1.2%	2.2%	3.4%	11.2%	2.6%	1.0%	3.0%	5.2%	15.8%	3.4%	2.3%	5.2%	1.1%	1.1%	1.4%	0.8%	0.5%	63.5%
Daily																				
Original O-D Inbound	4.9%	3.6%	4.4%	3.9%	5.6%	22.1%	5.0%	1.5%	4.3%	4.9%	25.6%	4.1%	2.1%	4.2%	0.9%	0.7%	1.3%	0.5%	0.4%	
Revised O-D Inbound	1.5%	1.8%	1.3%	2.0%	2.8%	11.1%	3.0%	0.8%	3.4%	3.9%	17.9%	2.9%	1.7%	4.2%	0.9%	0.7%	1.3%	0.5%	0.4%	62.0%
Original O-D Outbound	4.5%	3.3%	4.5%	4.1%	6.3%	23.2%	4.9%	1.8%	3.9%	5.2%	24.8%	3.6%	2.4%	4.1%	0.8%	0.6%	1.3%	0.4%	0.3%	
Revised O-D Outbound	1.4%	1.7%	1.4%	2.1%	3.2%	11.6%	2.9%	0.9%	3.1%	4.2%	17.4%	2.5%	1.9%	4.1%	0.8%	0.6%	1.3%	0.4%	0.3%	61.6%