6.2.7 FIVE YEAR (2021) POPULATION AND EMPLOYMENT

For the 2021 horizon year, a number of the above growth areas were considered. The Clairmont Heights area was given special consideration as it becomes established. The final population estimate used for the whole model area was 79,517 persons and 48,107 jobs based on a continued employment to population ratio of 0.61. See Figure 6-3 2021 Estimated Population and Employment on the next page.

6.2.8 TWENTY YEAR (2036) POPULATION AND EMPLOYMENT

The 2036 horizon year maintained the same growth rates in all areas of the County as was the case for 2021 with the exception of Clairmont Heights, which is again expected to be a major focus for future population growth. The final population growth estimates used for this horizon year for the entire area covered by the model were 93,760 persons and 57,245 jobs, which maintains the overall resulting average employment to population ratio of 0.61 jobs/persons. See Figure 6-4 2036 Estimated Population and Employment.

6.3 TRAFFIC FORECASTING

6.3.1 MODEL

A transportation demand model was considered necessary for this assignment to project traffic volumes for the 2021 and 2036 horizon years. By using such a model, the future projections take into account land use changes, such as population and employment, as well as road network changes, such as new roads or widened roads. The model was built using Emme software and using WSP's in house RAPID technique described further below.

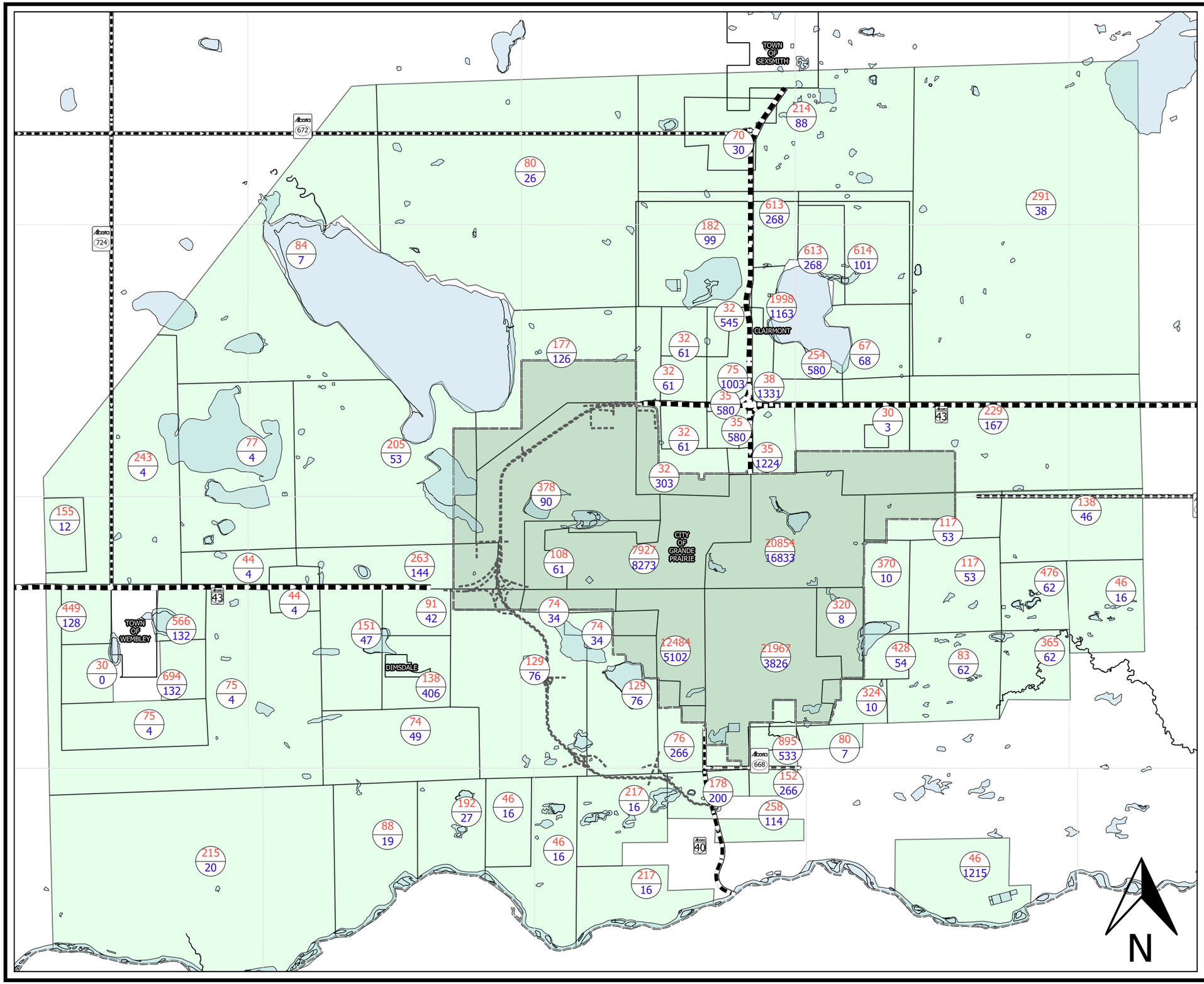
6.3.2 TRANSPORTATION NETWORK

The road network for the study area was initially taken from the previous Emme model developed for the County. The network was refined to take into account changes that have been made to the road network since that time. The network is made up of nodes, representing intersections and other points on the network such as road bends, and links connecting them. Links have characteristics such as number of lanes and speeds that represent the actual road system. There are also centroids which represent a zone or area of the County from which traffic enters and exits the network and these are connected to the network via centroid connectors. There is currently no transit network in the County of Grande Prairie, so there is no transit component to the model. It should be noted that while the City of Grande Prairie is included in the model, its network and zone system have been simplified as it is not part of the study area, yet it is surrounded by the County and cannot be ignored.

6.3.3 LAND USE

In order to model current traffic volumes as well as future volumes, the city was divided into traffic zones. The basis of these zones was the zone system in the previous model. A total of 74 zones internal to the county, along with 4 zones representing the City and 4 external zones were used. Land use used in the model consisted of population and employment. Future population and employment by zone were projected with details provided in the sections above. The number of trips to and from each zone is calculated based on the land use – population and employment – of each zone.

Figure 6-3 2021 Estimated Population and Employment



Legend

- Traffic Analysis Zones (TAZs)
- 2021_PopulationRnded
- 2021_EmploymentRnded

Provincial Road Network

- Highway - Primary
- Highway - Secondary
- Highway 43X Extension

Water bodies

- Lakes

Municipal_Boundaries

- City of Grande Prairie

County of Grande Prairie

Transportation Master Plan

showing

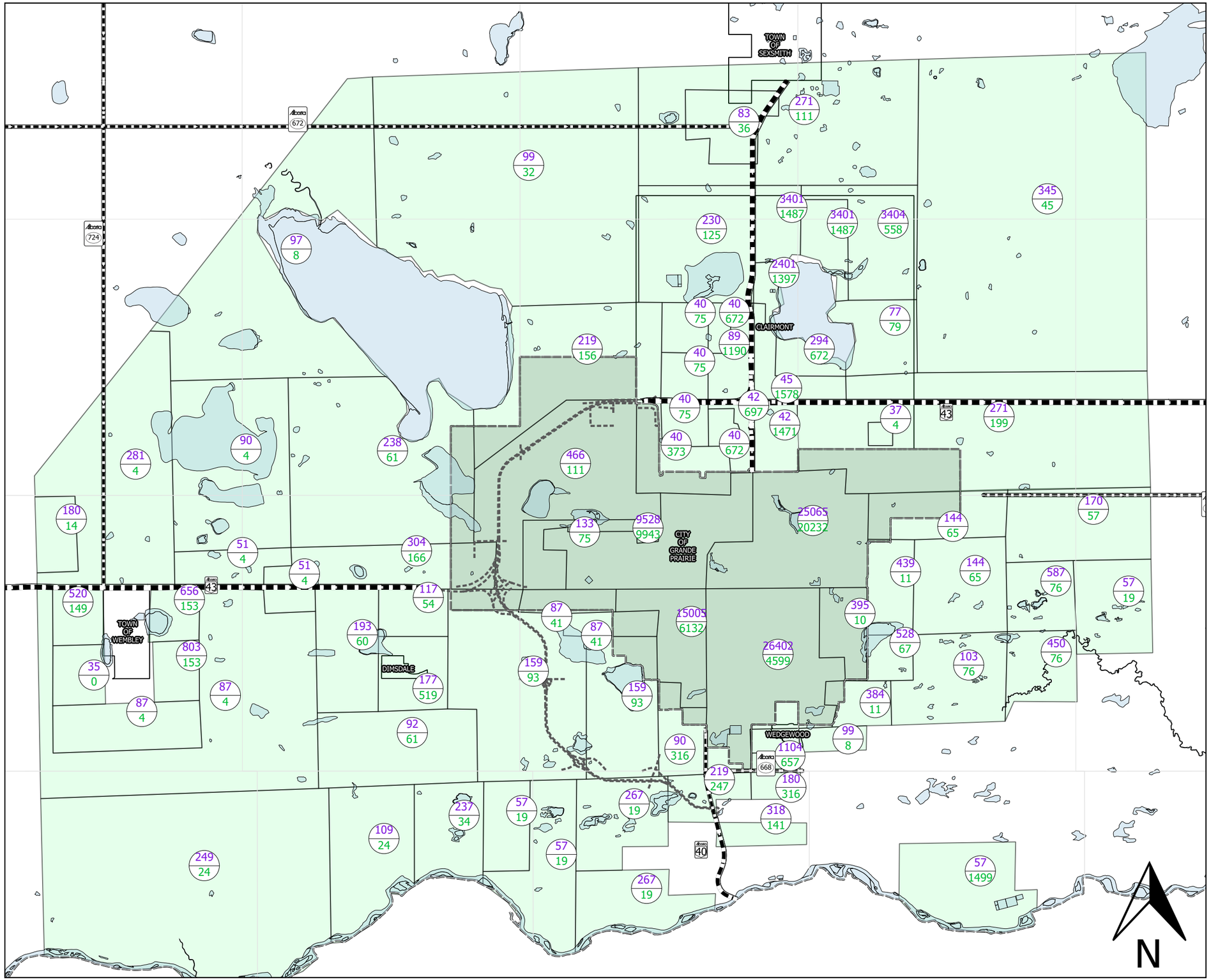
2021 Estimated Population and Employment by Traffic Analysis Zone (TAZ)

Scale 1:235,000

1.5 0 1.5 3 4.5 6 7.5 km

S200-2021pop&emp | C: Template11x17.qpt

Figure 6-4 2036 Estimated Population and Employment



County of Grande Prairie

Transportation Master Plan

showing

2036 Estimated Population and Employment by Traffic Analysis Zone (TAZ)

Scale 1:235,000

1.5 0 1.5 3 4.5 6 7.5 km

S300-2036pop&emp | C: Template11x17.qpt

6.3.4 TRAFFIC COUNTS AND EXTERNALS

Existing traffic volumes are key to calibrating the model. The model was built for the PM peak hour. As such traffic volumes in the weekday pm peak period were used to determine peak hour volumes on the various links in the County of Grande Prairie. Data from Alberta Transportation was used to determine the volumes on the approaches to the County along the main highways. This data was used in the calibration of the Emme model.

6.3.5 RAPID MODEL

WSP has developed a RAPID (Robust tool for Assessment, Prioritization, Implementation and Decision making) modeling methodology. This methodology was established for small to medium sized jurisdictions and is intended to be relatively transferable to be cost effective and efficient relative to building a new modeling procedure from scratch for every jurisdiction. The County of Grande Prairie was a suitable jurisdiction to model using this procedure.

6.3.6 VALIDATION

The County of Grande Prairie model validation component primarily focuses on the trip distribution and trip assignment components of the model, since the available data only allows for comparison to these two factors. The validation was conducted by comparing available traffic counts with corresponding modelled volumes, and reviewing results of comparison as a reasonableness check. The validation tests used in this study are adopted from “Travel Model Validation and Reasonableness Checking Manual”, second edition, prepared for the Federal Highway Administration (FHWA), 2010. A detailed description of the model validation process is included in Appendix A.

6.4 2021 TRAFFIC FORECAST

The calibrated model along with projected future land use and external traffic growth was used to project future traffic volumes on the existing road network. Using these volumes, locations of interest were established by looking at the volume to capacity ratios of the various links.

Table 6-1 Summary of Deteriorated Roadway Links in 2021 shows the roadway links with volume to capacity (v/c) ratios exceeding 0.70 for the 2021 horizon year. According to the v/c ratios resulting from the demand model, some level of congestion is expected on the listed links that may need some consideration to maintain good operating conditions. The links with high v/c ratios include Township Road 710 west of Highway 40, Township Road 712 north and west of Flyingshot Lake, Township Road 712 east of Range Road 55, Township 714 east of Range Road 55, and Range Road 63 north of the City of Grande Prairie limits. As it can be seen, the congestion is mostly anticipated on the sections of these roadways that are in the vicinity of the City of Grande Prairie.

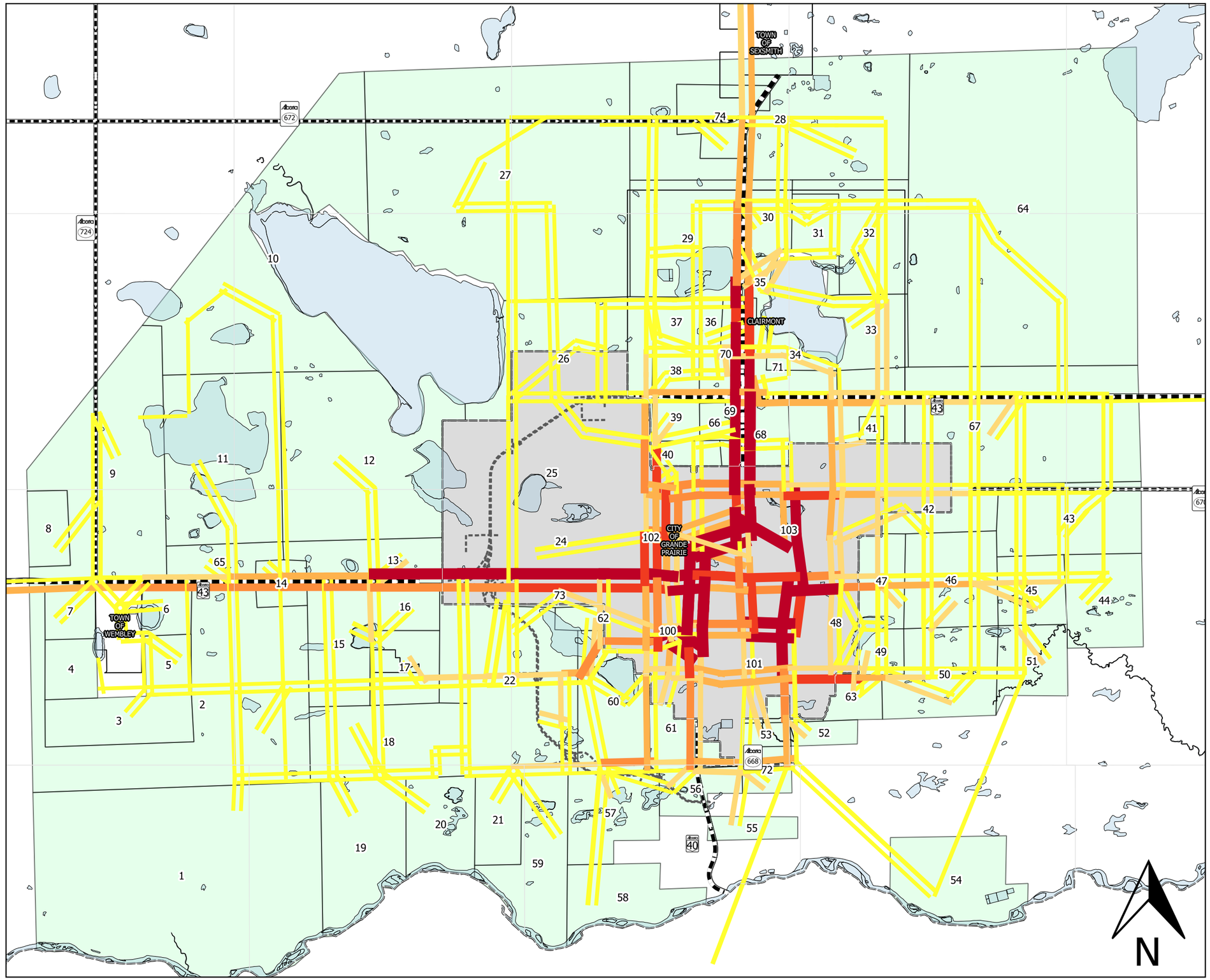
Table 6-1 Summary of Deteriorated Roadway Links in 2021

ROADWAY	SECTION	DIRECTION	V/C RATIO
TWP 710	RR 63 to RR 64	WB	1.17
TWP 712	RR 63 to RR 64	WB	1.28
TWP 712	RR 64 to RR 65	WB	0.91
TWP 712	RR 54 to RR 55	EB	1.47
TWP 714	RR 53 to RR 54	EB	0.78
TWP 714	RR 54 to RR 55	EB	1.19
RR 63	TWP 722 to City Limits	NB	0.98
RR 63	TWP 722 to City Limits	SB	0.71

Source: WSP Transportation Planning

Figure 6-5 2021 Traffic Volumes shows the estimated 2021 traffic volumes and Figure 6-6 2021 Traffic Operations shows the associated traffic operations in 2021.

Figure 6-5 2021 Traffic Volumes



Legend

- Traffic Analysis Zones

2016 PM Peak Volumes by Segment and Direction

- 1 - 200
- 200 - 400
- 400 - 600
- 600 - 800
- 800 - 1000
- >1000

Provincial Road Network

- Highway - Primary
- Highway - Secondary
- Highway 43X Extension

Municipal Boundaries

- City of Grande Prairie

Water bodies

- Lakes

County of Grande Prairie

Transportation Master Plan

showing

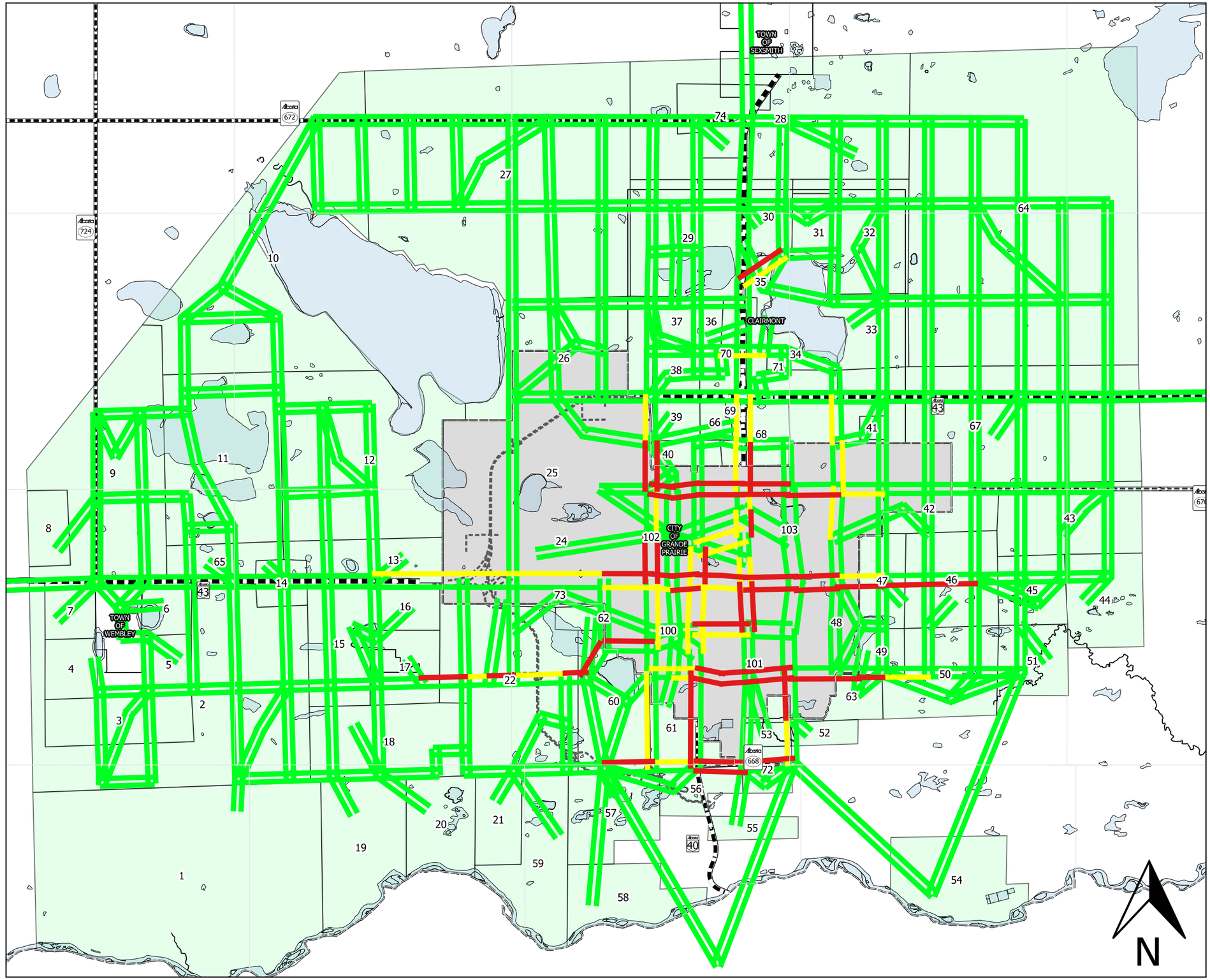
2021 PM Peak Volumes by Segment and Direction

Scale 1:235,000

1.5 0 1.5 3 4.5 6 7.5 km

S200-2021PM_enlargedsscale | C: Template11x17.qpt

Figure 6-6 2021 Traffic Operations



Legend

- Traffic Analysis Zones

VCR

- 0.00 - 0.40
- 0.40 - 0.60
- 0.60 - 1.50

Provincial Road Network

- Highway - Primary
- Highway - Secondary
- Highway 43X Extension

Municipal Boundaries

- City of Grande Prairie

Water bodies

- Lakes

County of Grande Prairie

Transportation Master Plan

showing

2021 PM Peak Estimated Volume to Capacity (v/c) Ratio

Scale 1:235,000

1.5 0 1.5 3 4.5 6 7.5 km

S200-2026PM_VCR_enlargedscale | C: Template11x17.qpt

6.5 2036 TRAFFIC FORECAST

The calibrated model along with projected future land use and external traffic growth was used to project future traffic volumes on the existing road network. Using these volumes, locations of interest were established by looking at the volume to capacity ratios of the various links.

Table 6-2 Summary of Deteriorated Roadway Links in 2036 shows the roadway links with volume to capacity ratios exceeding 0.70 for the 2036 horizon year. According to the v/c ratios resulting from the demand model, some level of congestion is expected on the listed links that might need some consideration to maintain good operating conditions. The links with high v/c ratios include Township Road 710 west of Highway 40, Township Road 712 north and west of Flyingshot Lake, Township Road 712 east of Range Road 55, Township Road 714 east of Range Road 55, and Range Road 63 north of the City of Grande Prairie limits. Some level of congestion is also expected on some small sections of the township roads north of the City of Grande Prairie such as Township Road 724 and Township Road 730. As it can be seen, the congestion is mostly anticipated on the sections of these roadways that are in the vicinity of the City of Grande Prairie.

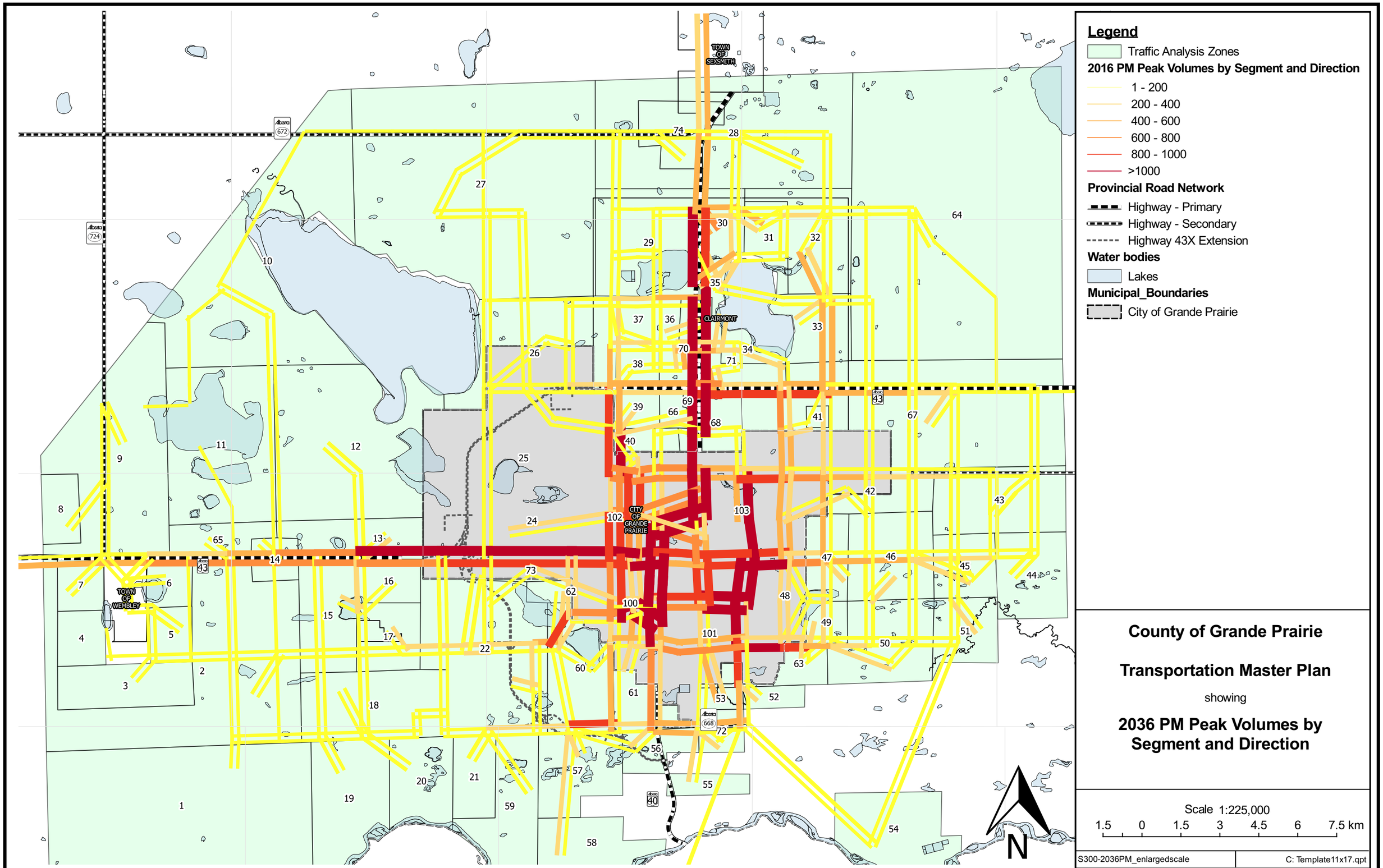
Table 6-2 Summary of Deteriorated Roadway Links in 2036

ROADWAY	SECTION	DIRECTION	V/C RATIO
TWP 710	RR 63 to RR 64	WB	1.36
TWP 712	RR 54 to RR 55	EB	1.61
TWP 712	RR 63 to RR 64	WB	1.38
TWP 712	RR 64 to RR 65	WB	0.93
TWP 714	RR 53 to RR 54	EB	1.31
TWP 714	RR 54 to RR 55	EB	1.31
TWP 714	RR 53 to RR 52	EB	0.70
TWP 724	RR 61 to RR 62	WB	0.74
TWP 730	RR 60 to RR 61	WB	0.71
RR 63	TWP 722 to City Limits	NB	1.31
RR 63	TWP 722 to City Limits	SB	0.97
RR 63	TWP 722 to TWP 722	SB	0.89

Source: WSP Transportation Planning

Figure 6-7 2036 Traffic Volumes shows the estimated 2036 traffic volumes, and Figure 6-8 2036 Traffic Operations has the associated 2036 estimated traffic operations.

Figure 6-7 2036 Traffic Volumes



County of Grande Prairie

Transportation Master Plan

showing

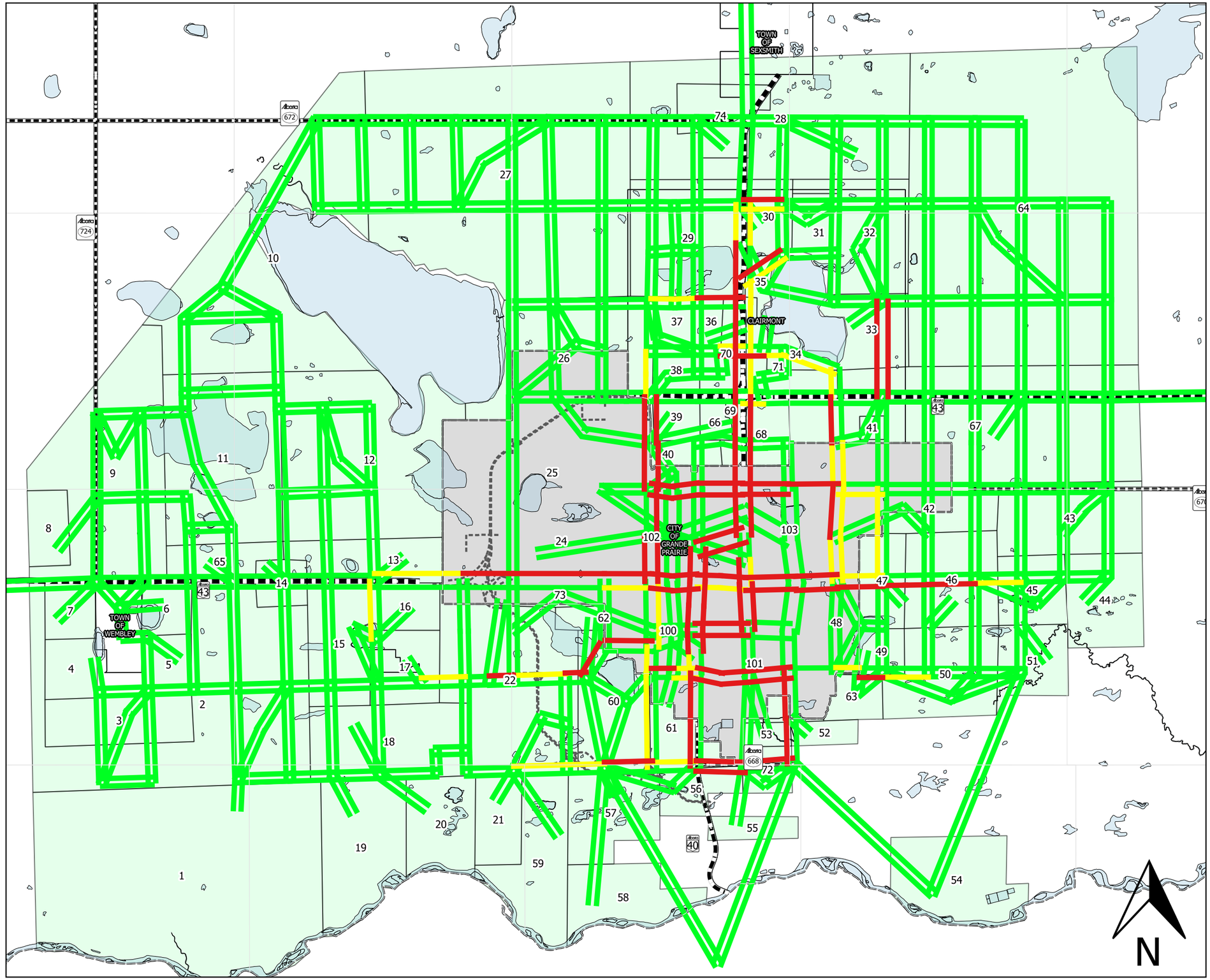
2036 PM Peak Volumes by Segment and Direction

Scale 1:225,000

1.5 0 1.5 3 4.5 6 7.5 km

S300-2036PM_enlargedscale | C: Template11x17.qpt

Figure 6-8 2036 Traffic Operations



Legend

- Traffic Analysis Zones

VCR

- 0.00 - 0.40
- 0.40 - 0.60
- 0.60 - 1.50

Provincial Road Network

- Highway - Primary
- Highway - Secondary
- Highway 43X Extension

Municipal Boundaries

- City of Grande Prairie

Water bodies

- Lakes

County of Grande Prairie

Transportation Master Plan

showing

2036 PM Peak Estimated Volume to Capacity (v/c) Ratio

Scale 1:235,000

1.5 0 1.5 3 4.5 6 7.5 km

S300-2031PM_VCR_enlargedscale | C: Template11x17.qpt

7 HOW WILL WE GET THERE?

7.1 APPROACH

This section identifies several strategic actions to help the County achieve the objectives of this study and continue developing a roadway network to serve the needs. This includes:

- → Redefining the roadway classifications to better meet the evolving needs of the County
- → Identifying the County roadways that will need investment to serve the projected transportation demand

7.2 ROADWAY CLASSIFICATIONS

Identifying and defining a hierarchy of roadway classifications is an integral part of transportation master planning. It allows the clear identification of the future roadway network and how people and goods will be able to move around, into, and out of the County. A network map that shows all future roads, their classification or purpose and associated design standards, and how people and goods can move around and access developed areas, is a key municipal tool facilitating industrial and economic development, labour mobility, and community and social development. **It is highly important that this is developed, communicated clearly to all interested parties, and enforced or amended by Council as and when required.**

Furthermore, **this TMP provides the direction for all other County transportation planning and design guidelines and as such all other documents must be consistent with the TMP direction e.g. engineering design standards / guidelines.**

This hierarchy of roadway classifications must also work with and support the provincial highway network that exists within the County's boundaries. The network of provincial highways in the County is considered to be the base of the transportation system which primarily moves people and goods quickly around the County and into and out of adjacent municipal jurisdictions and across the British Columbia border. The provincial highway network is typically served by higher speed highway facilities on which people and goods can move quickly between developed areas. The provincial highway network does not cover all developed areas within the County geographic area however and therefore the County must build, operate, and maintain its own network serving its citizens, communities, and economy. Considering a County owned network means acknowledgement of some of the key differences between the rural network and the urban network. **The rural and urban areas have different needs and require some differences in their hierarchy of roadway classifications definitions.**

This TMP sets the direction for the hierarchy of County roadways, and all other associated County publications, as they relate to the transportation system, shall be consistent with this hierarchy. This includes for example the Minimum Design Standards roadways section. This policy direction must translate into design standards and allow clarity of County expectations. The Minimum Design Standards must be reviewed in consideration of this TMP direction, and the Minimum Design Standards must be made consistent with this TMP as appropriate.

7.2.1 RURAL ROADWAYS

7.2.1.1 PRIMARY ROADWAYS

Primary Roadways are largely defined by providing regional connectivity where the provincial system does not, or where the provincial system can be augmented to serve the County's interests. All developed areas are within a reasonable distance to a Primary Roadway. Primary Roadways are the highest design standard roadway, other than the provincial highways, and they serve to move people and goods at higher speeds. Road rights-of-way for Primary Roadways are, or will be, typically the largest of the County roads. Posted speeds typically range from 80 – 100 km/h, but this shall be the subject of the Minimum Design Standards.

Development / land access directly from a Primary Roadway is discouraged, as that is not the intended function of the roadway. The intended function is to move people and goods at higher speeds between Developed Areas. Some access can be considered for larger commercial or industrial operations, but the number and location of accesses should be limited and intersection design should be of an appropriate standard providing vehicular capacity and due consideration for roadway safety.

Primary Roadways are also typically geographically spaced widely, as they are also the highest cost roadway to build, operate, maintain, and rehabilitate.

The existing County Minimum Design Standards does not have an existing rural Primary Roadway classification.

Figure 7-1 Example of a Rural Primary Roadway - Range Road 63

Source: Google Earth

7.2.1.2 SECONDARY ROADWAYS

Secondary Roadways exist to distribute traffic from the Primary Roadways, and collect traffic from Tertiary Roadways. Secondary Roadways can exist to serve the movement of industrial traffic where people movement is lower. They use a medium design standard, relative to Primary and Tertiary Roadways, and have a typical posted speed of 70 – 90 km/h.

Development / land access directly from a Secondary Roadway is permitted.

The County Minimum Design Standards have two existing rural Secondary Roadway classifications – Residential Collector and Industrial Collector. The two classifications are largely the same, with the exception of some small differences in roadway surface width and maximum gradients.

Figure 7-2 Example of a Rural Secondary Roadway - Range Road 92 South of Huallen

Source: Google Earth

7.2.1.3 TERTIARY ROADWAYS

Tertiary Roadways primarily provide access to development / land, from Secondary or Primary Roadways. They service lower volume corridors but where connectivity is still necessary. They are low to medium speed environments, as the purpose is accessing development / land primarily and moving to some extent. Cross sections are typically one lane in each direction, and intersections are often stop controlled only, not signalized.

The County Minimum Design Standards has two existing rural Tertiary Roadway classifications – Residential Local and Commercial Industrial Local. The two classifications are largely the same, with the exception of some small differences in roadway surface width and maximum gradients.

7.2.2 URBAN ROADWAYS

Urban roadways are defined in the Minimum Design Standards and the information therein reflects industry best practices of a roadway hierarchy of classifications for small urban areas. The urban classifications define roadway types that are oriented to an urban environment with more competing demands and design constraints than compared with a typical rural environment. This is reflected in such design elements as smaller minimum radii of curvature, and design speeds. A few excerpts of the Minimum Design Standards are below.

7.2.2.1 PRIMARY ROADWAYS

Primary Roadways are called Urban Arterials within urban areas, and the County has two types – Undivided and Divided.

An arterial road is a high capacity road designed to move traffic from collector roads to higher order roads such as freeways, expressways, or provincial highways and between urban centres at the highest level of service possible. Access to adjacent properties is controlled on arterial roads in order to move traffic with minimal interruptions over longer distances. Parking is not permitted on arterial roads (excerpt from the Minimum Design Standards).

7.2.2.2 SECONDARY ROADWAYS

Secondary Roadways are called Collectors, and the County has two types – Majors and Minors.

A Collector Road collects traffic from Local Roads and feeds it to Arterial Roads such as County grid roads or provincial highways, or distributes the traffic from arterial roads to local roads. The “collector road” classification is also applicable to subdivision roads that provide access through the subdivision and that provide access to two or more subdivisions. In addition to the movement of traffic, collector roads also provide access to adjacent properties (excerpt from the Minimum Design Standards).

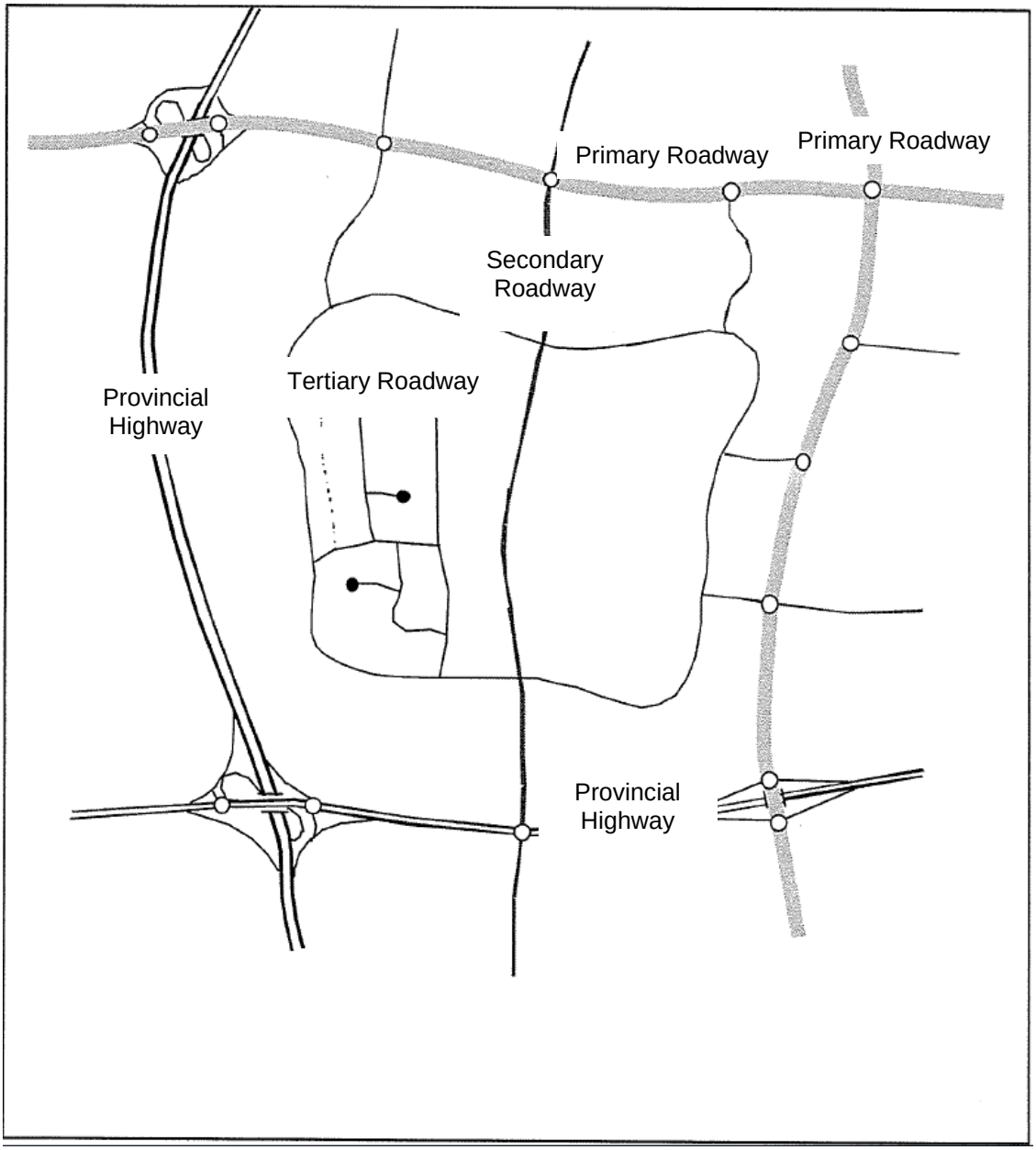
7.2.2.3 TERTIARY ROADWAYS

Tertiary Roadways are called Local Roads in the Minimum Design Standards.

A local road is an internal subdivision road whose primary purpose is to provide property access. In addition to providing access, local roads connect lanes and other local roads to collector roads (excerpt from the Minimum Design Standards).

The Figure 7-3 Typical Hierarchy of Roadway Classifications is an excerpt from the Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads. It shows a typical hierarchy of roadway classifications, and how the different classifications interact.

Figure 7-3 Typical Hierarchy of Roadway Classifications

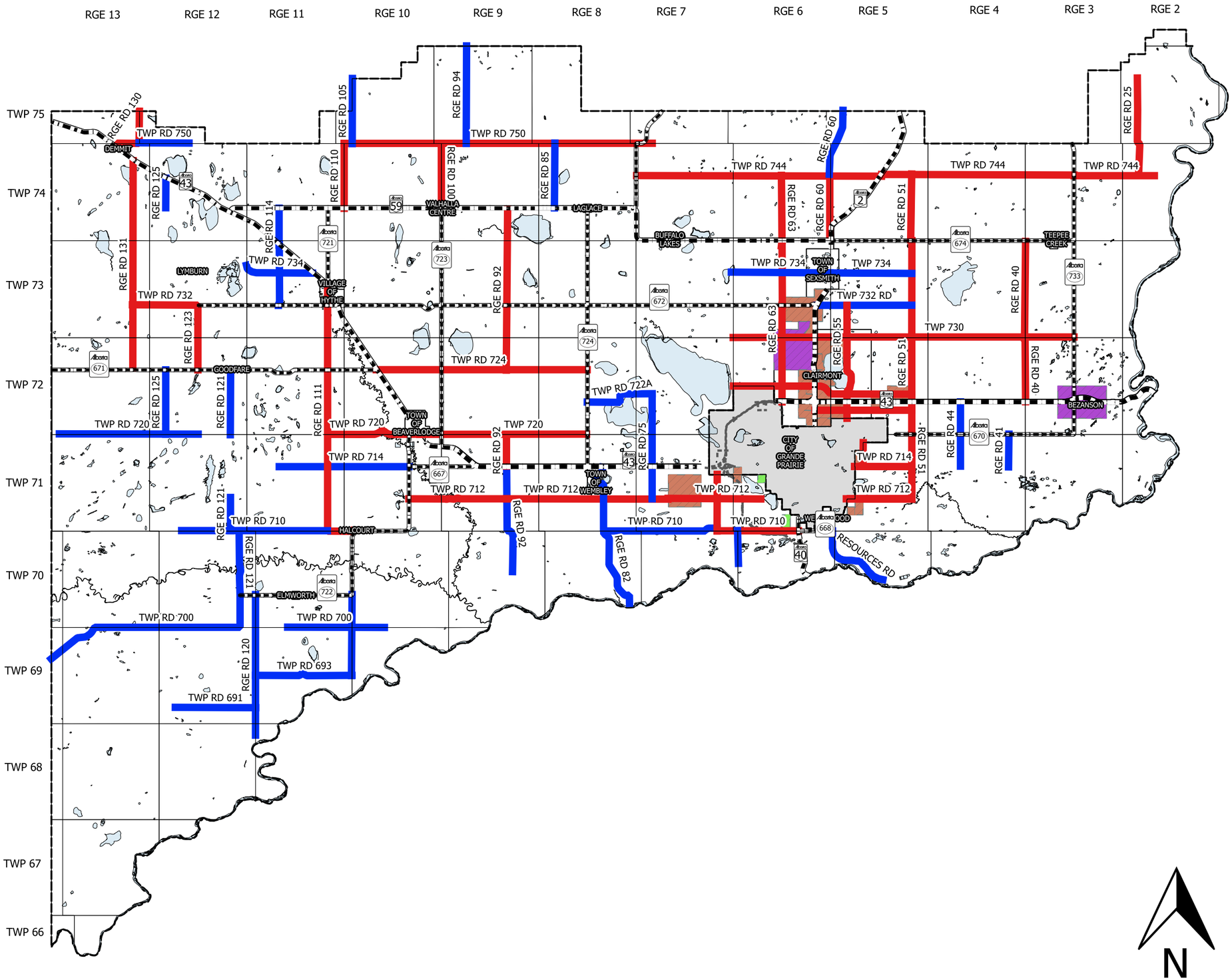


Source: Transportation Association of Canada

7.3 LONG TERM ROADWAY NETWORK

Figure 7-4 Roadway Network shows the future roadway network with the Primary and Secondary Roadways. This figure shows the future roadway network with the above hierarchy of roadway classifications applied. As it is the future network, many of the key corridors identified may not currently represent Primary or Secondary roadway design in reality. If development occurs as planned in the Municipal Development Plan, and the local economy and community continue to grow, this future roadway network will prepare the County with a quality transportation network.

Figure 7-4 Proposed Roadway Network



Legend

Proposed Network Hierarchy

- Primary
- Secondary

Provincial Road Network

- Highway - Primary
- Highway - Secondary
- Highway 43X Extension

Area Structure Plans

- Adopted
- Pending
- Proposed

Water bodies

- Lakes

N

County of Grande Prairie

Transportation Master Plan

showing

Proposed Road Hierarchy of Primary and Secondary Roadways

Scale 1:700,000

4 0 4 8 12 16 20 km

T: 2016RoadNetworkProposedHierarchy | C: Template11x17.qpt

7.4 FUTURE TRANSPORTATION SYSTEM INVESTMENTS

Future traffic volumes along major roadways within the County of Grande Prairie were estimated using the calibrated model along with projected future land use and external traffic growth. Future traffic operations for the 2021 and 2036 horizon years have been estimated and measured through volume to capacity ratios (v/c) on major roadways within the County of Grande Prairie.

Volume to capacity ratios are a common way to describe the operation, or estimated operation, of a roadway. A volume to capacity ratio near 0 represents a free flowing roadway, and a volume to capacity ratio near 1 represents a congested roadway with associated travel delay. Most jurisdictions aim to keep volume to capacity ratios between 0 and 0.9, and may begin to plan investments to reduce congestion, or otherwise improve the transportation system, at volume to capacity ratios of between 0.7 and 0.9.

Table 7-1 and Table 7-2 show the roadway links with volume to capacity ratios exceeding 0.70 for the 2021 and 2036 horizon years, respectively. The links listed in the tables are expected to operate with higher volume to capacity ratios and require some consideration to maintain good operating conditions on these roadways at the estimated timelines.

Table 7-1 Summary of Deteriorated Roadway Links in 2021

ROADWAY	SECTION	DIRECTION	V/C RATIO
TWP 710	RR 63 to RR 64	WB	1.17
TWP 712	RR 63 to RR 64	WB	1.28
TWP 712	RR 64 to RR 65	WB	0.91
TWP 712	RR 54 to RR 55	EB	1.47
TWP 714	RR 53 to RR 54	EB	0.78
TWP 714	RR 54 to RR 55	EB	1.19
RR 63	TWP 721 to City Limits	NB	0.98
RR 63	TWP 721 to City Limits	SB	0.71

Source: WSP Transportation Planning

Table 7-2 Summary of Deteriorated Roadway Links in 2036

ROADWAY	SECTION	DIRECTION	V/C RATIO
TWP 710	RR 63 to RR 64	WB	1.36
TWP 712	RR 54 to RR 55	EB	1.61
TWP 712	RR 63 to RR 64	WB	1.38
TWP 712	RR 64 to RR 65	WB	0.93
TWP 714	RR 53 to RR 54	EB	1.31
TWP 714	RR 54 to RR 55	EB	1.31
TWP 714	RR 53 to RR 52	EB	0.70
TWP 724	RR 61 to RR 62	WB	0.74
TWP 730	RR 60 to RR 61	WB	0.71
RR 63	TWP 721 to City Limits	NB	1.31
RR 63	TWP 721 to City Limits	SB	0.97
RR 63	TWP 721 to TWP 722	SB	0.89

Source: WSP Transportation Planning

According to the volume to capacity ratios summarized in the above tables some level of congestion is expected along sections of some of the major roadways that provide east-west or north-south connections within the County of Grande Prairie including Township Road 710 west of Highway 40, Township Road 712 north and west of Flyingshot Lake, Township Road 712 east of Range Road 55, Township Road 714 east of Range Road 55, and Range Road 63 north of the City of Grande Prairie limits for both the 2021 and 2036 horizon years. As it can be seen, the congestion is mostly anticipated on the sections of these roadways that are in the vicinity of the City of Grande Prairie. The rest of the County, in the modelled area, is not expected to have any congestion of significance as estimated in the demand model prepared in this TMP.

- **Township Road 714** is one of the major roadways that provides an east-west connection and is owned by the County. This roadway has a two-lane cross section with a posted speed limit of 80 km/h. The roadway has no shoulders and the pavement condition is poor. Township Road 714 passes through the City of Grande Prairie and is known as 100 Avenue. It connects to Highway 43 on the west side of the City of Grande Prairie, and also provides a connection to Highway 40. Most of the intersections along Township Road 714 are simple, unsignalized intersections which are controlled with two-way stop signs that give the priority to Township Road 714. The only intersection that is controlled with four-way stop signs is the intersection of Township Road 714 and Range Road 51. Township Road 714 is a paved roadway in the section between Highway 40 and Range Road 51.

  Based on the demand model the maximum daily traffic volume on Township Road 714, which is expected to be observed east of Range Road 55, is approximately 10,000 vpd (vehicles per day) by the 2021 horizon year and 11,000 vpd by the 2036 horizon year. To accommodate the future traffic volumes on this roadway in the section east of the City up to Range Road 51, it is recommended to provide paved shoulders, upgrade the pavement conditions and upgrade other design standards to make the road characteristics consistent with its designation as a Primary Roadway in the above long term roadway network map.

- **Township Road 712** runs in the east-west direction and passes through the City of Grande Prairie where it is known as 68 Avenue. Outside of the City of Grande Prairie limits, Township Road 712 has a two-lane cross section with paved shoulders. The posted speed limit on this roadway is 70 km/h from City limits to RR 54 and then it increases to 80 km/h. This roadway is paved up to Range Road 51 to the east and up to the Hamlet of Dimsdale to the west with good

existing pavement conditions. Almost all intersections along Township Road 712 are simple, unsignalized intersections which are controlled with two-way stop signs that give the priority to Township Road 712. This roadway provides a connection to Highway 40 within the City of Grande Prairie limits.

Based on the demand model the maximum daily traffic volumes on Township Road 712 are expected to be observed east of Range Road 55 and west of Range Road 63. East of Range Road 55 the maximum daily traffic volumes along Township Road 712 is expected to be 10,500 vpd (vehicles per day) and 12,500 vpd by the 2021 and 2036 horizon years, respectively. West of Range Road 63 the maximum daily traffic volumes along Township Road 712 is expected to be 9,500 vpd and 10,500 vpd by the 2021 and 2036 horizon years, respectively. To accommodate the future traffic volumes on this roadway, it is recommended to upgrade the roadway design standards on Township Road 712 on the east section up to RR 51 and on the west section up to the Hamlet of Dimsdale, and make it consistent with its designation as a Primary Roadway in the above long term roadway network map.

- **Township Road 710** is located south of the City of Grande Prairie, outside of the City of Grande Prairie limits. This roadway also provides an east-west connection and connects to Highway 668 and Highway 40 on the east. Township Road 710 has a two-lane cross section with a posted speed limit of 80 km/h. This roadway is paved to the west up to Range Road 73 and is gravel afterwards. Most of the intersections along Township Road 710 are simple, unsignalized intersections which are controlled with two-way stop signs that give the priority to Township Road 710.

  Based on the demand model the maximum daily traffic volume on Township Road 710, which is expected to be observed west of RR 63, is approximately 8,000 vpd by the 2021 horizon year and 9,500 vpd by the 2036 horizon year. To accommodate the future traffic volumes on this roadway, it is recommended to provide paved shoulders, upgrade the pavement conditions and upgrade other design standards to make the road characteristics consistent with its designation as a Primary Roadway in the section between Range Road 63 and Range Road 71. It is also recommended to upgrade this Township Road to its designation as a Secondary Roadway in the section between Range Road 71 and Range Road 82.

- **Range Road 63** is one of the major roadways that provides a north-south connection and is owned by the County of Grande Prairie. Range Road 63 is located on the west side of Highway 40 and Highway 2 and intersects with Highway 43, Highway 43X, Highway 672 and Highway 674. This roadway also runs through the City of Grande Prairie and is known as 116 Street. Outside the City of Grande Prairie limits, Range Road 63 has a two-lane cross section with a posted speed limit of 80 km/h. The roadway has paved shoulders with very good pavement conditions. Range Road 63 is paved to the south up to Township Road 710 and to the north up to Highway 672.

  One of the major intersections along Range Road 63 is at Highway 43X. This intersection is a two-way stop controlled intersection which gives the priority to Highway 43X. There is a channelized right turn on the south approach of this intersection and separate left turning lanes on both the south and the north approaches. The Province of Alberta is planning the implementation of a roundabout at this intersection to improve the traffic control conditions. Another major intersection along Range Road 63 is at Highway 672. This intersection is a two-way stop controlled intersection with the priority for Highway 672. There is a channelized right turn on the west approach of this intersection. The last major intersection along Range Road 63 is at Highway 674. Other intersections along Range Road 63 are simple, unsignalized intersections which are controlled with two-way stop signs that give the priority to Range Road 63.

  Based on the demand model the maximum daily traffic volume on Range Road 63, which is expected to be observed south of Highway 43X, is approximately 8,000 vpd by the 2021 horizon

year and 13,000 vpd by the 2036 horizon year. To accommodate the future traffic volumes on this roadway, it is recommended to review this corridor and ensure all geometric design and traffic control elements are consistent with the Primary Roadway classification. Range Road 63 should provide four lanes for through traffic (two lanes in each direction) at or before the year 2036.

To improve operating conditions, to support ongoing land development, and to accommodate the future traffic volumes on the mentioned links, it is recommended to improve the roadways and to make all geometric design and traffic control devices consistent with the classification of the roadway recommended in this TMP.

It should be noted that, according to the demand model the future traffic volume on Township Road 712, located north and west of Flyingshot Lake, is relatively high and some congestion is expected in that area. This section of Township Road 712 has a lower speed limit, 50 km/h, with several horizontal curves. It is recommended that traffic volumes and traffic operations in this area be monitored in the future to determine if and when any improvements are required.

7.5 GOODS MOVEMENT NETWORK

The goods movement network is not anticipated to change at this time, relative to the existing. See the summary in the Where Are We Now section of this report.

7.6 PROPOSED CAPITAL INVESTMENTS AND RECOMMENDATIONS SUMMARY

This section serves to summarize several of the report elements into a brief summary of areas of capital investment and other recommendations. For further information, see the above sections – Roadway Classifications, Long Term Roadway Network, and Future Transportation System Investments. The investment recommendations are based on both the demand model work and the network planning for the entire County area. This TMP makes several capital recommendations, and further study is required to fully define the transportation corridors and infrastructure elements of investment.

- Demand model based capital investments – roadways and facilities with estimated long term higher traffic volumes
  - Township Road 714 (east of City limits) – review the corridor and upgrade all geometric design and traffic control devices to a Primary Roadway.
  - Township Road 712 – review the corridor and upgrade all geometric design and traffic control devices to a Primary Roadway.
  - Township Road 710 – review the corridor and upgrade all geometric design and traffic control devices to a Primary Roadway, and Secondary Roadway as shown on the roadway network map.
  - Range Road 63 – review and upgrade corridor to a Primary Roadway four lane capacity condition before the year 2036.
- Network connectivity based capital investments – roadways and facilities providing regional and community connectivity
  - Prioritize this group of roadways for capital investment, in consideration of the existing capital plan, based on a multi-criteria approach including such criteria as existing pavement and structural condition, design consistency with TMP roadway functional classification, traffic volumes, collision history, community advantages and impacts etc.
- Begin a collision data collection program working with the police for collisions on County owned roadways. Collect as much information as possible on the reason for the collision to help inform the planning and design of potential solutions as warranted.
- Review the Minimum Design Standards in consideration of the functional roadway classifications and roadway network established in this TMP. Ensure the Minimum Design Standards follow the policy direction of the TMP, and the Minimum Design Standards provide the necessary information to allow the detailed design of roadways, intersections, and associated facilities. The Minimum Design Standards should maintain consistency of design principles with the new 2017 Transportation Association of Canada guidelines and Alberta Transportation guidelines.
- Review the off-site levies bylaw in consideration of the functional roadway classification and roadway network established in this TMP adding clarity to the bylaw and strengthening this source of municipal revenue.
- Require, under the direction of the development authority, subdivision and development permit applicants to submit a supporting transportation impact assessment (TIA) with the application. TIAs should cover private vehicles and the movement of larger vehicles for the delivery of goods. Follow the Alberta Transportation Traffic Impact Assessment Guideline on the Alberta Transportation website. Under the direction of the development authority, require applicants to invest in infrastructure upgrades, consistent with the TIA, as part of the subdivision and development approval process.

Appendix A

MODEL VALIDATION

VALIDATION

The County of Grande Prairie model validation component primarily focuses on the trip distribution and trip assignment components of the model, since the available data only allows for comparison to these two factors. The validation was conducted by comparing available traffic counts with corresponding modelled volumes, and reviewing results of comparison as a reasonableness check. The validation tests used in this study are adopted from “Travel Model Validation and Reasonableness Checking Manual”, second edition, prepared for the Federal Highway Administration (FHWA), 2010.

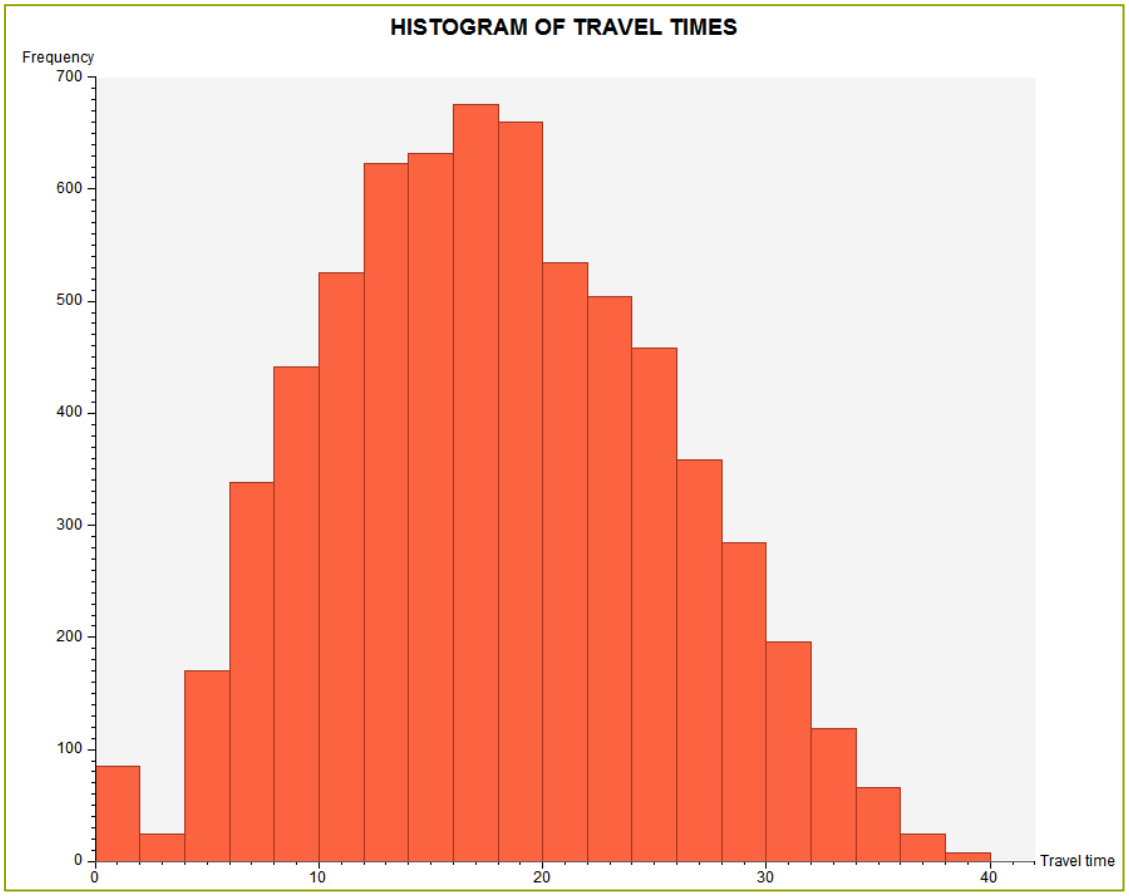
TRIP DISTRIBUTION

Trip distribution is the process used to determine the number of produced trips from each zone that will be attracted by each zone. A gravity model with a generalized cost function is used in the trip distribution component of the County of Grande Prairie model. The main ingredient of the generalized cost function is the travel time obtained between each pair of zones.

Figure 7-5 Travel Time Distribution shows the distribution of travel time for the base year of 2016. Overall 6,724 possible zone pairs are available and the average travel time is found to be 17.9 minutes. From Figure 7-5 Travel Time Distribution, it is shown that 82 measurements have a zero value of travel time. A zero value of travel time corresponds to the intra-zonal trips that are included in the calculation of average travel time (i.e. from zone 1 to zone 1). At the same time intra-zonal trips are not assigned to the network. The exclusion of the intra-zonal measurements from the travel time sample brings the average travel time value to 18.1 minutes.

Additionally, Figure 7-5 Travel Time Distribution shows that travel time distribution contains a small number of short trips, followed by a larger proportion of medium-length trips and the number of trips is dropping with very long trips. The distribution of the travel time, used in the generalized cost function, makes the gravity model suitable for the application for the County of Grande Prairie model.

Figure 7-5 Travel Time Distribution



Source: WSP Transportation Planning

TRAFFIC ASSIGNMENT

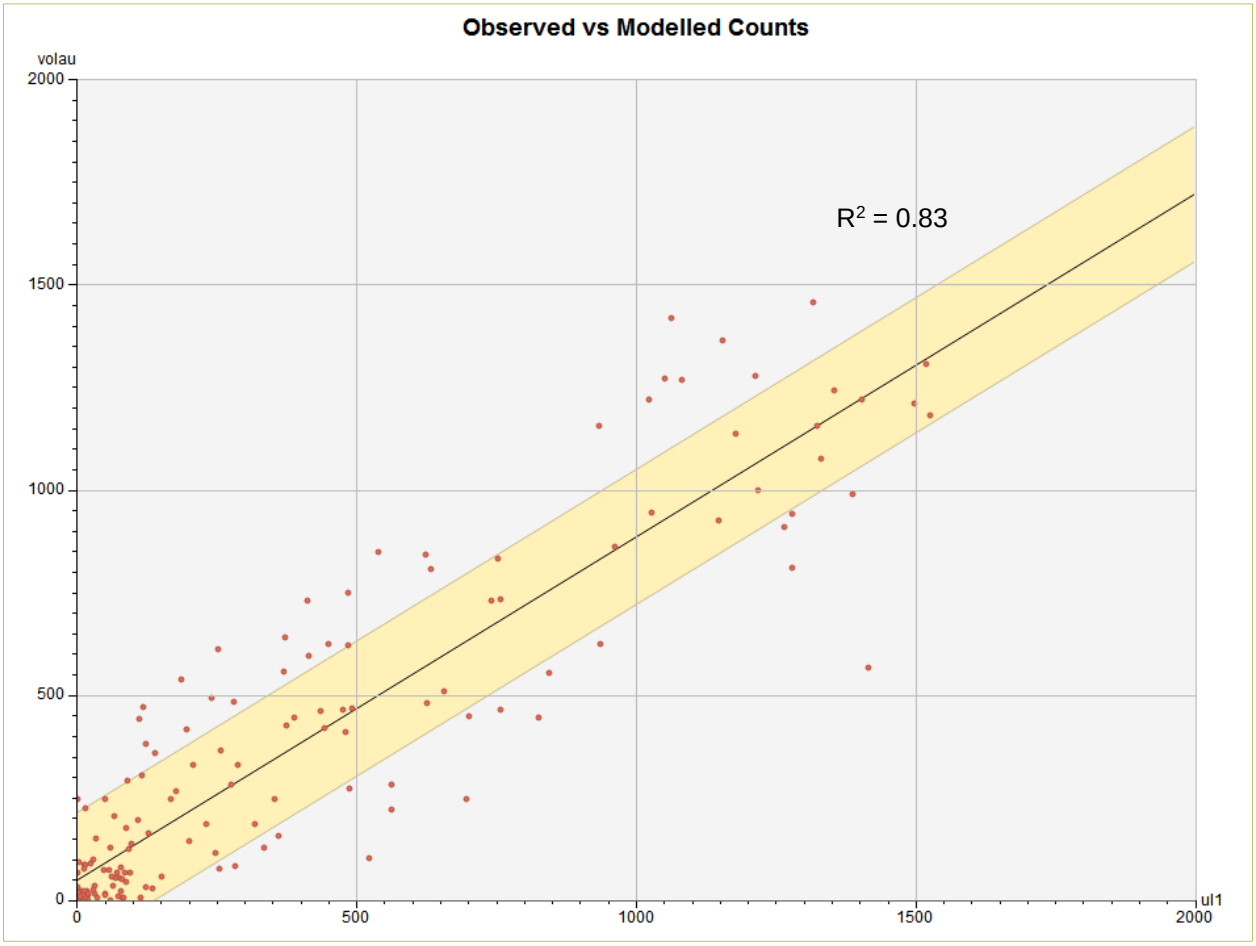
Traffic assignment is the process to estimate the routes (for each mode) that will be used to travel from origin to destination. This process yields the total number of vehicles or passengers that a particular route can expect to service. The user-optimal equilibrium assignment is used to evaluate the traffic assignment in Emme. Based on the Wardrop's first principle, the user-optimal equilibrium is reached when no trip can take an alternate path without increasing its travel time.

"Travel Model Validation and Reasonableness Checking Manual" recommends several traffic volume-related checks for the validation of a model at the traffic assignment component of the four-stage model. These traffic volume-related measures are: coefficient of determination (R^2), assignment by a roadway functional class (GEH and % difference), and percent RMSE. These measures are discussed below in the context of the County of Grande Prairie model.

COEFFICIENT OF DETERMINATION (R^2)

Coefficient of determination (R^2) is used to measure strength of a linear relationship between the traffic counts (observations) and the assigned modelled volumes (measurements). The R^2 value is a statistical measure of the model "Goodness of Fit", with R^2 equal to 1 indicating a perfect relationship between the modelled and observed volumes.

Figure 7-6 Coefficient of determination (R^2 = 0.83)



Source: WSP Transportation Planning

Figure 7-6 Coefficient of determination (R^2 = 0.83) shows the observed traffic counts plotted against the modelled volume on all available roadways in the County of Grande Prairie. For the County of Grande Prairie model, the R^2 value is computed as 0.83, which demonstrates a reasonable relationship between the observed and modelled volumes.

ASSIGNMENT BY FUNCTIONAL ROAD CLASSES

The review of traffic assignment by a functional road class, compares the assigned traffic volume with observed traffic counts, categorized by functional road classes. The roadways are classified into one of four road functional classes, in the case of Grande Prairie, highway, arterial, collector and local. In total 166 on-the-ground counts were collected, 64 of them on roadways categorized as highways, 56 as arterials, 44 as collectors and 2 as local roadways.

The observed traffic counts are considered to be the “ground truth” part of the process. Model link volumes and the counts are compared to determine a GEH statistic for each available road link in the study area. The results of the comparison are shown in Table 7-3 Assignment by functional road classes and GEH.

Table 7-3 Assignment by functional road classes and GEH

FACILITY TYPE	NUMBER	COUNTS	MODEL	GEH
Highway	64	41,327	39,296	10
Arterial	56	5,870	6,610	9
Collector	44	9,414	9,801	4
Local	2	1,761	1,036	19

All functional road classes, with the exception of the local class, demonstrate reasonable GEH results. Although the local class seems to be relatively high, this road class is represented by two observations, or a single count. A single count does not represent a significant data sample to make an analysis, similar to what is evaluated for other functional classes. Therefore the result for the local road class is of limited value.

Additionally, the accuracy of the model is validated through a comparison of the model volumes with traffic counts by computing a percent difference metric. The results of comparison are categorized by functional road classes and shown in Table 7-4 Assignment by functional road classes and % difference.

Table 7-4 Assignment by functional road classes and % difference

FACILITY TYPE	NO. OF COUNTS	MEAN OF COUNTS	MEAN OF MODEL	ACTUAL DIFFERENCE	% DIFFERENCE
Highway	64	646	614	32	5%
Arterial	56	105	118	-13	-13%
Collector	44	214	223	-9	-4%
Local	2	881	518	363	41%

The highway, arterial and collector road classes demonstrate reasonable percent difference results, while the local road class seems to be relatively high. While the local class seems to be relatively high, this road class is represented by two observations, or a single count. Again, a single count does not represent a large enough sample size to make a determination on goodness-of-fit. Therefore the result for the local road class is of limited value.

PERCENT ROOT MEAN SQUARE ERROR (%RMSE)

The %RMSE is a measure of accuracy of the traffic assignment measuring the average error between the observed and modeled traffic volumes on links with traffic counts. With all the available traffic counts in the network, the RMSE is computed as 50.7%. FHWA guidelines recommend a %RMSE value range between 30% and 50%. Given the assumptions taken to calibrate and validate the model, a RMSE of 50.7% represents a reasonable level of accuracy.

NETWORK LOADED SPEEDS

One of the measures in the model validation exercise is to review the link travel times and ensure that the adjustments made to them result in realistic speeds. Table 7-5 Resulting Speeds by a Functional Road Class shows the average speeds across the network, categorized by functional road classes. The model speeds appear to be well within the acceptable limits. The average speed on the network assigned with traffic is 79 km/h. This reinforces the relative lack of congestion in the entire network. Also it demonstrates the excellent level of service that the current network experiences.

Table 7-5 Resulting Speeds by a Functional Road Class

FACILITY TYPE	Speed (km/h)		
	Minimum	Maximum	Average
Highway	49	110	90
Arterial	40	90	78
Collector	21	80	76
Local	16	50	44

VEHICLE KILOMETERS TRAVELLED (VKT) AND VEHICLE HOURS TRAVELLED (VHT)

The VKT and VHT measure the amount of traveled kilometers and the length of travel time in the study area. Both of these measures are estimated in the model for the pm peak hour auto demand. Table 7-6 Summary of VKT and VHT by a Functional Class shows the VKT and VHT results summarized by four functional road classes.

Table 7-6 Summary of VKT and VHT by a Functional Class

FACILITY TYPE	VKT		VHT	
	Value	% Total	Value	% Total
Highway	80,697	48	963	38
Arterial	35,695	21	479	19
Collectors	37,768	23	688	27
Local	12,594	8	380	15
Total	166,754	100	2,510	100

The results from Table 7-6 Summary of VKT and VHT by a Functional Class show that approximately 48% and 38% of the peak hour VKT and VHT occur on the highway class. This result shows that the

highway class is relatively uncongested, since a large portion of the travelled distances are made via highways in less overall time.

SUMMARY OF THE MODEL VALIDATION

Overall the validation exercise indicates that the existing 2016 pm travel patterns are reasonably forecasted by the travel demand model. The model is validated to the observed traffic counts and found that coefficient of determination R^2, traffic assignment by functional road classes (i.e. GEH, % difference) and %RMSE metrics are reasonably forecasted.

There are several limitations to the calibration and validation of the County of Grande Prairie model. In particular, due to the scarcity of the household travel survey data, this model is evaluated at the traffic assignment component only. The validation of the model is done by summarizing recommended metrics as obtained from the model and the traffic counts.