

## Strathcona County

# Functional Planning Study Highway 15:06 From Range Road 220 to Highway 830

December 2016

E00311A

Report No. R-1160

**FUNCTIONAL PLANNING STUDY  
HIGHWAY 15:06  
From Range Road 220 to Highway 830**



Dan Dmytryshyn, P.Eng.

DATE: Dec. 9/16

December 2016

Approved by:

**Government  
of Alberta ■  
Transportation**

A handwritten signature in blue ink, appearing to read "Michael Botros", written over a horizontal line.

for: Michael Botros, P.Eng  
Regional Director  
North Central Region

DATE: FEB 6/2017

**STRATHCONA COUNTY**

**FUNCTIONAL PLANNING STUDY  
HIGHWAY 15:06**

**FROM RANGE ROAD 220 TO HIGHWAY 830**



*Dec. 9/16*

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<b>PERMIT TO PRACTICE</b>	
CIMA CANADA INC.	
Signature	
Date	<i>2016-12-09</i>
<b>PERMIT NUMBER: P8204</b>	
The Association of Professional Engineers, Geologists and Geophysicists of Alberta	

PROJECT N° E00311A  
December 9, 2016

## Executive Summary

Strathcona County, as requirement of the roadside development permit from Alberta Transportation for the intersection upgrade of Range Road 220, retained CIMA+ to conduct the Functional Planning Study of Highway 15 from Range Road 220 to Highway 830 north on Alberta Transportation's behalf. The study's objective is to determine the required interim and long term improvements to accommodate the estimated future traffic within the study area.

## Existing Conditions

Highway 15 is a major provincial highway under Alberta Transportation jurisdiction that transitions from a four-lane divided highway to a two-lane undivided highway within the study area. An existing CN rail line parallels Highway 15 to the north from Range Road 220 to Range Road 213. A Canadian Pacific (CP) rail line intersects the roadway west of Range Road 210. Highway 15 provides access to the City of Fort Saskatchewan, the Hamlet of Josephburg, the Town of Bruderheim and the facilities within Alberta's Industrial Heartland. Transportation infrastructure improvements are necessary to accommodate traffic resulting from new or expanding developments.

## Highway Classification

The Capital Region Board's Integrated Regional Transportation Master Plan classifies Highway 15 as an expressway. Due to the proximity to the Heartland, the highway is also a high load corridor and long combination vehicle route. Any intersection improvements must be able to accommodate these vehicles. Based on Alberta Transportation's Geometric Highway Design Guide, Highway 15 has a design designation of RAD-412.4-120. The roadway will require upgrades to meet this classification along its entire length within the study area.

## Traffic

A traffic analysis was completed for 20 and 50 year design horizons to estimate the future traffic on Highway 15. The 20 year horizon traffic model relied on the comprehensive travel demand model owned by the Alberta Industrial Heartland Association (AIHA). The assumptions made in this model are still applicable to a region that is complex, uncertain and heavily influenced by developments. The 50 year scenario was modeled using a 3.0% non-compounded growth rate from the 20 year horizon model.

The 20 year traffic model assumes that a total of 10 new hydrocarbon processing facilities will be constructed by 2030. The existing model assumes the intersection at Range Road 220 is unsignalized; however it has recently been upgraded to a similar configuration to that at Range Road 214.

The AIHA model includes the Regional Ring Road and a Fort Saskatchewan bypass road, neither of which are proposed in the IRTMP. The exclusion of these roads from the traffic model did not affect traffic volumes, as the IRTMP recommends other roadway upgrades to achieve similar results.

## 20 Year Design Horizon

Traffic modeling showed that all intersections operate at an adequate Level of Service (LOS) and that major intersectional improvements are not required at this stage.

The accesses at Range Road 213, 215 and 215A are recommended to close during the 20 year horizon due to safety concerns. The access at Range Road 215 will continue to operate as an access into Canadian National Railway Company's (CN's) Scotford Yard. In the event that the Range Road 215 access requires closure for safety reasons, the current westbound lane of Highway 15 will become a back service road for CN. The existing eastbound lane will be repurposed for westbound traffic and a new eastbound lane will be constructed.

Twinning to an expressway is considered when the traffic volume reaches 8000 AADT. Based on traffic analysis, Highway 15 will approach this value in 2030, however the exact year of twinning should be determined based on actual traffic volumes.

## Twinning Alignment Analysis

Two alignment options were considered for the remaining undivided portion of Highway 15, twinning to the north and twinning to the south. Both have a relatively equal land impact, however the north option impacts more residences and land parcels than the south alternative. Due to the proximity of Highway 15 to Alberta's Industrial Heartland, many utilities parallel and cross the Highway. The majority of the utilities are impacted by both twinning options with the exception of the Vegreville Corridor Water Services Commission. This water line is located north of Highway 15 and is a major constraint for the north twinning option.

Twinning to the south with a 54 m centerline to centerline spacing is the recommended option for Highway 15 as shown in the plans included in [Appendix C](#). It meets all the design criteria, and maintains continuity with the existing twinned section of roadway west of Range Road 213. There is a lower impact to residences, land and utilities, which reduces the overall cost.

When Highway 15 is twinned, the direct property accesses will no longer be permitted and will require removal. Alternate access will be provided via service roads off of adjacent range roads, as shown in Plans P-3406-01 to P-3406-03 in [Appendix C](#).

## 50 Year Design Horizon

As traffic increases, the intersection of Highway 15 with the CP rail line will warrant grade separation. Based on existing grades an overpass is the best option for this location. Due to a lack of available sight distance, closure of Range Road 211 intersection and redirection of traffic to the Range Road 212 intersection is recommended. An alternative approach is to close both the Range Road 211 and 212 intersections and construct a new intersection midway between these two locations. The feasibility of this option should be considered at such time upgrades to Range Road 212 and/or closure of Range Road 211 is required.

The intersections at Range Road 214 and 220 will operate at a LOS C using a 2.5% growth rate in the 50 year horizon. As both intersections operate near capacity, the protection of right-of-way for interchanges is recommended by provisions included in the Highway Development Act. The intersections at Range Road 212 and 210 will require signalization and minor configuration improvements to accommodate the increased traffic.

## Long Term

Beyond the planning horizon, the intersections of Range Road 214 and 220 with Highway 15 may require grade separation. Conceptual interchange configurations have been developed and are provided in **Appendix D**. A modified Parclo B4/Diamond is the recommended configuration based on traffic volumes and land restrictions. The recommended alignment deviates from a typical Parclo B4 because of constraints such as the CN rail line paralleling Highway 15 from Range Road 220 to 213. To accommodate the interchanges, the main corridor of the highway will need to be reconstructed further south of the rail line. By constructing the majority of the structure south of the highway in agriculturally zoned lands, the overall cost of the interchange is reduced.

## Right-of-Way Requirements

An additional right-of-way will be required for the south twinning of Highway 15. The new right-of-way boundary will be offset by 30 m from the eastbound lanes and will require approximately 27.7 ha of land. A right-of-way for the service roads adjacent to the highway will also need to be acquired.

It is recommended to protect the right-of-way required for future interchanges at the intersections of Range Road 214 and 220 with Highway 15.

## Conceptual Cost Estimate

50 year cost estimates were completed for both the north and south twinning options and are as listed below:

- + North Twinning - \$39,500,000.00
- + South Twinning - \$31,200,000.00

## Utilities

There are numerous pipelines, wells and electrical lines within close proximity of Highway 15. The majority of the oil and gas pipelines parallel the highway; however there are several crossing the roadway. The Vegreville Corridor Water Services Commission water line parallels Highway 15 from Range Road 213 to 210 along the highway's north right-of-way boundary. From Range Road 220 to 214, overhead electrical lines run parallel to the highway with a single crossing west of Range Road 214.

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## 1. Introduction

CIMA+ has been retained by Strathcona County on behalf of Alberta Transportation to conduct a functional planning study for approximately 11 km of Highway 15:06 from Range Road 220 to the junction of Range Road 210/Highway 830 (north), as shown in Figure 1.1. The objective of the functional planning study is to determine the required interim and long term improvements for Highway 15 in order to provide accommodation of future estimated traffic due to the development of large industrial facilities on lands adjacent to the study area.

**Figure 1.1 – Project Location Plan**



### 1.1 Project Background

Highway 15:06 is a major provincial highway which serves as a designated high load corridor for movement of goods to industrial sites adjacent to the study limits, as well as further north to Fort McMurray. This highway also is a key component in the Alberta Capital Region's transportation network, providing access to the City of Fort Saskatchewan, the Hamlet of Josephburg, the Towns of Lamont, Bruderheim, Lamont County and Strathcona County. Currently through the study area, Highway 15 transitions from a four-lane divided highway to a two-lane undivided highway east of Range Road 214.

The lands adjacent to the project limits are a mix of agricultural (mainly south of Highway 15) and industrial/zoned future industrial sites (north of Highway 15), which compose Strathcona County's portion of Alberta's Industrial Heartland.

The lands immediately south of Highway 15 are zoned as "industrial transition" lands, providing a buffer between industrial and agricultural areas. Canadian National (CN) has an existing rail line that parallels Highway 15 on the north side of the roadway from the west extents of the study area to Range Road 213. This rail line is a component of CN's transcontinental main line, thus generating several trains per hour

through the study area. CN's Scotford rail yard is also located immediately north of Highway 15 between Range Roads 214 and 215, further adding to rail traffic along the line.

Canadian Pacific (CP) also has an existing rail line which crosses Highway 15 in a northeasterly direction, approximately 0.96 km west of the intersection of Highway 15 and Highway 830 north. Rail traffic on this line is lower than the adjacent CN line however this may increase in conjunction with developments within the Alberta's Industrial Heartland and other surrounding areas.

Several major hydrocarbon processing facilities are currently located or are planned to be developed during the study's planning horizon north of Highway 15. Access to these facilities is gained directly from the highway along adjacent range roads. The exact number of new sites planned to be constructed adjacent to Highway 15 is unknown at present, however it is estimated that up to 10 hydrocarbon processing sites may be constructed north of the study area within a 20 year time frame. In order to facilitate these proposed developments, Highway 15 will have to be upgraded to accommodate increased traffic growth associated with the construction and operation of these facilities.

## 1.2 Background Studies and Reports

Several studies encompassing the project region have been completed on various aspects of highway planning. A list of relevant studies is as follows:

- + Highway 15 (North Side), Range Road 214 to Range Road 220, Short and Intermediate Term Access Management Plan, prepared by: Stewart, Weir & Co. Ltd., prepared for: Strathcona County, July 2011.
- + Alberta Industrial Heartland Transportation Study, prepared by: ISL Engineering and Land Services, prepared for: Alberta's Industrial Heartland Association, July 2011.
- + Integrated Regional Transportation Master Plan prepared by: Capital Region Board, September 2011.
- + Strathcona Area Industrial Heartland Transportation Study Update, prepared by: Static, prepared for: Strathcona County, November, 2007.
- + Safety Assessment, (Final) Highway 15:06, Intersection of Highway 15:06 and Highway 830 near Bruderheim, prepared by: EBA Engineering Consultants Ltd., prepared for: Alberta Transportation, January, 2006.
- + Highway 15 Fort Saskatchewan (130 Street) to East of Jct. Secondary Highway 637 West of Lamont Functional Planning Study Final Report, prepared by: Reid Crowther & Partners Ltd., prepared for: Alberta Transportation, 1997 (Updated October, 2011)

## 2. Traffic Analysis

A traffic analysis was performed for the Highway 15 Functional Planning Study to help determine the future right-of-way and infrastructural requirements within the study area. Traffic scenarios were analyzed at 20 and 50 year horizons to estimate the long term traffic on Highway 15. Due to the location of Highway 15 within Alberta's Industrial Heartland, traffic volumes are heavily influenced by industrial developments within the area.

The traffic model created for this study followed the conventional modeling process of trip generation, distribution, modal split, and assignment. However as a result of the complexities of development in the Alberta Industrial Heartland, the traffic model relied significantly on the comprehensive travel demand model owned by the Alberta Industrial Heartland Association (AIHA).

This travel demand model is documented in the 2011 Alberta Industrial Heartland Transportation Study prepared by ISL Engineering and Land Services. It is very comprehensive and attempts to account for many uncertainties such as the regional road network in the long term and the influence of market demand on the development of industrial facilities.

The AIHA model outputs include PM peak hour turning movement traffic volumes at all study intersections from Range Road 220 to Highway 830 north. In reviewing Alberta Transportation's 2011 turning movement diagrams for the study intersections, the observed peak hour factors in the AM and PM peaks range between approximately 0.10 to 0.11 at all intersections. The AM Peak volumes have been estimated based upon the PM Peak volumes, however the directionality has been changed to accommodate the actual traffic flow patterns during this time.

Since the development of this model, a number of changes have occurred in the envisioned ultimate Alberta Capital Region roadway network that was presented in the AIHA model. The Inter-Regional Transportation Master Plan (IRTMP), prepared by the Capital Region Board, provided the following changes to the ultimate 2041 roadway network. A copy of the IRTMP's recommended 2041 roadway network and classifications has been included in [Appendix B](#) for information.

- + A Regional Ring Road, located approximately 6 km to 20 km outside of Anthony Henday Drive, is included in the 2030 AIHA model. This route is not included within the recommendations of the IRTMP. As an alternative to this second ring road capacity improvements to existing commuter highways are recommended, as illustrated within the IRTMP recommendations.
- + The AIHA model included a limited access bypass of the City of Fort Saskatchewan in the 2030 model. The IRTMP has removed this bypass and as an alternative implemented several improvements to existing roadways adjacent to the City to function as a "virtual" bypass. The recommended improvements include:
  - o Upgrading Highway 830 from Highway 16 to Highway 15 to a multi-lane expressway configuration;
  - o Upgrading Range Road 222 from Highway 16 to Highway 15 to a multi-lane expressway configuration;

- Constructing a connector expressway, including a new crossing of the North Saskatchewan River, extending from the junction of Highway 15 with Highway 28A in the City of Edmonton to the junction of Highway 21 and Township Road 540 south of the City of Fort Saskatchewan, and;
- Upgrading Township Road 540 to a multi-lane urban arterial roadway standard.

Modifications to the trip distribution model have been made to recognize the above mentioned changes to the long term roadway network envisioned by the IRTMP.

## 2.1 Traffic Data

### 2.1.1. 20 Year Forecast Data

The 20 year horizon traffic model was based directly on the AIHA ultimate year 2030 model output. The assumptions made during the development of this model are still applicable to Highway 15 and the surrounding area. The model included the following assumptions:

- + The ultimate year 2030 model includes 10 hydrocarbon projects in the Alberta Industrial Heartland. This information is based on discussions between the project proponents and the AIHA after the 2009 economic recession. For the specific locations of these projects, please see the AIHA's 2011 Alberta Industrial Heartland Transportation Study;
- + All hydrocarbon upgraders and related facilities are expected to be complete in 2030;
- + The existing traffic model was based off the assumption that Range Road 220 is not signalized, however it is now signal controlled. The intersection at Range Road 214 was recently improved to include slot double protected left-turn lanes and dedicated right-turn bays;
- + All land uses in the region other than the industrial ones in the Alberta Industrial Heartland are consistent with the City of Edmonton Regional Travel Model (RTM)

### 2.1.2. 50 Year Forecast Data

Due to unavailability of proposed development information within Alberta Industrial Heartland and surrounding areas, it was assumed to apply a 2.5% non-compounded growth rate to the 20 year traffic volumes to extrapolate the 50 years horizon date. The use of a 2.5% annual growth rate is in accordance with Alberta Transportation's recommendations for long term traffic growth in Alberta.

## 2.2 Traffic Forecast Method

### 2.2.1 20 Year Method

The method used to develop the 20 year scenario is significantly based on the AIHA model as described above. This model includes a few transportation network routes that have not been included as part of the Capital Region Board's IRTMP. First, the City of Fort Saskatchewan bypass (bypass) is not included in the Capital Region Board's plans. As a result, we reassigned this traffic to the adjacent road network. Since the bypass users are likely coming from the southwest of Fort Saskatchewan and going to the northeast of the City and vice versa, CIMA+ maintained a similar trip distribution and assigned the trips with:

- + 25% using Highway 15 through Fort Saskatchewan;
- + 25% using Highway 830 south between Highway 15 and Highway 16; and
- + 50% using Highway 16 to move from the southwest of Fort Saskatchewan to the northeast. We assume that the users will travel on alternative highways to the east to move north and south.

Second, the Regional Ring Road outside of Anthony Henday Drive is not part of the Capital Region Board's current plans. A new expressway connection across the North Saskatchewan River along Township Road 540, connecting to Highway 28A, will serve as a bypass route for the City of Fort Saskatchewan. The AIHA model included a connector route along the Township Road 540 corridor, therefore this transportation road network model assumption still holds. The Regional Ring Road or the new expressway river crossing connection will likely serve a similar purpose, so the impacts on traffic flows will be similar. As a result, none of the traffic volumes changed due to the Capital Region Board's decision to exclude the Regional Ring Road from the future transportation network.

After these network changes, CIMA+ first modeled all intersections in the study corridor, then we closed access to Range Road 215, Range Road 215A, Range Road 213 and Range Road 211 as these closures will be required due to access management and safety considerations in the long term. Traffic from Range Road 213 and 211 was reassigned, based on a 50/50 split, to the adjacent Range Road 212. The AIHA model already excludes access to Range Road 215 and 215A.

### 2.2.2 50 Year Method

For the 50 year scenario, the 20 year volumes were utilized as a baseline and extrapolated according to the process described above in Section 2.1.2. No changes to the regional transportation network were anticipated and therefore performed no further trip reassignments.

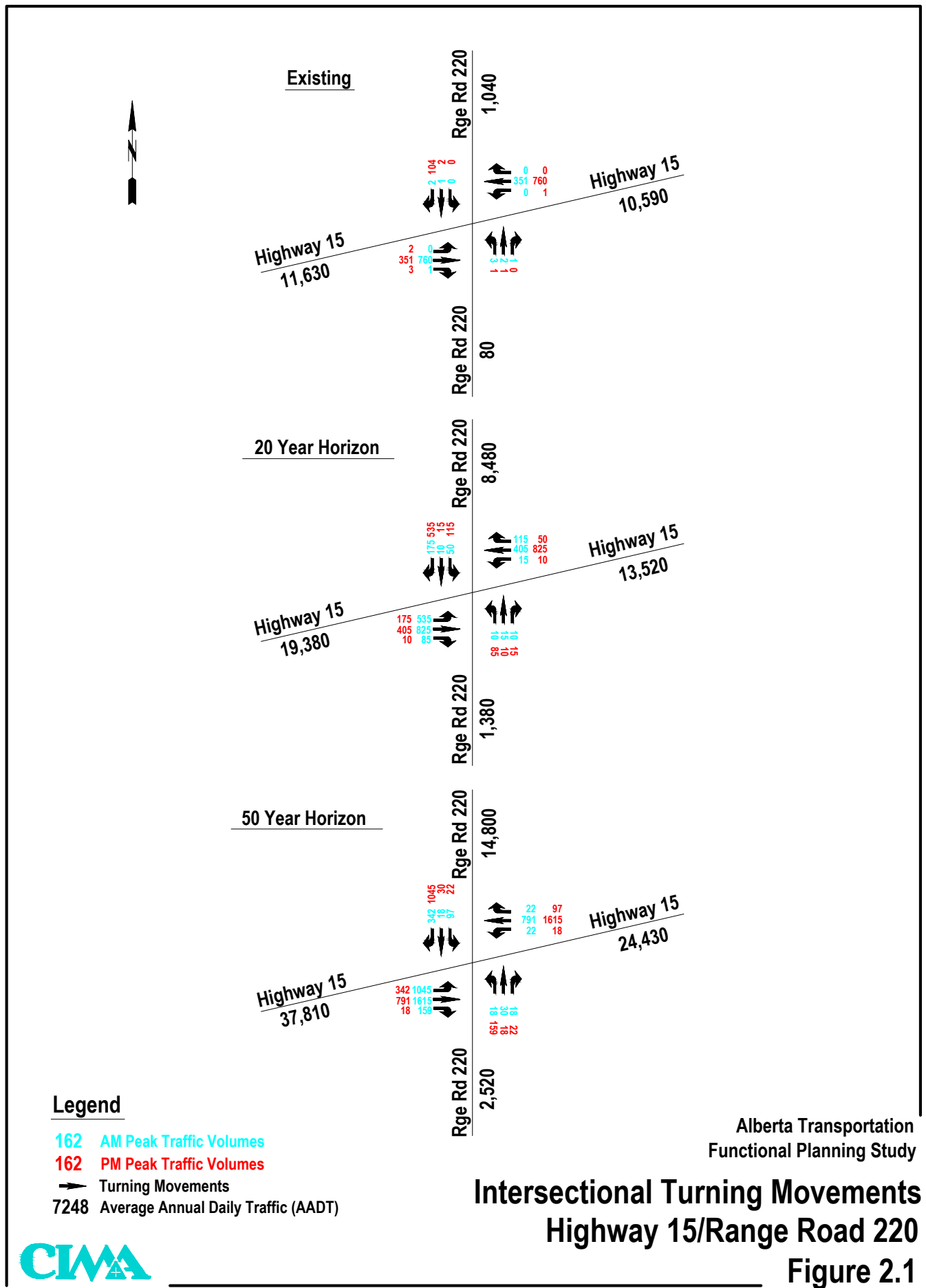
## 2.3 Forecast Traffic Volumes

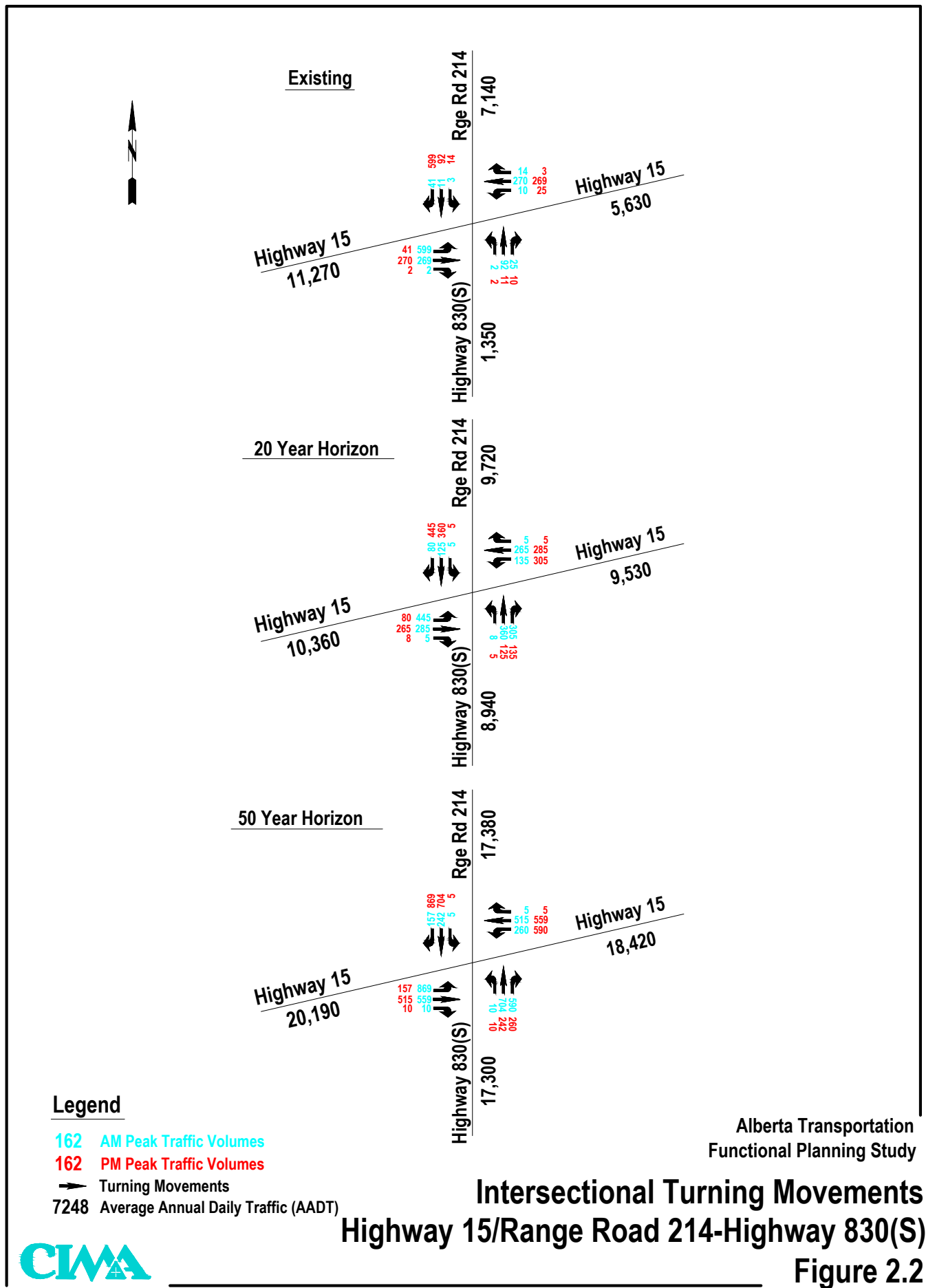
Traffic volumes were forecast for both the 20 and 50 year horizons based upon the assumptions made in the preceding sections. Figures 2.1 to 2.5 illustrate the current turning movements for each intersection included within the study area, along with the forecasted turning movements in the 20 and 50 year horizons.

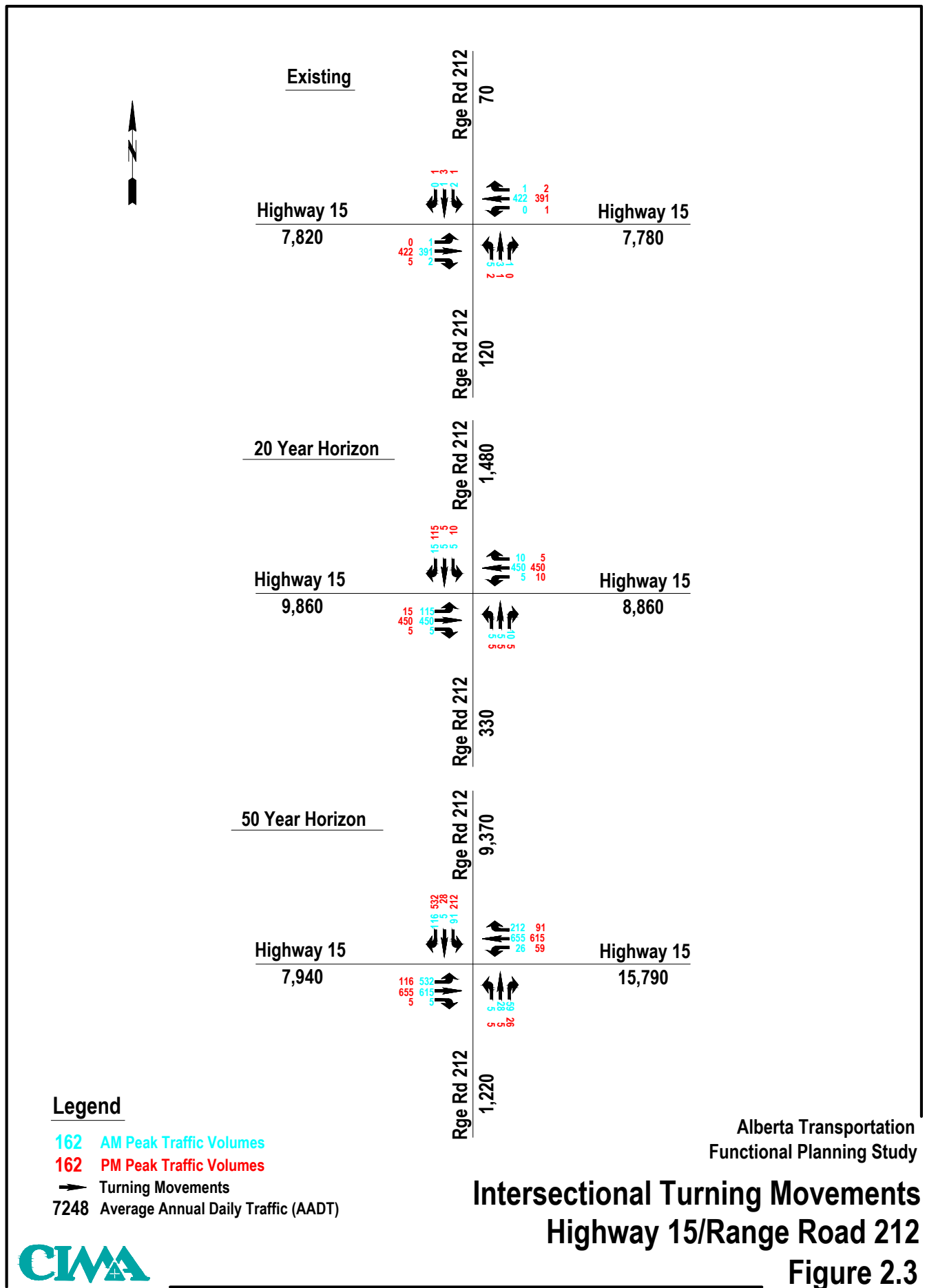
Further details regarding the PM peak hour traffic volume figures for both horizon years are enclosed as [Appendix A](#).

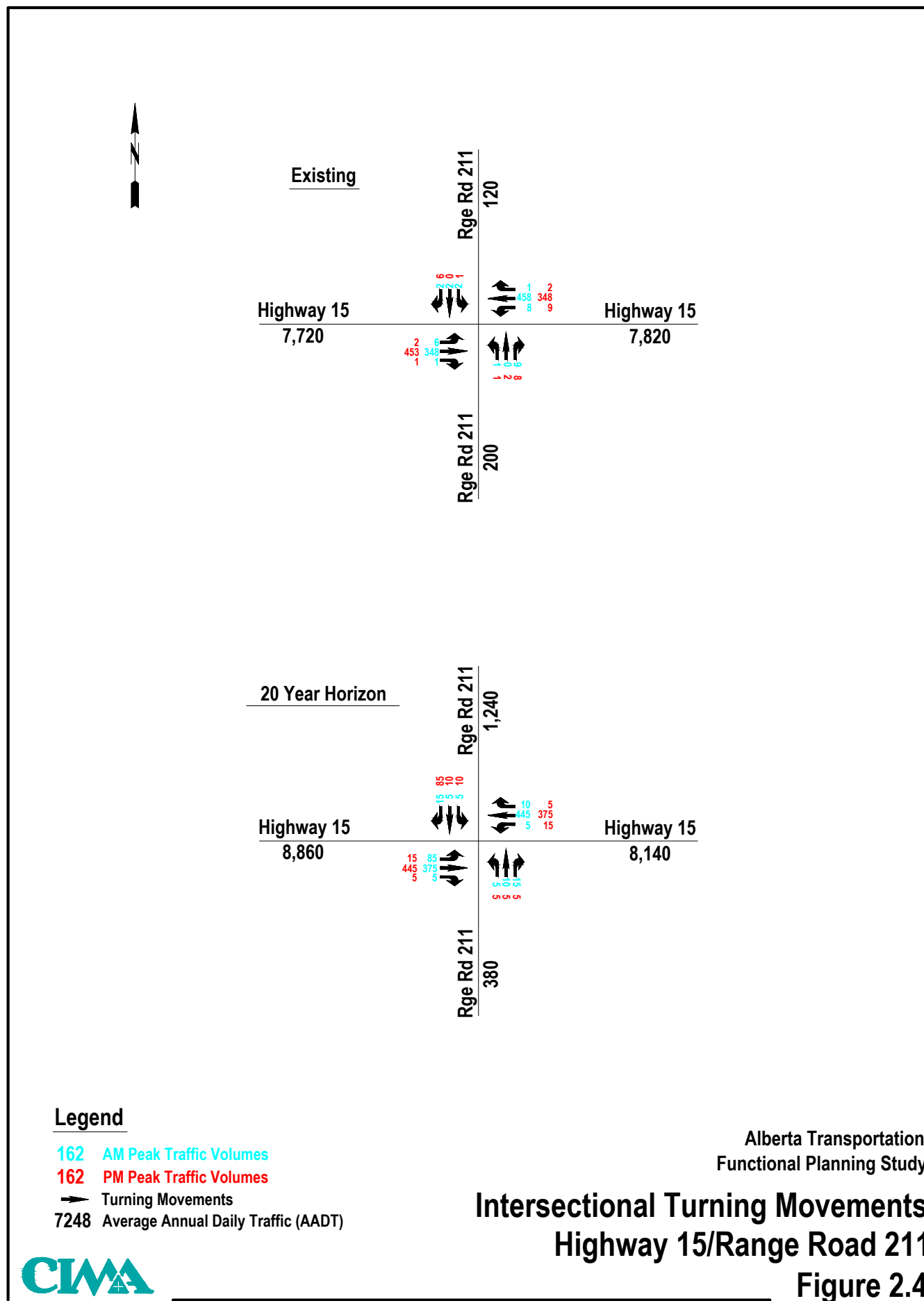
## 2.4 Twinning Analysis

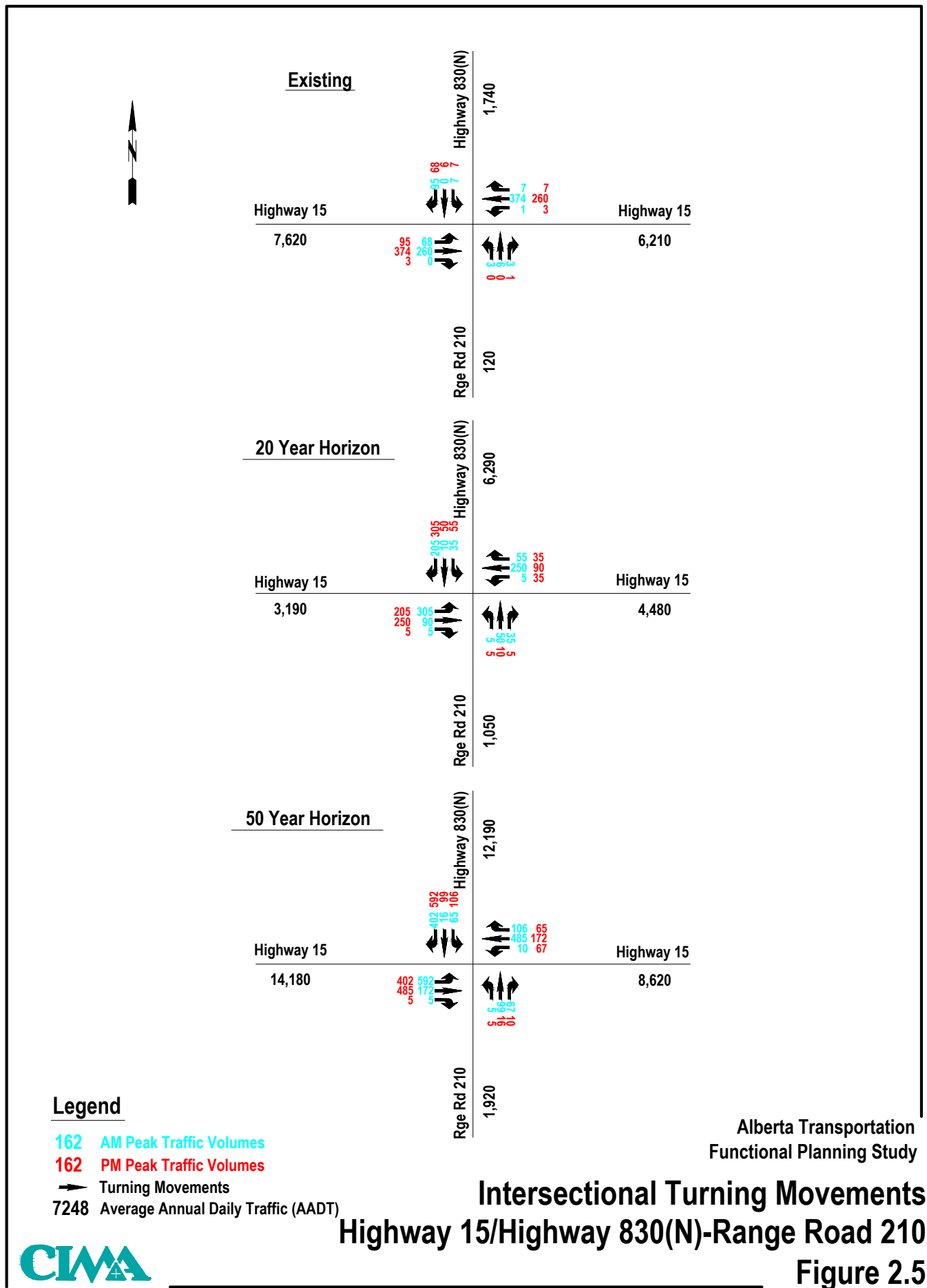
The Alberta Transportation Highway Geometric Design Guide Figure A-9 in Chapter A, states that a Level 2 highway approaches twinning need around the 8000 AADT threshold. This however depends on the percentage of passing zones and the level of service tolerance. According to CIMA+'s traffic forecast at the east end of the study area and at the 20 year scenario, Highway 15:06 will experience an AADT level around the 8000 range at the year 2030. Therefore, CIMA+ recommends consideration of twinning of Highway 15:06 through the remainder of the study area at the year 2030. The exact year of twinning should be determined based upon actual traffic volumes.











## 2.5 Capacity Analysis and Recommended Intersection Configurations

Capacity assessments were performed for the four study intersections at the two design horizons, namely the 20 year and the 50 year. Synchro/SimTraffic 8 computer software was used to perform the analyses. This, along with other factors, will determine the future configurations of the study intersections and the highway cross section. As per Alberta Transportation policy, LOS C will be considered to be the minimum acceptable value for capacity analysis at intersections in all design horizons.

Two intersection capacity improvement options are available, traditional signalization and the construction of modern roundabouts in accordance with Alberta Transportation Design Bulletin #68. For the purposes of this study, signalization was considered to be the preferred alternative based upon the following rationale:

- + Currently the intersections at the junction of Range Road 214/Highway 830 and Range Road 220 are signalized. In the interests of providing continuity along the corridor, signalization would be preferred over the construction of modern roundabouts. The notion of intersection type continuity is provided the Policy section of Design Bulletin #68; however in this instance signalization is favored over modern roundabouts. On this basis, any intersections where upgrades are contemplated in the future, such as at the intersection of Range Road 212 and Highway 830 North, should be signalized to maintain continuity along the corridor.
- + The proximity of railway lines to the Highway 15 corridor poses a significant safety and operational concern. Indeed, this condition is noted in Design Bulletin #68 as an instance where modern roundabouts would not be a desirable option. Signalization allows for interlocks with the railway crossing warning systems, which permits for adaptive signal timing, improving traffic flow, and prevents unsafe traffic movements from occurring whilst a train is crossing. It should be noted that in 2014, 10 to 12 trains per day are observed at the grade crossings located at Range Roads 214 and 220.
- + The National Highway Cooperative Highway Research Project Report 672, Roundabouts: An Informational Guide, strongly recommends against placing roundabouts in close proximity to railway crossings due to the safety and operational concerns posed by this configuration.
- + Based upon a high level assessment of roundabout capacity, a three lane roundabout configuration is likely required to accommodate the high volumes of eastbound to northbound traffic during the AM Peak and southbound to westbound traffic during PM Peak at both intersections. This type of configuration is very uncommon and is not typically used in North American jurisdictions.
- + Roundabouts are not feasible at either the Range Road 214 or Range Road 220 interchanges due to the proximity of the railway lines. To accommodate a roundabout, either the roundabout would need to be constructed on a structure over the railway line or the interchange footprint moved further south, which would lead to the relocation of the Heartland Hall and water reservoir in the case of Range Road 214.

## 2.5.1 20 Year Horizon

**Table 2.1** below summarizes the average Level of Service (LOS) for all study intersections at the 20 year scenario.

**Table 2.1: 20 Year Horizon Capacity Analysis Results**

Intersection	Signalized	Unsignalized – Approach LOS			
	Overall LOS	North	South	East	West
Range Road 220 and Highway 15	B	-	-	-	-
Range Road 214/Highway 830 South and Highway 15	C	-	-	-	-
Range Road 213 and Highway 15	-	C	E	A	A
Range Road 212 and Highway 15	-	B	C	A	A
Range Road 211 and Highway 15	-	C	B	A	A
Range Road 210/Highway 830 North and Highway 15	-	C	B	A	A

The results of the traffic analysis during the 20 year horizon indicate the following:

- + The Range Road 220 and Range Road 214/Highway 830 intersections will continue to operate acceptably with the current signals and configuration.
- + The south leg of the Range Road 213 intersection will be closed during the 20 year horizon due to the poor functionality of this intersection, and as well as due to safety concerns.
- + The intersection of Range Road 211 can continue to function in its current state, however closure will be required should grade separation of the CP railway crossing be required during this timeframe.
- + The intersection of Range Road 212 with Highway 15 will continue to operate acceptably with the current stop controls and configuration. As future upgrades are completed along Highway 15, eastbound and westbound left and right-turn storage lanes will be required.
- + Range Road 210/Highway 830 and Highway 15 will continue to operate acceptably with the current stop controls and configuration.

Considering the findings of the traffic analysis completed for the 20 year horizon, no major intersectional improvements are required at the intersections of Range Road 220 and Range Road 214/Highway 830 south. Minor intersection improvements will be required at the intersection of Range Road 212, however these will likely not be required until such time that twinning is required along the Highway 15 corridor.

## 2.5.2 50 Year Horizon

The capacity analysis at the 50 year horizon is summarized in **Table 2.2** below. The traffic model assumes the closure of Range Road 211 within the 50 year horizon as a result of the CP rail overpass.

**Table 2.2: 50 Year Horizon Capacity Analysis Results**

Intersection and Traffic Control Device	Signalized Intersection LOS
Range Road 220 and Highway 15	C
Range Road 214/Highway 830 South and Highway 15	C
Range Road 213 and Highway 15	<b>CLOSED</b>
Range Road 212 and Highway 15	B
Range Road 211 and Highway 15	<b>CLOSED</b>
Range Road 210/Highway 830 North and Highway 15	B

The intersection at Range Road 214/Highway 830 south will perform at LOS C within the 50 year design life, which meets the minimum LOS C criteria noted in Section 2.5 of this report. The intersection at Range Road 220 will perform at LOS C within the 50 year horizon if a 2.5% growth rate is used. Synchro reports for both scenarios are provided in **Appendix A**.

This intersection will be on the cusp of requiring grade separation at the 50 year horizon, depending on the actual traffic growth in the area. As both intersections are functioning close to their estimated maximums in the 50 year horizon, ongoing monitoring is recommended to ensure that no impacts to the serviceability of either intersection occur. Minor improvements, such as the addition of a second left turn lane may be required.

The intersections at Range Road 212 and Range Road 210/Highway 830 will function at LOS B during the 50 year horizon. It has been assumed that both intersections will require signalization during the 50 year horizon. Lastly, it has been assumed that the Range Road 211 and Range Road 213 intersections will be closed within the 50 year horizon as elaborated upon in previous sections.

## 2.5.3 Long Term Horizon

Since the potential exists for the intersections at Range Road 220 and 214 to operate at capacity beyond the 50 year horizon, right-of-way protection at these locations is recommended for future grade separated intersections. Grade separation, when warranted, will reduce the length of queues and vehicle delays. The appropriate interchange configuration includes:

- + A Parclo B4 design, according to the TAC Geometric Design Guide for Canadian Roads, on the south side of the interchange to handle the large AM peak hour movement travelling from the City of Edmonton area and heading northbound on Range Road 220 and 214 to the industrial facilities;

- + A simple diamond design, according to the TAC Geometric Design Guide for Canadian Roads, on the north side of the interchange. This design occupies less land than the Parclo and should be sufficient to meet the large PM peak hour travel demands of the industrial employees heading back to the Edmonton area;
- + Signalization where all ramps integrate with Range Road 220 and 214.

The intersection of Range Road 212 is located within 4 km of the proposed long term interchange at Range Road 214. Due to safety concerns with spacing, a safety study should be considered during design of the Range Road 214 interchange to determine if closure is required. This roadway, however, serves as a major access point to businesses within the Alberta's Industrial Heartland and therefore is an important link in the movements of goods and services beneficial to the regional, Provincial and National economy. Given the importance of this intersection, removal should only be considered if a significant safety concern exists in the future and a viable alternative routing for traffic can be provided.

A summary table of the recommended improvements for the study horizons is shown below:

**Table 2.3 – Recommended Timings and Improvements Summary**

Study Horizon	Recommended Improvement
<b>Year 2030<sup>1</sup></b>	Consideration of twinning Highway 15:06 through remainder of study area, or at such time the AADT on this section exceeds approximately 8,000 vpd <sup>2</sup> .
<b>20 Year Horizon</b>	<ul style="list-style-type: none"> <li>+ Intersection of RR 211 to be closed should grade separation of the CP railway crossing be required during this timeframe.</li> <li>+ Install eastbound and westbound left and right-turn storage lanes at RR 212 and Hwy 15 intersection.</li> </ul>
<b>50 Year Horizon</b>	<ul style="list-style-type: none"> <li>+ For RR 214/Hwy 830 and RR 220 with Hwy 15 intersections: On-going monitoring to ensure no impacts to the serviceability of either intersection.</li> <li>+ RR 212 and RR210/Hwy 830 to be signalized during this horizon.</li> <li>+ RR 211 and RR 213 intersections to be closed within this horizon.</li> </ul>
<b>Long Term Horizon</b>	<ul style="list-style-type: none"> <li>+ Protect right-of-way at RR 220 and RR 214 intersections for future grade separated intersections.</li> <li>+ A Parclo B4 design is recommended for the south side of the interchange.</li> <li>+ A simple diamond design is recommended for the north side of the interchange.</li> <li>+ Potential closure of the RR 215 intersection due to proximity to RR 214 interchange.</li> <li>+ Signalization where all ramps integrate with RR 220 and RR 214.</li> </ul>

Note 1: Exact year of twinning should be determined based upon actual traffic volumes.

Note 2: The IRTMP has identified Highway 15 as an Expressway, which implies that twinning will be required to meet this design criteria in the future

### 3. Roadway and Service Classification

Highway 15:06 is classified as an arterial (Level 2) road as per Alberta Transportation's Design Bulletin #27 in the immediate and long term horizon. This designation is given to roadways that provide predominantly intra-provincial traffic movement for a large number of vehicles. Highway 15 is a crucial link to Alberta's Industrial Heartland and provides the primary means of transportation for both products and services into and out of the region. Additionally, Highway 15 is classified as a high load corridor and a long combination vehicle route to accommodate the industrial traffic. All planned upgrades must be designed to meet the requirements for these classifications.

The Capital Region Board's IRTMP 2041 roadway network, included in [Appendix B](#), identifies future roadway upgrades necessary to improve network connectivity within the region by 2041. Alberta's Industrial Heartland is experiencing significant industrial development and appropriate transportation infrastructure is required to support this growth. As a result, the IRTMP has classified Highway 15 as an expressway. Improvements to the highway due to increased traffic will be required to meet future traffic demands.

Expressways can function as an interim stage towards an ultimate free flow configuration where each intersection along the entire length of the corridor is fully grade separated. Based on traffic modeling data, interchanges are not necessary within the 50 year design horizon of this study; however the roadway classification permits their construction when warranted. Details regarding the design features of expressways, as used in this study, have been included in Section 4.1 of this report.

## 4. Functional Planning

### 4.1 Design Criteria

The design criteria presented in **Table 4.1** is a summary of the roadway design standards utilized during the development of this functional plan.

**Table 4.1 – Highway Design Criteria**

Parameter	Highway 15:06	Highway 830 (North)	Range Road 220	Range Road 214 / Highway 830 (South)	Service Roads
<b>Highway Classification</b>	Expressway	Expressway	Collector	Expressway <sup>1</sup>	Local
<b>Design Designation</b>	RAD-412.4-120	RAD-412.4-120	RCU-209-110	RAD-412.4-120	RLU-208G-90
<b>Posted Speed (km/h)</b>	100	100	90	100	80
<b>Number of Lanes</b>	4	4	2	4	2
<b>Lane Width</b>	3.7 m	3.7 m	3.5 m	3.7 m	4.0 m
<b>Outside Shoulder Width</b>	3.0 m	3.0 m	1.0 m	3.0 m	-
<b>Inside Shoulder Width</b>	2.0 m	2.0 m	-	2.0 m	-
<b>Maximum Grade</b>	3%	3%	5%	3%	7-9%
<b>Maximum Super-Elevation</b>	6%	6%	6%	6%	6%
<b>Minimum Radius</b>	750 m	750 m	600 m	950 m	300 m
<b>Minimum Centerline to Centerline Divided Highway Spacing</b>	55 m	55 m	-	55 m	-
<b>Minimum Intersection Spacing</b>	1.6 km	1.6 km	N/A	1.6 km	N/A

Note 1: Design designation for Highway 830 south based on the recommendations included in the IRTMP.

### 4.2 Staging

#### 4.2.1 Interim Stage

Highway 15 will require upgrades to accommodate increased traffic as a result of developments in the area. Traffic modeling was completed to determine at what stage these improvements should be implemented. The twinning of Highway 15, east of Range Road 214, will act as a trigger for developments and will be required within the 20 year horizon. Twinning the highway supports the expressway status of

Highway 15 forcing access closures to meet minimum spacing requirements. The intersections at Range Road 213 and 215 will be closed and alternate access will be provided as discussed in the access management section of this report.

It should also be noted that staging of improvements for the signalized at-grade intersections at Range Road 212, 214, 220 and Highway 830 is considered to be an operational concern which is beyond the scope of this report. It is recognized that modifications to signal timings can be made to help improve the functionality of these intersections as an interim measure.

Two options for twinning this section of Highway 15 were identified. The first consists of constructing a parallel carriageway to the north of the existing lanes and the second consists of constructing a parallel carriageway to the south of the existing lane. Reconstruction of the existing horizontal curve near the present intersection of Range Road 213 is required to meet the design criteria established in [Table 4.1](#) above in both options.

Plan profile drawings illustrating both the north and south twinning options and required service road construction are included in [Appendix C](#). Plans illustrating proposed right-of-way acquisition requirements for both options have been included in [Appendix E](#).

In the 1997 Functional Planning Study completed for Highway 15, it is noted that constructing the parallel carriageway to the north of the existing highway is the preferred alternative from Range Road 213 to the intersection of Highway 29 near the Town of Lamont. Given the large scale changes in development patterns in the Alberta's Industrial Heartland since the preparation of the 1997 study, it is prudent to revisit the twinning alignment between Range Road 213 and Highway 830 North.

It has been assumed, however, that the recommendation of the 1997 study will be maintained east of Highway 830 North. With this in mind, the south twinning option included in [Appendix C](#) includes a transition to shift the twinning side from south to north to accommodate.

## 4.2.2 Ultimate Stage

When warranted based on developments and rail traffic within the 50 year horizon, the intersection of the CP rail line with Highway 15 will require grade separation. This results in the closure of Range Road 211 because of safety concerns. The intersections at Range Road 212 and 210 will require signalization and updated configurations to accommodate the increased traffic from the access closure.

## 4.2.3 Long Term

Beyond the ultimate stage of the project, ensuing facility upgrades may cause signalized intersections to fail, resulting in the need to construct interchanges. Traffic modeling has identified that interchanges may be required at the intersections of Range Road 220 and 214 in the long term. Conceptual interchange configurations have been developed and will be discussed in more detail in Section 6.0 of this report.

## 4.2.4 Functional Plans

The objective of the functional planning study is to determine the required improvements for Highway 15 based on traffic needs. Highway 15 is the main highway through Alberta's Industrial Heartland and provides access to the developments and towns located within the region. Public consultation was a major part of the functional planning study and imperative to the development of the final plans.

There are currently plans to upgrade existing facilities and to construct new ones in the near future and adequate transportation infrastructure will be needed to support the industrial growth planned for the area. Traffic modeling data has indicated that the undivided section of Highway 15 will require twinning and intersection improvements will be needed to accommodate increased traffic.

#### 4.2.5 Public Consultation

Affected stakeholders, including local residents and other County Departments, were invited to three open houses held at critical stages of the project. The objective of the open houses was to gain public input from impacted residents regarding the proposed improvements. The public consultation program that was implemented during the project is summarized in the accompanying Highway 15 Public Consultation Report.

#### 4.2.6 Twinning Alignment Analysis

Traffic modeling has indicated that Highway 15 will require twinning from the west of Range Road 213 to Range Road 210 to accommodate increased traffic in the region within the interim stage. Two alignments were considered, twinning to the north and twinning to the south of Highway 15. Both twinning options utilize the existing roadway as one of the twinned lanes to reduce costs and environmental impacts. The north and south twinning options share many similarities based on their proximity and the topography of the region.

To assist in the selection the preferred twinning option a ranking matrix was developed. In the development of this matrix, the following evaluation parameters were considered:

- + Length of new roadway constructed, including both service roads and main-line lanes;
- + Amount of right-of-way required for roadway construction purposes north and south of the existing Highway 15 right-of-way;
- + Impacts on residences and/or businesses directly impacted by the construction of new roadways;
- + Access management requirements;
- + Impacts on existing utility infrastructure, including oil, gas and water pipelines, and;
- + Capital construction costs.

The impact of other evaluation parameters, including the overall length of twinned roadway, power and telecom infrastructure impacts along with geotechnical, environmental and historical resource considerations, are considered to be similar for both twinning options. These parameters are not considered to be influencing factors in the selection of the final recommended plan and have not been included within the ranking matrix.

A scoring system was devised to rate both options in terms of the six evaluation parameters mentioned above. A three point basis was utilized in the development of evaluation scores taking into consideration the impact that each parameter has on the feasibility, constructability and functionality of each parameter, ranging between low (1 point), moderate (2 points) and high (3 points). After summation of the scores for each parameter, the option with the lowest score will be the preferred option.

The impact ranking matrix for both twinning options is included in **Table 4.2** below.

**Table 4.2 – Twinning Option Impact Ranking Matrix**

Parameter	North Option		South Option	
	Score	Rationale/Comment	Score	Rationale/Comment
<b>Service Road Length</b>	2	Total length – 6.909 km	2	Total length – 6.315 km
<b>Right-of-Way Required – Mainline Lanes</b>	3	Land required – 38.20 ha	2	Land required – 27.64 ha
<b>Right-of-Way Required – Service Road</b>	2	Land required – 19.75 ha	2	Land required – 20.42 ha
<b>Estimated Land Costs<sup>1</sup></b>	3	Estimated Cost - \$1,250,000	1	Estimated Cost - \$510,000
<b>Direct Property Impacts</b>	3	One Business (Gas Station) and Three Residences	2	One Business (Gas Station) and Two Residences
<b>Utility Impacts – Water Main</b>	3	Watermain to be relocated or remain within median	1	Watermain to remain as presently located
<b>Utility Impacts – Oil and Gas Pipelines</b>	2	Estimated number of pipeline relocations - 24	3	Estimated number of pipeline relocations - 31
<b>Capital Construction Costs<sup>2</sup></b>	3	\$39,500,000 (26.5% increase from south option)	2	\$31,200,000
<b>Total Score</b>		<b>21</b>		<b>15</b>

*Note 1: Land acquisition costs based upon \$8,000/ha for land south of Highway 15 and \$25,000/ha for land north of Highway 15.*

*Note 2: Does not include the costs of constructing the CP Railway grade separation between Range Roads 211 and 212. Separate estimate for CP Railway grade separation included in [Appendix F](#).*

Based upon the impact ranking matrix above, the south twinning option is the preferred alternative. The following sections will provide further rationale for the selection of the south option.

## 4.2.7 Land Acquisitions

Twinning Highway 15 will have a major impact on the surrounding land and residents. The north twinning option impacts more land parcels than the south alternative due to how the land is divided and the placement of service roads. The land zoning is industrial to the north of Highway 15 and agricultural on the southern side, and twinning to the south takes advantage of the lower cost of agricultural land.

The construction of twinned lanes to the south of the existing highway will impact three residences as shown in Plans P-3406-04, P-3406-05, and P-3406-07 in [Appendix C](#). With this alternative, the removal or relocation of the Tempo gas station would be required. During the public consultation phase of the project, impacted land owners demonstrated an acceptance to the possibility of land purchase. The north

twinning alignment impacts more residences along Highway 15 than the south option. The lower number of land parcels and residences affected with the south twinning option reduces the efforts and costs associated with respect to land acquisition.

#### 4.2.8 Utilities

As Highway 15 is the main transportation corridor through Alberta's Industrial Heartland, utilities were a major consideration in the development of the recommended plan. Oil and gas pipelines impacted by the twinning are those that cross the highway, equally impacting both twinning options. However there is a water line that parallels the northern right-of-way boundary of the roadway.

This has a low impact on twinning to the south, but is a major constraint for the north alternative. North twinning would require the water line to be located in the highway median. However, this creates concerns regarding the impact on the water pipeline during highway construction, as well as the implications of servicing the water line in the event of a failure. By twinning to the south, the water main is unaffected, eliminating this constraint.

Twinning to the south of the existing lanes is the recommended option based on the following reasons, as illustrated in the ranking matrix presented in [Table 4.1](#) above:

- + Lower land acquisition costs and impacts.
- + Lesser impact on land parcels, residences and businesses
- + Little to no impact on existing watermain.
- + Lower capital construction costs.

Plans for the recommended south twinning option are contained in [Appendix C](#).

#### 4.2.9 CP Rail Overpass

CP has plans for a major expansion in the Alberta Industrial Heartland region and the number of trains is expected to increase. The CP line provides access to industries in the area, and the expansion is dependent upon facility upgrades. A grade separated crossing will likely be warranted during the ultimate stage for the CP rail line located east of Range Road 211. An overpass is the only viable solution due to the existing uphill grade of approximately 1.5% from Range Road 212 continuing easterly past Highway 830 North, as shown on Plan P-3406-07 in [Appendix C](#).

Significant utility impacts will occur at the CPR crossing, due to the number of pipelines paralleling the rail line. The construction of the CPR overpass will be dependent on developments and traffic volumes in the area. This location should be monitored to determine when a grade separated crossing is warranted.

#### 4.2.10 CN Service Road

The access at Range Road 215 North presently operates as a secondary access to CN's Scotford Yard. The Highway 15 (North Side), Range Road 214 to Range Road 220, Short and Intermediate Term Access Management Plan, prepared by Stewart, Weir & Co. Ltd. in 2011, reviewed the access management requirements for the CN Scotford Yard and provided recommendations on the development of a parallel service road and improved intersection configuration for this location. It is expected that during the

20 year horizon, the recommendations included in the Stewart Weir report will be implemented and will remain functional up to and including the 50 year horizon. This Stewart Weir report is to be considered as being in a draft state. The proposed service road configuration for this location is illustrated in drawing P-3406-01A in [Appendix C](#).

Beyond the 50 year horizon, the construction of interchanges at the intersections of Range Road 214 and 220 will be required, thus converting the section of Highway 15 between these two interchanges into a short freeway section. At the time of construction of one of both of these interchanges, the need to maintain this access should be reviewed. If a safety and/or operational concern exists with the access, or becomes deemed redundant by the railway, the closure should be considered. The south leg of the Range Road 215 intersection should be closed at this time regardless of the railway's requirement in order to limit access to Highway 15 as much as possible.

#### 4.2.11 Jurisdictional Transfer

As previously mentioned, the Capital Region Board's IRTMP indicates that Highway 15 from the City of Fort Saskatchewan corporate limit to the junction of Highway 830 south is designated as an expressway. It is also indicated that Highway 15 within the City of Fort Saskatchewan is maintained in its current arterial roadway configuration. As growth of both developments and the roadway network occur in the study area, a discontinuity will develop with respect to the level of service and available capacity provided along the Highway 15 corridor due to the change in roadway classification.

From a network point of view, this section of Highway 15 will play only a minor role in carrying inter-regional traffic. Upon completion of the Fort Saskatchewan "by-pass" via Highway 830, Township Road 540 and the future Highway 28A river crossing, as per the IRTMP, most inter-regional traffic will travel along this route thus downgrading the significance of Highway 15 west of Highway 830 south. Given the lesser importance this link will have on the overall roadway network in the Capital Region, further consideration and study should be given to the option of transferring this section of Highway 15 to Strathcona County. If a future transfer does not occur and jurisdiction stays with Alberta Transportation, the Range Road 215 access is to be closed at the time interchanges are constructed at Range Road 214 and/or Range Road 220. This will be noted in the functional plan.

Given the potential challenges associated with for this transfer, it is recommended that further study be considered to garner a full appreciation of all the risks and opportunities this option may provide. As further assessment of this option is beyond the scope of this study, we will assume that Highway 15 will fully remain a part of the Provincial Highway Network for the remainder of this study.

## 5. Access Management

### 5.1 Existing Conditions

Highway 15 currently transitions from a divided highway to an undivided highway within the study area. The divided highway is from the boundary of the City of Fort Saskatchewan to just east of Range Road 214. Within this section, access to the highway is provided from adjacent Range Roads 220, 215A, 215 and 214. The intersections at Range Roads 214 and 220 have been improved to include signalization and turning lanes. Both range roads are four paved lanes and are integral to the network connectivity of the Alberta Industrial Heartland. The intersection at Range Road 215 has a median opening to accommodate both eastbound and westbound turning traffic, while Range Road 215A provides right-in, right-out access only.

East of Range Road 214, the highway reverts to a two-lane undivided roadway to east of Highway 830 north. Along this section of the highway access is unrestricted, with a mixture of residential, field and road allowance access. There are a total of six private accesses, leading to three residences and one business. The access to Range Road 213 north has been previously closed due to safety concerns (north leg of Range Road 213 was closed in 2010), but the south access remains open.

Many existing facilities within the Alberta Industrial Heartland access their sites from range roads adjacent to Highway 15. Access management recommendations will maintain adequate provision of access off Highway 15 to allow efficient access to the industrial and commercial sites. However specific access management for developments within the Alberta Industrial Heartland is beyond the scope of this functional planning study. Detailed access management must wait for the approval of developments and their design and configuration.

### 5.2 Recommendations

Highway 15 is a main roadway in Alberta's Industrial Heartland and as such is classified as an expressway by the IRTMP. **Table 5.1** below contains excerpts from Alberta Transportation's Access Management Guidelines for an expressway designation.

**Table 5.1 – Excerpts from Table I.5 of the *Highway Design Guide***

Access Type	Criteria/Guideline
<b>Public Road</b>	Consider new access based upon demonstrated need. Minimum spacing 1.6 km.
<b>Rural Industrial</b>	Existing access may remain on temporary basis. Remove when upgrading Highway Do not permit direct access for new developments. Provide indirect access by existing public roads. Discourage spot developments in favor of industrial parks.
<b>Farmstead</b>	Existing access may remain on temporary basis. Remove when upgrading Highway Do not permit new direct access for new farmsteads. Provide indirect access by existing public roads or may consider joint use of existing direct access.

During the 20 year horizon, the intersection of Highway 15 and Range Road 213 South will be closed as it is situated within a horizontal curve, providing inadequate sight distances. The north leg of Range Road 2013 was previously closed in November 2010 due to ongoing safety concerns.

Traffic modeling has shown that the closure of the Range Road 215 access is expected in 20 years due to Sasol's proposed development in this area. Range Road 215 north will then function as shown in the draft Access Management Plan prepared by Stewart Weir solely as an access to the CN Scotford Yard. This access can continue to be maintained until such time interchanges are constructed at the junctions of Range Road 214 and 220 or safety concerns arise regarding the use of this intersection, as explained previously in Section 4.3.3. Retaining the Range Road 215 south access is not required given the lack of usage of this link and alternative access provided by the signalized intersections at Range Road 214 and 220. At the future date during the detailed design stage for interchange design, spacing should be reviewed within a safety audit.

The CP rail line intersecting Highway 15 west of Highway 830 will warrant a grade separation within the 50 year horizon of this study. As previously stated, an overpass is the recommended option at this location based on existing grades. The presence of an overpass restricts the available sight line distances at the intersection of Range Road 211 and does not conform to current standards. As a result, this access will be closed. The intersections at Range Road 210 and 212 will require upgrades and signalization to accommodate the traffic resulting from the Range Road 211 access closure. In regards to the intersection at Range Road 212, future development within the Alberta's Industrial Heartland may necessitate closure of this access point. Future study may be warranted at this location with respect to development within the AIHA and resultant site-specific TIAs.

With regards closure of the Range Road 211 intersection, an alternative approach to be considered is to consolidate the intersections of Range Roads 211 and 212. To meet sightline requirements at the future CP rail line overpass and to provide a flat to low gradient to allow for large trucks to reach traffic speeds from the intersection, careful consideration of the final location of the intersection needs to be taken into account relative to needs of roadway users. From a geometric standpoint, the intersection can be located between approximately Sta. 208+200 and 208+600 and meet sightline and truck acceleration requirements.

During detailed design, the placement of the consolidated intersection should be reviewed in greater detail to determine the optimal location in terms of sight lines, available acceleration distance before the CP rail line overpass and other factors. While this alternative reduces the total detour distance for Range Road 211 traffic, it also provides greater separation between the Range Road 212 intersection and future Range Road 214 interchange.

When improvements to the Range Road 212 intersection are warranted, closure of the existing Range Road 211 and 212 intersections and consolidation at Range Road 211.5 should be considered in concert with future requirements for a grade separation at the CP Railway crossing. If a grade separation is warranted within the design life of the intersection improvements at Range Road 212, intersection consolidation should be strongly considered as an option before construction of a grade separation. With this staging approach, costs associated with reconstruction of the intersection at a later time can be avoided.

Along the existing undivided portion of Highway 15 there are many direct accesses to private homes or businesses. These will remain open temporarily, but will be removed when the highway is twinned within

the 20 year horizon or sooner such as at the roadside development or pavement rehabilitation stage. Access to individual properties will be maintained through service roads from adjacent range roads.

The alignment of the service roads is shown on Plans P-3406-04 to P-3406-08 in **Appendix C**. Plan P-3406-05 provides two different alignment options for the service road south of Highway 15. The first option detours the existing residence, while the second parallels the highway in the event the land is purchased by the province. Service roads will be constructed to current standards and will tie into existing service roads where possible.

Proposed alignments and access management schemes discussed in this Functional Planning Study are conceptual only and are subject to future study.

## 6. Interchanges

Alberta's Industrial Heartland is a rapidly developing area and the surrounding road network must be able to accommodate the growth. Traffic modeling completed for this functional planning study has indicated that at-grade intersections are sufficient along Highway 15 during the 50 year horizon. However, with expanding facilities and increased traffic in the region it is possible that interchanges may be required beyond the ultimate stage of the study. Interchanges are required when signalized intersections fail and no further upgrades can be completed. Based on the traffic model, the intersections at Range Road 214 and 220 fit this criterion and may require grade separation beyond the project horizon. Conceptual interchange alignment, profile and double line plans have been created and are provided in [Appendix D](#).

### 6.1 Design Criteria

The following design criteria were obtained from Alberta Transportation's Highway Geometric Design Guide and used in the development of the potential interchange configurations.

**Table 6.1 – Interchange Design Criteria**

<b>Design Speed</b>	Mainline Lanes		130 km/h
	Cross Roads		90 km/h
	Ramps	Maximum	100 km/h
		Minimum	70 km/h
	Loops	Minimum	50 km/h
<b>Curve Radius</b>	Mainline Lanes	Minimum	950 m
	C/D Roads	Minimum	950 m
	Cross Roads (Highway 830)	Minimum	950 m
	Cross Roads (Local Roadways)	Minimum	400 m
	Ramps	Minimum	250 m
	Mainline Gore	Minimum	440 m
	Loops	Minimum	90 m
<b>Weaving Distance</b>	Maximum		1000 m
	Minimum		800 m
<b>On-Ramp to Off-Ramp Distance</b>	Minimum		1000 m
<b>On-Ramp to On-Ramp Distance</b>	Minimum		300 m
<b>Decision Site Distance</b>	90 km/h Design Speed		280 m
	100 km/h Design Speed		300 m
	110 km/h Design Speed		330 m
	130 km/h Design Speed		390 m
<b>Bridge Clearance</b>	Mainline		5.6 m
	Railway		7.2 m

## 6.2 Interchange Design Development

Interchange design options were developed Range Roads 214 and 220 based upon the design criteria previously established in Section 6.1. In the design development process, several typical interchange configurations were reviewed including a simple diamond configuration, various Parclo configurations and a cloverleaf. Atypical interchange configurations were also considered, including a simple diamond with flyover ramp and a half diamond/half Parclo B4 configuration.

During the review of potential interchange configurations, it became quickly apparent that the CN Railway line would become a major design constraint. Due to the close proximity of Highway 15 to the rail line at both Range Roads, significant amounts of realignment would be required to shift the roadway away from the railway line to accommodate the interchanges. While some degree of shift was expected in any interchange configuration, it is desirable to keep the amount of shift to a minimum in order to reduce right-of-way requirements and thus overall cost.

A second consideration at the Range Road 214 interchange is the proximity of the Heartland Hall/Strathcona County Fire Hall #4 and proposed water reservoir to Highway 15. At this location the amount of land available to shift Highway 15 is even more limited, thus greatly restricting the number of viable interchange configuration options.

After preparing high level designs for numerous options, only two viable configurations which provided adequate capacity for motorists while minimizing the amount of right-of-way required, the length of realignment required on Highway 15 and impacts to the Strathcona County Fire Hall #4 and proposed water reservoir were available. These two options included the simple diamond and the half diamond/half Parclo B4.

To select a recommended configuration, a simple Pros and Cons matrix was developed to identify the positive and negative aspects of each alternative. **Table 6.2** shows the Pros and Cons matrix developed for the two interchange alternatives.

**Table 6.2 – Interchange Configuration Assessment Matrix**

Interchange Alternative	Pros	Cons
<b>Simple Diamond</b>	<ul style="list-style-type: none"> <li>+ Lower overall capital cost.</li> <li>+ Lowest amount of land acquisition required.</li> </ul>	<ul style="list-style-type: none"> <li>+ Eastbound to northbound movement capacity limited due to signals at intersection of eastbound offramp and crossroads.</li> </ul>
<b>Half Diamond/ Half Parclo B4</b>	<ul style="list-style-type: none"> <li>+ Higher capacity eastbound to northbound movement as a result of added loop ramp.</li> </ul>	<ul style="list-style-type: none"> <li>+ Higher overall capital cost.</li> <li>+ Higher amount of land required as compared to Simple Diamond</li> </ul>

On a first glance, the simple diamond configuration would be the preferred option due to lower overall costs. Upon further review, it was found that the signal located at the intersection of the eastbound offramp and crossroad would function poorly during the AM Peak hours. The functionality of the simple diamond configuration would degrade further with increased traffic growth in the Alberta's Industrial Heartland. Therefore, due to the lack of capacity and robustness of the simple diamond configuration, the

Half Diamond/Half Parclo B4 configuration was chosen as the recommended configuration for the future interchanges at Range Roads 214 and 220.

The recommended configuration provides a diamond on the north side of Highway 15, and a Parclo B4 on the southern side. The loop in the southeast quadrant is necessary to provide free flow movement north onto the respective range road. The intersections of Range Road 214 and 220 will be relocated to reduce the skew angle and consequently the span of the bridge structure. Signals should be installed at both the north and south tie-in locations on Range Road 214 and 220. The eastbound tie-in is included to accommodate the high loads utilizing the highway by providing an alternate route where it is possible to avoid the bridge.

A modified configuration was developed as it was not possible to accommodate a typical Parclo B4 configuration due to major land constraints. The CN rail line located north of Highway 15 leaves minimal land for ramps and headslopes. Also, the facilities within the Alberta Industrial Heartland are concentrated north of Highway 15. These sites represent the destination of the majority of the traffic utilizing the highway and therefore free flow opportunities must be provided. By constructing most of the structure to the south of Highway 15, the cost is reduced due to the agricultural zoning of these lands.

### 6.3 Conceptual Plans

The recommended interchange configuration for the intersections at Range Road 214 and 220 is a modified Parclo B4/Diamond as shown in the plans provided in [Appendix D](#). Range Road 214 and 220 have similar traffic requirements and constraints, therefore the modified interchange configuration will be applicable to both intersections. There are approximately 4 km between Range Road 214 and 220, therefore the construction of interchanges at both locations agrees with the spacing requirements for an expressway.

Wherever possible, the existing twinned section of Highway 15 between the two interchanges will be maintained, however within the vicinity of the interchanges the eastbound and westbound lanes of Highway 15 will need to be relocated south of the existing east/west bound in order to fit the interchange ramp terminals without obstructing the existing rail line. When the construction of interchanges is warranted, these lanes will be repurposed for westbound traffic and new eastbound lanes will be constructed to the south with a 40 m centerline to centerline spacing. The narrower median reduces the span of the bridge structures and thus the overall cost and footprint of the structure. The vertical profile of the new east/west bound main line at the interchange stage is expected to match the existing main line profile (+/- 0.5 m). A vertical profile for this alignment has not been created.

Plan P-3406-10 in [Appendix D](#) illustrates the interchange alignment at the intersection of Range Road 214 and Highway 15. The recommended configuration avoids the water reservoir south of the highway; however this will need to be confirmed during detailed design. Astotin Creek is located to the east of Range Road 214 and will require channel realignment.

In the design of the Range Road 214/Highway 15 interchange, twinning upgrades to Highway 830 to the south were continued to the intersection with Township Road 552. Access to the Heartland Hall and Strathcona County Fire Hall #4 will be provided via parallel service road originating at Township Road 552 and continuing northerly along the previous Highway 830 alignment. An emergency use access will be provided to this facility direct from Highway 830 from an intersection to be constructed at approximately the midpoint along the reversing curves north of Township Road 552.

Located immediately to the north of the Heartland Hall complex is a proposed water reservoir facility, to be constructed in the future by Strathcona County. The facility will include a large underground tank, above ground control building and associated parking area. While the Range Road 214/Highway 15 interchange does not interfere with this facility, the parking area is located within the 40 m setback requirement for permanent structures adjacent to the highway right-of-way boundary. Relocation of the parking area may be required when the interchange is constructed. Alternatively, Guardrail and/or High Tension Cable Barriers may be considered along the eastbound off ramp as a means to mitigate any safety concerns associated with permanent structures within the highway setback.

## 7. Right-of-Way Requirements

To accommodate the proposed twinning of Highway 15, additional right-of-way will be required. Currently, the right-of-way boundaries are offset by approximately 24 m from the highway centerline. Twinning to the south is the preferred option; therefore the north right-of-way boundary will remain as is and an additional right-of-way will only be required south of Highway 15. The new south right-of-way boundary will be offset by 30 m from the centerline of the new eastbound lanes and approximately 27.7 ha of land will be required. A right-of-way will also need to be protected for the construction of service roads adjacent to the Highway. The service roads will have a 30 m right-of-way width offset from the nearest Highway 15 right-of-way boundary and require approximately 20.1 ha of land.

Interchanges are not required in 50 years, however there exists the possibility they may be required beyond the design horizon. In order to accommodate this possibility, consideration should be given to protect the required right-of-way to accommodate interchanges in the future. The required right-of-way was calculated using the recommended interchange configuration. It is based on the preliminary toe of fill using 4:1 sideslopes and a 10 m buffer. The total right-of-way required for the grade separation at Range Roads 220 and 214 is approximately 57.9 ha. Right-of-way plans are provided in [Appendix E](#) for the roads and conceptual interchanges.

As a final note, Strathcona County is currently planning the construction of a water reservoir located immediately north of the existing Heartland Fire Hall, accessed from the current Highway 830 South alignment. Strathcona County owns the land and has undertaken full detailed engineering of the water reservoir facility in advance of this Functional Planning Study. The design was advanced to a point of Roadside Development Permit application and approval by AT, but Strathcona County requested the approval to be held in abeyance pending sufficient industrial clients to come on board so as not to have the RDP expire prior to construction commencement. CIMA+ has redesigned the preliminary ramp alignment so as to minimize or eliminate conflict between the backslope and proposed parking area on the reservoir site.

## 8. Conceptual Cost Estimates

50 year conceptual cost estimates were developed for both the north and south twinning options. Both options include a rail overpass over the CP rail line. No interchange and related upgrade costs have been included in the estimate. The cost estimate is summarized in **Table 8.1** below.

**Table 8.1 – Conceptual Cost Estimate Summary**

Item	North	South
<b>Grading</b>	\$8,821,000	\$8,389,000
<b>Surfacing</b>	\$10,547,000	\$10,241,000
<b>Land</b>	\$3,202,300	\$1,809,900
<b>Utilities Relocation</b>	\$12,994,000	\$6,838,000
<b>Site Remediation</b>	\$3,000,000	\$3,000,000
<b>Signage</b>	\$250,000	\$250,000
<b>Signalization</b>	\$600,000	\$600,000
<b>Total</b>	<b>\$39,500,000</b>	<b>\$31,200,000</b>
<b>Bridges (CP Railway Grade Separation)</b>	\$32,100,000	\$32,100,000
<b>Total (with CP Bridges)</b>	<b>\$ 71,600,000</b>	<b>\$ 63,300,000</b>

Details of the conceptual cost estimate associated with each twinning alignment are provided in **Appendix F**.

The estimate is in 2012 dollars.

## 9. Bridge Assessment

A bridge culvert assessment was completed for BF 73649E and BF 73649W, and the findings are summarized in the BF 73649 E/W Bridge Culverts Highway 15 Crossing Astotin Creek Bridge Culvert Assessment Report provided in [Appendix G](#). A site visit was conducted on November 6, 2012 to verify the most recent BIM report findings for both structures.

A three span precast concrete bridge supported on treated timber substructures were constructed in 1956 over Astotin Creek. The deteriorating bridge structure was replaced in 1991 with twin precast box culverts (BF 73649W) located under the westbound lanes of Highway 15. BF 73649E is located under the Highway 15 eastbound lanes, approximately 60 m east of the Highway 15 and Secondary 830 intersection. This culvert was constructed in 1999 and consists of a 5.23 m diameter structural plate corrugated steel plate pipe.

The structural condition, hydrotechnical issues, geotechnical issues, environmental issues, roadway geometrics, and traffic usage and future development of BF 73649E and BF 73649W have been reviewed based on the information available. No controlling factors have been identified from this review.

Based on a review of the most recent inspections and the field visit, the pipes were observed to be in generally good condition. No repairs to the structures are warranted at this time. It is recommended to continue with regular programmed BIM inspections, and should the condition of the structure significantly change the culverts should be reassessed at that time to determine an appropriate strategy.

## 10. Geotechnical Assessment

In accordance with the Highway 15 Functional Planning study, a geotechnical assessment was completed by Thurber Engineering Ltd. Their findings are summarized in the report entitled, Functional Planning Study for Highway 15:06 Twinning Fort Saskatchewan Alberta Geotechnical Assessment and is provided in **Appendix H**. The objective of this study is to provide a preliminary geotechnical assessment of the expected soil conditions along a corridor extending approximately 500 m on either side of the existing Highway 15. Information was obtained through a desktop study of existing aerial photographs and in-house geotechnical information along with a site reconnaissance visit on May 16, 2012.

The surficial geologic deposits underlying the project area are comprised of sediments ranging from stratified sand to ground moraine. This indicates that the deposits are of preglacial, glacial and postglacial origin. The total thickness of these surficial deposits (or the depth to top of bedrock) within the study area varies between 20 and 40 m. The bedrock belongs to a formation named the Belly River Group and is comprised of thick-bedded sequences of sandstone, siltstone and clay shale. The study area is located on the southeastern slope of a buried channel and as a result, a difference in elevation of approximately 40 m is observed between the western and eastern project limits.

During the site visit, some minor surface erosion was observed on the creek uplands, apparently caused by runoff water draining from the road surface towards the creek. Embankment fill slopes and roadway ditches should be covered with topsoil and vegetated to reduce the potential for erosion by surface runoff. Water flows in roadway ditches should be evaluated to assess if additional erosion protection measures are needed.

In general, ground support for the proposed road upgrades is anticipated to be adequate.

Localized pockets of soft and weak glaciolacustrine sediments may be present, especially in the poorly drained areas in the central and western portions of the study zone. In such areas, the removal and replacement of near surface weak/soft horizons and/or enhanced foundation preparation procedures would be required.

The subsurface conditions in the project area are anticipated to be generally favorable for the proposed upgrade works depicted on the plan and profile drawings. However, at the design stage a detailed geotechnical investigation, including borehole drilling, must be conducted to confirm the subsurface conditions inferred in this report and to provide the geotechnical parameters required for design.

## 11. Environmental Assessment

An Environmental Assessment was prepared by Fiera Biological Consulting as a requirement of the Highway 15 Functional Planning Study. A summary of this assessment is contained in the report entitled, Environmental Assessment, Strathcona County Property in: Township 55, Range 21, W4M, provided in **Appendix I** of this report. The objective of this report was to assess the ecosystems, habitats and species present within the study area and to assess the impacts resulting from development. This report considered an affected area of 11 km of Highway 15 with a surrounding 1 km buffer. Relevant information was gathered from a desktop information review and a field reconnaissance trip on June 14, 2012. The collected information was reviewed along with current and historical literature including: consultant reports, aerial images, photographs and maps. All recommendations provided are in accordance with regulations and policies regarding the protection of wildlife, vegetation, and aquatic resources.

The study area is located in a transition zone between the Dry Mixedwood and the Central Parkland natural sub-region of Alberta. This region contains forests which include balsam poplar, trembling aspen, white and black spruce and various types of shrubs. There is no known occurrence of rare plants within the study area, however that does not prohibit their existence; rather it may be a result of having very few inventories completed in this area. Weeds are prevalent throughout the study area due to the highly modified state that all land in the region is now in. Clubroot is a potential issue where land is to be cleared for construction and improvements and where re-vegetation is not planned or slow to begin.

The environmental assessment has identified 21 species that potentially inhabit the study area based on range maps and habitat preferences. This list contained two species considered to be a special concern, the Canada Warbler and Northern Leopard frog. Neither was seen during the site visit, however five bird species and one amphibian species were observed.

A portion of the study area has been identified as part of an aquatic environmentally significant area containing Astotin Creek, which flows into the North Saskatchewan River. The creek was identified as an environmentally significant area because of the presence of both focal fish species and rare fish species (those listed as species of conservation concern). In addition, the creek was identified to contain important habitat of aquatic bird species, highlighting the aquatic significance of the area.

A total of 23 wetlands were found to be contained within the study area, of which none are considered to be fish bearing. These wetlands have been impacted by more than one-half century of agriculture practices and erosion and sedimentation from major transportation corridors.

Approximately 80% of the native vegetation has been replaced by cultivation and crop production. However it still thrives in small, isolated patches deemed less valuable for agriculture. The urban and industrial development seen in the study area has resulted in habitat alterations for both plants and wildlife. Impacts to the natural areas along the roadways will largely consist of disturbance of small areas of trees, shrubs and wetlands during the road improvement work, which will result in an overall reduction in habitat area. The long term effects on valued ecosystem components resulting from road construction in the study area will be local and negligible with proper mitigation measures.

This is a preliminary assessment and additional surveys should be considered during the future upgrading of Highway 15 regarding timing restrictions due to fish and bird habitats.

## 12. Historical Resources Overview

A Historical Resources Overview (HRO) was prepared by Bison Historical Services Ltd. as one of the objectives for this functional planning study. The HRO report entitled, Justification for Historical Resources Act Requirements: Strathcona County – Highway 15 Functional Planning Study summarizes the findings of the historical assessment.

The project occurs largely in lands that have been previously disturbed by agricultural, industrial and construction activities; however small portions of land associated with drainage remain undisturbed. Several archeological sites identified in the HRO have Historical Resources Values of zero and have largely been destroyed. The report states that “given the level of disturbance and the low interpretive value of these sites, impact would not be significant”.

Historical Resources Act Clearance (HRC) is recommended for the Highway 15 Functional Planning Study as there is a low potential for encountering intact historical resources.

A copy of the HRO report is provided in [Appendix J](#).

### 13. Stormwater Overview

A brief overview of the stormwater management has been undertaken for this project. Most of the lands in the area surrounding the study area are rural in nature; as such most drainage is accomplished through overland flows leading to watercourses or small localized wetland areas. As illustrated in Figures 1 to 7 in [Appendix K](#), a topographical plan of the study area has been developed illustrating the general flow patterns in the study area, the localized high elevation points and wetlands present.

The topographical characteristics of the study area can be considered as two distinct areas. The first area, located east of Range Road 212, slopes at approximately 1.5% from east to west. This area is well drained with stormwater runoff flowing in a west to northwesterly direction. West of Range Road 212 the topography becomes much more rolling with an ill-defined drainage pattern, most runoff flows into localized wetland areas whereby the runoff water dissipates mostly through evaporation. A major watercourse, Astotin Creek, is present east of the Range Road 214 intersection and ultimately flows into the North Saskatchewan River.

The only drainage features present are ditches and associated culverts which have been established adjacent to highways and other roadways. The purpose of these conduits is to convey drainage to sag points in the highway profile whereby stormwater is redirected into natural drainage pathways. Some of the existing ditches along Highway 15 are poorly drained, especially the common ditch between Highway 15 and the CN railway line.

A summary of the existing culverts along Highway 15 within the study area is presented in [Table 13.1](#) below:

**Table 13.1 – Culvert Table**

Km	Diameter (mm)	Material	Location
0.123	800	CSP	EBL
1.487	800	CSP	EBL
1.487	760	CSP	WBL
1.953	800	CSP	EBL
2.173	800	CSP	EBL/WBL
2.323	600	CSP	EBL
2.969	800	CSP	EBL
2.969	760	CSP	WBL
4.083	800	CSP	EBL
4.170	3000	PCB	WBL
4.170	5230	SP	EBL
4.623	600	CSP	EBL
4.908	800	CSP	EBL
5.059	610	CSP	CL

Km	Diameter (mm)	Material	Location
5.668	760	CSP	CL
6.399	760	CSP	CL
7.074	760	CSP	CL
7.548	760	CSP	CL
7.973	760	CSP	CL
8.476	760	CSP	CL
8.986	610	CSP	CL
9.713	760	CSP	CL
9.992	760	CSP	CL
10.427	760	CSP	CL

During the course of Detailed Design the stormwater management scheme will need to be reviewed. As typical for most rural highways, drainage will be accomplished through the use of roadside ditches and associated culverts ultimately connecting the natural drainage pathways. Improvements to the existing drainage infrastructure should be considered during the construction of any highway improvements.

Areas for consideration include:

- + Repair or replacement of any damaged existing culverts;
- + Replacement of any culverts which are undersized to handle present day stormwater flows, and;
- + Improving the slope of any ditches where water appears to pool.

Given the proximity to future industrial developments in the Alberta's Industrial Heartland, drainage modifications within these development sites should be considered during design of highway improvements, if they are known. Internal drainage is designed to stay within the industrial site which can have an impact on the drainage patterns of the surrounding areas. This could lead to the stormwater management infrastructure along Highway 15 corridor to not perform as design, in a worst case scenario this could lead to localized flooding. The opportunity for utilizing joint drainage facilities with industrial developers should be considered during the Detailed Design phase.

Additional measures for stormwater drainage may be required at the future interchanges at the intersections of Highway 15 with Range Roads 214 and 220; however it is anticipated that drainage of these interchanges will be accomplished through similar means to the mainline Highway. The future interchange at Range Road 214 will have significant impacts on the alignment of Astotin Creek, necessitating the realignment of this watercourse. The technical and regulatory requirements for the realignment of this watercourse should be reviewed during the Detailed Design phase.

## 14. Utility Assessment

As the main transportation corridor through Alberta's Industrial Heartland, Highway 15 is paralleled and crossed by numerous utilities including: pipelines, power lines and wells. These utilities service both the industries north of Highway 15 and the residents in the surrounding rural area.

The Capital Region Vegreville Corridor Water Services Commission owns and operates a water line within the study area. The diameter of this pipeline varies along its length from 550 mm to 350 mm. The water main parallels Highway 15 from Range Road 213 to Range Road 210/Highway 830 north and is located immediately north of the existing north highway right-of-way boundary. Due to the proximity of the water main to the existing highway, provisions for protection should be considered.

Within the extents of the project, the Battle River REA line is the sole overhead power line to cross Highway 15. It crosses in NW-21-55-21-4 at a height of 11.3 m. There is also an overhead power line which parallels Highway 15 from Range Road 220 to Range Road 214/Highway 830 south, where it deviates from the highway and continues north. Underground power is assumed to only be located in the areas surrounding Range Road 214 and 220 as a result of the intersection signalization.

The heavy presence of oil and gas pipelines throughout the region is attributed to the refineries located north of Highway 15. Consequently, the majority of these pipelines parallel the highway to the north. Proposed upgrades will impact existing utilities which may require relocation or protection. The number of utilities within the study area will continue to increase as a result of new developments and facility upgrades. As such, a full utility investigation should be completed during the detailed design phase. A complete list of all oil and gas pipelines and wells in the region is provided in [Appendix L](#).

## 15. Railway Assessment

There are two major railway facilities within the study area, the first and most significant is CN's Vegreville Subdivision located immediately adjacent to Highway 15 between Range Road 213 and 220. This section of railway is a component of CN's transcontinental main line and experiences heavy volumes of traffic. CN's Scotford Yard is immediately adjacent to the study area, serving many of the industries located within the Alberta's Industrial Heartland.

The most significant impact on this railway line is not found on Highway 15 but rather on two intersecting roadways, Range Roads 220 and 214. Both crossings on these range roads are located within close proximity to Highway 15 and as such have significant impacts on the operation of the roadway. At present both crossings are fully signalized, complete with crossing arms and are connected with the traffic signals located on Highway 15. In reviewing Alberta Transportation's collision statistics for this section of highway, no collisions have occurred at either at-grade crossing between 2006 and 2011.

It is anticipated that no changes will occur to these existing crossings during the 20 and 50 year horizons. The safety performance of both crossings should be reviewed periodically to ensure that the existing crossing signals are functioning as intended. Grade separation during this time frame is considered infeasible due to the close proximity of the mainline lanes of Highway 15 to the grade crossings. During the long term horizon, grade separation will be required at both crossings due to the geometric constraints of the proposed interchanges at Range Roads 220 and 214. The preliminary grade lines established for both interchanges in Section 6.0 of this report have taken into account the clearance requirements for these crossings.

The second railway line within the study area is CP's Willingdon Subdivision line which crosses Highway 15 between the junctions of Range Road 211 and Highway 830 north. This line is currently utilized as a spur line to provide access to several industrial facilities within the Alberta's Industrial Heartland and points east. Major facilities near to the study area serviced by this line include several grain terminals, with the closest located approximately 1.0 km north of the Highway 15 crossing. This line terminates at the Hamlet of Star located about 12 km to the northeast of the study area. In reviewing Alberta Transportation's collision statistics for this section of highway, no collisions have occurred at either at-grade crossing between 2006 and 2011.

CP has plans to expand service from this spur line into the Strathcona and Sturgeon County portions of the Alberta's Industrial Heartland, including construction of an intermodal yard adjacent to Range Road 211 approximately 6.4 km north of Highway 15. The timing of the construction of these facilities is highly dependent on the rate of development within the Alberta's Industrial Heartland, as such is difficult to determine with accuracy when a grade separation of the CP crossing is required.

According to Transport Canada railway crossing regulations in force at the time of writing, the minimum Cross Product (i.e. average number of trains per day multiplied by the AADT) where a grade separation will be warranted is 200,000. Considering that estimated AADT at the crossing location is approximately 8,200 in the 20 year horizon and 14,200 in the 50 year horizon, a minimum of 24 trains per day in the 20 year horizon and 14 trains per day in the 50 year horizon will be required to meet the grade separation warrant.

Current train volumes are significantly below the warrant levels, however for the purposes of this Functional Planning Study it is likely that the warrant will be met within the 50 year horizon based upon anticipated growth within the Alberta's Industrial Heartland. With this consideration in mind, allowance should be made for its construction in the future. Should construction of CP's facilities within the Alberta's Industrial Heartland proceed at such time, warrant analyses for grade separation should be conducted to determine if a grade separation is required.

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