transportation planning &
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Municipal District of Foothills

Highway 2A Industrial Area Structure Plan Transportation Functional Study

Municipal District of Foothills, AB

May 18, 2010

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May 18, 2010

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EXECUTIVE SUMMARY

A. Introduction

Background

The Municipal District of Foothills (MD) is planning the transportation network located in the vicinity of Highways 2 and 2A between the Towns of Okotoks and High River and within the *Highway 2A Industrial Area Structure Plan* (H2AIASP) (**Exhibit ES - 1**). The H2AIASP, a future development area within the MD, currently has land use designated as agricultural with some industrial pockets. In order to facilitate the proposed development of the H2AIASP, a review of the transportation network in the area was required to establish the long term transportation network concept and identify the required improvements to the existing road network.

The MD retained HDR | iTRANS (formerly iTRANS Consulting Inc.) to review the transportation network. The main objectives of this study were as follows:

1. The development of a transportation model for the entire MD area.
2. The development of the long term transportation network within the H2AIASP.
3. Identify the staging of improvements required to upgrade the existing transportation network to its ultimate configuration within the H2AIASP.
4. Develop the ultimate transportation network to accommodate both motorized (private and commercial vehicles, transit) and non-motorized (pedestrians, cyclists) modes of transportation within the H2AIASP.

Key Issues

The identified key issues addressed during the study are described below in order of priority, and have been separated into four major groups:

- Development of a Traffic Model
- Future Operating Conditions (Traffic Forecasting) at the 5 (2015), 10 (2020) and 20 (2030) year horizons
- Functional Planning within the H2AIASP
- Community Planning within the H2AIASP

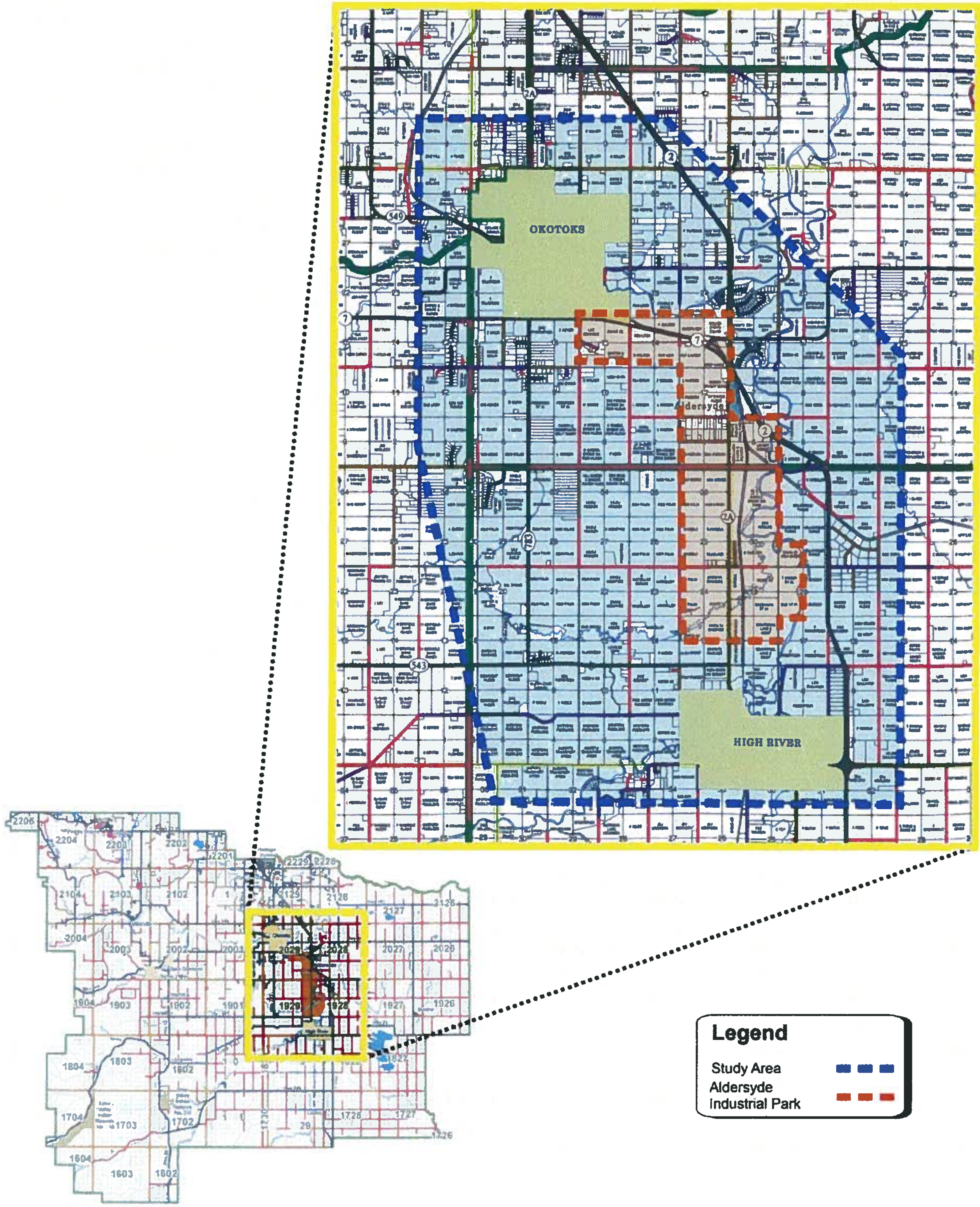

Exhibit ES - 1: Highway 2A Industrial Area Structure Plan

B. MD Traffic Model

The MD traffic model was developed using VISUM Travel Demand Modelling Software for compatibility with the Town of Okotoks' traffic model. During the course of the study, the model study area was expanded from the H2AIASP area to include the entire MD.

This change of scope only applied to the model development and was not included in the traffic analysis for existing and future conditions, functional planning, community planning, and transportation strategy portions of this study.

C. Analysis

Intersectional capacity analysis was conducted at existing and future horizons. These intersections were identified by MD staff:

- Within the H2AIASP Area
  - Existing Conditions
    - 434th Avenue / 64th Street E
    - 466th Avenue / 64th Street E
    - 402nd Avenue / 32nd Street E
    - 418th Avenue / 64th Street E
  - Future Conditions
    - 402nd Avenue / 32nd Street E
    - 402nd Avenue / 48th Street E
    - 418th Avenue / 64th Street E
    - 434th Avenue / 64th Street E
    - 466th Avenue / 64th Street E
- Outside the H2AIASP Area – Existing Conditions Only
  - 338th Avenue / 32nd Street
  - Holy Trinity Church Entrance / 32nd Street
  - 306th Avenue / 32nd Street
  - 226th Avenue / 96^{t}h Street
  - 370th Avenue / 48th Street

All intersections were found to operate at a LOS of A and v/c ratio of 0.28 or lower for all horizon years.

D. FUNCTIONAL PLANNING AND DESIGN

Design Criteria

The design criteria established for preparing the functional plans of the H2AIASP area were based on Alberta Transportation (AT) design standards and adopted for this study upon consideration of future traffic volumes.

Functional Plans

Typical cross-sections used in the functional plans are AT standard RAU/RCU-209-110 and RAU-210-110 and are provided in **Exhibit 7-1** and **Exhibit 7-2**. Cross sections were based on road classifications illustrated in **Section 2.11** and **Section 6**.

The standard intersection treatment used in the functional plans is AT standard Type IIc (two-lane highway) and is provided in **Exhibit 7-3.**

The functional plans for the H2AIASP area showing the horizontal alignments are illustrated in **Appendix VII.**

E. Pathways

Proposed pathway alignment options include paralleling the Canadian Pacific Rail (CPR) line or Highway 2A. The pathway at a minimum will be required to accommodate two-way bicycle traffic. If the purpose of the pathway is to accommodate other users such as pedestrians, a wider pathway may be required.

Both alignment options required different design criteria; therefore, it is recommended that once details of the purpose and alignment of the pathway is known, more design criteria can be investigated.

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1. INTRODUCTION

1.1 Background

The Municipal District of Foothills (MD) is planning the transportation network located in the vicinity of Highways 2 and 2A between the Towns of Okotoks and High River and within the *Highway 2A Industrial Area Structure Plan* (H2AIASP) (**Exhibit 1-1**).

The H2AIASP, a future development area within the MD, currently has land use designated as agricultural with some industrial pockets. In order to facilitate the proposed development of the H2AIASP, a review of the transportation network in the area was required to establish the long term transportation network concept and identify the required improvements to the existing road network.

1.2 Objectives

The MD retained HDR | iTRANS (formerly iTRANS Consulting Inc.) to review the transportation network. The main objectives of this study were as follows:

1. The development of a transportation model for the entire MD area.
2. The development of the long term transportation network within the H2AIASP.
3. Identify the staging of improvements required to upgrade the existing transportation network to its ultimate configuration within the H2AIASP.
4. Develop the ultimate transportation network to accommodate both motorized (private and commercial vehicles, transit) and non-motorized (pedestrians, cyclists) modes of transportation within the H2AIASP.

1.3 Key Issues

The identified key issues to be addressed during the study are described below in order of priority, and have been separated into four major groups:

1. **Development of Traffic Model**
    - Data collection
    - Model development
    - Analysis of existing conditions
    - Road classification
2. **Future Operating Conditions (Traffic Forecasting) at the 5 (2015), 10 (2020) and 20 (2030) year horizons for the H2AIASP**
    - Model assignment
    - Functional classification of major roadways
3. **Functional Planning for the H2AIASP**
    - Future links and connections
4. **Community Planning within the H2AIASP**
    - Parks/trails/linkages
    - Pedestrian connections

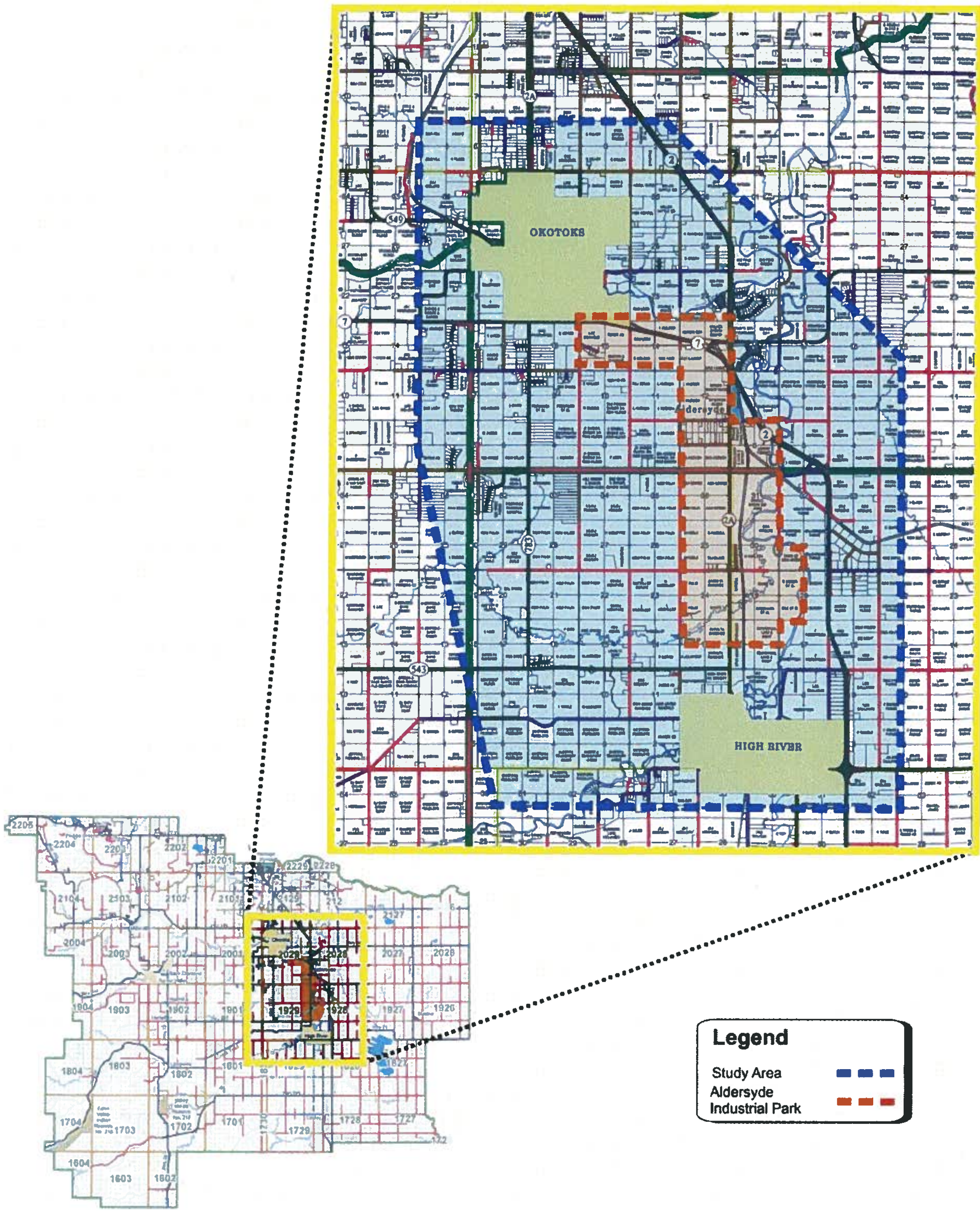


Exhibit 1-1: Highway 2A Industrial Area Structure Plan

2. MD TRAFFIC MODEL

2.1 Model Introduction

Analysis of the existing and future horizon years for the MD was completed using the VISUM multi-modal transportation modelling software. The selection of the VISUM package is detailed in **Section 2.1.2**.

The purpose of the traffic model is to act as a forecasting tool to support the MD's short and long term goals, policies, and objectives as related to the management of the land use and transportation network. The model is applicable to large-scale, inter-municipal, and municipal development plans, and area structure or redevelopment plans. It is not designed to be applicable to street or block layout plans, subdivision plans, or zoning type projects. The model can perform sensitivity testing of road networks, land use, and modal split scenarios.

2.1.1 Model Benefits

The model provides the MD with a general overview of how developments and network changes can impact the transportation network. Though the model cannot replace a traffic impact assessment of potential development changes, it can help support its findings and provide cumulative assessment of the proposed development and network changes. Model results may be used in the assessment of traffic movements at a single intersection, area network, or the entire MD network.

With proper maintenance, the model can indicate areas in need of attention where roads may be reaching capacity, and accordingly can assist in identifying the capital budget required to install improvements that increase the transportation network capacity. With the horizon year forecasting capability, the operations of the network can be reviewed and planned for improvements. This provides the MD with the advantage of having a good indication of how traffic is expected to behave accounting for the addition of larger developments or changes in the network.

2.1.2 Modeling Software Selection

In consideration of the above description of how the model is expected to perform, and the cooperation between the MD and the Town of Okotoks, the VISUM Travel Demand Modelling Software (VISUM) was selected. As the Town of Okotoks had developed their own traffic model in VISUM within the past year, the MD expressed interest in the integration of this traffic model with the Okotoks model.

VISUM is designed for multi-modal analysis that allows for private and commercial vehicles and public transit vehicles to be modelled on one consistent network. With this software, network variations are easily analyzed and compared.

VISUM also has the advantage of utilizing spatially positioned digital data for the street network. This provides the capability of the model to more accurately represent the MD and H2AIASP transportation network. The MD provided their own digital information for the road network for model development, which was complemented by NAVTEQ street network data within the Town of Okotoks. NAVTEQ street network data reflects the street network for Okotoks, developed using Global Positioning Satellite (GPS) information.

It is important that all results provided by the model be interpreted to assess the validity of the output.

2.1.3 Model Structure

The VISUM model "populates" and analyses the network using a four-step demand approach:
1. Trip generation
2. Trip distribution
3. Modal split
4. Trip assignment

The MD model currently only analyses single occupancy vehicles, namely private passenger vehicles, commercial vehicles and heavy trucks. High occupancy vehicles, such as transit, have not been introduced at this initial model development. However, transit can be incorporated into the model at a later time. As such, the current MD model analyses the network using a three-step demand approach:
1. Trip generation
2. Trip distribution
3. Trip assignment

Scenarios modelled were based on the following horizon years:
1. 2009 – base year horizon
2. 2015 – 5 year horizon
3. 2020 – 10 year horizon
4. 2030 – 20 year horizon

The population and employment base year numbers and forecasts were provided by the MD.

Trip generation and distribution is performed using excel spreadsheet analysis, with trip assignment being implemented within the VISUM traffic forecasting package. Assignment results are adjusted by modifying the trip table to match observed volumes at major points of interest and calibrated to approximate, as closely as possible, the observed counts, allowing for inconsistencies between count figures. More detailed discussion on the model structure is provided in **Section 2.6**.

2.2 Data Sources

During the preliminary stages of the study, existing documents and other technical information was assembled and reviewed:

- Provincial and Regional planning policies and transportation planning context including:
  - Aldersyde ASP
  - Highway 2A Industrial ASP
  - Okotoks Municipal Development Plan
  - High River – Corridor and Urban Design Plan
- Road Network: Jurisdiction and functional designations; existing right-of-way widths, basic number of lanes, posted speed limits, interchanges, grade separations, signalized intersections, and 4-way STOPS.
- AT intersectional turning movement count database.
- MD traffic volume counts along segments of roadways.
- Town of Okotoks VISUM transportation model.
- Land use (population and employment) for the existing and future horizon years provided by the MD.
- Traffic counts obtained as part of this project (conducted by ME2) in August 2009.
- Base Network provided though the MD's digital library and the NAVTEQ street network database information used in the VISUM model for the Town of Okotoks.

The reliability of results from the forecast horizon scenarios is dependent on the accuracy of the base model. The above listed sources were used to calibrate and validate the base model.

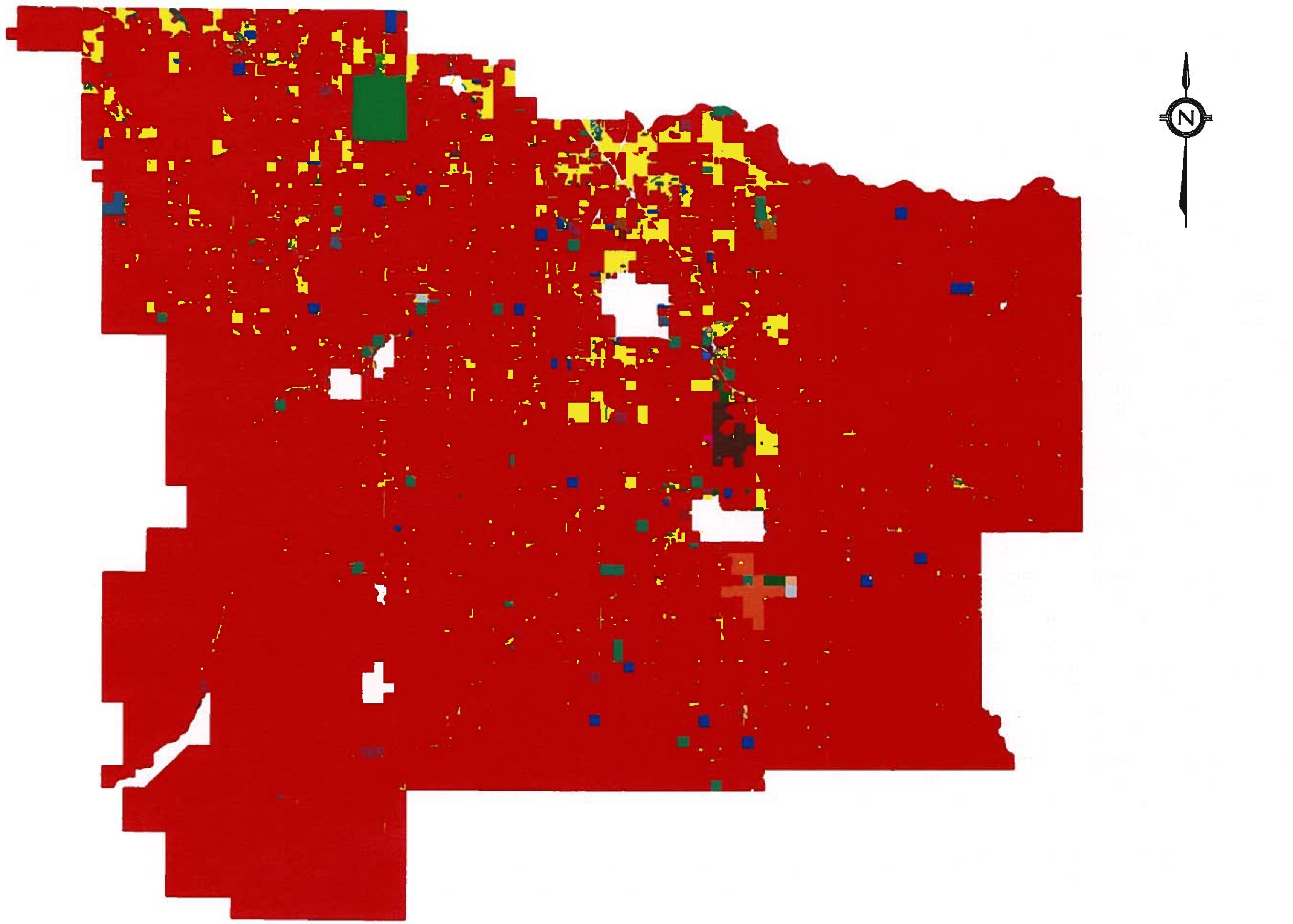
2.3 Model Development

The traffic model is based on existing and forecast land use data (including population and employment information), calibrated to traffic counts at key locations. The model provides a representation of the p.m. peak hour and simulates private passenger vehicles and heavy trucks.

Model analysis depends on the accuracy of the input data, which is a function of the methods used to collect the data. Any results provided by the model must be interpreted by the model analyst to justify if the results are acceptable. The better the data inputs, the better the model results.

2.3.1 Model Traffic Analysis Zones

Traffic Analysis Zones (TAZ) for the model were developed based on the zone system provided by the MD (through Canada Census Zones and dissemination block areas), land use zoning (e.g. from residential to industrial as illustrated in **Exhibit 2-1**), major roadways and natural boundaries, such as rivers.



Municipal District of Foothills Network Study

Land Use Map
Exhibit 2-1

Scale: N.T.S

May 18, 2010

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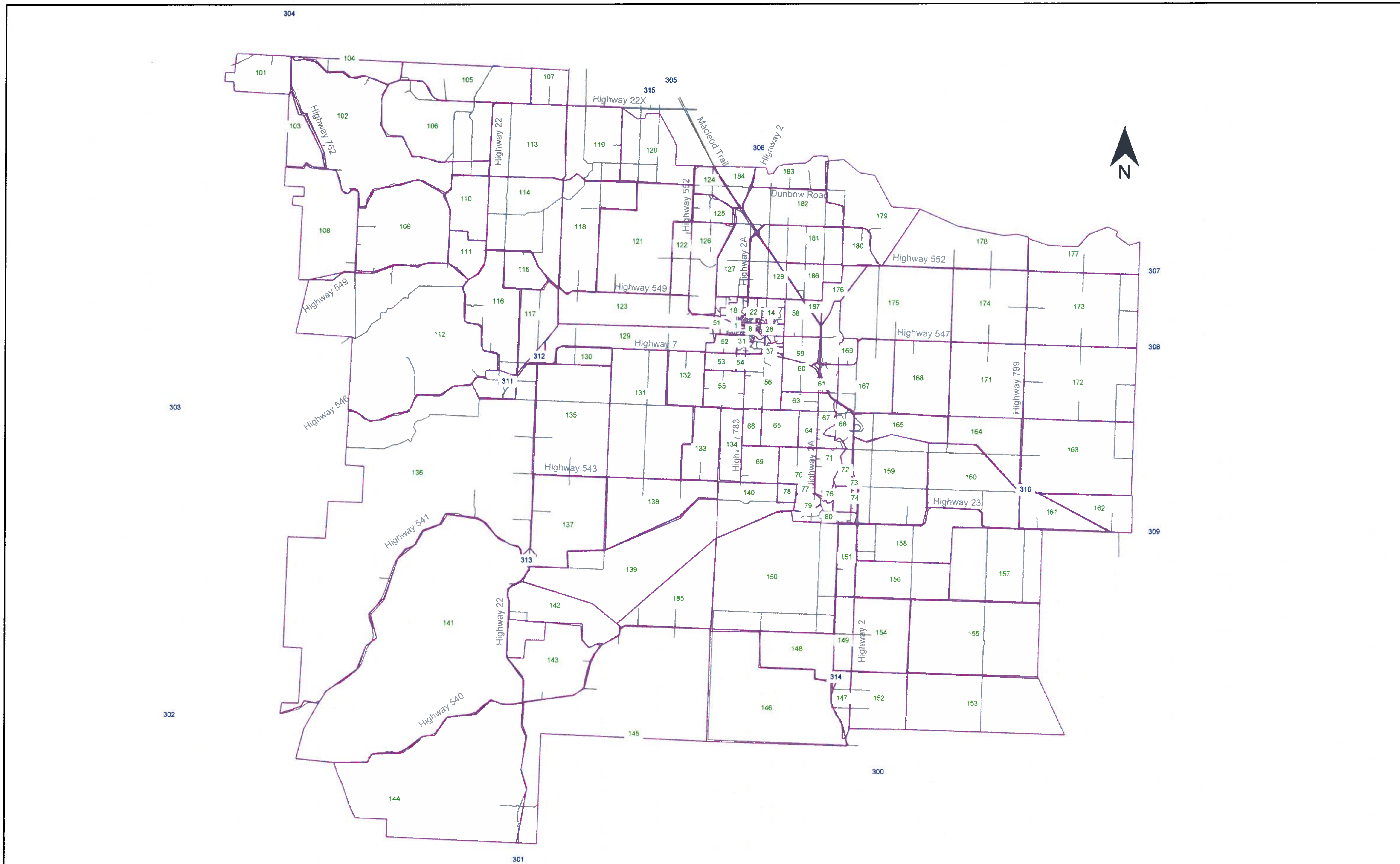
PLOTDATE: May 18, 2010 - 10:41am
PLOTTED BY: kboldwin

To simulate the entrance and exit of vehicular traffic to the MD, external zones, also referred to as gateways, were created at connections on the outer boundary of the MD. These gateway connections included Hamlets and Towns, but did not include the Towns of Okotoks or High River. With the study boundaries between the Towns of Okotoks and High River, those two Towns were not approximated with gateways, but modeled with the existing population and employment data.

For this model, there are eleven gateways on the outer boundary of the MD numbered 300 to 309, and 315, and five external gateways representing the Hamlets of Blackie and Cayley, Towns of Turner Valley and Black Diamond and the Village of Longview, numbered 310 to 314.

The 174 zone system and gateways developed for the MD model are illustrated in **Exhibit 2-2**.



May 18, 2010		Highway 2A Industrial Area Structure Plan Transportation Functional Study
VISUM 10.03 PTV America || Model Run Date: April 16, 2010 || Project# 5235	8	Exhibit 2-2: MD Foothills Traffic Anlaysis Zones and Gateways

2.4 Model Analysis

The model converts land use data into network traffic flows using a three-step demand approach:

1. Trip generation
2. Trip distribution
3. Trip assignment

The following subsections will provide more detail regarding each step in the demand approach.

2.4.1 Trip Generation

The trip generation stage calculates the total number of trips that start and end in each zone based on the land use characteristics of the area or, in cases where these are unavailable, such as gateway locations, on traffic counts. For Okotoks, trip generation is based on numbers obtained from the Okotoks model.

This model uses population and employment figures and projections provided by the MD, together with traffic counts, to determine the numbers of trips. Land use data projections are for the 2009 base year and for five, ten, and twenty year horizons, which correspond to the horizon years of 2015, 2020, and 2030.

2.4.2 Trip Distribution

Trip distribution allocates trips into origin-destination (OD) pairs. Each trip starts in one zone and finishes in another, starting and/or finishing at a gateway location for trips that have one or both ends outside the study area.

Trip distribution for the model was based on determining probabilities of a trip being made between two zones by averaging the trip rates of the two zones involved. The higher the employment in the origin zone (and consequently the higher the trip rate) and the higher the population in the destination zone (and consequently the higher the trip rate), the higher the number of trips developed between the OD pair.

For gateways, the trips travelling to or from the gateway were allocated to an internal zone based on the internal zone's land use, or to another gateway, to act as a "through" or external-external trip, based on the number of through trips observed in the Okotoks model.

2.4.3 Trip Assignment

Trip assignment was carried out in VISUM using an equilibrium assignment technique that allocates vehicular traffic to links in such a way that minimizes travel time. The assignment iterates, taking into account the effects of traffic volume in reducing travel speeds due to congestion, until a state of equilibrium, where no vehicle can find a faster route to its destination by choosing an alternate route, is reached.

2.5 Road Network Development

The road network geometry was based on a street network data file received from the MD and imported into VISUM. This street network data file was provided through GPS correct street network for the entire MD area and the NAVTEQ street network data base for the Town of Okotoks. The street map contains all roads within the model area, many of which are local streets, where models often have difficulty accurately modelling traffic flow. For this reason, local streets unsuitable for inter-zonal traffic were removed and replaced with centroid connectors.

The network was modified to include a zone centroid for each TAZ, the start and end point, for all trips to/from that zone. Centroid connectors, representing local streets, link the zone centroids to the network of arterial and collector roads.

Roads were then coded with lane, posted speed and volume capacity information. The types of roads defined in the network are listed in **Table 2-1**.

Table 2-1: Road Type Parameters

Type Number	Rank	Road Type	Travel Speed (km/h)	Road Capacity (vehicles/hour)	Lanes per Direction
01	2	Highway I	100	1800	1
02	2	Highway II	100	3600	2
03	2	Highway III	100	5400	3
04	4	Collector	35	900	1
06	4	Local Street	30	700	1
07	4	Local Collector	30	800	1
11	1	Freeway I	110	2000	1
12	1	Freeway II	110	4000	2
13	1	Freeway III	110	6000	3
14	1	Freeway IV	110	8000	4
15	1	Freeway V	110	10000	5
21	3	Arterial Class I	50	1500	1
22	3	Arterial Class II	50	3000	2
23	3	Arterial Class III	40	1200	1
41	2	Ramp I	50	1600	1
42	2	Ramp II	50	3200	2
50	3	Gravel Road*	80	800	1

* Gravel road type includes oiled and dust control roads

2.5.1 Road Types

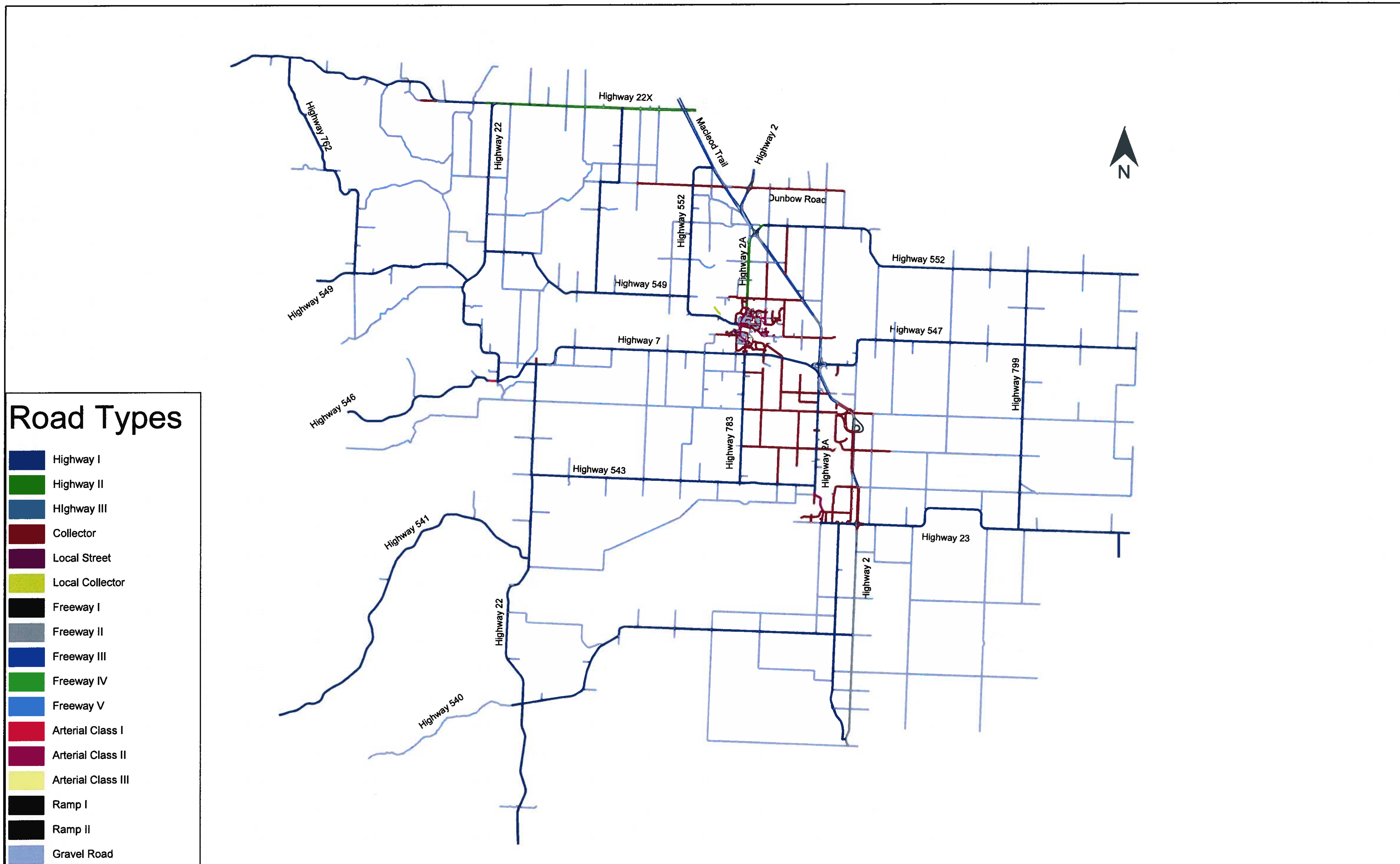
For coding purposes, the different road types were assigned a '**type**' number as an identifier. With the inclusion of the Okotoks model, the smaller road types, such as arterials and collectors, were already defined and adopted into the MD model. Other road types such as freeways, highways, ramps, and gravel roads were introduced for the MD model.

The Roman numeral following the road type indicates the number of lanes per direction. The road types are illustrated in **Exhibit 2-3** for the MD area.

The '**rank**' indicates the choice that a driver can be expected to make when presented with two or more alternative road types to make a trip on, with the lower numbered rank being the more popular.

The travel speed indicates how fast traffic can be expected to move in the absence of congestion (i.e. free flow conditions). Typically, posted speeds are used. The speeds coded into the model are based on the information provided by the MD and are shown for the entire MD in **Exhibit 2-4**.

Road capacity is a function of the road classification and has been assumed for this model. The road capacity summarized previously in **Table 2-1** indicates the capacity as related to the number of lanes.



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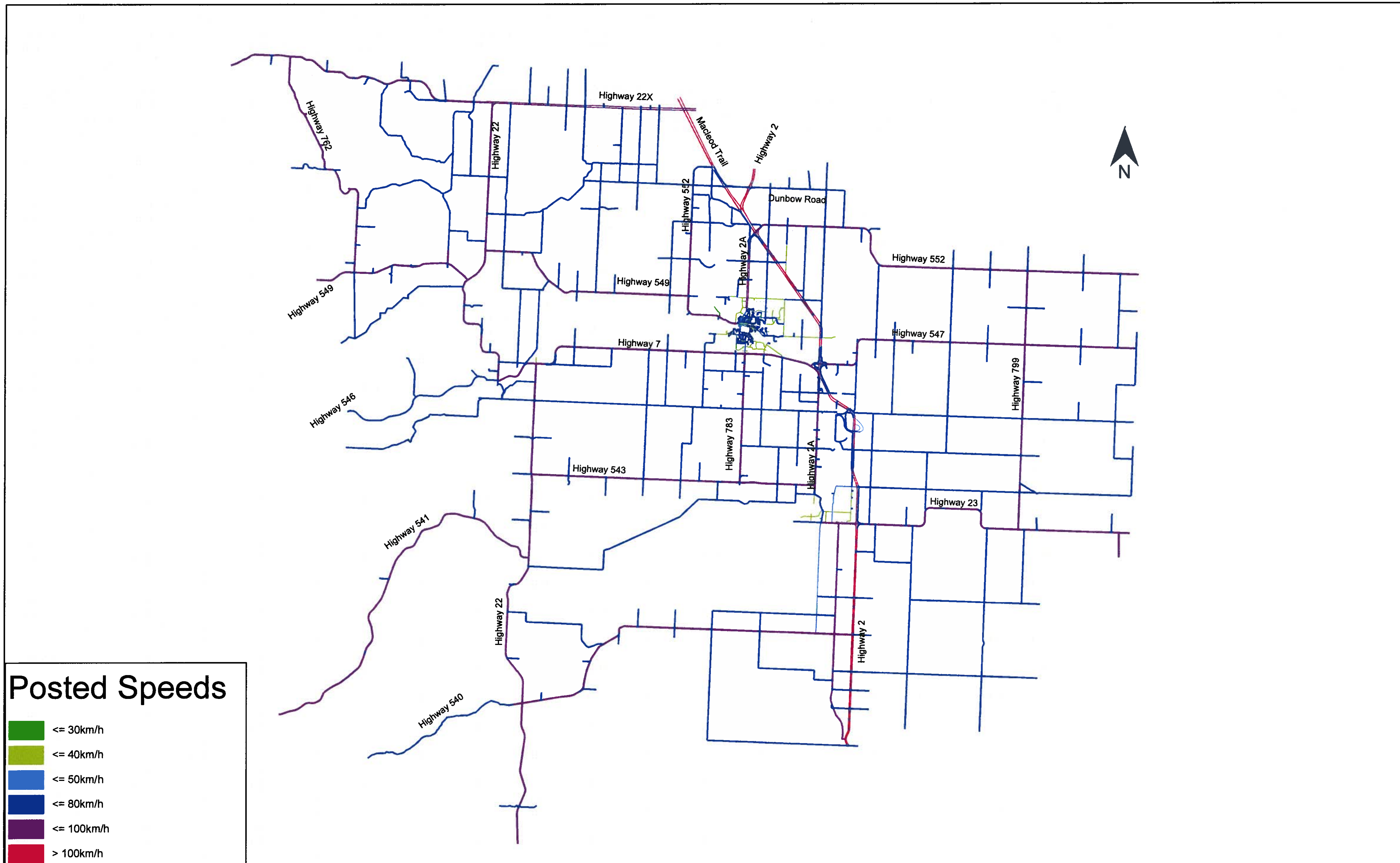
VISUM 10.03 PTV America || Model Run Date: April 16, 2010 || Project# 5235 | | Exhibit 2-3: MD Foothills Road Network by Road Type

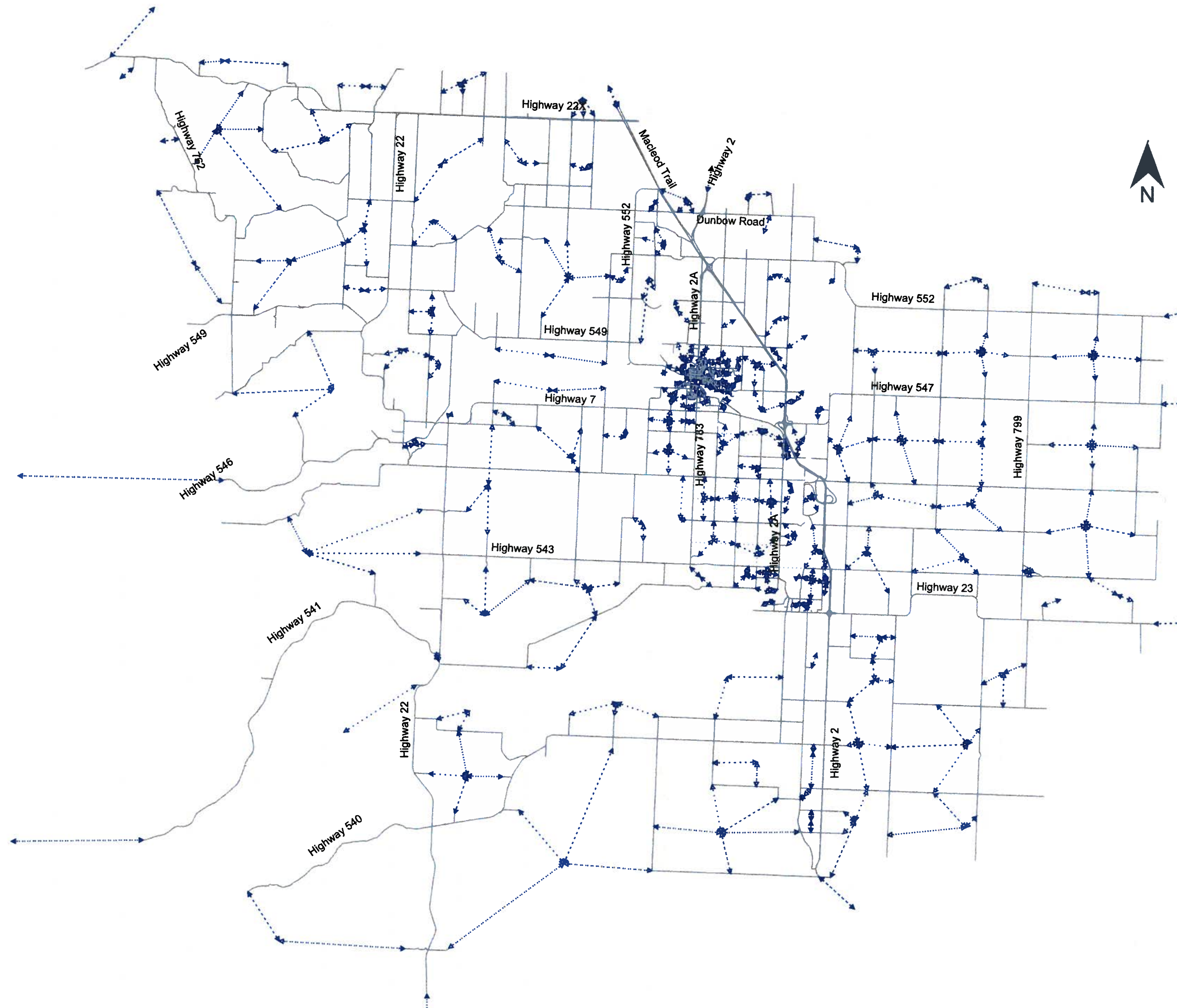


May 18, 2010		Highway 2A Industrial Area Structure Plan Transportation Functional Study
VISUM 10.03 PTV America || Model Run Date: April 16, 2010 || Project# 5235	13	Exhibit 2-4: MD Foothills Posted Speeds

2.5.2 Centroid Connectors

Centroid connectors are used to provide connections from the demographic centre of each zone to the main access points to and from the zone. Some zones only require one connector while others have several. For zones with multiple centroid connectors, volumes entering or exiting the zone are equally distributed to all connectors. The percentage of distribution of traffic on the centroid connectors can be manually adjusted to simulate traffic volumes using specific accesses. The positioning of centroid connectors is illustrated in **Exhibit 2-5**.

In general, centroids are not connected directly to arterial roads or to intersections. This ensures that traffic flows are reasonable and intersection turning movements are not exaggerated or misrepresented. External zones and gateways are the exception, as these zones are typically using the highways for access into and out of the MD.



May 18, 2010 | Highway 2A Industrial Area Structure Plan Transportation Functional Study

VISUM 10.03 PTV America || Model Run Date: April 16, 2010 || Project# 5235 | 15 | Exhibit 2-5: MD Foothills Centroid Connectors

2.6 Model Structure

The model uses a variation of the traditional four-step demand modelling approach - trip generation, trip distribution, and trip assignment. The modal split component was not included as the only mode considered was auto driver.

Across all years, from the 2009 base to the 2030 horizon year, the generation and distribution steps were completed with Microsoft Excel (Foothills Model Input - … .xlsx). Trip assignment was implemented within the VISUM traffic forecasting package, and the results were compared with the observed counts.

2.6.1 Trip Generation

The trip generation component of the model calculates the total number of trips that start and end in each zone. These are based on a combination of employment at the point of origin and population at the destination point, as these are considered to be the driving influences behind p.m. peak (i.e. work to home) trips.

In this and the following section, 'External' is used to refer to the gateways around the outer perimeter of the MD and not the separate municipalities within the borders of the MD. Rates are calculated and applied separately for internal and external trips.

Trip rates are calculated differently for different areas of the model. These can be summarized as follows:

- Trips to/from zones within the MD
- Trips to/from Okotoks zone
- Trips to/from High River zones
- Trips to/from other municipalities within the MD's border
- Trips to/from External areas

2.6.1.1 Trips To/From Zones within the MD

Land use figures provided at the traffic zone level by the MD are used to develop trips to and from those zones. As a starting point, the trip rates used in the Rocky View County's model were adopted:

- 0.04 trips/job to internal zones
- 0.35 trips/job to external zones
- 0.06 trips/resident from internal zones
- 0.60 trips/resident from external zones

Adjustments were made to these rates to account for different characteristics of the MD, such as a reduction in trip rates for areas where the traffic counts were significantly lower than modelled volumes. An additional adjustment factor of 0.4 was added during calibration, to be applied to trip rates to all internal zones (including Okotoks and High River) from other internal zones. This has the effect of reducing the number of internal-internal trips and increasing the number of external-internal trips to help deal with the fact that the model was tending to over simulate compared with counts at internal locations, and under simulate compared with gateways.

2.6.1.2 Trips To/From Okotoks Zones

Trip rates are not calculated directly; instead, the trips totals by zone are taken from the Okotoks model, and factored down by 50% to be consistent with the peak-hour rates and counts used elsewhere.

2.6.1.3 Trips To/From High River Zones

In the absence of direct employment figures to generate trip origins, as is done for the MD zones, the trip rates from the Okotoks part of the model were used as proxies for determining a ratio of trips out to trips in, as representative of land use patterns within a nearby urban area. This ratio is 2.18 for trips to/from internal zones, and 0.68 for gateways. The inbound trips were calculated using the zone population, and the outbound trip rates were then derived by multiplying the inbound numbers by the Okotoks ratio.

2.6.1.4 Trips To/From Other Municipalities within the MD's Border

The same trip rate calculation method described in **Section 2.6.1.3** was used for MD zones.

2.6.1.5 Trips To/From External Areas

Numbers were taken directly from traffic counts at the gateway locations.

An overall calibration factor was applied (one each for inbound and outbound trips) to all external trips by zone so that the total number of inbound and outbound external trips matches the total number of observed vehicles crossing into and out of the MD at the gateway points.

2.6.2 Trip Distribution

In the trip distribution module, the trips generated were distributed among all zones in OD pairs. The distribution is conducted as a function of the zonal land uses, the established OD travel patterns, and the characteristics of the transportation network. Forecast trip distributions were based on the Fratar method that balances the future years' trip tables to the underlying base year flow patterns, using the forecast population and employment totals as input.

The trip distribution module has been developed for four OD vectors which depend on the location of start and end points of a trip:

1. **External-External trips** (both outside the MD): use the number of trips for that OD pair, as determined from the distribution of trips in the Okotoks model, factored up to gateway counts for the new model. The trips in the Okotoks model are broken down into sixteen

by cardinal direction (north, south, east, and west) of OD (e.g., west to north). If there is more than one possible gateway location for a direction (such as two roads leaving the MD to the north) trips are distributed between the gateways according to the ratios of the traffic counts (for example, if 900 vehicles are counted at gateway 305 and 100 at gateway 306, 90% of the distribution will be sent to 305).

2. **Internal-Internal trips** (both inside the MD and within the municipalities enclosed by the MD): use origin trips generated in the previous stage for each internal zone and distribute them according to the percentage of the overall internal population contained in the destination zone. Thus, if zone 1 generates 100 trips, and zone 20 contains 10% of the overall population of the internal zones, there will be 10 trips in the OD table from zone 1 to zone 20.
3. **Internal-External** and **External-Internal trips** (either origin or destination inside the MD and the other outside): use a hybrid of the first two methods—use the trips generated for the previous stage for the internal end of the trip and the number of trips passing each gateway for the external end. Trips are distributed based on a combination of the percentage of the directional count at each gateway and the percentage of the overall land use at each internal zone.

The full trip table consists of four quadrants as shown in **Exhibit 2-6**, which are subsequently combined into a single table for assignment to the road network.

		DESTINATIONS	
		Foothills/internal municipality Zones	Gateways
ORIGINS	Foothills/internal municipality Zones	INTERNAL-INTERNAL	INTERNAL-EXTERNAL
	Gateways	EXTERNAL-INTERNAL	EXTERNAL-EXTERNAL

Exhibit 2-6: Components of the Assignment Trip Table

2.6.3 Trip Assignment

Trips were assigned by importing the trip tables developed in the previous steps into VISUM and then running an equilibrium assignment on the auto network. This process allocates traffic to links so as to minimize the 'cost of travel' for the vehicle between the origin and destination pairs; where 'cost' is defined as travel time. A congestion delay function accounts for the effect on travel time of links approaching capacity.

The results are displayed in both graphical and tabular format and can be exported to external software, such as Excel.

2.7 Calibration and Validation

With VISUM, as with other transportation modeling tools, traffic volumes on low volume, local roads with less than 2000 vehicles per day (typical of most roads under the MD's jurisdiction) may not be accurately represented. To better portray the existing transportation network, many of these local roads were approximated with centroid connectors.

The calibration and validation process uses p.m. peak hour traffic counts from AT (2008) and compares them with modeled volumes. The model was calibrated to gateway counts and the

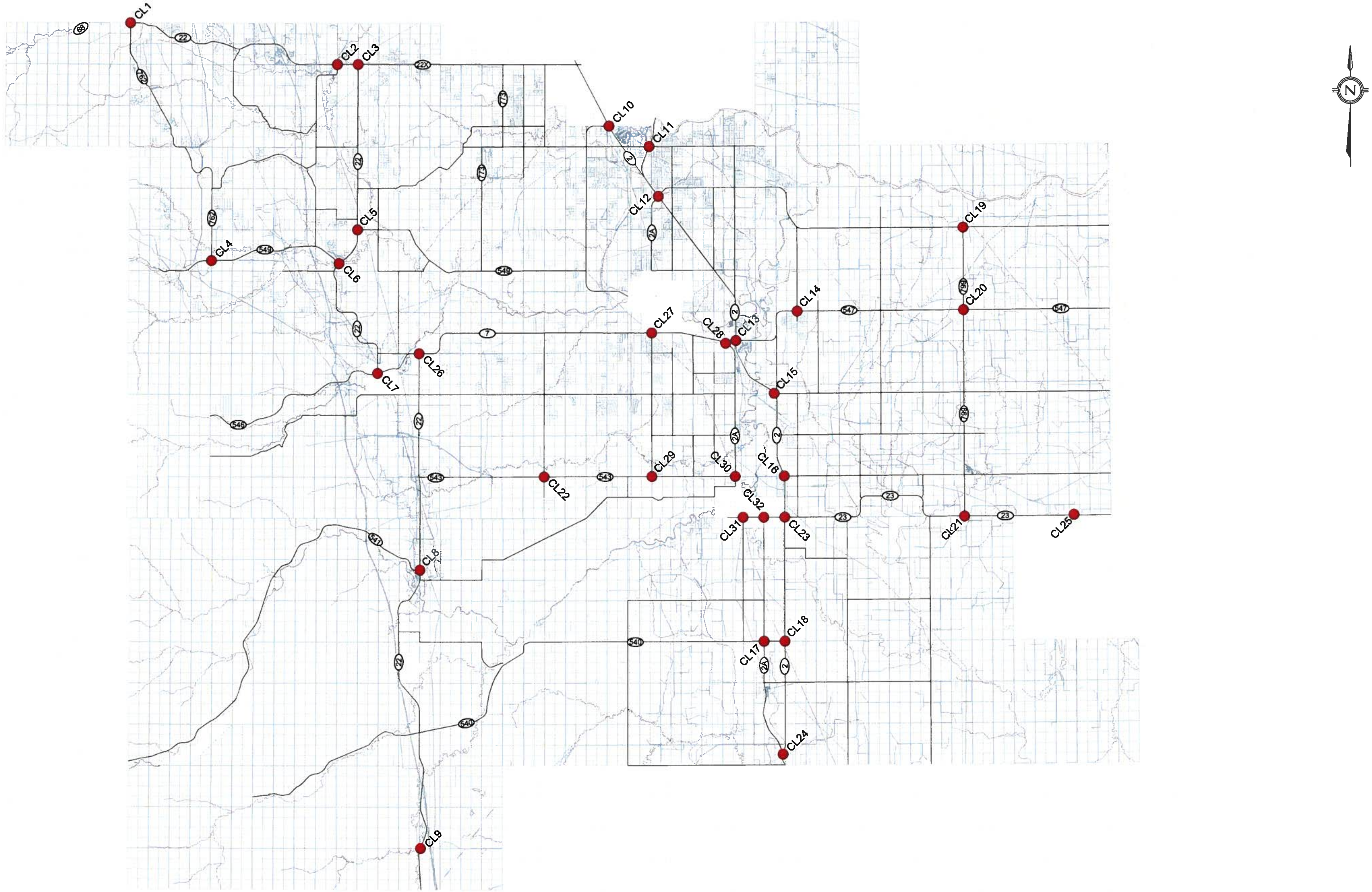
Okotoks model distribution, and validated against other counts within the MD boundaries. Some AT counts were found to be inconsistent with the modeled volumes, meaning that forcing the model to match the counts (as can be done in VISUM) led to the development of some negative trip rates. Consequently, emphasis was placed on matching the gateway volumes (which are indicative of OD flows) and attempting to match the internal count location volumes (which are often affected by route choice) as best as possible.

The calibration table used to match the base model to gateway traffic counts has been provided for the p.m. peak in **Table 2-2**.

The base model results were validated according to key locations, such as major intersections and screenlines (**Exhibit 2-7**), to verify the accuracy of the base model. The validation results are provided in **Appendix I.**

Table 2-2: Model Calibration Results p.m. Peak Hour

Gateway Traffic Zone	Description	Modelled volumes	Count volumes	Difference	Percentage Difference
300	Highway 2 NB to MD of Foothills	680	545	135	124.77%
	Highway 2 SB to south of MD of Foothills	522	566	-44	92.23%
301	Highway 22 NB to MD of Foothills	194	154	40	125.97%
	Highway 22 SB to south of MD of Foothills	137	149	-12	91.95%
302	Highway 541 EB to MD of Foothills	23	35	-12	65.71%
	Highway 541 WB to Rockies	14	21	-7	66.67%
303	Highway 546 EB to MD of Foothills	39	29	10	134.48%
	Highway 546 WB to Rockies	62	46	16	134.78%
304	Highway 22 EB to Highway 22X	367	281	86	130.60%
	Highway 22 WB to Highway 66	427	323	104	132.20%
305	Macleod Trail SB to MD of Foothills	1269	1565	-296	81.09%
	Macleod Trail NB to Calgary	879	867	12	101.38%
306	Highway 2 SB to MD of Foothills	1474	1818	-344	81.08%
	Highway 2 NB to Calgary	1299	1281	18	101.41%
307	Highway 552 WB to MD of Foothills	27	20	7	135.00%
	Highway 552 EB to east of MD of Foothills	34	27	7	125.93%
308	Highway 547 WB to MD of Foothills	56	42	14	133.33%
	Highway 547 EB to east of MD of Foothills	40	33	7	121.21%
309	Highway 23 WB to MD of Foothills	82	63	19	130.16%
	Highway 23 EB to east of MD of Foothills	50	43	7	116.28%



Legend:

● Traffic Count Location

Scale: N.T.S.

Municipal District of Foothills

Highway 2A Industrial Area Structure Plan Transportation Functional Study

Key Count Locations

Exhibit - 2-7

May 18, 2010

FILENAME: M:\Foothills MD of\5235 MD Foothills Network Study\5.0 Design\5.2 Design\Active\Sketches\Exhibits\5235-Exhibit-2-7.dwg
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PLOTTED BY: kbaldwin

2.8 Base Year Analysis

The base year scenario was established using the population and employment data of 2009 from the MD.

After calibration and validation, the model simulated base year volumes. Model results in terms of absolute volumes and volume-to-capacity (v/c) ratios, for major roads are displayed in **Exhibit 2-8** and **Exhibit 2-9**.

Summaries of modeled v/c ratios on major routes, along with estimates of variation between the modeled and observed volumes are provided in **Appendix II**.

2.8.1 Volume-to-Capacity Ratios

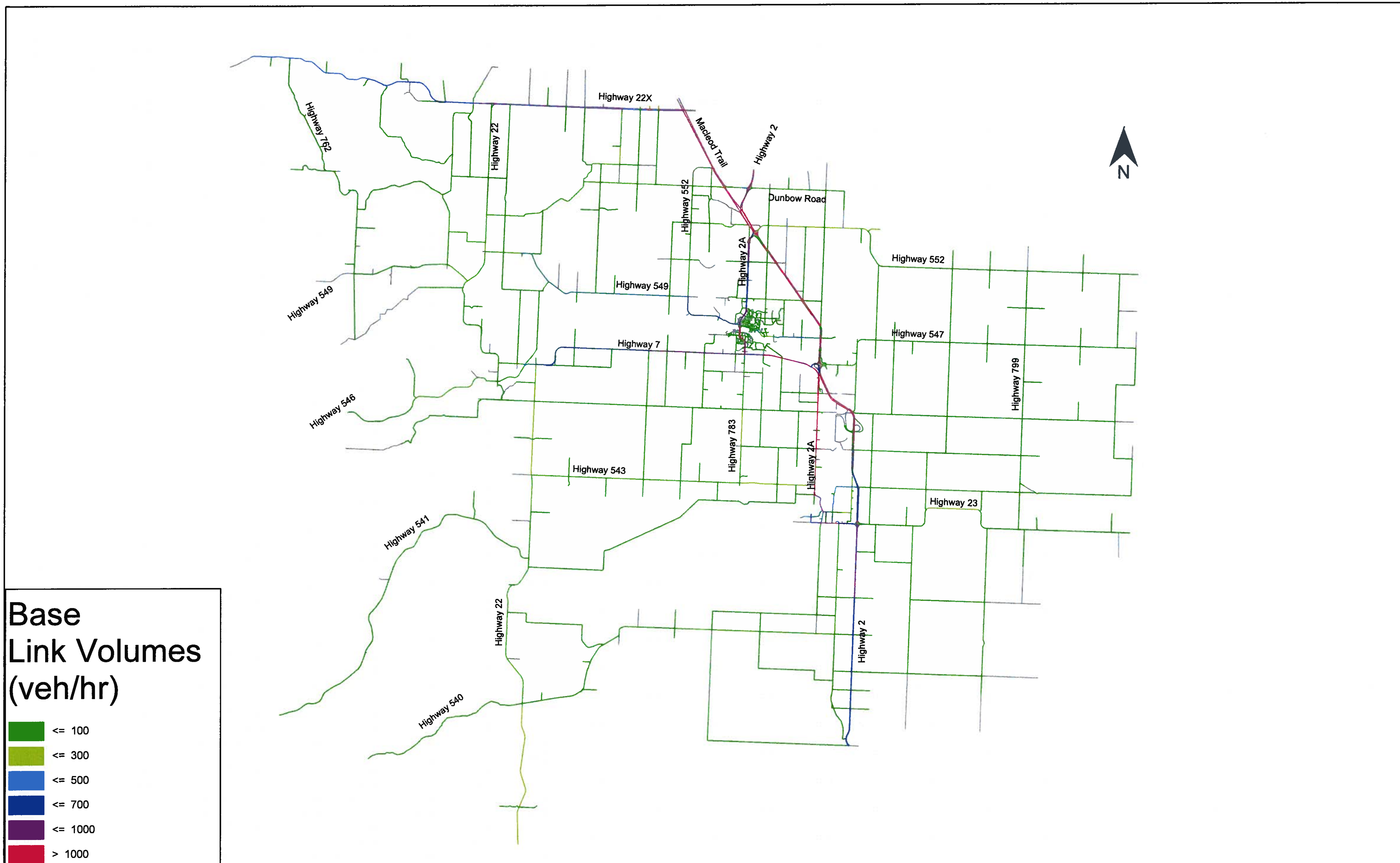
The volume-to-capacity (v/c) ratio is an indicator of the percentage of the roadway capacity used. Typically, municipalities set a target v/c ratio value to instigate roadway improvements, and may differ between municipalities based on time and resources and priorities.

To understand the effects of the v/c ratio, a brief description of the different v/c levels is provided in **Table 2-3**.

Table 2-3: Volume-to-Capacity Descriptions

Volume-to-Capacity Ratio (v/c)	LOS Equivalency*	Description
v/c < 0.80	A – C	The intersection has very little congestion. Traffic fluctuation can be handled with minimal congestion.
0.80 < v/c < 1.00	D – E	The intersection is right on the verge of congested conditions. Minor traffic fluctuations cause significant congestion.
v/c > 1.00	F	The intersection is operating over capacity and likely experiences congestion periods of 15 to 60 minutes per day.

* LOS Equivalency is provided as information only. LOS may not necessarily correspond with the v/c ratio.

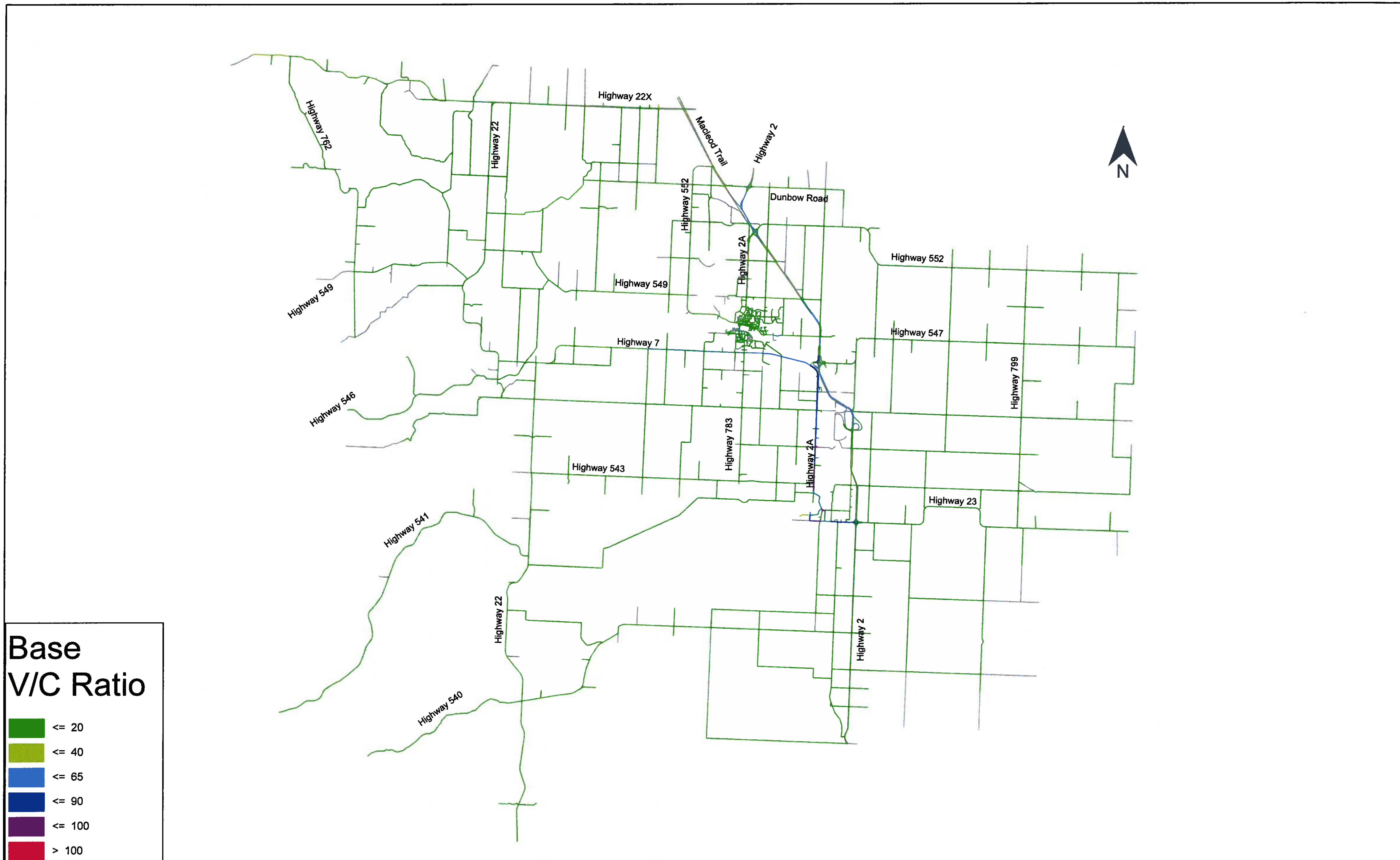


May 18, 2010

Highway 2A Industrial Area Structure Plan Transportation Functional Study

VISUM 10.03 PTV America || Model Run Date: April 16, 2010 || Project# 5235

Exhibit 2-8: MD Foothills Base Modelled Link Volumes



May 18, 2010	Highway 2A Industrial Area Structure Plan Transportation Functional Study
VISUM 10.03 PTV America || Model Run Date: April 16, 2010 || Project# 5235	24 | Exhibit 2-9: MD Foothills Base Modelled v/c Ratios

2.9 Land Use

The MD provided a list of traffic zones (according to a 163-zone system including the five towns located within the MD boundaries) with calculated population and employment forecasts for 2009, 2015, 2020 and 2030 for two land use scenarios. The scenarios differed in the job allocation amongst the zones.

Table 2-4: Land Use Comparison of Scenarios

Scenario	Population				Employment			
	2009	2015	2020	2030	2009	2015	2020	2030
1	21,803	25,503	30,899	36,295	3,593	5,353	7,113	10,633
2	21,803	25,503	30,899	36,295	35,93	6,483	8,243	12,893
Difference between Scenarios	**0**	**0**	**0**	**0**	**0**	**1,130**	**1,130**	**2,260**

The additional employment in Scenario 2 was distributed across the entire MD and not within a concentrated area. As a result, Scenario 2 was adopted for model data input to simulate 'worse-case' conditions with the higher overall population and employment. The data provided was in shapefile format and imported into Excel; the numbers provided are summarized in **Appendix III**. The employment and population numbers for the scenario 1 are also provided in **Appendix III.**

Traffic trips generated by the zones within Okotoks for the 2008 year were imported from the Okotoks model to use in VISUM for the base model. To project future traffic trips within Okotoks, a growth rate was determined from previous traffic data. However, during the years of 2001 to 2008, Okotoks appeared to have had an unusually high growth rate. The future traffic trips for Okotoks were estimated using the growth rate of 4.5% (to be consistent with the High River growth rate).

The traffic trips for the gateway zones (300 - 309 and 315 were assumed from nearby traffic counts and estimated for the years 2015, 2020 and 2030 with the per year growth rate of 3.35% (average of growth rates of MD of Foothills, Okotoks, High River, Turner Valley and Black Diamond).

The population numbers provided by the MD for the towns of Longview, Turner Valley and Black Diamond differed substantially from the numbers obtained from population bar charts **(Appendix IV)** for 2008 from census 2006 (Albertafirst website). To be conservative, these numbers were entered into a model spreadsheet in order to realistically simulate trips in the area for the base model. The 2008 population numbers for High River were also obtained from census data and were equally distributed among three traffic zones (80, 81, and 82).

The future population forecast for these towns was calculated by using the growth rate obtained from census 2006 (Albertafirst website). As Turner Valley and Black Diamond form a single municipality, the growth rates for both towns were averaged out to arrive at a growth rate of 2.0%. Population numbers for the towns and future forecast are detailed in **Table 2-5**.

Table 2-5: Census Population

Location	Traffic Zone	Population (2008)	Growth Rate	Population		
				2015	2020	2030
High River	80,81 & 82	10,716	4.5%	14,583	18,173	28,222
Turner Valley	311	2,022	2.0%	2,323	2,564	3,126
Black Diamond	312	1,986	2.0%	2,281	2,519	3,070
Longview	313	334	1.0%	358	376	416

2.10 Future Travel Demand

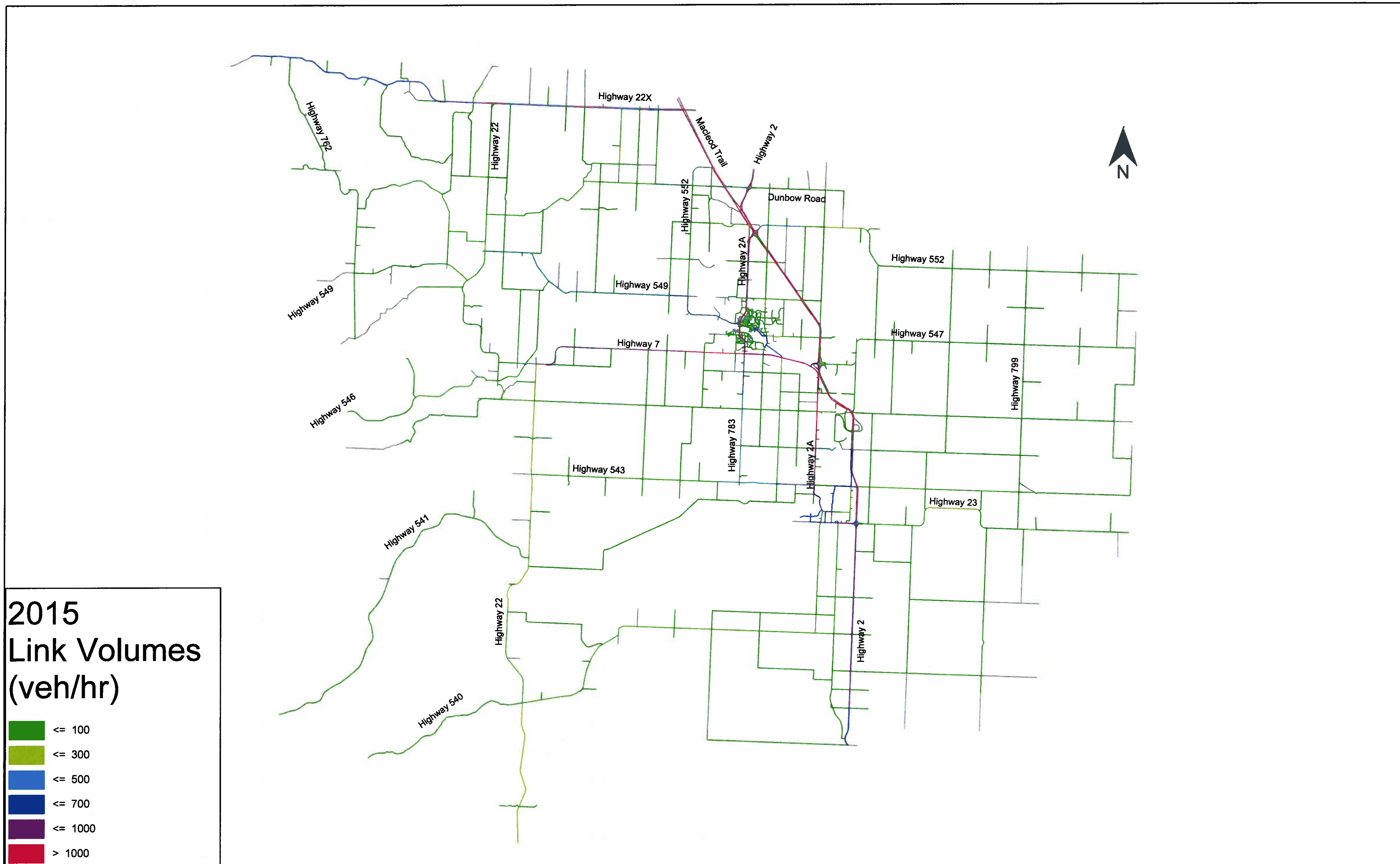
The databank used for model runs contains scenarios, in addition to the 2009 base, for 2015, 2020, and 2030. The network scenarios include road network changes proposed by the MD in the area and also based on the model analysis **(Table 2-6)**.

The model derives trip tables for each future year according to the balancing method explained earlier in **Section 2.6.3**. A comparison of volumes between the base and horizon scenarios on some of the major roads is provided in **Appendix V**.

Table 2-6: Road Network Changes Over Horizon Years

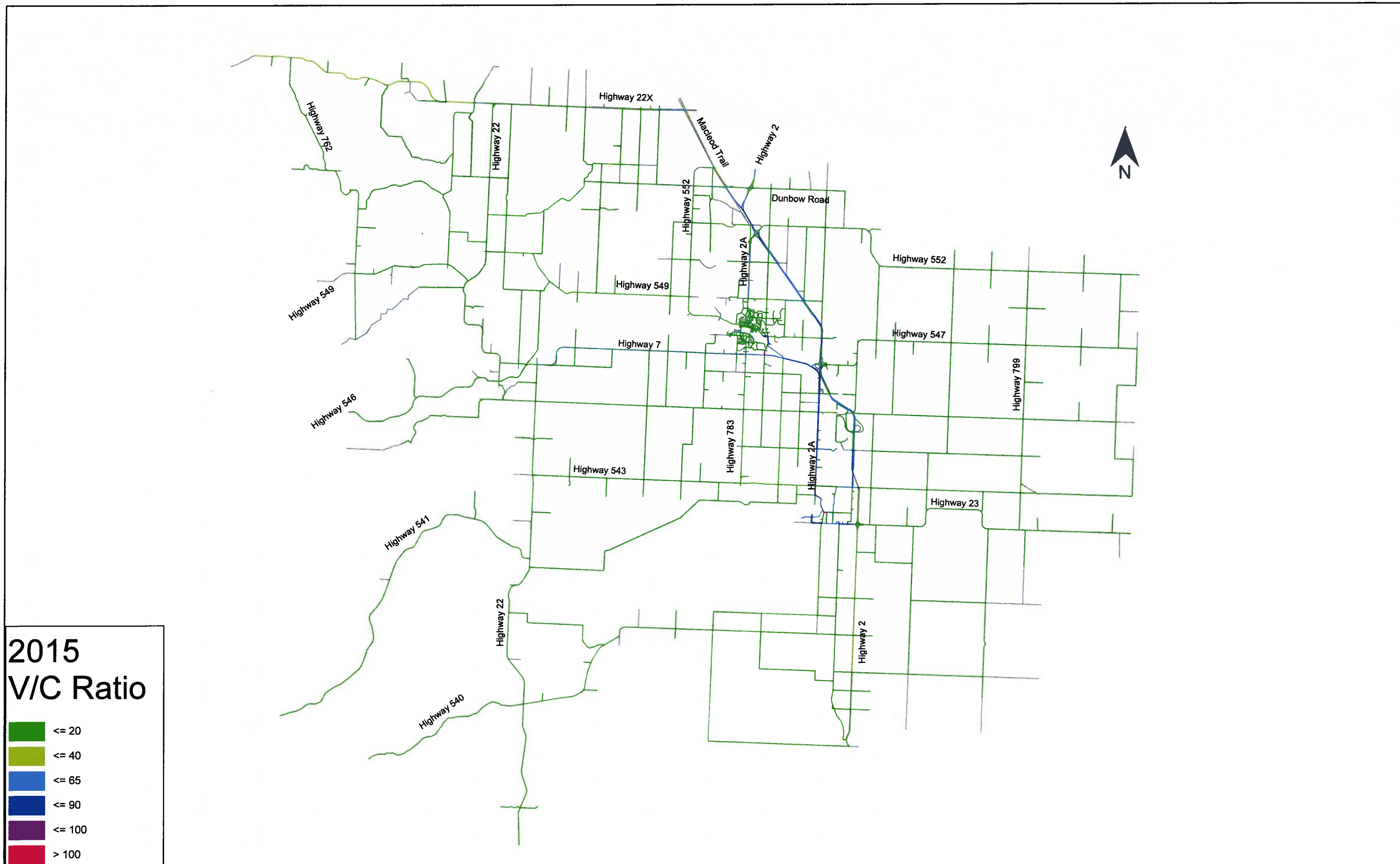
Horizon Year	Network Changes / Location
2015	Inclusion of: • Okotoks bridge connection • 32nd Street E connection south of Highway 2A • Highway 543 extension from Highway 2A to Highway 2 • 64th Street E north of 434th Avenue • 48th Street E from 434th Avenue to 466th Avenue • 402nd Avenue was extended east from 32nd Street E to 64th Street E Removal of: • Access to Highway 2 at 466th Avenue • Access to Highway 2A at 426th Avenue
2020	Same as 2015 horizon year Inclusion of Highway 2A as a four-lane highway between Okotoks and High River
2030	Same as 2020

Individual plots for each future year for modelled link volumes and modelled v/c ratios are shown in **Exhibit 2-10** to **Exhibit 2-15**.



May 18, 2010 | Highway 2A Industrial Area Structure Plan Transportation Functional Study

VISUM 10.03 PTV America || Model Run Date: April 16, 2010 || Project# 5235 | 27 | Exhibit 2-10: 2015 Modelled Link Volumes

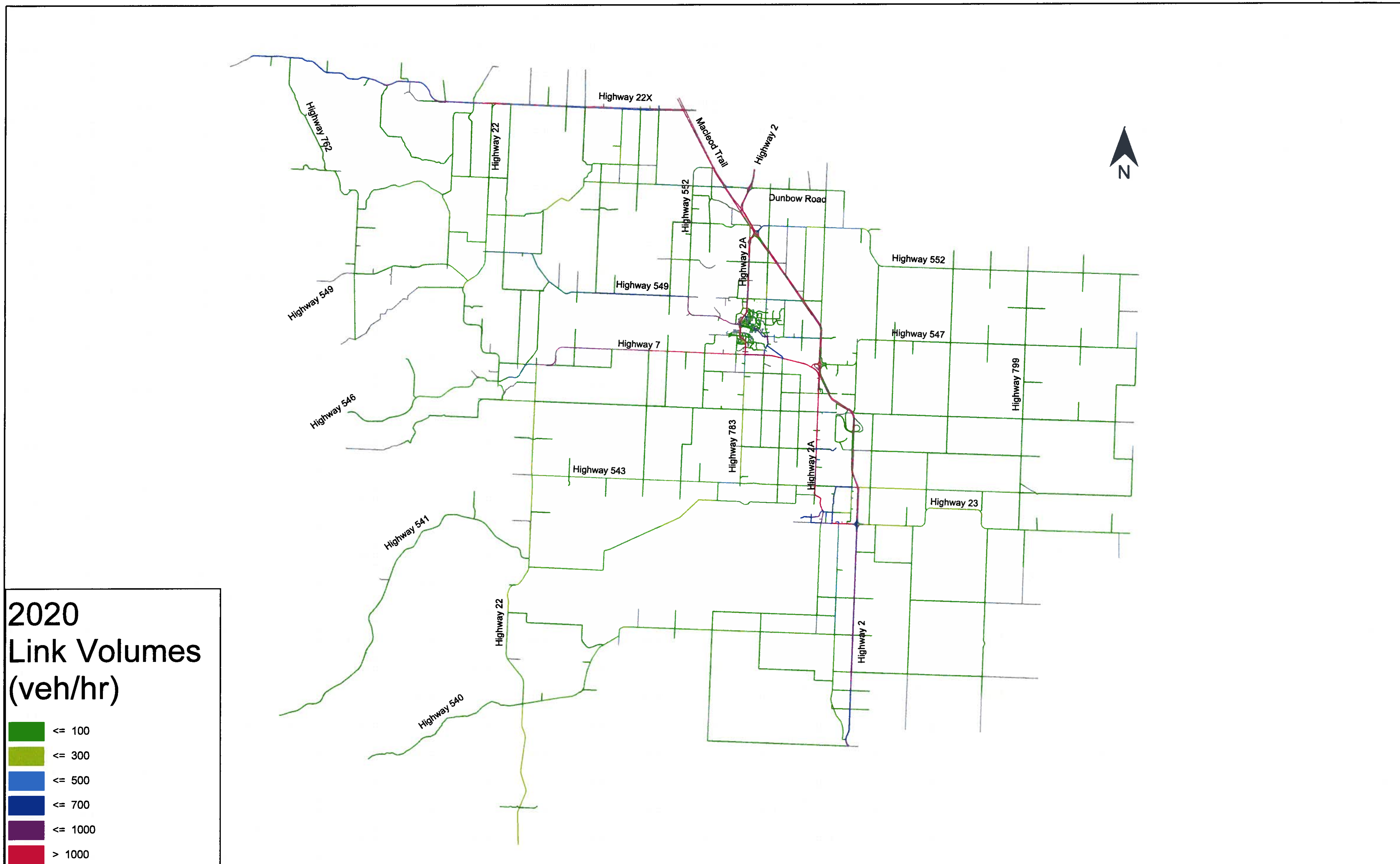


May 18, 2010

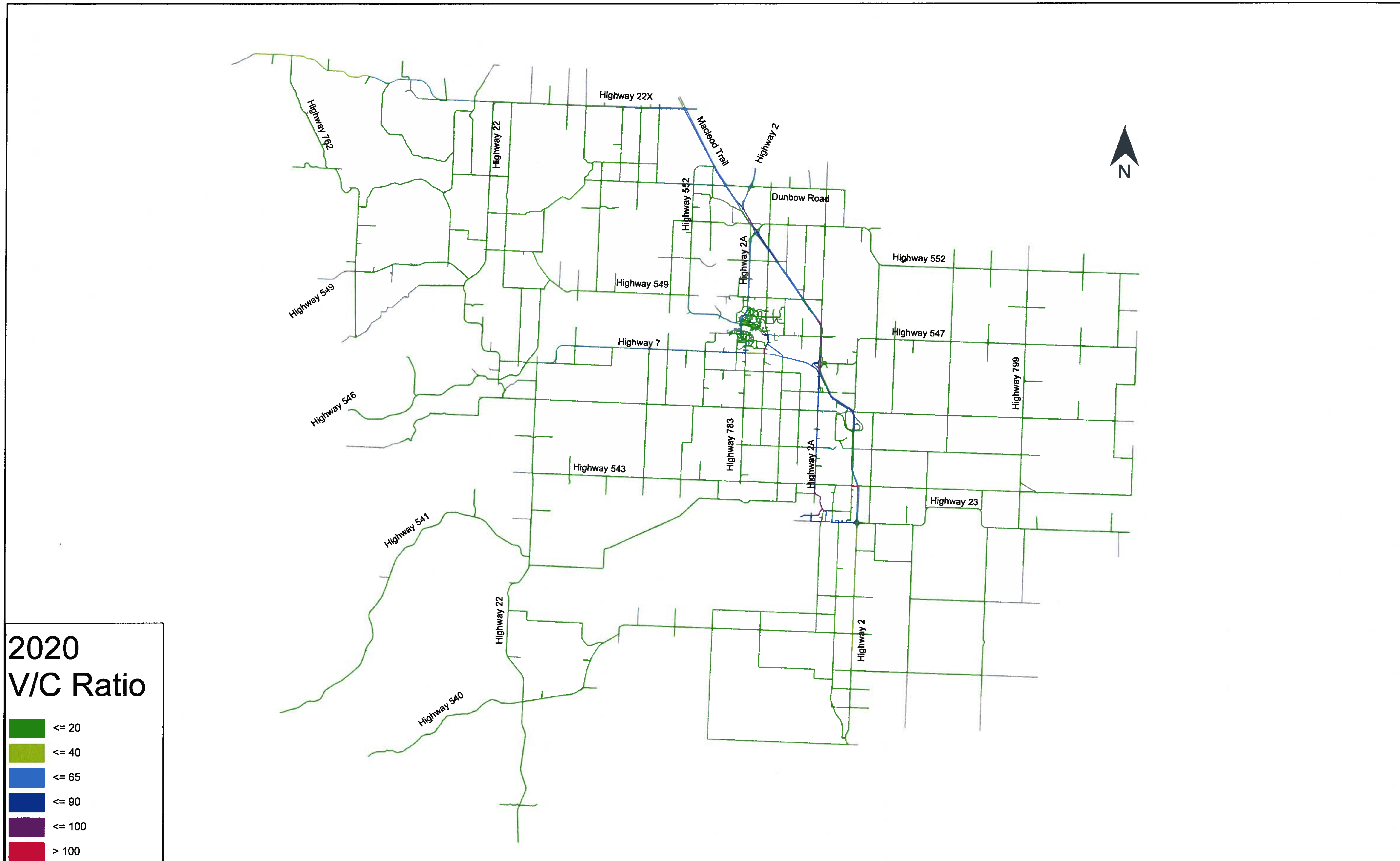
Highway 2A Industrial Area Structure Plan Transportation Functional Study

VISUM 10.03 PTV America || Model Run Date: April 16, 2010 || Project# 5235

Exhibit 2-11: 2015 Modelled v/c Ratios

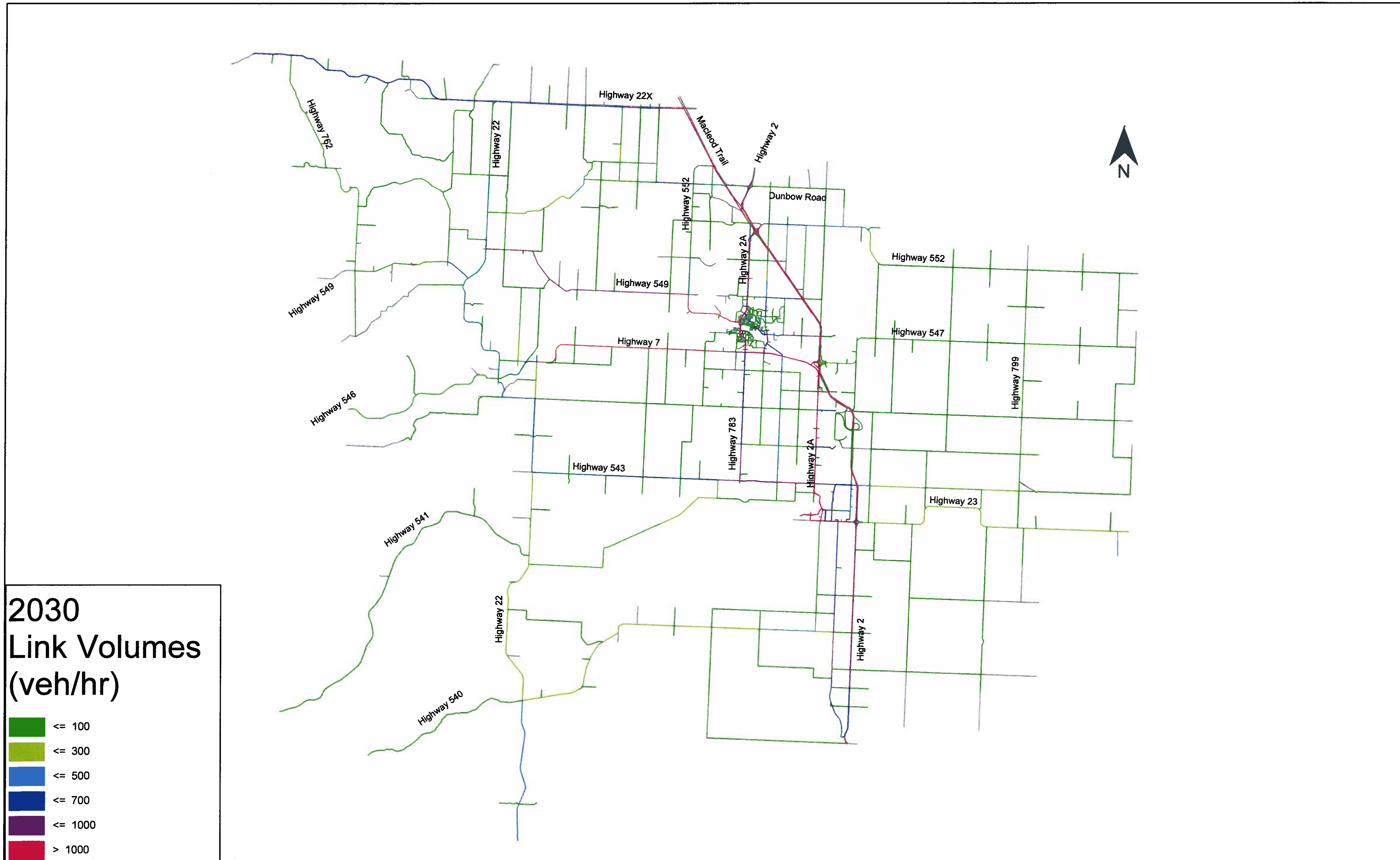


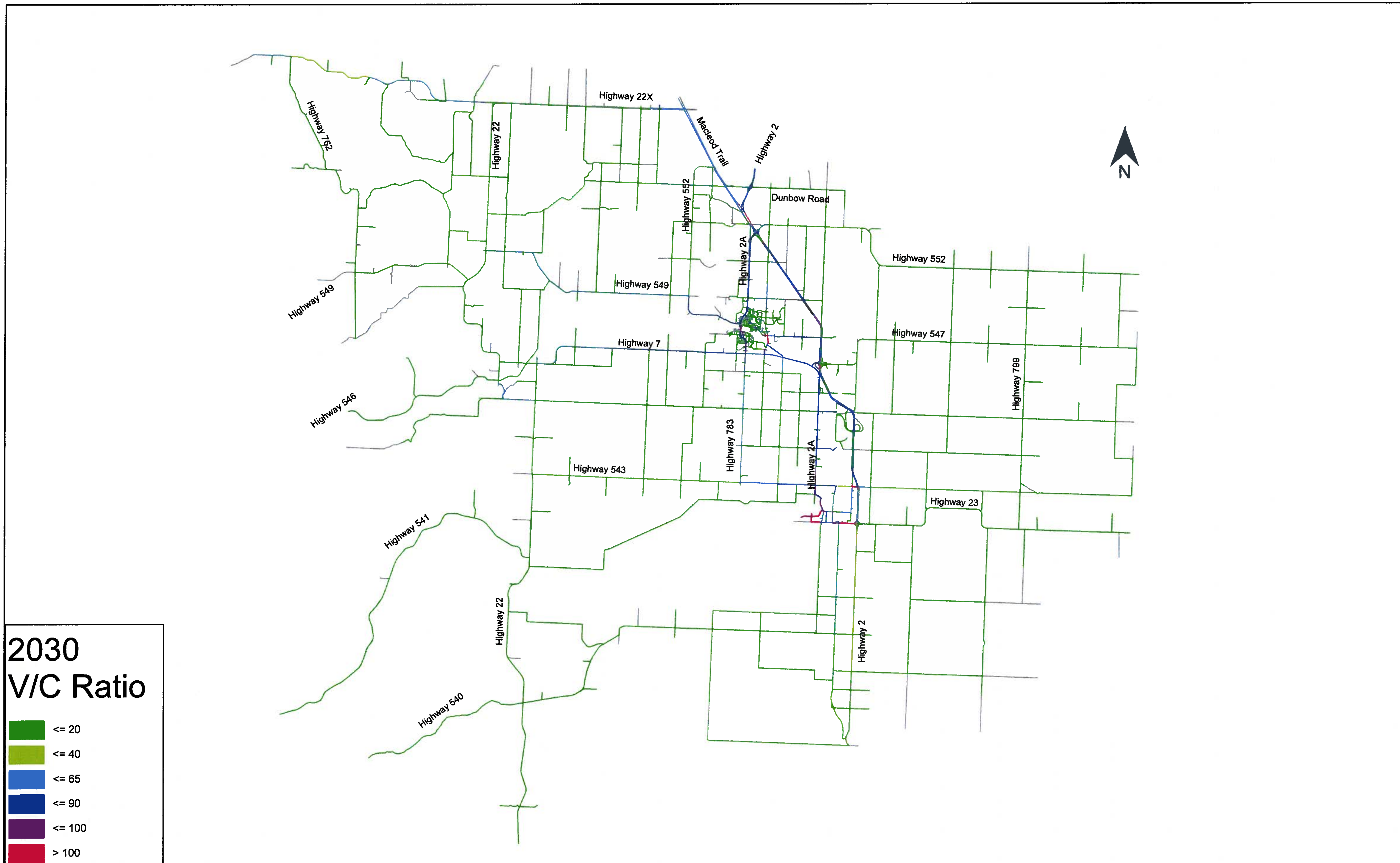
May 18, 2010	Highway 2A Industrial Area Structure Plan Transportation Functional Study
VISUM 10.03 PTV America || Model Run Date: April 16, 2010 || Project# 5235	29	Exhibit 2-12: 2020 Modelled Link Volumes



May 18, 2010 | Highway 2A Industrial Area Structure Plan Transportation Functional Study

VISUM 10.03 PTV America || Model Run Date: April 16, 2010 || Project# 5235 | 30 | Exhibit 2-13: 2020 Modelled v/c Ratios


Highway 22X
Macleod Trail
Highway 2
Highway 762
Highway 22
Highway 552
Dunbow Road
Highway 2A
Highway 552
Highway 549
Highway 549
Highway 7
Highway 547
Highway 546
Highway 799
Highway 783
Highway 2A
Highway 543
Highway 23
Highway 541
Highway 22
Highway 2
Highway 540
N
2030
Link Volumes
(veh/hr)
<= 100
<= 300
<= 500
<= 700
<= 1000
> 1000



May 18, 2010		Highway 2A Industrial Area Structure Plan Transportation Functional Study
VISUM 10.03 PTV America || Model Run Date: April 16, 2010 || Project# 5235	32	Exhibit 2-15: 2030 Modelled v/c Ratios

2.11 Road Classification

A road classification for the entire MD area was proposed based on AT road classifications with minimal adjustment in threshold average daily traffic (ADT) volumes. The adjustment in ADT volumes for road classification purposes was discussed and confirmed with MD staff.

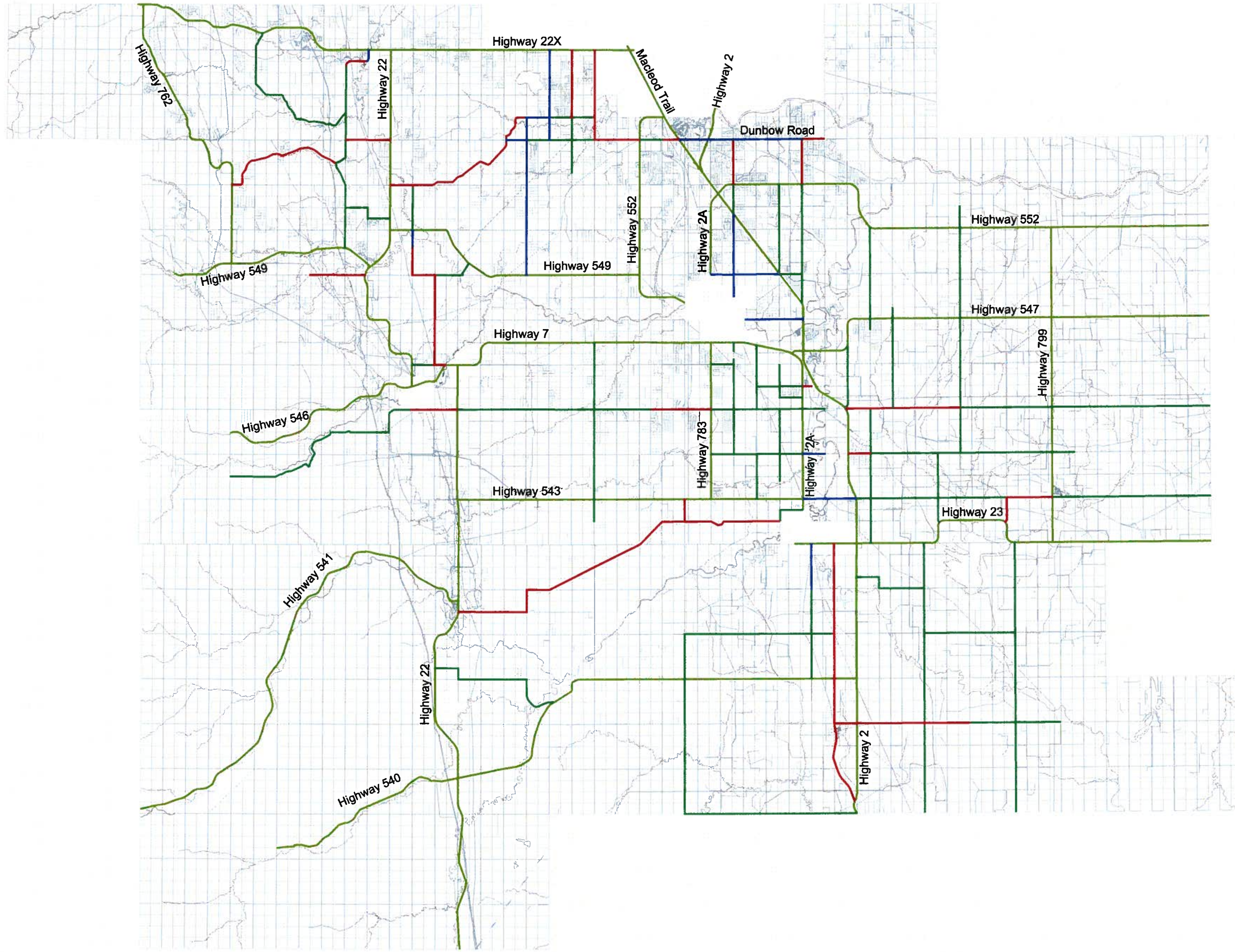
A summary of the classification and accompanying daily traffic volumes are shown in **Table 2-7**.

Table 2-7: Road Classification Summary

Road Classification	Average Daily Traffic (ADT)
Arterial	> 1,000
Collector	301 - 999
Local	< 300

The p.m. peak hour link volumes obtained from the MD model were multiplied by a factor of ten to approximate the daily traffic volumes. This factor of ten was developed as an average through a review of the existing traffic counts in the area. It is recognized that this daily factor may not be applicable to all areas of the MD. The scope of this project was the H2AIASP area which was reviewed in detail to adjust the daily factor from ten to eight; this reduced factor was developed as the majority of proposed development was industrial.

The appropriate road classifications were applied to each segment of the road network and the resulting road classifications are illustrated in **Exhibit 2-16** to **Exhibit 2-19** for the base 2009 year and future horizon years 2015, 2020, and 2030, respectively.



Legend:

- Provincial Highway
- Arterial (1000 + ADT)
- Collector (301 - 999 ADT)
- Local (<300 ADT)

Notes:
1. Scale: 1: 300,000

Municipal District of Foothills

Highway 2A Industrial Area Structure Plan Transportation Fuctional Study

Base Year 2009
Proposed Road Classification
Exhibit 2-16
May 18, 2010

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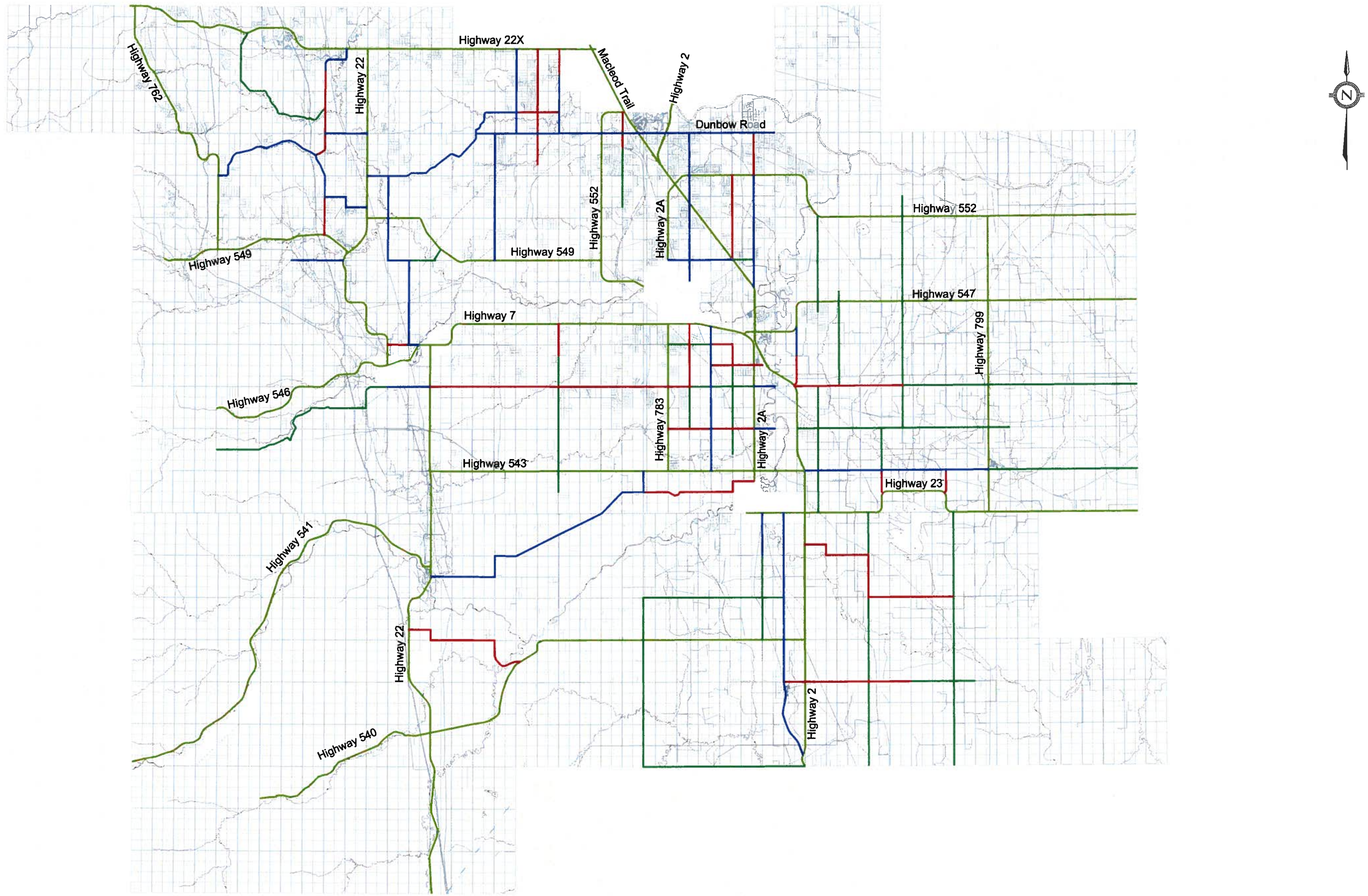

Legend:

- Provincial Highway
- Arterial (1000 + ADT)
- Collector (301 - 999 ADT)
- Local (<300 ADT)

Notes:
1. Scale: 1: 300,000

Municipal District of Foothills

Highway 2A Industrial Area Structure Plan Transportation Fuctional Study

2015 Proposed Road Classification

Exhibit 2-17

May 18, 2010

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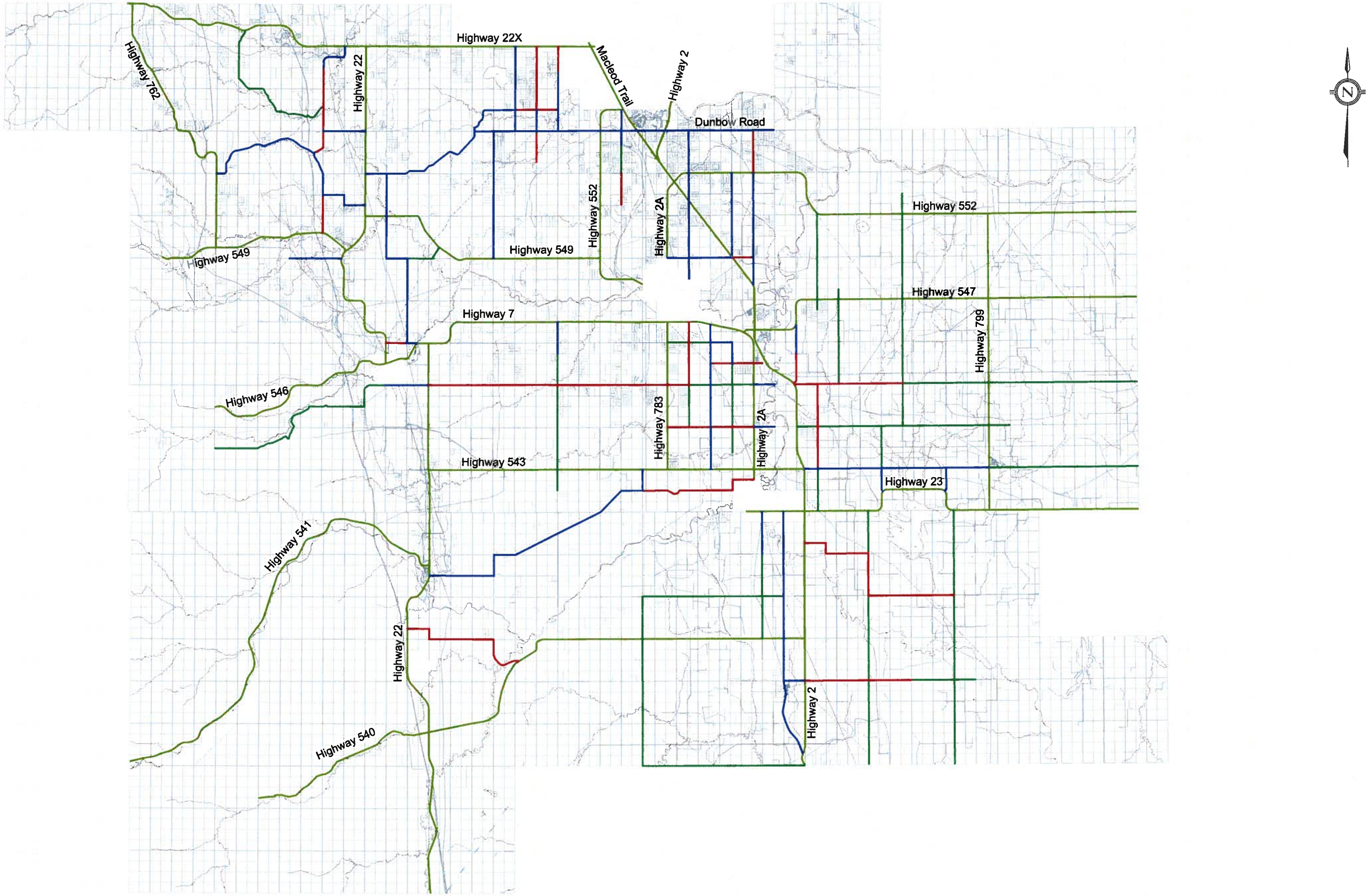

Legend:

- Provincial Highway
- Arterial (1000 + ADT)
- Collector (301 - 999 ADT)
- Local (<300 ADT)

Notes:
1. Scale: 1: 300,000

Municipal District of Foothills

Highway 2A Industrial Area Structure Plan Transportation Fuctional Study

2020 Proposed Road Classification

Exhibit 2-18

May 18, 2010

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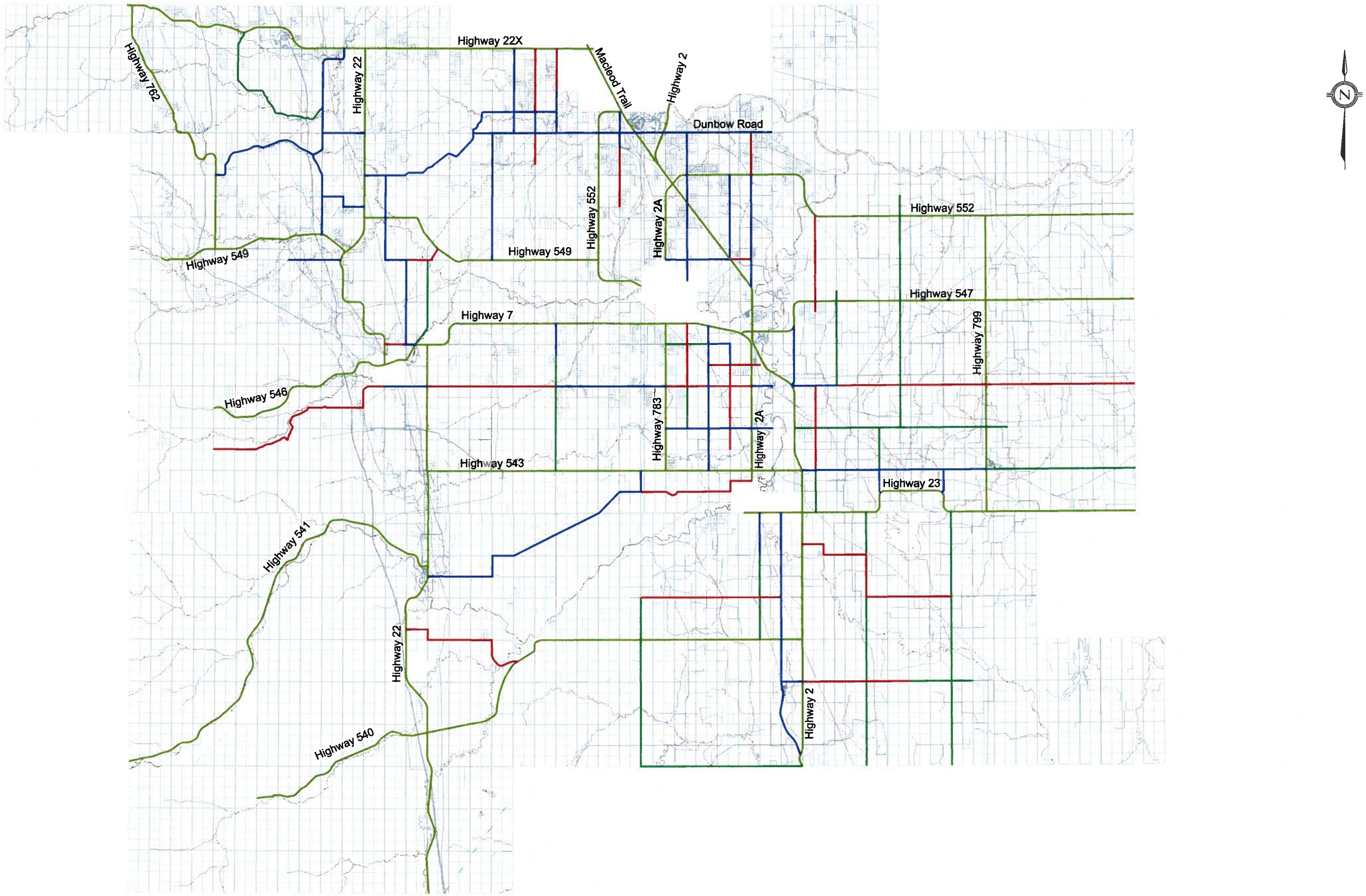

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PLOTDATE: May 17, 2010 – 12:21pm
PLOTTED BY: kboldwin

M.D. of FOOTHILLS No. 31

HDR

iTRANS

Legend:

- Provincial Highway
- Arterial (1000 + ADT)
- Collector (301 - 999 ADT)
- Local (<300 ADT)

Notes:
1. Scale: 1: 300,000

Municipal District of Foothills

Highway 2A Industrial Area Structure Plan Transportation Fuctional Study

2030 Proposed Road Classification

Exhibit 2-19

May 18, 2010

2.12 Model Operation

The model structure consists of two main components; a Microsoft Excel workbook (Foothills Model Input - … .xlsx) and a VISUM version file (containing network, demand data, and assignment information).

2.12.1 Setting Up The Model

The initial work of establishing the demand trip tables was completed with Excel, leaving the network assignments and graphical display of results to be completed with VISUM. User input involved three stages:

1. Land use adjustment:
   - Setting the population and employment numbers in the "Change land use here" columns of the "Landuse" sheet by zone, as described in **Section 2.9**.
2. Survey and count results:
   - Setting the number of trips and counts at calibration/survey stations, as described in **Section 2.7**.
3. Adjustment factors:
   - For recalibrating or altering the model; reconciling the modelled volumes with counts at calibration and validation locations (usually an iterative process that requires several test assignment runs) by applying factors as appropriate for trips to or from individual zones. For example, changing a trip rate for an individual zone from the averages currently applied if more information should become known about travel patterns involving that zone. The user should alter the two gateway reduction factor numbers highlighted in yellow at the top of the "Foothills Zones" sheet to ensure that the two ratios depicted to the right of these numbers are both 1.00. This will preserve the calibration of the model to the gateway counts.

Once these steps are carried out, the zone-to-zone origin-destination tables are ready to be copied to VISUM and assigned.

2.12.2 Running Assignments

The assignment is run directly in VISUM using an equilibrium assignment method. When the run is completed, the results are automatically available in both tabular and graphical format, ready for input to external programs or (in the case of the results volume tables) for re-input to the original Excel file for comparison and validation. No user input is required at this stage other than identifying the table for assignment and the assignment method, and then exporting the results.

2.12.3 Working with Assignment Results

VISUM provides link volumes in a tabular format that can be directly copied back into Excel and used for calibration, validation, and displaying results for comparison between forecast years and against observed totals.

3. TRAFFIC ANALYSIS

In addition to evaluating the study area utilizing the model, intersectional capacity analysis was conducted for key intersections at both existing and future horizons.

3.1 Methodology

The peak hour volumes were evaluated using Synchro v6.0, a software package typically used in the transportation planning industry. Synchro is based on the U.S. Highway Capacity Manual (HCM). Two measures of effectiveness are used to evaluate the operations of an intersection:

- level of service (LOS)
- volume to capacity ratio (v/c)

In addition summarizing the LOS and v/c ratio results, average delay and 95th percentile queue lengths were also provided.

3.1.1 Level of Service

In the HCM methodology, LOS is the primary evaluation criteria for operating conditions. For unsignalized intersections, the LOS is based on the computed delays; LOS A represents minimal delays to minor street traffic movements and LOS F represents a scenario with an insufficient number of gaps on the major street for minor street motorists to complete their movements without significant delays. The HCM intersectional capacity evaluation criterion for unsignalized intersections is summarized in **Table 3-1**.

Table 3-1: Level-of-Service Criteria for Unsignalized Intersections

Level-of-Service (LOS)	Average Delay for UNSIGNALIZED Intersection Movements
A	0 – 10 sec. per vehicle
B	> 10 – 15 sec. per vehicle
C	> 15 – 25 sec. per vehicle
D	> 25 – 35 sec. per vehicle
E	> 35 – 50 sec. per vehicle
F	> 50 sec. per vehicle

3.1.2 Volume to Capacity Ratios

The v/c ratio is another measure of operational conditions and is discussed in **Section 2.8.1**.

4. EXISTING CONDITIONS

Existing conditions were evaluated for intersections both inside the H2AIASP study area and for intersections of concern identified outside the H2AIASP area.

4.1 Outside the H2AIASP Area

Five key intersections were identified by the MD for detailed evaluation and analysis for existing conditions only. These intersections are located outside the H2AIASP area:

1. 338th Avenue / 32nd Street
2. Holy Trinity Church Entrance / 32nd Street
3. 306th Avenue / 32nd Street
4. 226th Avenue / 96th Street
5. 370th Avenue / 48th Street

4.1.1 Intersectional Traffic Volumes

Intersection traffic counts were conducted by ME2 Transportation Data Corporation on Thursday, August 13th, 2009 during the periods of 7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m. The observed existing a.m. and p.m. peak hours and the date of surveys are summarized in **Table 4-1**. The intersectional traffic counts for a.m. and p.m. peak hours are illustrated in **Exhibit 4-1**.

Table 4-1: Intersectional Peak Hour Summary

Intersections	Observed a.m. Peak Hour	Observed p.m. Peak Hour
338th Avenue / 32nd Street	7:15 - 8:15	4:30 - 5:30
Holy Trinity Church Entrance / 32nd Street	7:15 - 8:15	5:00 - 6:00
306th Avenue / 32nd Street	7:45 - 8:45	4:15 - 5:15
226th Avenue / 96th Street	7:15 - 8:15	4:15 - 5:15
370th Avenue / 48th Street	7:45 - 8:45	4:00 - 5:00

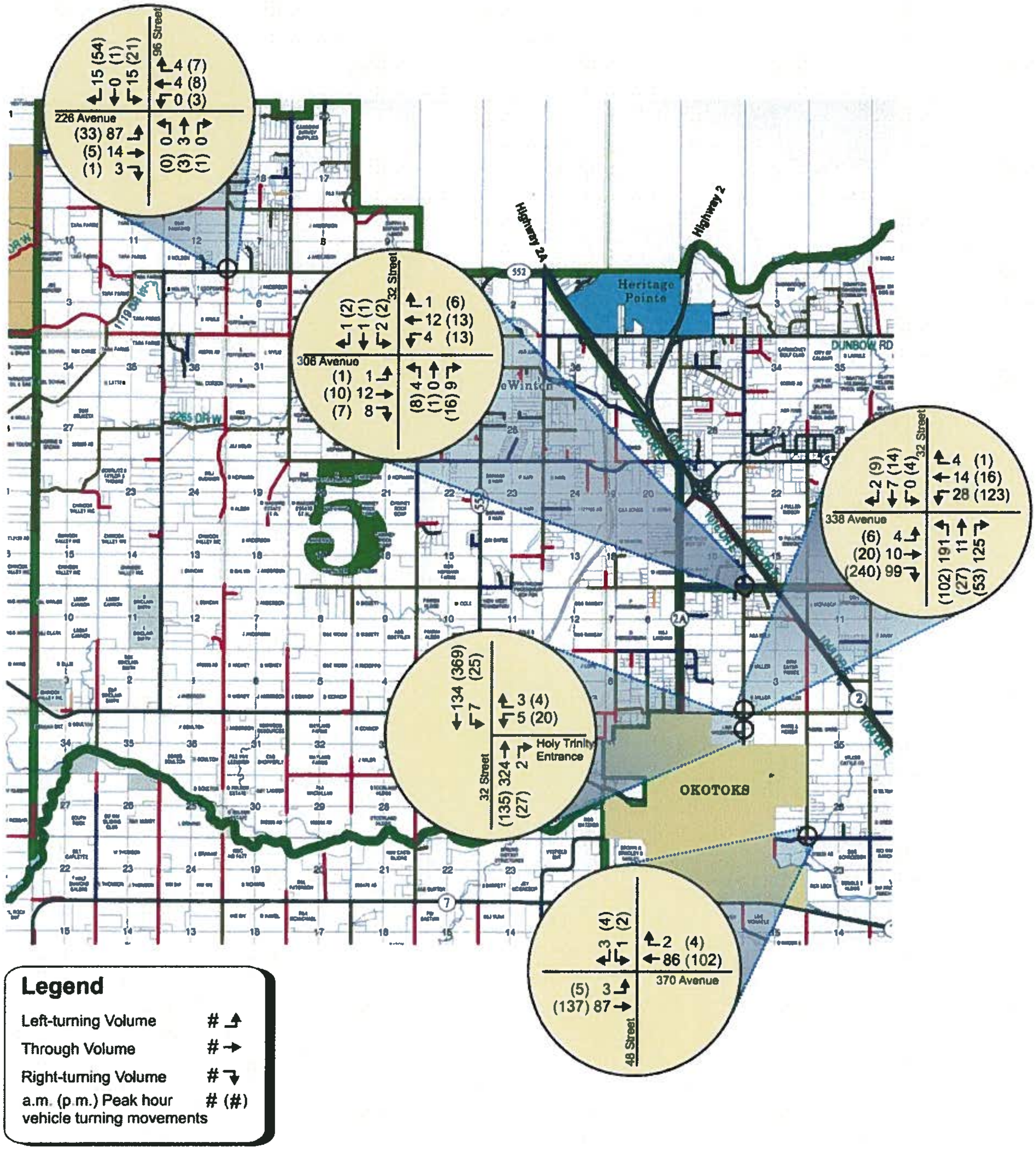
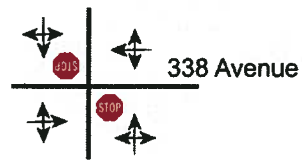
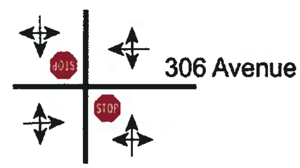
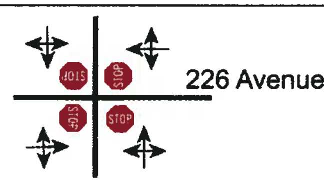
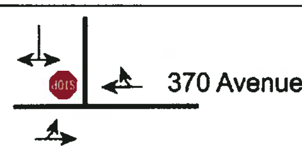


Exhibit 4-1: Intersection Traffic Counts for a.m. and p.m. Peak Hours

4.1.2 Intersection Configuration

All roads at the studied intersections are undivided, two-lane roads (one lane per direction) with the exception of the intersection at the Holy Trinity Church entrance on 32nd Street. This intersection is designed with a Type IVa intersection treatment that provides a bypass southbound through lane permitting an exclusive left, and an exclusive right turn lane. The five intersections are all unsignalized and STOP controlled. A description of the intersection configuration and control is listed in **Table 4-2**.

Table 4-2: Key Intersections – Existing Conditions

Intersection	Configuration
338th Avenue / 32nd Street	
Holy Trinity Church Entrance / 32nd Street	
306th Avenue / 32nd Street	
226th Avenue / 96th Street	
370th Avenue / 48th Street	

4.1.3 Analysis

The a.m. and p.m. peak hour traffic volumes from **Exhibit 4-1** were input into Synchro and each intersection was evaluated. The Synchro analyses for the a.m. and p.m. peak hours are summarized in **Table 4-3**. The Synchro output is attached in **Appendix VI**.

Table 4-3: Existing Intersection Operating Conditions

Intersections / Movement			Measures of Effectiveness							
			a.m. peak hour				p.m. peak hour			
			LOS	Delay (s)	v/c ratio	Queue (m)	LOS	Delay (s)	v/c ratio	Queue (m)
338th Avenue / 32nd Street	EB	Left-Thru-Right	A	0.9	0.01	0.2	A	0.2	0.00	0.1
	WB	Left-Thru-Right	A	4.7	0.02	0.5	A	7.2	0.10	2.4
	NB	Left-Thru-Right	B	12.0	0.39	14.2	B	14.8	0.33	11.0
	SB	Left-Thru-Right	B	10.4	0.01	0.3	B	12.4	0.05	1.3
	Intersection Summary		*A*	*8.6*	*0.39*	-	*A*	*6.6*	*0.33*	-
Holy Trinity Entrance / 32nd Street	WB	Left-Right	B	10.7	0.00	0.1	B	11.4	0.04	1.0
	NB	Thru	A	0.0	0.19	0.0	A	0.0	0.08	0.0
		Right	A	0.0	0.00	0.0	A	0.0	0.02	0.0
	SB	Left-Thru	A	0.4	0.05	0.1	A	0.5	0.14	0.4
	Intersection Summary		*A*	*0.2*	*0.19*	-	*A*	*0.8*	*0.14*	-
306th Avenue / 32nd Street	EB	Left-Thru-Right	A	0.4	0.00	0.0	A	0.4	0.00	0.0
	WB	Left-Thru-Right	A	1.7	0.00	0.1	A	3.0	0.01	0.2
	NB	Left-Thru-Right	A	8.7	0.01	0.3	A	9.0	0.03	0.6
	SB	Left-Thru-Right	A	8.9	0.00	0.1	A	9.0	0.00	0.1
	Intersection Summary		*A*	*3.4*	*0.01*	-	*A*	*4.6*	*0.03*	-
226th Avenue / 96th Street	EB	Left-Thru-Right	A	7.5	0.06	-	A	7.5	0.05	-
	WB	Left-Thru-Right	A	7.0	0.01	-	A	7.1	0.02	-
	NB	Left-Thru-Right	A	7.1	0.00	-	A	7.0	0.00	-
	SB	Left-Thru-Right	A	7.1	0.03	-	A	7.0	0.08	-
	Intersection Summary		*A*	*7.3*	*0.06*	-	*A*	*7.2*	*0.08*	-
370th Avenue / 48th Street	EB	Left-Thru	A	0.3	0.00	0.0	A	0.3	0.00	0.1
	WB	Thru-Right	A	0.0	0.05	0.0	A	0.0	0.06	0.0
	SB	Left-Right	A	8.9	0.00	0.1	A	9.2	0.01	0.2
	Intersection Summary		*A*	*0.3*	*0.05*	-	*A*	*0.4*	*0.06*	-

EB – eastbound WB – westbound NB – northbound SB – southbound

As summarized in **Table 4-3**, all the reviewed existing intersections and individual movements operate at a LOS B or higher and v/c ratio 0.39 or lower for the a.m. peak hour, and a LOS B or higher and v/c ratio 0.33 or lower for the p.m. peak hour. The numbers indicate that all five intersections are operating with minimal delay and that no intersectional improvements are required at this time.

4.2 H2AIASP Area Analysis

Four key intersections were selected for detailed evaluation and analysis for the p.m. peak hour for the base year 2009:

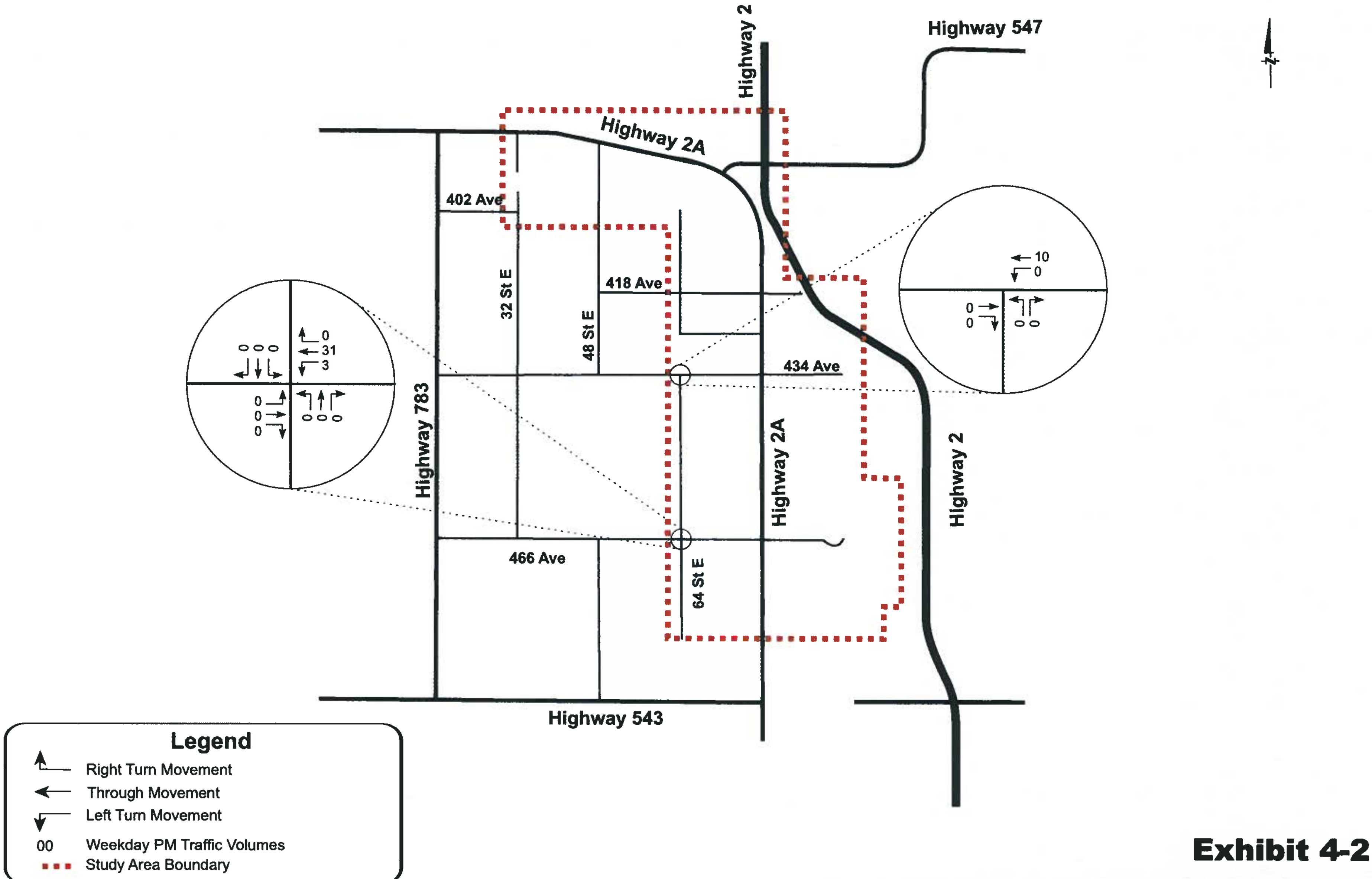
1. 434th Avenue / 64th Street E
2. 466th Avenue / 64th Street E
3. 402nd Avenue / 32nd Street E
4. 418th Avenue / 64th Street E

Existing turning movement counts for these intersections were unavailable, therefore, the MD model p.m. peak volumes were used for the analysis. All intersections were noted to have zero volumes for all turning movements with the exception of:

1. 434th Avenue / 64th Street E
2. 466th Avenue / 64th Street E

The intersectional traffic volumes for these intersections are illustrated in **Exhibit 4-2**.

These intersections were analyzed and found to operate at acceptable levels with all movements at a LOS A and v/c ratios of 0.00. Detailed Synchro output is attached in **Appendix VI**.



Not To Scale

Exhibit 4-2
Existing Intersectional Traffic Volumes

5. FUTURE CONDITIONS

For future conditions, intersection capacity analysis was conducted only for intersections within the H2AIASP study area and for the p.m. peak hour.

5.1 Future Road Network

The proposed road network changes for the future horizons are summarized in **Table 2-6**.

5.2 Analysis

Traffic analysis was carried out using the intersectional traffic volumes from MD model developed and detailed in the previous sections for the following horizon years:

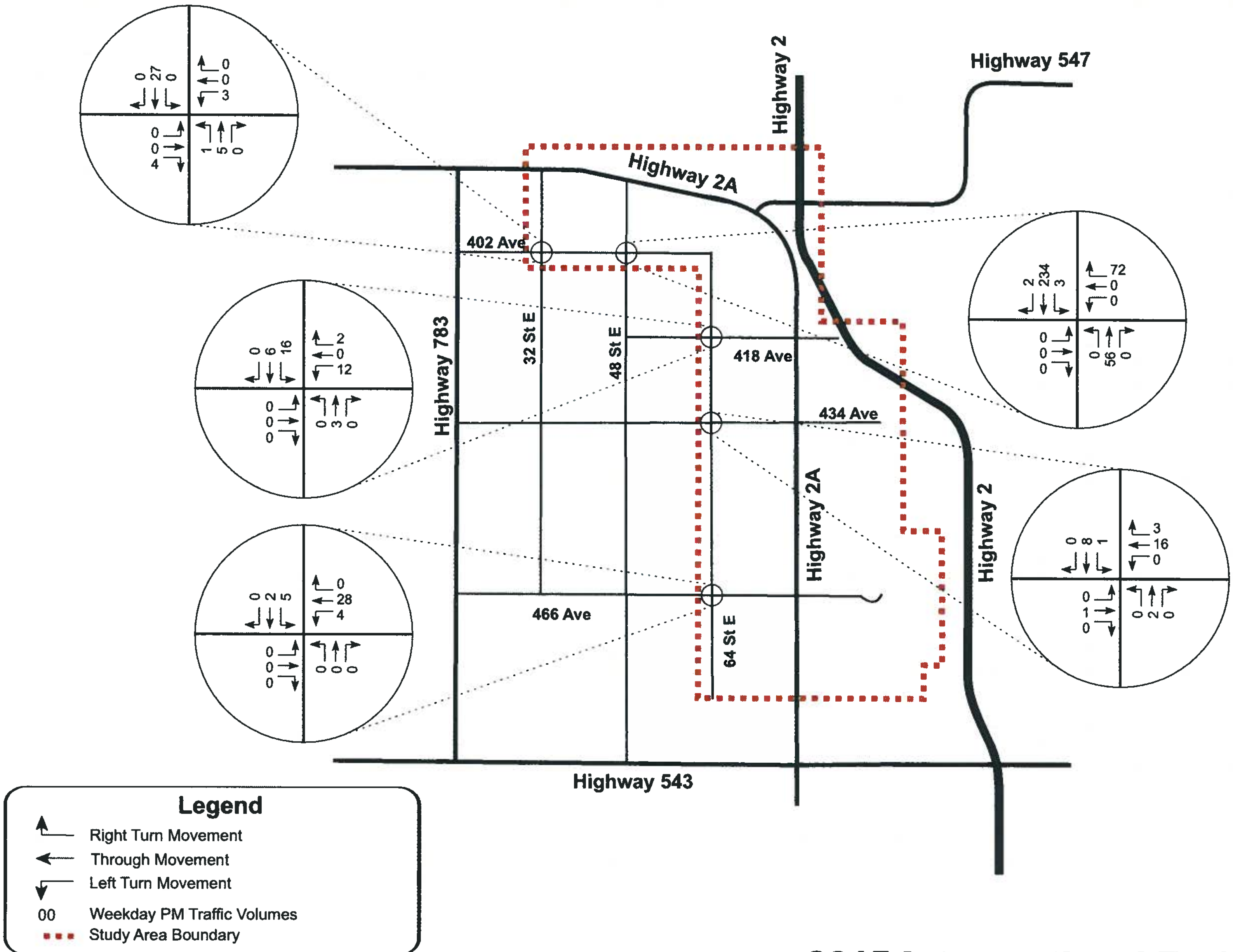
1. 2015
2. 2020
3. 2030

Five key intersections were selected for detailed evaluation and analysis using model volumes for the horizon years:

1. 402nd Avenue / 32nd Street E
2. 402nd Avenue / 48th Street E
3. 418th Avenue / 64th Street E
4. 434th Avenue / 64th Street E
5. 466th Avenue / 64th Street E

For the Synchro analysis, all intersecting roads were assumed to have a 2 lane cross section with unsignalized STOP control.

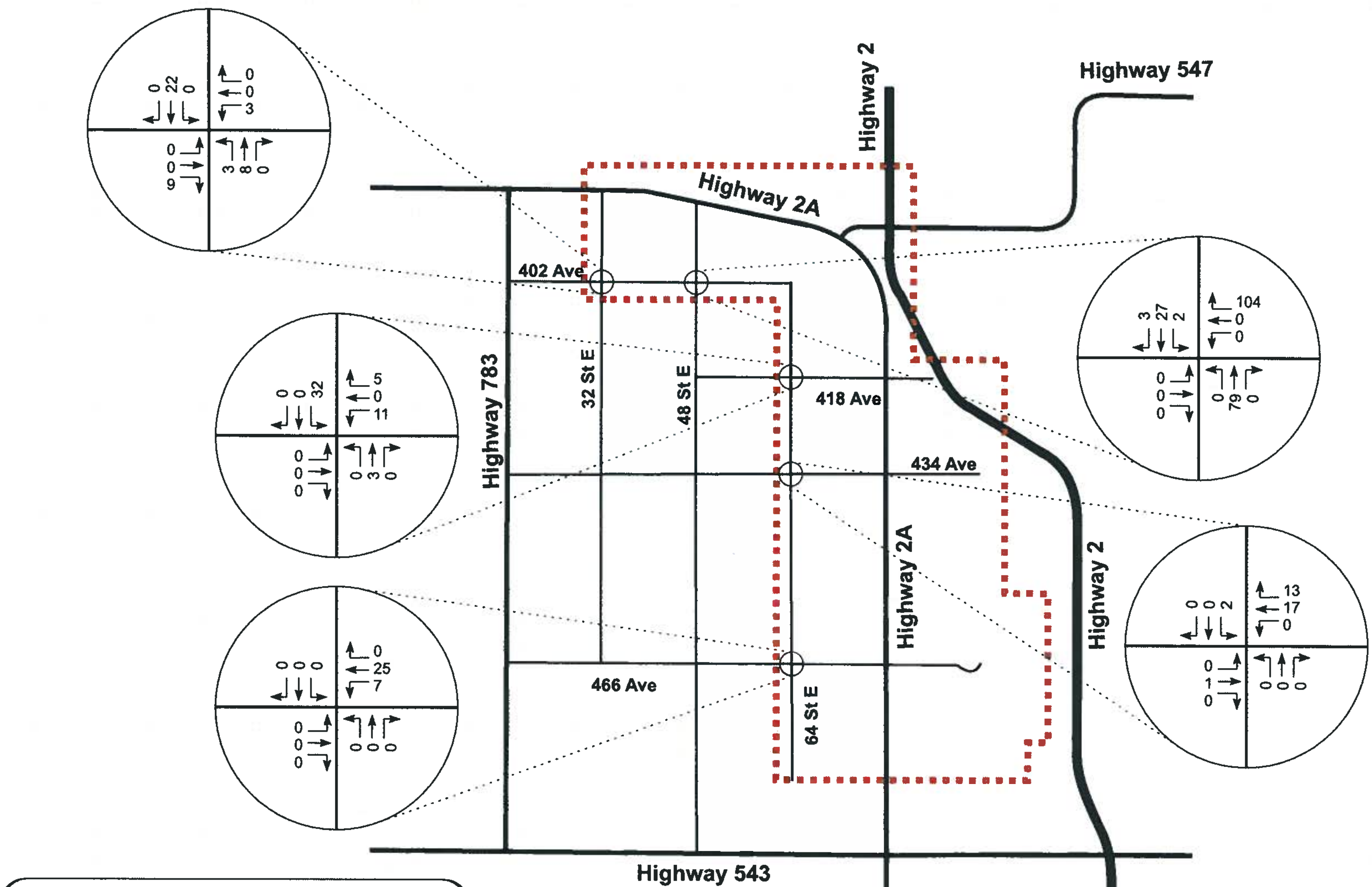
The intersectional p.m. peak hour traffic volumes are illustrated in **Exhibit 5-1** to **Exhibit 5-3**, and were input into Synchro and each intersection was evaluated. The results of the analysis are shown in **Table 5-1** to **Table 5-3**. The Synchro output is attached as **Appendix VI**.



Not To Scale

Exhibit 5-1

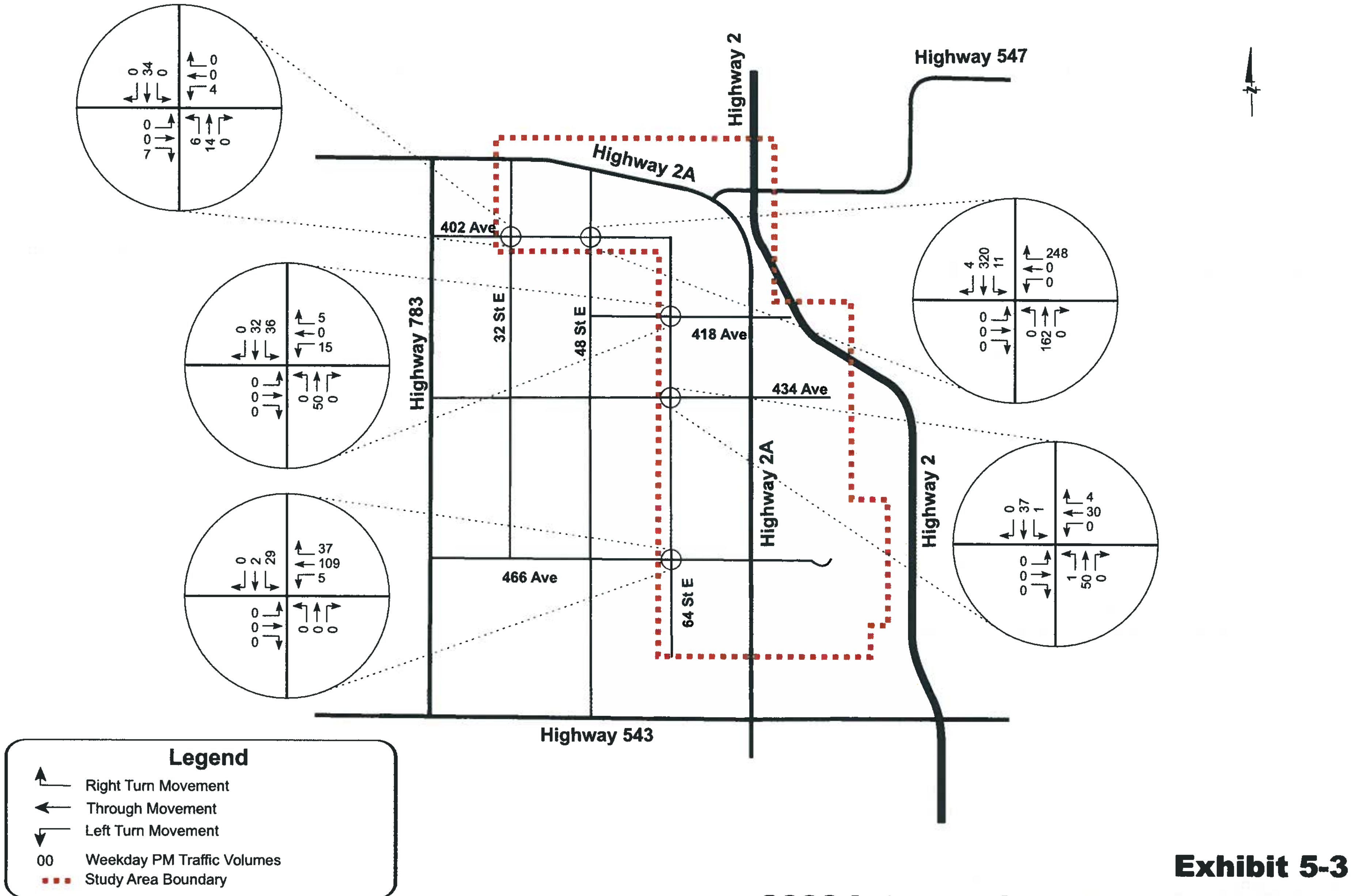
2015 Intersectional Traffic Volumes



Not To Scale

Exhibit 5-2

2020 Intersectional Traffic Volumes



Not To Scale

Exhibit 5-3
2030 Intersectional Traffic Volumes

Table 5-1: 2015 Intersection Operating Conditions

Intersection/Movement			Measures of Effectiveness			
			p.m. peak hour			
			LOS	v/c ratio	Delay (s)	Queue (m)
402nd Avenue / 32nd Street E	EB	Left-Through-Right	A	0.00	8.4	0.1
	WB	Left-Through-Right	A	0.00	8.8	0.1
	NB	Left-Through-Right	A	0.00	1.2	0.0
	SB	Left-Through-Right	A	0.00	0.0	0.0
	Intersection Summary		*A*	*0.00 (max)*	*1.7*	-
402nd Avenue / 48th Street E	EB	Left-Through-Right	-	-	-	-
	WB	Left-Through-Right	A	0.07	8.8	1.7
	NB	Left-Through-Right	A	0.00	0.0	0.0
	SB	Left-Through-Right	A	0.00	0.1	0.0
	Intersection Summary		*A*	*0.07 (max)*	*1.8*	-
418th Avenue / 64th Street E	EB	Left-Through-Right	-	-	-	-
	WB	Left-Through-Right	A	0.01	8.8	0.3
	NB	Left-Through-Right	A	0.00	0.0	0.0
	SB	Left-Through-Right	A	0.01	0.1	0.2
	Intersection Summary		*A*	*0.01 (max)*	*6.1*	-
434th Avenue / 64th Street E	EB	Left-Through-Right	A	0.00	9.1	0.0
	WB	Left-Through-Right	A	0.02	9.0	0.5
	NB	Left-Through-Right	A	0.00	0.0	0.0
	SB	Left-Through-Right	A	0.00	0.0	0.0
	Intersection Summary		*A*	*0.02 (max)*	*6.1*	-
466th Avenue / 64th Street E	EB	Left-Through-Right	-	-	-	-
	WB	Left-Through-Right	A	0.00	0.0	0.1
	NB	Left-Through-Right	-	-	-	-
	SB	Left-Through-Right	A	0.01	8.9	0.2
	Intersection Summary		*A*	*0.01 (max)*	*2.3*	-

EB – eastbound WB – westbound NB – northbound SB – southbound

Table 5-2: 2020 Intersection Operating Conditions

Intersection/Movement			Measures of Effectiveness p.m. peak hour LOS	v/c ratio	Delay (s)	Queue (m)
402nd Avenue / 32nd Street E	EB	Left-Through-Right	A	0.01	8.4	0.2
	WB	Left-Through-Right	A	0.00	8.8	0.1
	NB	Left-Through-Right	A	0.00	2.0	0.0
	SB	Left-Through-Right	A	0.00	0.0	0.0
	Intersection Summary		*A*	*0.01 (max)*	*2.8*	-
402nd Avenue / 48th Street E	EB	Left-Through-Right	-	-	-	-
	WB	Left-Through-Right	A	0.11	9.1	2.7
	NB	Left-Through-Right	A	0.00	0.0	0.0
	SB	Left-Through-Right	A	0.00	0.5	0.0
	Intersection Summary		*A*	*0.11 (max)*	*4.5*	-
418th Avenue / 64th Street E	EB	Left-Through-Right	-	-	-	-
	WB	Left-Through-Right	A	0.02	8.8	0.4
	NB	Left-Through-Right	A	0.00	0.0	0.0
	SB	Left-Through-Right	A	0.02	0.1	0.5
	Intersection Summary		*A*	*0.02 (max)*	*7.3*	-
434th Avenue / 64th Street E	EB	Left-Through-Right	A	0.00	9.0	0.0
	WB	Left-Through-Right	A	0.03	8.8	0.7
	NB	Left-Through-Right	-	-	-	-
	SB	Left-Through-Right	A	0.00	0.0	0.0
	Intersection Summary		*A*	*0.03 (max)*	*8.8*	-
466th Avenue / 64th Street E	EB	Left-Through-Right	-	-	-	-
	WB	Left-Through-Right	A	0.00	0.0	0.1
	NB	Left-Through-Right	-	-	-	-
	SB	Left-Through-Right	-	-	-	-
	Intersection Summary		*A*	*0.00 (max)*	*1.6*	-

EB – eastbound WB – westbound NB – northbound SB – southbound

Table 5-3: 2030 Intersection Operating Conditions

Intersection/Movement			Measures of Effectiveness			
			p.m. peak hour			
			LOS	v/c ratio	Delay (s)	Queue (m)
402nd Avenue / 32nd Street E	EB	Left-Through-Right	A	0.01	8.5	0.2
	WB	Left-Through-Right	A	0.00	8.9	0.1
	NB	Left-Through-Right	A	0.00	0.0	0.1
	SB	Left-Through-Right	A	0.00	0.0	0.0
	Intersection Summary		*A*	*0.01 (max)*	*2.1*	-
402nd Avenue / 48th Street E	EB	Left-Through-Right	-	-	-	-
	WB	Left-Through-Right	B	0.28	10.7	8.8
	NB	Left-Through-Right	A	0.00	0.0	0.0
	SB	Left-Through-Right	A	0.01	0.3	0.2
	Intersection Summary		*A*	*0.28 (max)*	*3.7*	-
418th Avenue / 64th Street E	EB	Left-Through-Right	-	-	-	-
	WB	Left-Through-Right	A	0.02	9.4	0.6
	NB	Left-Through-Right	A	0.00	0.0	0.0
	SB	Left-Through-Right	A	0.02	0.2	0.5
	Intersection Summary		*A*	*0.02 (max)*	*3.3*	-
434th Avenue / 64th Street E	EB	Left-Through-Right	-	-	-	-
	WB	Left-Through-Right	A	0.04	9.6	1.0
	NB	Left-Through-Right	A	0.00	0.0	0.0
	SB	Left-Through-Right	A	0.00	0.0	0.0
	Intersection Summary		*A*	*0.04 (max)*	*2.8*	-
466th Avenue / 64th Street E	EB	Left-Through-Right	-	-	-	-
	WB	Left-Through-Right	A	0.00	0.3	0.1
	NB	Left-Through-Right	-	-	-	-
	SB	Left-Through-Right	A	0.04	9.5	0.9
	Intersection Summary		*A*	*0.04 (max)*	*1.8*	-

EB – eastbound WB – westbound NB – northbound SB – southbound
LOS – level of service v/c ratio – volume/capacity ratio

As illustrated in **Table 5-1** to **Table 5-3**, all studied intersections operate at a LOS of A and v/c ratio of 0.28 or lower for all horizon years.

6. H2AIASP AREA ROAD CLASSIFICATION

As discussed in **Section 2.11**, road classifications were proposed based on AT road classifications with minimal adjustment in threshold average daily traffic (ADT) volumes. The adjustment in ADT volumes for road classification purposes was discussed and confirmed with MD staff.

As the transportation model output provided the p.m. peak hour volumes only, a multiplying factor was required to determine the daily link volumes. When determining road classifications for the entire MD area a factor of 10 was assumed; however, since land use within the H2AIASP is proposed as predominantly industrial, the *Trip Generation – An ITE Informational Report 8th Edition* (ITE) was referenced to determine a more realistic daily trip rate.

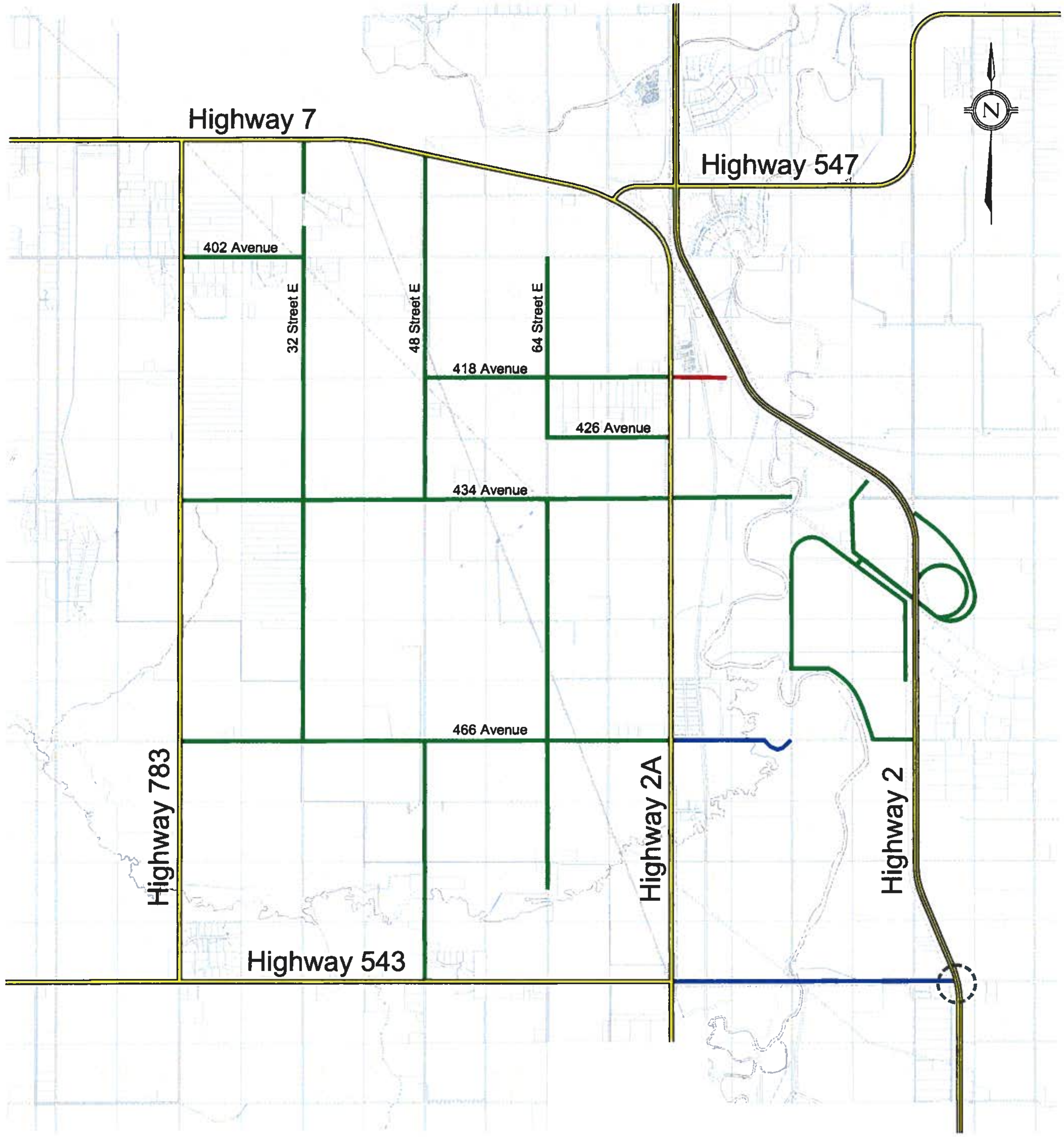
The weekday multiplying factor was calculated using the weekday trip rate for Land Use 110 – General Light Industrial - from ITE and is summarized in **Table 6-1**.

Table 6-1: Multiplying Factor Calculations

Trip Rate per 1,000 GFA		Multiplying Factor
p.m.	Daily	
0.97	6.97	8.0

GFA – Gross Floor Area

The p.m. peak hour link volume obtained from the MD model was multiplied by the calculated factor to approximate the average daily traffic volumes. The appropriate road classifications were applied to each segment of the road network and the resulting road classifications are illustrated in **Exhibit 6-1** to **Exhibit 6-4** for the base year 2009 and future horizon years 2015, 2020, and 2030, respectively.



Legend:

- Highway 2
- Provincial Highway
- Arterial (1000 + ADT)
- Collector (301 - 999 ADT)
- Local (<300 ADT)
- Possible Future Interchange

M.D. of FOOTHILLS No. 31

HDR | iTRANS

Municipal District of Foothills

Highway 2A Industrial Area Structure Plan Transportation Functional Study

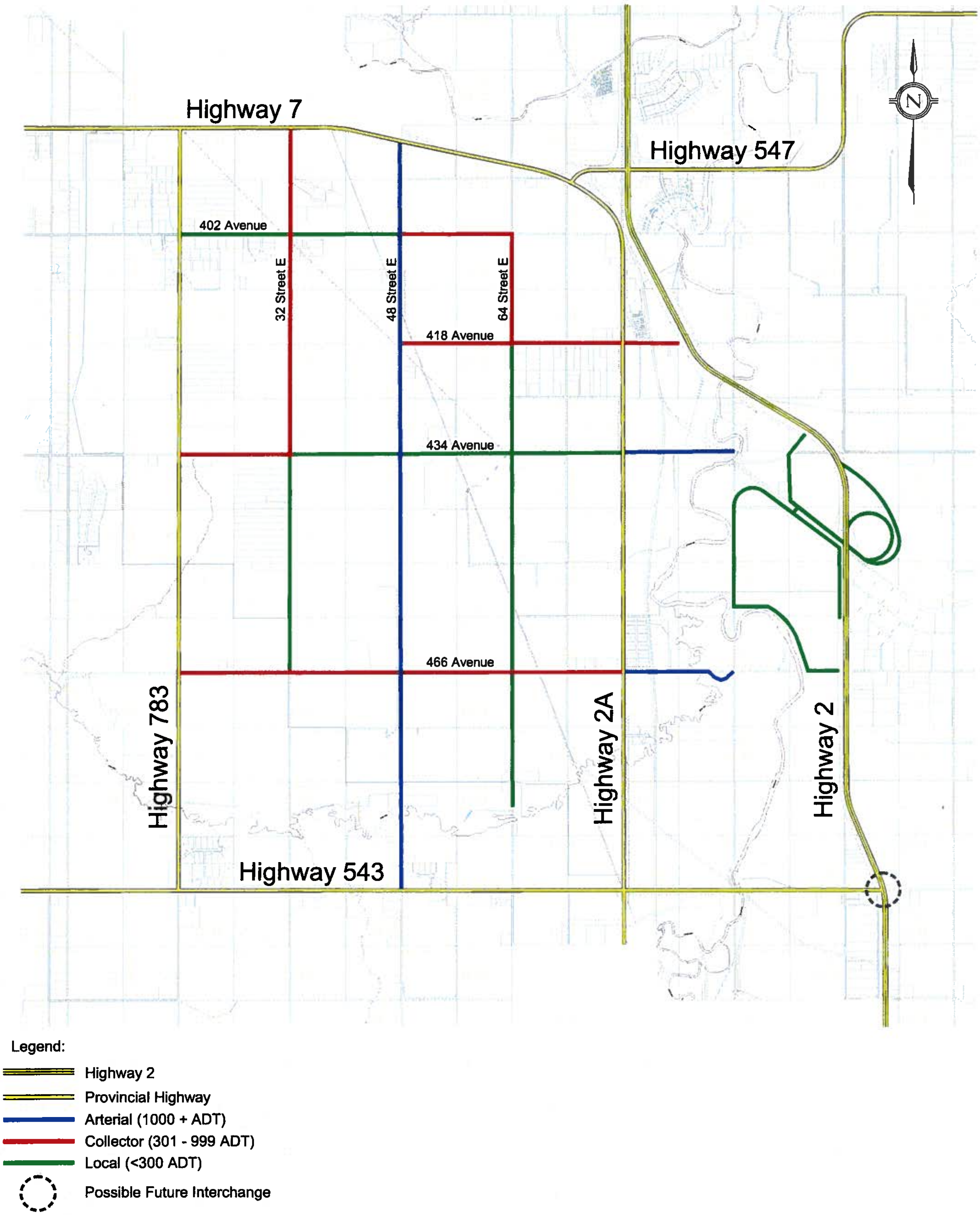
Scale: N.T.S.

Existing Road Classification

Exhibit 6-1

May 18, 2010

FILENAME: M:\Foothills MD of\5235 MD Foothills Network Study\5.0 Design\5.2 Design\Active\Sketches\Exhibits\5235-Exhibit-6-1.dwg
PLOTDATE: May 18, 2010 - 10:46am
PLOTTED BY: kbaldwin



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PLOTDATE: May 17, 2010 - 12:23pm
PLOTTED BY: kboldwin

M.D. of FOOTHILLS No. 31

HDR | iTRANS

Municipal District of Foothills

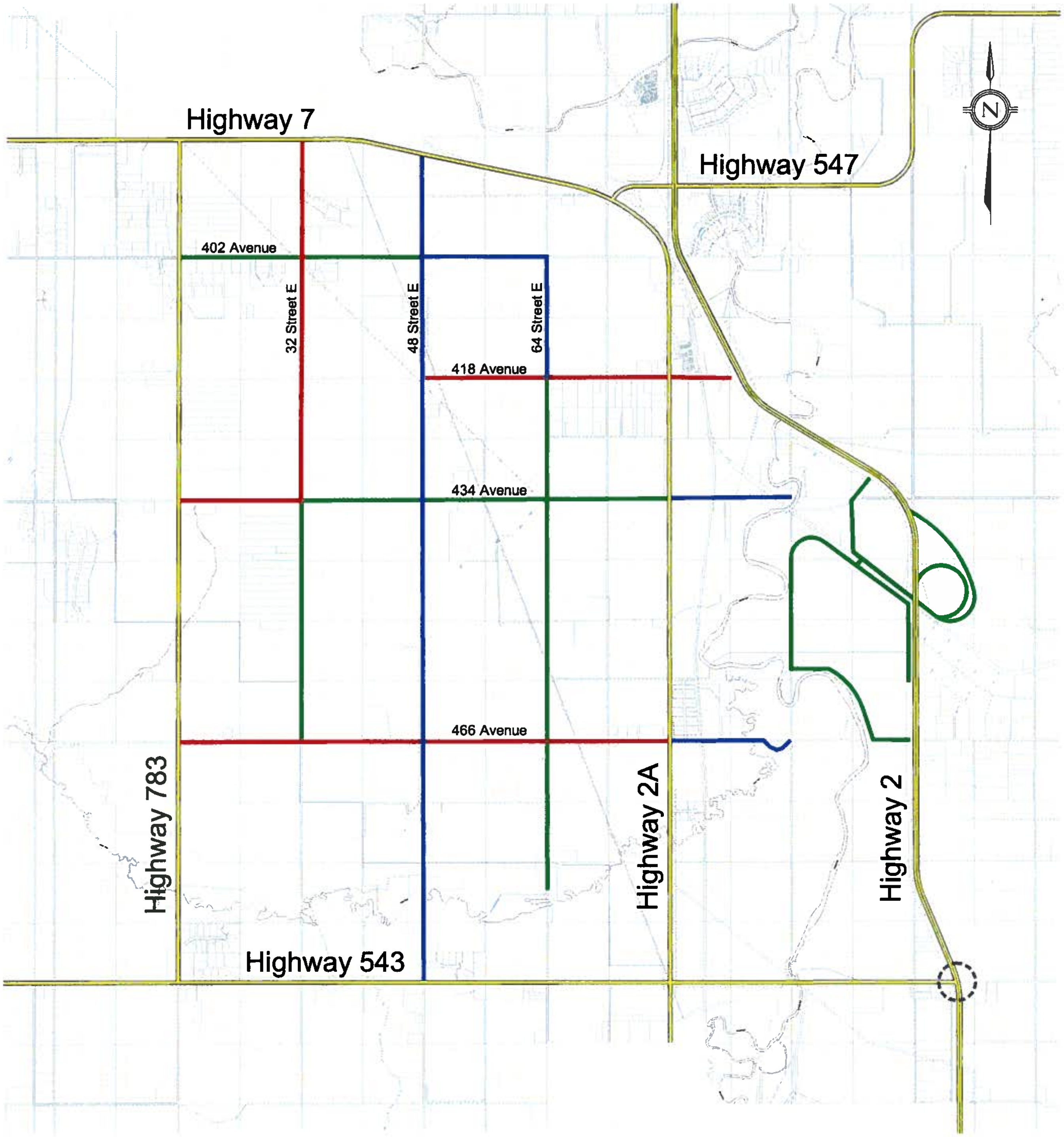
Highway 2A Industrial Area Structure Plan Transportation Functional Study

Scale: N.T.S.

Future Road Classification - 2015

Exhibit 6-2

May 18, 2010



Legend:

- Highway 2
- Provincial Highway
- Arterial (1000 + ADT)
- Collector (301 - 999 ADT)
- Local (<300 ADT)
- Possible Future Interchange

Municipal District of Foothills

Highway 2A Industrial Area Structure Plan Transportation Functional Study

Scale: N.T.S.

Future Road Classification - 2020

Exhibit 6-3

May 18, 2010

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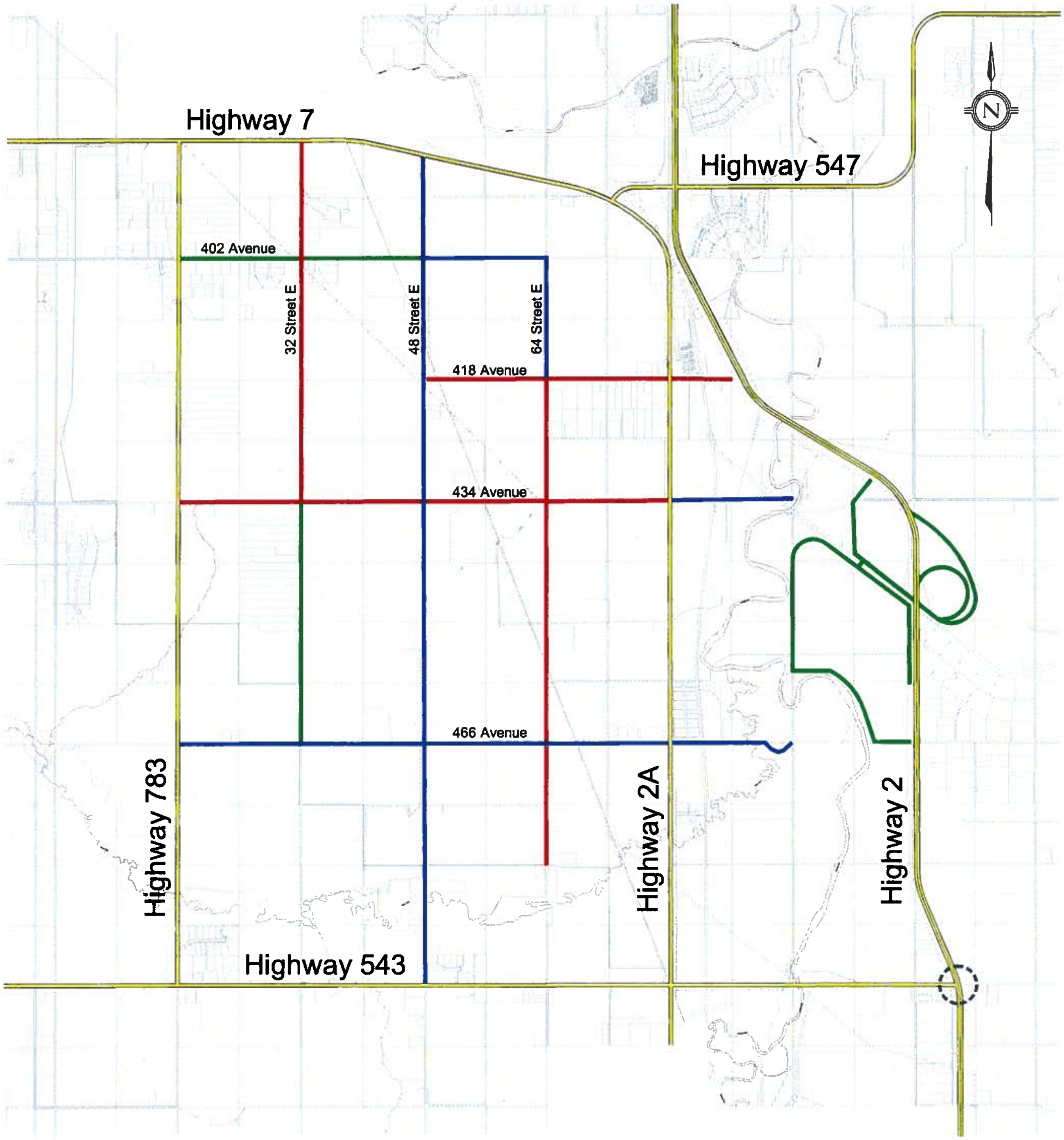


Legend:

- Highway 2
- Provincial Highway
- Arterial (1000 + ADT)
- Collector (301 - 999 ADT)
- Local (<300 ADT)
- Possible Future Interchange

FILENAME: M:\Foothills MD of\5235 MD Foothills Network Study\5.0 Design\5.2 Design\Active\Sketches\Exhibits\5235-Exhibit-6-4.dwg
PLOTDATE: May 17, 2010 - 11:57am
PLOTTED BY: kbaldwin

Municipal District of Foothills

Highway 2A Industrial Area Structure Plan Transportation Functional Study

Scale: N.T.S.

Future Road Classification - 2030

Exhibit 6-4

May 18, 2010

7. H2AIASP AREA FUNCTIONAL PLANNING

7.1 Design Parameters

The road types and typical intersection were selected based on the daily traffic volumes as forecasted by the MD traffic model for the 2030 horizon year as described in **Section 2.11** To correspond with the MD's road classifications, **Table 7-1** summarizes the road classification, daily traffic thresholds, and road designation for design.

Table 7-1: Road Summary

MD Road Classification	MD Daily Traffic Volume Thresholds	Road Designation *
Arterial	≥ 1,000	RAU-210
Collector	301 - 999	RCU-209
Local	≤ 300	RCU-209

* Road designations as per Alberta Transportation Highway Geometric Design Guide August 1999

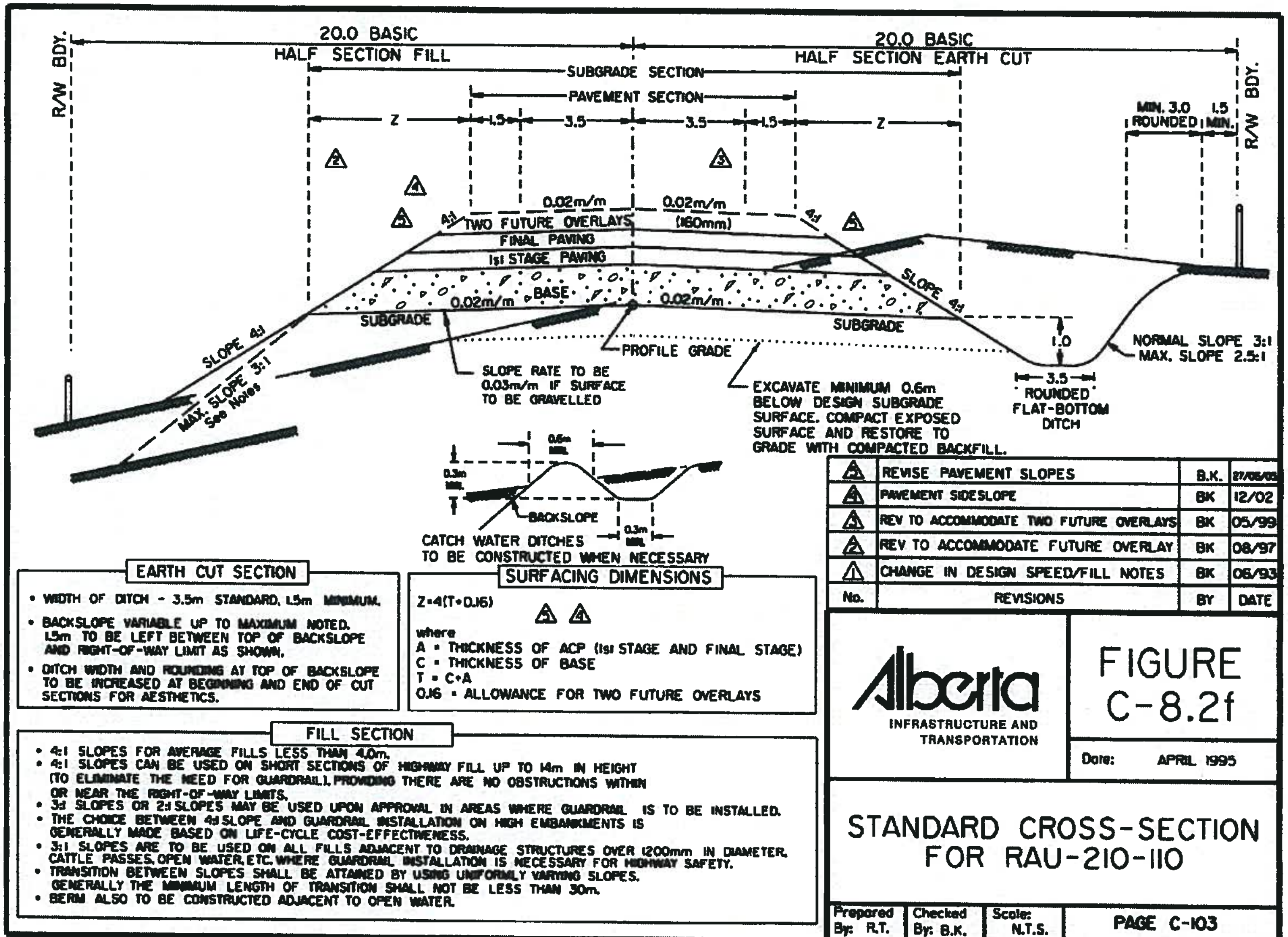
The internal roads and intersections within the H2AIASP will be of rural cross section and designed in accordance with AT specifications, as listed in **Table 7-2.**

Table 7-2: Proposed Design Parameters

Design Parameter	Collector / Local Class	Arterial Class
Ultimate Roadway Classification	RCU-209-100	RAU-210-110
Cross Section		
Right-of-Way (m)	40	40
Design Speed (km / h)	100	110
Number of Lanes	2	2
Minimum Lane Width (m)	3.5	3.5
Shoulders Width (m)	1.0	1.5
Min. Radius (m)	440	440
Min. A Value	190	190
Min. Cross Slope (m / m)	0.02	0.02
Max. Superelevation (m / m)	0.06	0.06
Intersection		
Minimum Turning Radius (m)	55-18-55	55-18-55
Acceleration Tapers (min.)	25:1	25:1
Deceleration Tapers (min.)	25:1	25:1

Typical cross sections are attached and illustrated in **Exhibit 7-1** and **Exhibit 7-2**:

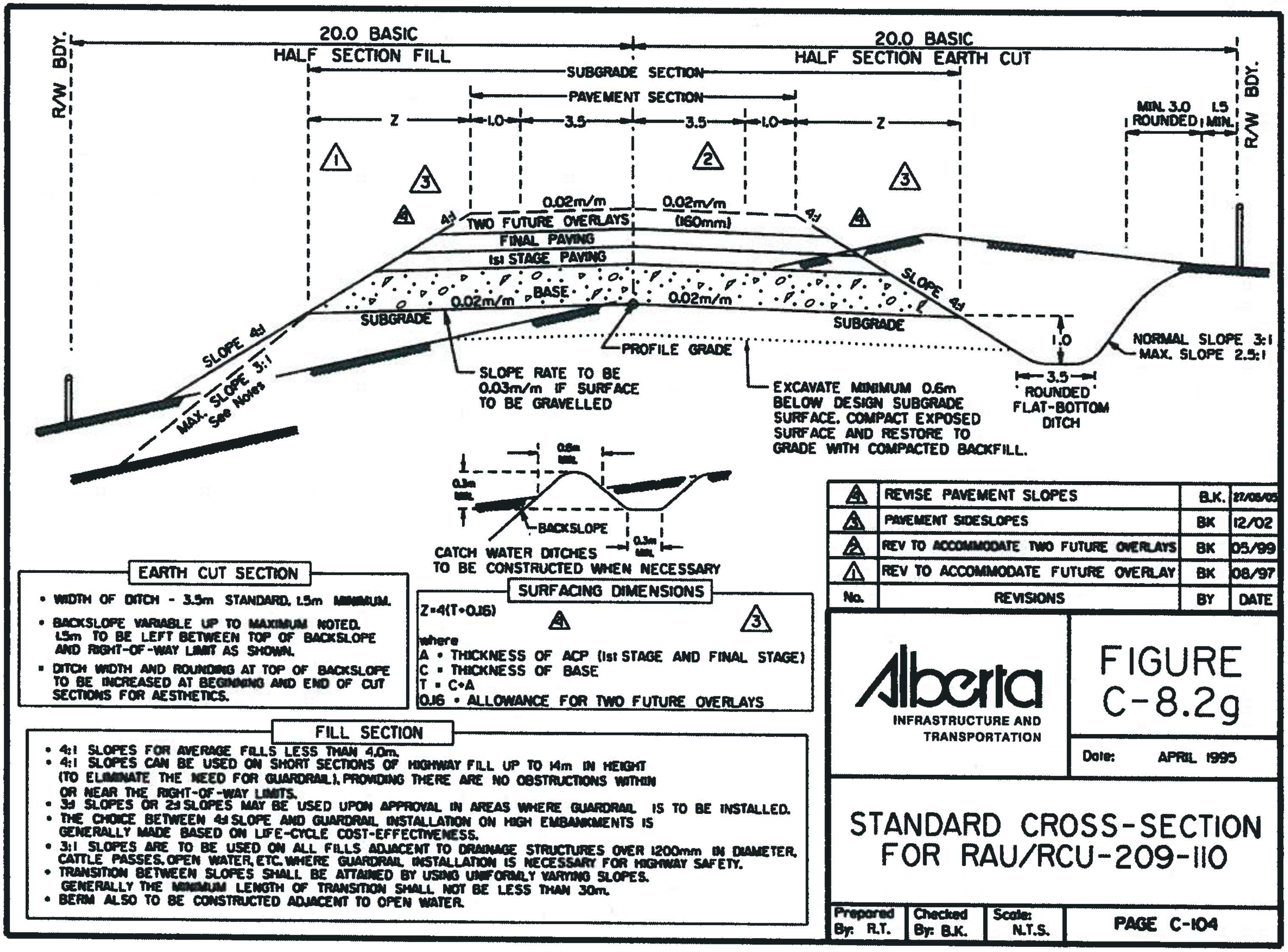
- Arterial (RAU-210) **Figure C-8.2f**
- Collector / Local (RCU-209) **Figure C-8.2g**



Not To Scale

Exhibit 7-1

Typical Arterial Cross-Section



Not To Scale

Exhibit 7-2

Typical Collector Cross-Section

Based on the forecast volumes from the MD traffic model, the Type IIc intersection treatment was selected (Figure D-7e), and the typical layout is illustrated in **Exhibit 7-3**. However, the functional designs developed were modified where appropriate based on the results from the road classification, traffic operation, and storage length analysis completed in previous sections.

7.2 Functional Plans

The recommended functional plans are illustrated in **Appendix VII**.

HIGHWAY DESIGNATION	LANE/SHOULDER WIDTHS (m)	SHOULDER WIDTH AT INTERSECTION (m)
RAU-213.4	3.7/3.0	1.5
RAU-211.8	3.7/2.2	1.5
RAU-210.0	3.5/1.5	1.5
RAU-209.0	3.5/1.0	1.0
RAU-208.0	3.5/0.5	0.5

* AUXILIARY LANE WILL BE 3.5m IN ALL CASES

NOTES: DIMENSIONS SHOWN ARE FINISHED SURFACE PAVEMENT WIDTHS. ADDITIONAL SUBGRADE WIDTHS TO BE PROVIDED TO ALLOW FOR DEPTH OF BASE COURSE AND PAVEMENT.

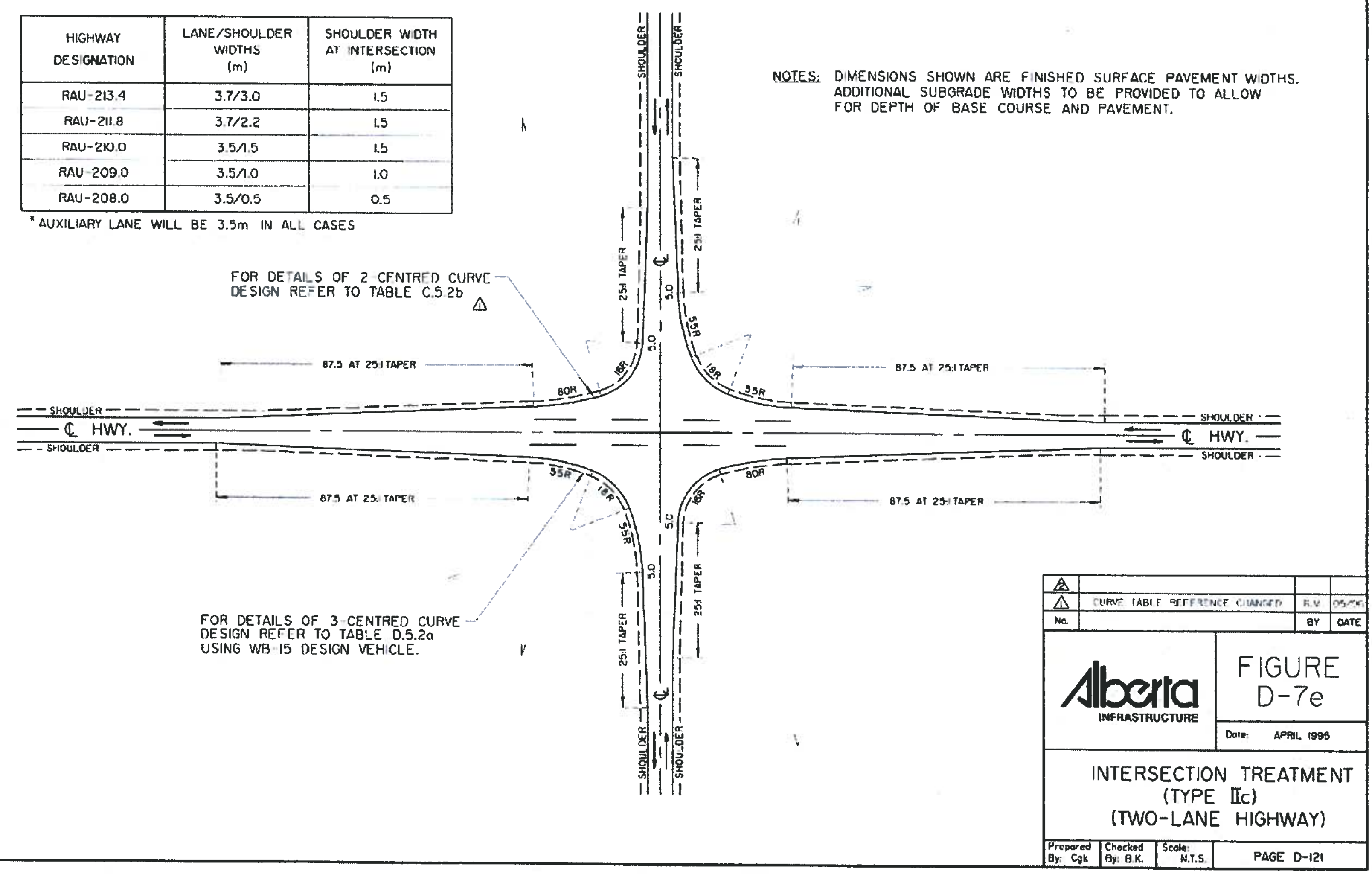


Exhibit 7-3
Typical Intersection Layout

Not To Scale

7.3 Cost Estimates

The cost estimates for improvements were based on rates provided by the MD and are summarized in **Table 7-3**.

Table 7-3: Cost Estimate

Road Segment	From	To	Length (km)		Number of Intersections	Costs			Subtotal	Engineering & Contingency 30%	Totals
			New Construction	Reconstruction		($1,000K / km) New Construction	($400K / km) Reconstruction	($500K / intersection) Intersection			
32 Street	Highway 7	402 Avenue	0.5	1.2	1	$ 500,000	$ 480,000	$ 500,000	$ 1,480,000	$ 444,000	$ 1,924,000
48 Street	Highway 7	402 Avenue	0	1.4	1	$ -	$ 560,000	$ 500,000	$ 1,060,000	$ 318,000	$ 1,378,000
418 Avenue	64 Street	Highway 2A	0	1.7	1	$ -	$ 680,000	$ 500,000	$ 1,180,000	$ 354,000	$ 1,534,000
434 Avenue	64 Street	Highway 2A	0	1.7	1	$ -	$ 680,000	$ 500,000	$ 1,180,000	$ 354,000	$ 1,534,000
466 Avenue	64 Street	Highway 2A	0	1.7	1	$ -	$ 680,000	$ 500,000	$ 1,180,000	$ 354,000	$ 1,534,000
402 Avenue	32 Street	48 Street	1.6	0	0	$ 1,600,000	$ -	$ -	$ 1,600,000	$ 480,000	$ 2,080,000
402 Ave/64 St	48 Street	418 Avenue	3	0	0	$ 3,000,000	$ -	$ -	$ 3,000,000	$ 900,000	$ 3,900,000
64 Street	418 Avenue	434 Avenue	0.8	0.8	0	$ 800,000	$ 320,000	$ -	$ 1,120,000	$ 336,000	$ 1,456,000
64 Street	434 Avenue	466 Avenue	1.6	1.6	0	$ 1,600,000	$ 640,000	$ -	$ 2,240,000	$ 672,000	$ 2,912,000
64 Street	466 Avenue	Study Limit	1.6	0	0	$ 1,600,000	$ -	$ -	$ 1,600,000	$ 480,000	$ 2,080,000
									TOTAL COST ESTIMATE		$ 20,332,000

8. PATHWAYS

8.1 Existing Facilities Inventory

There are no existing pedestrian and cyclist infrastructure within the H2AIASP area. The majority of the H2AIASP area is predominantly industrial and has no formally identified trails. The existing street network does not have cycle lanes, marked cycling routes, or sidewalks.

The study area shares its boundaries with the Town of Okotoks in the north and the Town of High River in the south. All trails in the study area should be tied to existing and proposed trails with these two towns.

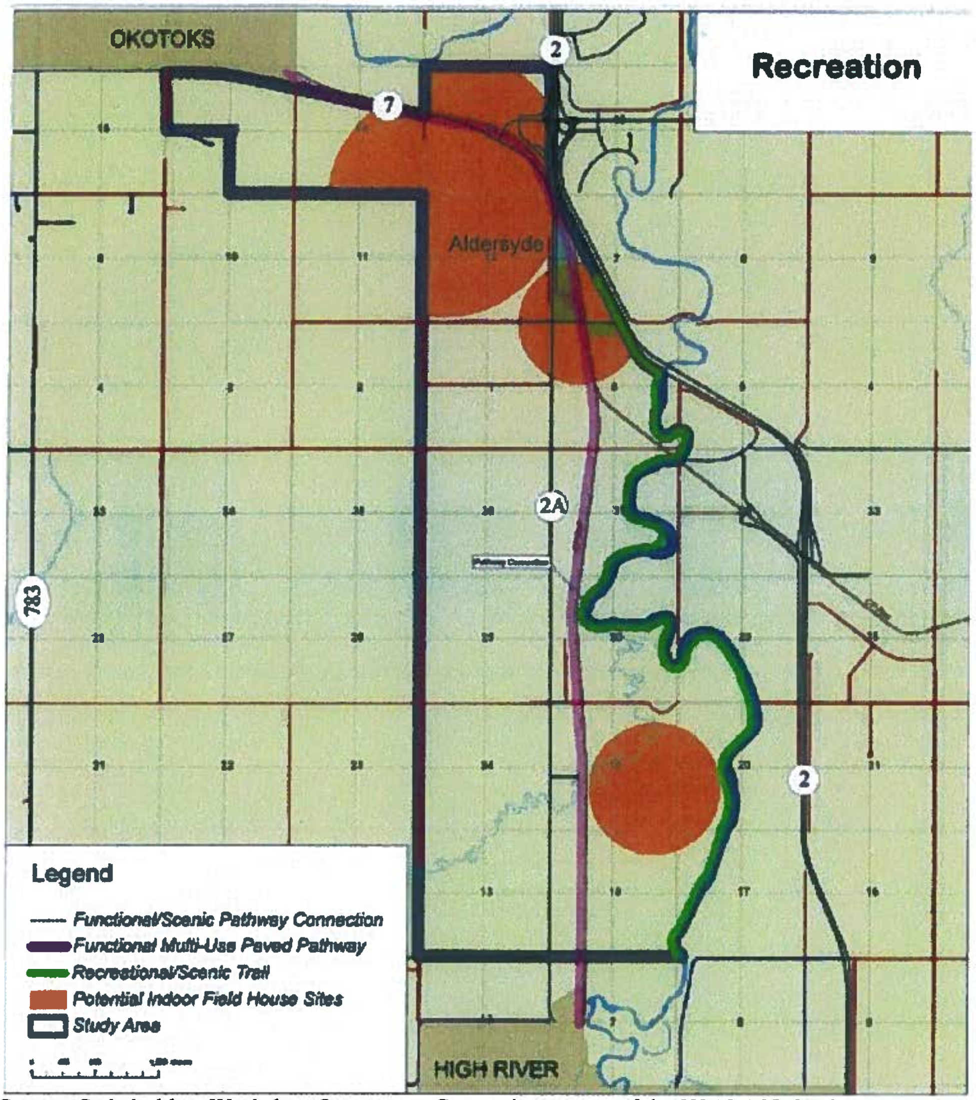
8.2 Proposed Network and Alignment

The Highway 2A Industrial ASP study identified two potential pathways.

1. The proposed Functional Multi-Use Paved pathway would run along the west of CPR's right-of-way and connect to the High River in the south and to Okotoks in the north.
2. The proposed Recreational/Scenic Trail pathway would run along the west side of the Highwood River.

Both proposed pathway alignments from the Highway 2A Industrial ASP are illustrated in **Exhibit 8-1**.

Based on discussions with MD staff the proposed Highwood River pathway has been deemed unfeasible due to safety concerns associated with animal crossings. Therefore, the CPR pathway or another alignment option paralleling Highway 2A are the preferred options.



Source: Stakeholders Workshop Outcomes – Recreation as part of the H2AI ASP Study

Exhibit 8-1: Highway 2A Industrial ASP Proposed Pathway Alignments

8.3 Pathway Cross Section

The *Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads 1999 Edition* and the *Technical Handbook of Bikeway Design 2nd Edition* were referenced to identify appropriate pathway cross sections (**Table 8-1**).

Table 8-1: Recommended Bike Path Cross Section Widths

Reference	Modes	Classification	Recommended Path Width (m)
TAC	Bicycle only	Two-way	2.5 – 3.5
	Bicycle and Pedestrian	Two-way shared	3.0 – 4.0
Technical Handbook of Bikeway Design 2nd Edition	Bicycle only (multi-use trail along active railway lines)	Two-way	3.0
	Bicycle only (bidirectional bikeways)	Two-way	3.0 plus 1.0 clearance on both sides

Pathway width also depends on the purpose and alignment, and the following should be considered:

- The pathway must accommodate two-way bicycle traffic; therefore, a minimum width of 2.5 metres is required. If the pathway will also accommodate pedestrians, additional width is required.
- Pathways located along rail right-of-ways allow for more free flow conditions with less interruption travel due to intersections.
- Pathways along rail lines, however, can be more remote and not as easily accessible for emergency vehicles.
- It is recommended that once the purpose and alignment for the future pathway is finalized, details associated with design be investigated in further detail.

9. CONCLUSIONS AND RECOMMENDATIONS

The following summarizes conclusions and recommendations identified from this study.

9.1 Recommendations for Future Model Maintenance

To maintain the ability to produce defendable forecasts the model should be updated and recalibrated at least every five years. The recalibration should be undertaken to adjust trip generation and travel distribution to new base years and take account of actual population and employment trends, as well as emerging trends in mode split between auto and transit alternatives.

At present, transit is not included in the model but at a future point it may be necessary to do so, in which case transit lines could be added to the same VISUM network used for road assignments.

The road network should be kept up to date and frequently checked to track new infrastructure improvements planned and implemented by the MD and other jurisdictions. As the traffic volume increases, it may be necessary to add additional roads not significant enough for inclusion at the moment, as well as newly-constructed roads.

Zone centroid connectors will probably have to be added, replaced, and reconfigured to adjust to changes in land use and infrastructure.

As land use density increases, it may be necessary to disaggregate or reconfigure the zone system, as was done for this model. It would help the model's accuracy if the MD were to collect data (such as with surveys) with the zone system in mind, in order to cut down on the assumptions necessary to distribute data into several zones.

The quality of transportation demand modelling forecasts is directly linked to the quality of the input data. It is recommended that the MD considers expanding its current data collection efforts to collect for:

- Periodic roadway travel volumes by direction of travel in 15-minutes intervals, capable to be summarized by peak hour or peak period.
- Roadway classification counts to distinguish between passenger car travels for personal use versus commercial travel (light-heavy trucks, buses, school buses, taxis, etc) undertaken prior to future model recalibration.
- If modal variations are to be considered, it would be useful to have information such as that provided by a vehicle occupancy count focused on recording number of occupants in a passenger car/van, number of occupants in a bus (transit, inter-city) and number of occupants in a school bus undertaken prior to future model recalibration.
- Origin-destination and household travel characteristic telephone interview survey of the MD population undertaken prior to future model recalibration.

- Employment surveys focused on travel patterns of employees and businesses undertaken prior to future model recalibration.

Items summarized in points 2 to 5 are often undertaken simultaneously by a group of municipalities to reduce costs and achieve greatest possible coverage of the area. The valuable information collected in periodic traffic count programs or surveys have found numerous applications not only in long term transportation planning but also in short range planning, operations and maintenance (pavement management), land use planning and the overall community planning.

9.2 Existing and Future Analysis

The following is concluded for the analysis:

- Based on the intersection operational analysis, all intersections analyzed for existing and future conditions are operating at a LOS of A and v/c ratio of 0.28 or lower for all horizon years.

Due to all intersections operating at acceptable levels, there are no recommendations for improvement for these intersections.

9.3 Road Classification

Based on results from the model and traffic analysis the following is concluded:

- The road network classifications summarized in **Exhibit 6-1** to **Exhibit 6-4** indicate requirements for the base and future conditions for the H2AIASP area.
- For roads outside the H2AIASP area, the road classifications required are summarized in **Exhibit 2-16** to **Exhibit 2-19**.

It is recommended the MD protect for the appropriate right-of-way as per the road classifications in **Exhibit 6-1** to **Exhibit 6-4** for the H2AIASP area and **Exhibit 2-16** to **Exhibit 2-19** for roads outside the H2AIASP area.

9.4 Functional Planning

The following is concluded:

- Design guidelines following AT standards were agreed upon and are summarized in **Table 7-2**.
- Typical cross sections follow the standards illustrated in **Exhibit 7-1** and **Exhibit 7-2** and typical intersection layout follow standards illustrated in **Exhibit 7-3**.
- Cost estimates were based on rates provided by the MD and summarized in **Table 7-3**.

The following is recommended:

- The roads be detailed designed as per the functional plans illustrated in **Appendix VII**.

9.5 Pathways

The following is concluded:

- Based on user safety, the recreational/scenic trail originally proposed in the Highway 2A Industrial ASP is no longer a consideration for the proposed pathway.
- The pathway alignment paralleling either the CPR tracks or Highway 2A are deemed more feasible options.
- The pathway must accommodate two-way bicycle traffic and therefore provide a minimum of 2.5 metres for two passing cyclists. If the pathway is proposed to accommodate other users such as pedestrians, a wider path will be required.

It is recommended that once the purpose and alignment for the future pathway is finalized, details associated with design be investigated in further detail.