FINAL REPORT

Highway 1 Interchange
[Between Range Road 33 and Stoney Trail]
Functional Planning Study
Alberta Transportation

Presented to:
Government of Alberta
Southern Region
Willowglen Business Park
803 Manning Road NE, 2nd floor
Calgary, Alberta
T2E 7M8
FUNCTIONAL PLANNING STUDY

HIGHWAY 1:08
Between Range Road 33 and Stoney Trail

CastleGlenn Consultants Inc.
Engineers, Project Managers & Planners

Mr. Arthur E. Gordon, B.A. P. Eng.
Transportation Planning
CastleGlenn Consultants Ltd.
Consulting Engineers

Date: June, 2014

Alberta Transportation

Accepted by:

Mr. Darrell Camplin
Regional Director
Southern Region

Date: June 16, 2014

Mr. Moh Lali
Executive Director
Technical Standards

Date: June 20/14
This study has been prepared by CastleGlenn Consultants Inc. ("CGI") for the benefit of the Client to whom it is addressed. The information and data contained herein represents CGI’s best professional judgment in light of the knowledge and information available to CGI at the time of preparation. Except as required by law, this study and the information and data contained herein are to be treated as confidential and may be used and relied upon only by the Client, its officers and employees. CGI denies any liability whatsoever to other parties who may obtain access to this study for any injury, loss or damage suffered by such parties arising from their use of, or reliance upon, this study or any of its contents without the express written consent of CGI and the Client.
ACKNOWLEDGMENTS

The Consulting Team of CastleGlenn Consultants, The Archaeology Group, Vertex Environmental, Golders Associates and Terrace Engineering wish to extend their sincere appreciation to those individuals and groups from Alberta Transportation, Rocky View County, the City of Calgary and the residents, employers and organizations without whose cooperation and input this study could not have been accomplished.

In particular, we wish to express our sincere appreciation to those who have served as members of the Technical Review Committee, which include:

- Jerry Lau, P.Eng., Planning Engineer, Infrastructure-Calgary, Alberta Transportation
- Vince Diot, C.E.T., Municipal Engineering Technologist, Rocky View County
- Byron Riemann, General Manager, Infrastructure and Operations, Rocky View County
- Naveed Butt, P.Eng., Senior Transportation Engineer, Network Planning, City of Calgary
- Travis Shaw, Planner, Land Use Planning and Policy, City of Calgary
- Shawn Small, Senior Planner, Land Use Planning and Policy, City of Calgary
- Kevin Froese, Coordinator, New Community Planning, City of Calgary
- Marcus Paterson, Planner, New Community Planning, City of Calgary
- Viola Forrester, Manager, Transportation Data, City of Calgary
- Cameron Matwie, Manager, Network Planning, City of Calgary

The contents of this document must be credited to numerous other individuals within the above agencies who have inadvertently been excluded from the above list, but which have contributed to the study process through their comments and guidance.
A regular meeting of the Policy and Priorities Committee of Rocky View County was held in Council Chambers of the Municipal Administration Complex, 911 – 32nd Avenue NE, Calgary, Alberta on March 4, 2014 commencing at 9:00 a.m.

Present:  Councillor L. Habberfield, Division 7, Chair
          Councillor A. Sacuta, Division 8, Vice-Chair
          Reeve M. Bahcheli, Division 3
          Deputy Reeve G. Boehlke, Division 6
          Councillor L. Breakey, Division 1, arrived at 9:02 a.m.
          Councillor J. Arshinoff, Division 2, arrived at 9:05 a.m.
          Councillor R. Ashdown, Division 4
          Councillor E. Solberg, Division 5
          Councillor B. Kendall, Division 9, arrived at 9:30 a.m.

Also Present:  K. Greig, County Manager
               B. Riemann, General Manager, Infrastructure and Operations Services
               K. Robinson, General Manager, Corporate Services
               S. Baers, Manager Development Services
               G. Kaiser, Manager Communication Services
               S. Jewison, Manager Operations
               M. Marko, Senior Planner
               G. Van Soest, Municipal Lands Specialist
               S. Graham, Community Services Co-ordinator
               M. Norman, Municipal Planner
               N. Housenga, Manager Legislative Services
               J. Handby, Legislative Clerk – Council

**Call to Order**

The Chair called the meeting to order at 9:00 a.m.

**14-03-04-01**

**Updates/Acceptance of Agenda**

Add:     Presentations to Communication Services and Infrastructure and Operations Services

MOVED by Deputy Reeve Boehlke that the March 4, 2014 Policy and Priorities Committee agenda be approved as amended.  

Carried
Absent:  Councillor Breakey
         Councillor Arshinoff
         Councillor Kendall

Approved April 1, 2014
14-03-04-02  
**Confirmation of Minutes**

MOVED by Councillor Sacuta that the January 7, 2014 Policy and Priorities Committee meeting minutes be approved as circulated.  

Carried  
Absent: Councillor Breakey  
Councillor Arshinoff  
Councillor Kendall

Councillor Breakey joined the meeting at 9:02 a.m.

14-03-04-03  
**Presentations**

The International Association of Marketing and Communications Professionals presented Rocky View County with its 2013 Platinum Award for Print Advertising. The award recognizes the County’s move away from rule-based print ads to approachable, plain-language, and sometimes humorous ads that treat residents as partners in making the County a great place to live.

Stacy Byer of the Alberta Public Works Association (APWA) presented the “Project of the Year” award to the Infrastructure and Operations Department for the East Balzac Potable Water Project.

Councillor Arshinoff joined the meeting at 9:10 a.m.

14-03-04-04 (C-1)  
**All Divisions – Highway 1 at Range Road 31 (Old Banff Coach Road) Functional Planning Study**  
*File: 5011-298*

**Delegate:** Arthur Gordon, of CastleGlen Consulting presented the Highway 1 Interchange Functional Planning Study, including the study objectives.

Councillor Kendall joined the meeting at 9:30 a.m.

MOVED by Reeve Bahcheli that the Policy and Priorities Committee receives the Highway 1 at Range Road 31 (Old Banff Coach Road) Functional Planning Study for information.  

Carried

14-03-04-05 (C-2)  
**All Divisions – Marigold Library Presentation**  
*File: 1006-600*

**Delegate:** Michelle Toombs, CEO of the Marigold Library System presented an overview of the Marigold Library System, including the services provided.

MOVED by Councillor Ashdown that the Policy and Priorities Committee receives the Marigold Library System presentation for information.  

Carried

Approved April 1, 2014
The Chair called a recess at 10:08 a.m. and called the meeting back to order at 10:21 a.m.

14-03-04-06 (C-3)
Division 6 – Rockyview Motorsports Park Presentation
File: 07330002-05


Dominic Young of Rockyview Motorsports and Dennis Westhoff came forward to answer questions of the Committee.

MOVED by Deputy Reeve Boehlke that the Policy and Priorities Committee receives the Rockyview Motorsport Park presentation for information.

Carried

The Chair called a recess at 11:33 a.m. and called the meeting back to order at 11:45 a.m.

14-03-04-07 (C-4)
Division 2 – Presentation Update by Harmony Developments Inc.
File: 05707001-004; 05708002/004; 05709002; 05705003

Delegates: Al Copithorne, Birol Fisekci, President and CEO of Bordeaux Properties; Karin Finley, Vice President of Qualico Communities came forward to provide a status update on the Harmony Development project.

MOVED by Councillor Arshinoff that the Policy and Priorities Committee receives the Harmony Development Inc. presentation update for information.

Carried

The Chair called a recess for lunch at 12:21 p.m. and called the meeting back to order at 1:00 p.m.

14-03-04-08 (D-1)
All Divisions – 2013 Langdon and Bearspaw Mosquito Program Review
File: 6030-425

MOVED by Councillor Ashdown that the Policy and Priorities Committee receives the 2013 Langdon and Bearspaw Mosquito Program Review for information.

Carried

Approved April 1, 2014
Division 9 – Proposed Highway 1A Seasonal Speed Limit Reduction
File: 4065-200

MOVED by Councillor Kendall that the Policy & Priorities Committee provide support to Alberta Transportation for the implementation of a Seasonal Speed Limit Reduction Zone for the period from May 15, 2014 to September 15, 2014 along Highway 1A east and west of the Ghost Lake Marina access road.

Carried

Adjournment

MOVED by Councillor Kendall to adjourn the meeting at 1:22 p.m.

Carried
May 22, 2014

Jerry Lau, P.Eng.
Infrastructure Engineer
Alberta Transportation
803 Manning Road NE, Second Floor
Calgary, AB T2E 7M8

Dear Mr. Lau:

Re: Highway 1 at Old Banff Coach Road Functional Planning Study

I am writing on behalf of the City of Calgary Transportation Planning regarding the above mentioned functional planning study draft report that Alberta Transportation sent us. As a stakeholder, we are happy to let you know that The City accepted the recommendations in the report in general. Thank you for offering us the opportunity of working with you.

With the acceptance of this study, The City continues to submit that an additional half interchange at 133 Street to provide access to the surrounding new development areas within the City’s boundary be considered in the future.

Please feel free to contact me if you have any concerns.

Regards,

Manager
Network Planning, Transportation Planning

T 403.268.5984 | F 403.268.1874 | Mail code #8124
Floor 7, Calgary Municipal Building, 800 Macleod Tr. S.E.

cc: Malcolm Logan, General Manager Transportation, City of Calgary
    Don Mulligan, Director, Transportation Planning, City of Calgary
    Naveed Butt, City of Calgary
    Jeffrey Xu, City of Calgary
EXECUTIVE SUMMARY

The Highway 1 Interchange (Between Range Road 33 and Stoney Trail) Functional Planning Study was initiated in February, 2012 to determine the “ultimate” configuration of the Highway 1 corridor within the vicinity of Old Banff Coach Road (OBCR). The study was intended to address the preferred location/configuration of a new interchange that would replace the existing Hwy 1/Hwy 563 (OBCR) interchange and define the “ultimate” requirements of the Highway 1 corridor in the vicinity of the interchange. As well, the study was intended to define the future classification requirements of the Highway 563 corridor between RR-31 and Springbank Road.

Study Area

- The study area encompasses the area of influence along Highway 1 (between RR-33 and Valley Ridge Blvd) located within both Rocky View County and the City of Calgary.
- The Highway 1 corridor lies predominantly within the jurisdiction of Rocky View County; however the eastern limit (from a point 800m east of RR-31) lies within the jurisdiction of the City of Calgary. The entire Highway 563 corridor lies within Rocky View County’s jurisdiction.
- The land uses on the western portion of the study area are best described as a mixture of country residential with some commercial and industrial uses. The eastern portion of the study area is characterized by urban developments (Valley Ridge and Crestmont communities). The lands south of the Hwy 563 corridor comprise the rural Springbank community (Artist View and Horizon View rural country residential acreages).

Existing Conditions and Envisioned Growth

- The section of Highway 1 within the study area is classified as a “Level 1” highway within the National Highway System (NHS) and is classified as a Long Combination Vehicle (LCV) route posted at 110kph. Highway 563 is a “Level 4” rural highway posted at 60 kph.
- Existing (2012) traffic volumes (AADT) along Highway 1 were approximately 23,000-to-24,000 vehicles-per-day (vpd) west of the RR-31 corridor, 28,000-to-29,000 vpd east of the RR-31 corridor, and 39,000-to-40,000 west of the Stony Trail/Hwy 1 interchange. Traffic volumes along Highway 563 were approximately 1,500-to-2,000 vpd.
- The 10-year average annual growth rate for Hwy 1 in the vicinity of the RR-31 interchange was found to be in the order of 2-to-3 percent. The annual growth rate along Hwy 563 was determined to be just over 5 percent.
- The Highway 1 corridor is classified as a “Long Combination Vehicle Route” but is not a “High Load Corridor”. Highway 563 is a “Double Trailer Combination (WB-23) Route”. Approximately 6% of the Highway 1 vehicle traffic in the vicinity of the RR-31 interchange is heavy vehicle traffic.
• The most recent 5-year historical collision statistics over a 6.5km section in the vicinity of the existing Hwy 1/RR-31 interchange indicated a collision rate of 53 collisions per-100-million-vehicle-km, which is only slightly lower than the 2012 Provincial average of 63 collisions per-100-million-vehicle-km. However, along the steep Hwy 1 grade (6.4%) east of the interchange, the collision rate was almost double the Provincial average, with 120 collisions per-100-million-vehicle-km.

• The existing Hwy 1/RR-31 interchange overpass bridge (BF 75933) assessment indicated an original construction year of 1965 and a 2012 BIM report indicated that the 48-year old structure is in “fair-to-poor” condition and is “schedule for a full deck replacement in 2017”. Extending the life of the existing structure through rehabilitation was found to be superior to the option of bridge replacement. A deck replacement estimated at $2M was anticipated to add approximately 30 years to the life of the structure.

• An access exists on the north side of the Hwy 1 corridor to a country residential acreage. On the south side of the Hwy 1 corridor there is a maintenance access to a water retention pond nearest the Crestmont development. Two accesses exist on the west side of the Rge Rd 31 corridor (north and south of Hwy 1) to a country residential acreage and an industrial access. All accesses are to ultimately be closed at the time of widening of the Highway 1 corridor and an alternative access would be provided for properties that currently have access to Rge Road 31.

• The forecast growth potential for the lands within the immediate proximity of the interchange is anticipated to result in:
  • an additional 6,000-to-7,500 homes;
  • a business park/office/industrial development potential of an additional 3.0-to-4.6 million square feet;
  • a retail expansion of 1.4-to-2.2 million square feet; and
  • public institutional development (inclusive of schools, community centres, parks, etc.).

• These results indicate that the forecast traffic growth of the lands within the study area would generate approximately:
  • 7,500-to-10,600 new vehicle trips in the morning peak hour; and
  • 9,500-to-13,500 new vehicle trips in the afternoon peak hour of travel demand.

**Planning with the Public**

• The public consultation/involvement activities provided for three public open houses and six focus group meetings.

• The 1st public open house was attended by 158 individuals and 56 persons attended the 1st set of focus groups. The 2nd public open house was attended by 110 individuals and the 38 individuals attended the second set of focus groups. The third set of focus groups was attended by 13 individuals and the 45 individuals attended the 3rd public open house. A total of 63, 52 and 48 comment sheets were received at each of the three sets of public meetings, respectively.

• Throughout the entire process comments and concerns were recorded and responses provided.
Proposed Hwy 1 / RR-31 Interchange Improvements

- The Hwy 1 improvement strategy envisioned the first activities as incorporating the rehabilitation (re-decking) of the existing interchange overpass bridge and the installation of a high tension cable barrier system along the length of the median separating the eastbound and westbound lanes through the rural-urban transition zone.

- At the time when Hwy 1 warrants a continuous 6-lane freeway cross section, the improvement strategy envisions that the Hwy 1/RR-31 (OBCR) interchange would be reconfigured to a diamond configuration to utilize the existing outside lanes (currently used by the loop ramps) under the bridge to achieve the widening beneath the structure. This will involve ramp relocation, ramp terminal relocation/reconfiguration, raising the existing RR-31 profile, closure of adjacent intersections and accesses and intersection improvements.

- At the time when RR-31 warrants widening to support 4 continuous north-south lanes over the Hwy 1 corridor, the improvement strategy envisions the development of a new 2-lane overpass bridge to the east of the existing bridge intended to accommodate NB traffic, the 4-laning of RR-31 north and south of the interchange, the reconfiguration of the ramps terminals, widening of the off-ramps to accommodate two approach lanes and integration with local municipal improvements.

- At the time when Hwy 1 warrants a continuous 8-lane freeway cross section under the Hwy1/RR-31 overpass structures, the improvement strategy envisions a reconfigured “Parclo A” Hwy 1/RR-31 interchange that would comprise:
  - a replacement overpass structure to accommodate SB traffic;
  - further widening of the NB structure to access a loop ramp in the north-east quadrant;
  - a separate overpass structure to accommodate SB traffic destined to a double loop ramp in the south-west quadrant;
  - additional widening of the RR-31 corridor to support a 6-lane cross-section north and south of the ramp terminals; and
  - integration with additional local municipal improvements.

Hwy 563 Improvements

- Planned development and roadway improvements will, over time, result in Hwy 563 ceasing to function as a Provincial Highway corridor.

- It is considered prudent for the Province to have discussions with the County to affect the transfer of the Hwy 563 corridor to the local municipal jurisdictions in advance of the initial Hwy 1/RR-31 interchange improvements.

- This study suggests a future function and form for the various segments of the Hwy 563/OBCR corridor as indicated in Exhibit ES-2, however most infrastructure requirements along the majority of the length of the corridor will, for the most part, be driven by adjacent development initiatives.
**Hwy 1 Widening Improvements**

- The plans call for the widening of the Highway 1 corridor to initially accommodate 6-highway thru-lanes.
- The ultimate plans for the widening of the Highway 1 corridor will provide for 8 continuous highway thru-lanes beneath the overpass bridges linking to a 10 lane highway 1 cross section on either side of the interchange.
- The functional plans remain flexible in that the span of the ultimate bridges can be modified to accommodate an outside fifth lane as a “barrier-ed” lane, by cutting into the head-slope or clear-zone. This provides the flexibility to accommodate a 10-lane cross-section under the Highway 1/Old Banff Coach Road/RR-31 interchange structure were it to become warranted in the future.

**Hwy 1 Grade Improvements**

- The collision rate (2006-2010) along the steep 6.4% segment of Hwy 1 (Station 11+400-to-12+400) was 120 collisions-per-100-million-vehicle-kilometers, which is twice the provincial average (63 collisions-per-100-million-vehicle-kilometers) and over twice the collision rate for the 6.5 km study area between Station 7+500 at RR-33 and Station 14+000 at the City of Calgary boundary (53 collisions-per-100-million-vehicle-kilometers). The steep 6.4% grade is believed to remain as a factor that contributes to the high collision rate along this segment of corridor and improvements to the grade would be anticipated to reduce collision frequency along this segment of highway.
- An analysis determined that, it remains prudent from a long term cost-benefit perspective (in terms of internal rate of return, decision sight distance and level of service) to protect for sufficient property to accommodate a 3% maximum grade along the Highway 1 corridor on either side of the Hwy 1/RR-31 interchange.
- For the purpose of this functional planning study, it was assumed that the 3% grade improvement along the Hwy 1 corridor would precede the 6-lane widening.
- The cost of delaying the Highway 1 grade improvements to the time of 8-lane widening would be significantly higher given future property values, the rate of development and the availability of adjacent lands to develop interim construction bypass routes, and the additional cost of having to develop wider by-passes to accommodate much higher traffic volumes.

**Costs**

The conceptual cost of the entire project was determined to be approximately $208M, inclusive of property. The components of this overall total were determined as follows:

- $83M allocated to Hwy 1/RR-31 interchange improvements with:
  - $33.4M – allocated to Stage I;
  - $19.4M – allocated to Stage II; and
  - $30.3M – allocated to the Ultimate Stage.
- $21.8M allocated to Hwy 1 corridor improvements with:
  - $11.8M – allocated to widening to a 6/8 lane freeway standard; and
  - $10.0M – allocated to widening to a 8/10 lane freeway standard.
- $27.1M allocated to Hwy 1 vertical profile improvements to a 3% desired grade with:
- $6.9M – allocated to a 4-lane by-pass corridor during construction; and
- $20.2M – allocated for removal of approximately 2km of the existing Hwy 1 corridor and replacement to meet a 6/8 lane freeway standard.
- $33.1M - allocated as a 25% estimate for contingency, engineering and mobilization.
- $42.5M - allocated for the cost of property acquisition involving 134.5 acres.

The net component of the costs related solely to the 3% grade improvement on either side of the interchange was determined to be $25M in construction costs (assuming the grade improvement precedes the 6-laning of the Hwy 1 corridor) and $25M for property resulting in a total cost of approximately $50M.

In addition, approximately $400K of improvements related to the Highway 563 corridor associated with the adjacent Hwy 1/RR-31 and the Stoney Trail/Springbank interchange improvements.

**Recommendations**

It is recommended that...

1. The infrastructure improvements consistent with the *Highway 1 Interchange (Between Range Road 33 and Stoney Trail) Functional Planning Study* be received and approved by Alberta Transportation.

2. The City of Calgary and Rocky View County be informed that the *Highway 1 Interchange (Between Range Road 33 and Stoney Trail) Functional Planning Study* represents a planning document and Highway 1 improvements are not currently scheduled.

3. The City of Calgary and Rocky View County be requested to incorporate the *Highway 1 Interchange (Between Range Road 33 and Stoney Trail) Functional Planning Study* within their planning documents (Municipal Development Plans and Area Structure Plans).

4. Subsequent to Alberta Transportation’s endorsement of the Highway 1 corridor and Hwy 1/RR-31 interchange functional designs, as recommended in the *Highway 1 Interchange (Between Range Road 33 and Stoney Trail) Functional Planning Study*, Alberta Transportation is encouraged to pursue those initiatives necessary to confirm the detailed engineering feasibility of the proposed “interim” and “long term” improvements. These activities would likely include, but are not limited to:
   a. Presenting to Rocky View County with the goal of seeking endorsement of those components of the functional plan that would proceed to detailed design.
   b. Initiating discussion regarding the jurisdictional transfer of Highway 563 corridor to Rocky View County.
c. Responding to development driven initiatives to assure that access provisions are in accordance with the access management strategy presented within the Functional Plans.

d. Developing individual detailed construction staging plans that would offer the flexibility to implement improvements along Highway 1 corridor when warranted.
Exhibit ES-1: The Highway 1 / RR-31 Ultimate Interchange Improvements

- New Pedestrian Facility
- Improved RR-31 Horizontal Curvature
- Dedicated Access to Loop Ramp Facilitates Improved Operations at Ramp Terminal
- Grade Improvement
- New Median Cable Barrier
- Double Loop Ramp
- Provision of Double Left Turn Lanes
- New Access
- New Overpass Bridges
- Access Closure
- Closure
- Closure
- New Access
Profile Improvements to Desired 3% Maximum Grade

Provision of 10-lane Corridor

Exhibit ES-2: Highway 1 and Highway 563 Corridor Improvements

Improvements within this box are considered local initiatives that would be required to be approved by the municipality and undertaken in conjunction with adjacent municipal development initiatives.

The north leg of the Springbank Rd/101st St SW intersection and the closure of the existing Burnco site access is considered a local initiative and is development driven.
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1.0 INTRODUCTION

CastleGlenn Consultants Inc. was retained in February, 2012 to undertake a functional planning study that would determine the “ultimate” configuration of the Highway 1 corridor within the vicinity of Old Banff Coach Road. The “Highway 1 Interchange (Range 33 to Stoney Trail) FPS was intended to address:

- the preferred location/configuration of a new interchange that would replace the existing Hwy 1/Hwy 563 (Old Banff Coach Road) interchange;
- the “ultimate” requirements of the Highway 1 corridor in the vicinity of the interchange; and
- the future classification requirements of the Highway 563 corridor between RR-31 and Springbank Road.

This study also outlines the property requirements necessary to ensure the “ultimate” development of the corridor and the associated interchange improvements.

1.1 Study Area

The study area (See Exhibit 1-1) encompasses the area of influence along Highway 1 (between RR-33 and Valley Ridge Blvd) located within both Rocky View County and the City of Calgary. Highway 1 functions as a primary east-west intercity corridor that connects the City of Calgary to the areas immediately west of the City boundaries (Rocky View County, the Springbank community, etc.) and extends westward to function as the major gateway to the Rockies connecting the Foothills with communities such as Canmore and Banff. The study area is bisected such that the western portion of the corridor falls within the jurisdiction of Rocky View County while the easterly portion encompasses the Valley Ridge and Crestmont communities within the City of Calgary.

The surrounding land uses within the jurisdiction of Rocky View County and immediately adjacent to the Highway 1 corridor vary between open space/agricultural acreages, residential/country residential acreages, industrial, commercial and institutional developments. Within the municipal boundary of the City of Calgary, the surrounding lands uses currently consist of open space/agricultural acreages (for which urbanization plans are in the process of being formulated) and the existing residential communities of Valley Ridge and Crestmont.
1.2  Past Planning Initiatives

Numerous individual functional planning studies have taken place along the Highway 1 corridor in recognition of the extensive growth experienced within the Province. Development pressures on adjacent lands combined with plans for urbanization of lands incorporated within the 2007 annexation by the City of Calgary have resulted in significant pressures for transportation facilities. In addition, the recent completion of Stoney Trail (north of Hwy 1) and the planning that has taken place for the Stoney Trail Extension (south of Hwy 1 to Hwy 22X) have, and will continue to result in increased use of the Hwy 1 corridor.

Past planning initiatives undertaken over the last decade by various agencies have produced alternative visions for a future Highway 1 interchange (to replace the existing Old Banff Coach Road interchange) located between RR-33 (Springbank) and Valley Ridge. Such visions included:

- The City of Calgary’s transportation network and Area Structure Plans: A past City of Calgary study1 depicted a diamond interchange located at Hwy 1/133rd St (1.6 km east of Hwy 563) with 133rd St classified as major arterial providing access to the future Melcor “Sweet Lands”2 development (380 acres, 2 communities, 8,900 additional residents, 6,700

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1 “West Regional Context Study, Map B-1 Transportation Network”, City of Calgary (April 2010)
2. See Section 3 – Appendix C-3
employees). The 133rd St interchange is seen as key infrastructure necessary to accommodate the build-out of the “Sweet Lands” area. Throughout the process of this functional planning study an additional concept envisioned by City representatives involved two nested tight diamond interchanges with one located at Hwy 563/Old Banff Coach Road/RR-31 location and the other at 133rd Street.

- Rocky View County’s “Greater Springbank Functional Study” (2008) envisioned the Hwy 1/Hwy 563 interchange remaining in its existing location. The study indicated that RR-31 would ultimately warrant a 6-lane arterial/expressway standard (capable of accommodating 51,000 vpd) and Highway 563 would warrant a 6-lane arterial (capable of accommodating 30,000 vpd).
- Alberta Transportation’s interchange spacing guidelines indicate that a maximum of one interchange can be located along the 3.8 km segment between Highway 563 and Valley Ridge Blvd; and
- The “Hwy 1 Freeway Corridor Management Study” (ARA Engineering, 2005) recommended maintaining the existing Hwy 1/Hwy 563 junction as the site for a future interchange along this section of highway.

As well, Alberta Transportation has expended significant resources, time and effort in terms of planning to meet the requirements for the future transportation infrastructure along the Highway 1 corridor west of Stoney Trail. These planning efforts have included:

- Highway 1/Range Road 33 Interchange (CastleGlenn): AT conducted a functional planning study of the future interchange. The project would likely be constructed in three phases. The “ultimate” configuration would be a modified Parclo “A” with a 10-lane Highway 1 and a 6-lane divided RR 33 cross-section. Loops would be constructed in the NE and SW quadrants of the interchange.
- Stoney Trail Extension, Highway 8 to Highway 1 (TransTech): AT has completed a functional planning study to evaluate the requirements of the western portion of the Calgary Ring Road. The prepared plans identified interchanges at: Highway 1, Old Banff Coach Road (partial), Bow Trail SW, 17th Avenue/Twp Rd 242 (partial) and Highway 8/Glenmore Trail. The plan accounts for an ultimate 8-lane divided cross-section.
- Valley Ridge Boulevard Interchange Upgrades (Earth Tech): The functional planning for the Valley Ridge Boulevard interchange upgrades included loops in the northwest and southwest quadrants. The site would encourage free flow traffic in and out of the Valley Ridge community as a result of 101st Street (at the time of the Stoney Trail expansion).
- Highway 22 at Highway 1 Functional Planning Study (ISL): AT is nearing completion of a functional planning study of Highway 22 at the Highway 1 interchange and the Highway 22 corridor aimed at identifying the ultimate interchange configuration and future twinning requirements of Highway 22.

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3 See Appendix F-4, Correspondence with the City of Calgary. See also Section 11.4 for comment regarding the nested diamond interchange concept.
1.3 Future Development Initiatives

The following information were collected, reviewed and referenced as part of the study area familiarization process:

- Historical Traffic Count Information (Referenced from AT’s website);
- “North Springbank Area Structure Plan: Bylaw C-5035-99”, Municipal District of Rocky View No. 44 (May 4, 1999);
- “Central Springbank Area Structure Plan: Bylaw C-5354-2001”, Municipal District of Rocky View No. 44 (October 2, 2001);
- “Sweet Lands Brochure”, Melcor Developments Ltd, (Website: February 13, 2012);
- “West View Area Structure Plan: Draft Report”, City of Calgary (September 2010);
- “Valley Ridge Area Structure Plan: Revised”, City of Calgary (September 2009);
- “Crestmont Communities: Stage 4 Outline Plan & Land Use Redesignation”, Qualico Communities (Received Jan. 30, 2012);
- “11011 TransCanada Hwy SW Outline Plan”, Shape Properties - Calgary West (Received Jan. 30, 2012);
- “Bow Valley Crossing Outline Plan & Land Use Redesignation”, Loblaw Properties West Inc & BVX Development Corp (Received Jan 30, 2012);
- “Bingham Crossing Traffic Impact Assessment”, Urban Systems (March 2007);
- “Pradera Springs Transportation Impact Assessment” (November, 2008);
- “Springbank Airport Master Plan: 2009-2029” (Calgary Airport Authority, February 2009);
- “Harmony Development Traffic Impact Study” (Urban Systems, July 2006);
- “Greater Springbank Functional Study” (iTrans & Urban Systems, May 2008); and

The above documents were used to determine future land use assumptions and travel demand forecasts related to this functional planning study.

1.4 Goals and Objectives

The following four objectives were established within the Terms of Reference for this functional planning study.

1.1 Determine the ultimate cross-section and other related improvements required to upgrade Highway 1 to an appropriate design standard from Range Road 33 to Stoney Trail with consideration of the urban context that Highway 1 forms within the City limits.

1.2 Develop a functional plan for the recommended interchange location and configuration on Highway 1 between Highway 563 (Old Banff Coach Road) and 133rd Street.
1.3 Determine the impact on the existing and proposed local roadway network between Range Road 33 and Stoney Trail attributed to the recommended plan in the short and long term.

1.4 Determine modifications and future classification requirements on Highway 563.

In addition to the above objectives, the functional planning process itself catalyzed several related issues that required resolution as part of the study mandate. The issues are stated below in the form of questions, which are addressed within this study document:

- What is the strategy for widening Highway 1 and how does it integrate with the future interchange improvements within the study area?
- Where is the preferred location for an “ultimate” Highway 1 interchange between the Springbank (RR-33) and Valley Ridge interchanges?
- What is the “ultimate” Hwy 563/Old Banff Coach Road/RR-31 interchange configuration that would provide AT with design and staging flexibility supported by a justification?
- Can the existing infrastructure be used as part of the staging strategy?
- What is the optimal service roadway network required to accommodate and integrate with the proposed Hwy 563/Old Banff Coach Road/RR-31 interchange?
- How much property is required to ensure the “ultimate” development of the corridor, service roads and the associated interchange?
- Has the “short-term” (removal of an existing at-grade Highway 1 access) and “ultimate” Highway 1 access management strategy been addressed?
- Does an opportunity present itself that would trigger the de-designation of Highway 563 to a local road?

1.5 Functional Planning Methodology

Phase I – Identify Existing Conditions, Alternatives and Constraints

The initial phase of this functional planning study was used to:

- determine the existing conditions within the study area; and
- obtain an understanding of the potential constraints related to designing a multi-lane freeway standard Highway 1 corridor. (The corridor is somewhat unique in that the facility is to be characterized by an appropriate transition from a 130 km/hr rural design speed facility west of the interchange to a highway urban facility that would transition into/out of the City of Calgary’s urban gateway area to the east of the interchange.)

This initial phase involved:

- The preparation of base mapping with sufficient coverage to depict the proposed highway improvements and adjacent service roadway network;
- The collection and review of relevant information inclusive of previous and ongoing studies conducted by AT, the City of Calgary and Rocky View County;
- A Traffic Overview that provided a balanced representation of current traffic volumes and operational characteristics along the Highway 1 corridor;
- The preparation of Traffic Forecasts through a rationalization approach that incorporated existing traffic counts and land-use information, along with previous traffic modelling efforts undertaken by the City of Calgary and Rocky View County staff. The travel demand model was used to forecast 30 year and build-out forecasts along the Highway 1 corridor with emphasis on the proposed interchange site;
- A Utility Inventory within the study area;
- An Environmental Evaluation pertinent to the subject area;
- A Historical Resource Overview for the impacted study area;
- A Geotechnical Assessment for the general study area;
- An Existing Conditions Bridge Planning Assessment for the existing Hwy 1/Hwy 563 interchange bridge (BF 75933), Highway 1 watercourse crossing (BF 74659) and watercourse crossing on Twp Rd. 250 (BF 13644);
- An assessment of the Existing Drainage Patterns within the study area;
- An In-Service Road Safety Audit following TAC’s “Canadian Road Safety Audit Guide” (2001) and AT’s “Road Safety Audit Guidelines” (2004) to address the Highway 1 and Highway 563 (to municipal arterial standards) corridors and the existing interchange;
- Documentation of all identified existing conditions, constraints and design issues associated with the study area;
- The preparation of Unit Cost Information to assure uniform application across all alternatives;
- The preparation of preliminary conceptual Highway 1 interchange location and configuration alternatives (including the existing interchange location at Highway 563); and
- The initial Public Open House and set of Focus Group Sessions to present the existing conditions, constraints, design standards and conceptual interchange locations and obtain public feedback.

**Phase II – Identify Highway 1 Interchange Alternatives**

The second phase of the functional planning study included an evaluation and feasibility assessment of the Highway 1 interchange locations and configuration alternatives. The following tasks were undertaken within this phase of the study:
- Highway 1 cross-section options were identified inclusive of centerline spacing, median width, grading requirements, staging strategy and improvement timelines;
- Improvements to the Highway 1 Corridor were identified to assure that the study recommendations would effectively tie-in and coincide with the Highway 1 configuration on either side at the Springbank (RR-33) and Valley Ridge interchanges;
- The conceptual Highway 1 interchange location/configuration options were refined to assure that each element would be designed to comply with “Level 1” freeway corridor standards;
- the environmental impacts and historical impacts for each interchange configuration and associated roadway improvements were evaluated and assessed;
potential geotechnical issues at the existing Highway 1 (Old Banff Coach Road) interchange and alternative interchange locations and the general study area were identified;

potential property impacts associated with the “ultimate” cross-section of Highway 1, each interchange alternative and potential Highway 563 improvements were quantified and documented for comparison purposes;

service road requirements in compliance with AT’s “Access Management Guidelines” were identified;

Pedestrian and Cyclist requirements at the various interchange locations were assessed;

utility impacts for the various interchange options were identified and assessed;

conceptual cost estimates for each interchange alternative were developed; and

a “first-cut” vetting of the all options considered to be viable solutions was undertaken.

Phase III – Evaluate, Analyze and Recommend Preferred Interchange

The third phase of the project involved the evaluation of the identified Highway 1 improvements and interchange concepts and their refinement toward a recommended solution.

Traffic Operations Analyses (LOS, intersection capacity analysis, weaving) was undertaken that addressed each alternative interchange location and configuration;

A Bridge Planning Evaluation was completed as part of the comparative assessment of the future interchange configurations that explored and assessed the optimal long term and staging strategies for the Highway 1 interchange bridge;

A benefit-cost analysis was completed for the refined interchange concepts/locations and proposed roadway realignments taking into account road user costs, benefit/cost relationships, travel time, construction lengths, collisions and the impacts on the associated corridors;

A Comparative Assessment of all viable interchange options in a matrix analysis format was undertaken that took into consideration construction cost, traffic operations, utility impacts, bridge requirements, environmental impacts, geotechnical issues, property impacts, a compatibility with Rocky View County supporting roadway network, and additional factors that arose during the study;

The preferred “ultimate” location and configuration for the interchange was determined and integration with the proposed “ultimate” Highway 1 cross-section was ensured;

Environmental, Historical and Geotechnical Impacts for the proposed interchange including the associated connecting roadway corridors was confirmed;

Utility Impacts and Drainage Implications for the proposed solution was confirmed;

The Access Management solution for the corridor including future service roads was determined and recommended to assure integration with the proposed interchange; and

The second Public Open House and set of Focus Group Sessions were undertaken to present the different interchange locations and concepts along with the preliminary recommendations to the public to obtain feedback.
Phase IV – Develop and Refine Recommended Solution

The fourth phase of this planning study involved the refinement of the interchange functional design along with the corresponding access provisions. Both “short-term” and “long-term” solutions were developed and recommended.

- The preferred Highway 1 cross-section, interchange configuration and supporting service road network was Formally Recommended;
- Preliminary Functional Designs depicting the “ultimate” and “interim” Highway 1 interchange and corridor improvements were developed;
- An “ultimate” Storm Water Drainage Master Plan for the proposed highway infrastructure consistent with current environmental guidelines was developed;
- The Historical Resources Overview was finalized and submitted to Alberta Culture (AC). The Overview determined that a follow-up Historical Resource Impact Assessment (HRIA) would be required. (The earliest the HIRA could be scheduled will be Spring, 2014);
- The Environmental Evaluation report was finalized and submitted to Alberta Environment Protection and AT’s Environmental Specialist, Mr. Don Snider, for comment;
- Rocky View County, the City of Calgary and AT’s Edmonton Technical Standards Branch undertook Plan Refinement; and
- The third Public Open House and set of Focus Group Sessions were undertaken presenting the final recommendations.

Phase V – Develop Functional Plans, ROW Mosaic and Report

The fifth and last phase of the project was achieved subsequent to a consensus regarding the scope of the proposed improvements. At this stage the “ultimate” design was further refined leading to the recommended solution. These activities included:

- Refinement of the Highway 1 interchange design and staging strategy;
- The preparation of Functional Plans incorporating all typical roadway cross sections, plan and profiles drawings for the recommended “ultimate” and “interim” Highway 1 interchange, highway corridor and associated improvements;
- A Road Safety Audit following TAC’s “Canadian Road Safety Audit Guide” (2001) and AT’s “Road Safety Audit Guidelines” (2004) was undertaken on the above plans and refinements were addressed;
- The preparation of Right-of-Way Request Plans depicting plans for recommended Highway 1 interchange and corridor improvements;
- The compilation of itemized Cost Estimates for the final recommended improvements; and
- The preparation of a Draft and Final Report.
2.0 EXISTING CONDITIONS

An existing conditions overview and assessment was conducted to provide documentation concerning the existing and current state of the Highway 1 corridor. As well, this effort served to identify and outline issues and constraints that could potentially arise with the implementation of the proposed Highway 1 interchange.

Appendix “A” contains independent sub-consultant studies dealing with the existing conditions along the Highway 1 corridor within several areas, which include:

- **Environmental Evaluation** (See Appendix A-1): This was undertaken to identify the study area existing conditions and areas of potential environmental concern, including: landforms and soils, vegetation, wildlife, wetlands, fisheries, water quality and navigation;

- **Historical Resources Overview** (See Appendix A-2): This was aimed at evaluating the resource potential inclusive of archaeological sites, historic sites and registered historic structures within the study area and their historical significance. The HRO would also make recommendations regarding the need for further work within the study area;

- **Preliminary Geotechnical Assessment** (See Appendix A-3): This assessment provided a general overview of the site geology and geotechnical conditions within the study area;

- **Bridge Planning** (See Appendix A-4): This assessment provided a review of the existing structures within the study area. The review verified information documented within Bridge Inspection and Maintenance (BIM) Inspection Reports and existing drawings; and

- **In-Service Safety Review** (See Appendix A-5): This was aimed at evaluating the safety and operations within the study area. The review identified current safety issues.

The following sections serve to describe the existing characteristics of the Highway 1 study corridor and provide a brief summary of the key findings.

2.1 The Existing Highway 1 Corridor

The Highway 1 (TransCanada Highway) corridor within the study area represents an 8km long (from 500m west of the RR 33 interchange to 500m east of the Valley Ridge interchange) corridor that can be characterised as follows:

- **Classification**: Highway 1\(^1\) is classified as a “Level 1” highway that accommodates the movement of people, goods and services inter-provincially and internationally and is defined as a core route in the National Highway System (NHS). The section of Highway 1 addressed within this functional planning study represents only a portion (approximately 1.5%) of the total NHS, which extends from the British Columbia border through to the Saskatchewan border (about 536 km)\(^2\). Access to the NHS corridor is generally restricted to arterial roadways only.

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\(^1\) “Alberta Transportation Design Bulletin #27/2005” (Revised December 2008)

\(^2\) “Provincial Highway Service Classification” Stantec Consulting Ltd., 2007
- **Vehicle Designation:** Highway 1 is a Long Combination Vehicle (LCV) route\(^3\) accommodating Turnpike Double (Modified WB-36) heavy vehicles up to 41m in length.

- **Over-Dimension Vehicles:** Highway 1 is **not** designated as a High Load Corridor\(^4\).

- **Posted Speed:** The posted speed limit along Highway 1 is 110km/hr.

- **Cross-Section:** The existing 4-lane divided Hwy 1 cross-section within the study area consists of:
  - highway grades that vary from approximately 0-to-6.4%;
  - pavement widths that vary from 11.4-to-12.8 m;
  - shoulder widths that vary from 2.0-to-2.6m;
  - the undulating Hwy 1 profile consists of a sag curve (K 115) at Hwy 563 and a crest curve (K 75) located approximately 500m west of 133\(^{rd}\) Street;
  - approximately 800m west of Hwy 563, the Hwy 1 center median transitions from a rural 22.6m width to an urban 7.8m width; and
  - the vertical alignment along this segment of the highway corridor generally accommodates a 100-to-110 km/hr design speed and presents limitations upon the available decision sight distance (DSD) at interchange gore points.

- **Access Management:** Table 2-1 indicates and Exhibit 2-1 illustrates the location (stationing) of each of the grade separated interchanges and the existing at-grade accesses that intersect with the existing Highway 1 corridor over the 8km length of the study area. The study area has:
  - Two at-grade intersections (one country residential access and an additional at-grade fenced access exists nearest the western edge of the Crestmont development which provides alternate access to the adjacent water retention pond. An interim, construction access is in place connecting Valley Point Way NW directly to Highway 1); and
  - Three grade separated interchange structures along the 8 km segment.

### Table 2-1: Location of Existing Accesses and Interchanges

<table>
<thead>
<tr>
<th>Roadway / Access</th>
<th>Description</th>
<th>Station(^5)</th>
<th>Jurisdiction</th>
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</thead>
<tbody>
<tr>
<td>1 Range Road 33 (Springbank)</td>
<td>Two-lane, undivided, paved.</td>
<td>8+181</td>
<td>Rocky View County</td>
</tr>
<tr>
<td>2 Highway 563 (Old Banff Coach Rd)</td>
<td>Two-lane, undivided, paved.</td>
<td>11+442</td>
<td>Rocky View County</td>
</tr>
<tr>
<td>3 Country Residential Access (At-grade)</td>
<td>Single-lane, undivided, paved.</td>
<td>12+442</td>
<td>Rocky View County</td>
</tr>
<tr>
<td>4 Emergency Access (At-grade)</td>
<td>Single-lane, undivided, paved.</td>
<td>13+932</td>
<td>Rocky View County</td>
</tr>
<tr>
<td>5 Valley Ridge Blvd</td>
<td>Four-lane, divided, paved.</td>
<td>15+306</td>
<td>City of Calgary</td>
</tr>
</tbody>
</table>

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\(^3\) Alberta Transportation Highway Geometric Design Guide (ATHGDG): Figure D-5c, Section D.5: Design Vehicle, Chapter D: At-Grade Intersections

\(^4\) ATHGDG: Figure A-11, Section A.11: High Load Corridor, Chapter A: Basic Design Principals

\(^5\) Stationing is referenced from Functional Plans (See Annex A).
Topography - 15m to 30m elevation difference between S & N side of Hwy 1

Steep Hwy 1 Grades are located on either side of a K77 vertical crest curve

Exhibit 2-1: Study Area Characteristics and Constraints
2.2 The Existing Hwy 563/Old Banff Coach Road/RR-31 interchange

The existing Hwy 563/Old Banff Coach Road/RR-31 interchange:

- is characterised by a Parclo A4 configuration with Hwy 563 forming the south leg of the interchange and RR-31 forming the north leg;
- was constructed in 1965 (approximately 48 years old). To better conform to present day standards, improvements/enhancements would be required to upgrade the interchange characteristics inclusive of the entrance/exit terminal lengths and the ramp/loop radii; and
- was the subject of a 2011 deck testing report\(^6\) that indicated the remaining service life of the bridge deck to be 7-to-10 years (See Section 2.12).

Exhibit 2-2 identifies the individual areas where improvements to the existing Hwy 563/Old Banff Coach Road/RR-31 interchange merit further consideration.

*Exhibit 2-2: Highway 563 Interchange Design Improvements*

2.3 The Existing Highway 563 Corridor

The Highway 563 corridor within the study area represents a 5.2km long (from RR-31 to Springbank Road) corridor that can be characterised as follows:

- **Classification:** Highway 563\(^7\) is classified as a “Level 4” highway, which accommodates the movement of people, goods and services within an intra-jurisdictional nature or within a localized area.

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\(^6\) 2011 - Hwy 1 Grade Separation Near Calgary (Hwy 563) - BF 75933

\(^7\) “Alberta Transportation Design Bulletin #27/2005” (Revised December 2008) Nov. 2008 Service Classification Map
• **Traffic Volumes**: 1,500 to 2,000 vehicles-per-day.

• **Location Jurisdiction**: Rocky View County.

• **Vehicle Designation**: Highway 563 is a Double Trailer Combination (WB-23) route\(^8\) accommodating heavy vehicles up to 25m in length.

• **Over-Dimension Vehicles**: Highway 563 is **not** a designated High Load Corridor\(^9\) Route.

• **Posted Speed**: The posted speed limit along Highway 563 is 60km/hr.

• **Cross-Section**: Two-lane rural undivided cross-section.

• **Pavement Width**: 6.9m consistently throughout its length.

• **Shoulder Width**: There is no shoulder along the length of the corridor.

• **Vertical Alignment**: The undulating Hwy 563 profile consists of sag curves that range from K-13 to K-123 and crest curves that range from K-24 to K-153.

  • there are 22 vertical curves of which 6 (27%) can be further improved to comply with the current design guidelines; and

  • highway grades vary from approximately 0.0%-to-7.2%. Grades that can me further improved to comply with current design guidelines exist along a 315m stretch of Township Road 245 that begins at the intersection of RR-31 and Twp Rd 245 and ends approximately 315m east of that same intersection.

• **Horizontal Alignment**: There are 12 horizontal curves of which 5 (42%) can be further improved to comply with the current design guidelines.

• **Access Management**: There are nine intersections in total along the corridor, between RR-31 and Springbank Road:

  • Separation between at-grade intersections range from 130m to 1,900m (Table 2-2);

  • Separation between private accesses to intersections range from 22m-to-440m; and

  • Separation between private accesses ranges from 100m-to-425m.

  \[\text{Table 2-2: Location of Existing at grade intersections}\]

<table>
<thead>
<tr>
<th>Intersections</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Range Road 33 to Township Rd 245</td>
<td>525m</td>
</tr>
<tr>
<td>2 Township Rd 245 to Horizon View Rd</td>
<td>1900m</td>
</tr>
<tr>
<td>3 Horizon View Rd to Solace Ridge Pl</td>
<td>430m</td>
</tr>
<tr>
<td>4 Solace Ridge Pl to Artist View Way</td>
<td>290m</td>
</tr>
<tr>
<td>5 Artist View Way to Shantara Grove</td>
<td>130m</td>
</tr>
<tr>
<td>6 Shantara Grove to Artist View Pointe</td>
<td>430m</td>
</tr>
<tr>
<td>7 Artist View Pointe to Westbluff Rd</td>
<td>440m</td>
</tr>
<tr>
<td>8 Westbluff Rd to 10th Street West</td>
<td>850m</td>
</tr>
<tr>
<td>9 Westbluff Rd to 10th Street West</td>
<td>400m</td>
</tr>
</tbody>
</table>

\(^8\) ATHGDG: Figure D-5c, Section D.5: Design Vehicle, Chapter D: At-Grade Intersections

\(^9\) ATHGDG: Figure A-11, Section A.11: High Load Corridor, Chapter A: Basic Design Principals
2.4 Land Uses within the Study Area

In general, the land uses within the study area are best described as a mixture of country residential with some commercial and industrial uses. The municipal boundary between the City of Calgary and Rocky View County was changed through the Provincial annexation process less than a decade ago (effective January 1st, 2007\(^{10}\)). The boundary shift resulted in portions of the County’s Springbank area being incorporated within the City of Calgary’s urban boundary. As such, urban developments, such as the Valley Ridge and Crestmont communities now characterize the land uses immediately west of the Valley Ridge interchange. Immediately east of the Hwy 563/Old Banff Coach Road/RR-31 interchange, the lands remain within the jurisdiction of Rocky View County and are characterized by several country residential acreages within the rural Springbank community. In general the area of influence within this functional planning study includes the:

- **City of Calgary**: The City of Calgary boundary is situated to the east of the Hwy 1/Hwy 563 interchange. The population of the City of Calgary according to its 2010 municipal census was approximately 1.1M.

- **Rocky View County**: Rocky View County is a municipal district which includes the area surrounding the City of Calgary. Within the study area, Rocky View County begins west of the City of Calgary boundary and incorporates a large portion of the study area. The population of Rocky View County according to its 2011 municipal census is was in the order of 34,500 persons.

- **Springbank Community**: The greater Springbank community is situated to the immediate west of the of the study area within the vicinity of the Hwy 1/Range Rd 33 interchange.

- **Valley Ridge and Crestmont Communities**: The Valley Ridge and Crestmont communities are situated within the City of Calgary’s urban boundary and are located on the north and south sides of the Hwy 1 corridor, respectively. The communities are currently accessed by the Valley Ridge Blvd/Hwy 1 interchange and consist of primarily residential dwellings with some minor adjacent commercial and recreational land uses. The 2011 population of these communities was in the order of 6,470 persons.\(^{11}\)

- **Artist View and Horizon View Communities**: These Rocky View County rural residential communities are located on the south side of the Hwy 1 corridor and north of Springbank Road. The communities can generally be described as country residential pocket sub-divisions with dwellings on multiple acre rural lots.

- **Springbank North Communities**: Several country residential pocket sub-divisions and the Springbank Links Golf Club lie in the area north of the Hwy 563/Old Banff Coach Road/RR-31 interchange on the lands bounded by Twp Rd 250 on the south, RR-33 on the west and the Bow River on the east.

\(^{10}\) Alberta Municipal Affairs, “Municipal Government Board, Board Order No. MGB 079/07” – File: AN05/CALG/01

\(^{11}\) The City of Calgary Community and Neighborhood Services, “Community Social Statistics: Crestmont & Valley Ridge”, 2011.
The future transportation system must integrate to the greatest extent possible with the envisioned land use plans within the study area. Some of the more significant land use proposals include:

- The *Harmony* residential development;
- The *Bingham Crossing* commercial development; and
- The *West Calgary Marketplace* commercial development.

Section 3.1 and Appendix B-2 of this report provide additional information concerning existing and forecast land use assumptions adopted as part of this functional planning study.

### 2.5 Current Traffic Volumes

Exhibit 2-3 presents the current (2012) average morning and afternoon peak hour traffic volumes along the Hwy 1 corridor. Daily traffic volumes on:

- Hwy 1 west of the Hwy 563/Old Banff Coach Road/RR-31 interchange are currently in the range of 23,000-to-24,000 vehicles-per-day (vpd). Summer AADTs reach 28,500 vpd. Approximately 6% of the Hwy 1 vehicle traffic in the vicinity of the interchange is considered heavy vehicle traffic;
- Hwy 1 east of the Hwy 563/Old Banff Coach Road/RR-31 interchange are currently in the range of 28,000-to-29,000 vpd. Summer AADTs reach 34,100 vpd;
- Hwy 1 west of the Stoney Trail interchange are in the range of 39,000-to-40,000 vpd. Summer AADTs reach 43,720 vpd; and
- Hwy 563 between RR-31 and Springbank Road, are in the range of 1,500-to-2,000 vpd.

### 2.6 Historical Traffic Growth

Historical traffic count information along the Hwy 1 and Hwy 563 corridors within the study area was referenced from Alberta Transportation in concert with a review of traffic counts obtained from previous studies. The historical traffic count information was used to determine an average annual growth rate for both corridors.

- In general over the last decade, the Hwy 1 corridor west of the Springbank Road (RR-33) interchange exhibited a growth rate of 1.0-to-2.0 percent.
- East of the Springbank Road (RR-33) interchange, to a point 1 km-east of the Hwy 563/Old Banff Coach Road/RR-31 interchange, the 10-year average annual growth rate was found to be in the order of 2.0-to-3.0 percent.
- The average annual 10-year traffic growth along the Hwy 563 corridor east of RR-31 was found to be just over 5.0 percent. (This was attributed to the rapid development of the Artists View and Horizon View rural country residential developments combined with the proportion of cut-thru traffic that connects Hwy 1 west from/to SW Calgary communities, such as Cougar Ridge, Paskapoo, West Springs, Coach Hill, Aspen Woods, Christie Park, etc.)

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12 Alberta Transportation “*Alberta Highways 1 TO 986, Traffic Volume History 2003 – 2012*” Planning Branch, Strategic and Network Planning

13 See Appendix B-1 Growth Rate Analysis and Appendix C-2: Technical Memorandum #2 - Section 4b
Exhibit 2-3: Existing Traffic Volumes within the Study Area (2012)
2.7 Existing Traffic Operations

Intersection capacity analysis was conducted assuming the existing volumes at the Highway 1/Old Banff Coach Road interchange ramp terminals. It was determined that existing peak hour traffic operational characteristics were satisfactory at each of the study area intersections, which exhibited Level of Service (LOS) of “B” or better with delays of less than 13 seconds on all approaches. Table 2-3 identifies the analysis characteristics for the worst case directional approach for each ramp terminal.

### Table 2-3: Intersection Capacity Analysis: Existing (2012) Traffic Volumes

<table>
<thead>
<tr>
<th>Intersections</th>
<th>AM Peak Hour</th>
<th>PM Peak Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Approach</td>
<td>LOS</td>
</tr>
<tr>
<td>Highway 1 Interchange Ramp Terminals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>North Ramp Terminal</td>
<td>WB</td>
<td>B</td>
</tr>
<tr>
<td>South Ramp Terminal</td>
<td>EB</td>
<td>B</td>
</tr>
</tbody>
</table>

2.8 Collision History

The results of a collision analysis of current (2006-to-2010) information indicated that a total of 140 collisions were reported along the 6.5 km segment within the vicinity of the existing Hwy 563/Old Banff Coach Road/RR-31 interchange. Of this total:

- 62 (44%) collisions were reported within the influence area (600m on either side of the interchange on the Hwy 1 corridor [between Station 10+850-to-12+050]). These include all collisions that occurred at the interchange and on the connecting ramps to/from Highway 1;
- 71 (51%) collisions were reported (beyond the 600m influence area of the interchange) along the remainder of the Hwy 1 corridor; and
- 7 collisions (5%) were reported on the Hwy 563 corridor overpass within 1.5km of the interchange area.

Exhibit 2-4 illustrates the approximate location within each ½ km intervals of the 133 collisions that occurred along the Highway 1 corridor.

- The highest frequency of collisions (34) were found to occur just to the east of the interchange bridge [between Station 11+500-and-12+000]; and
- A group of 17 collisions occurred in the 500m interval surrounding the RR-33 (Springbank) interchange [between Station 8+000-and-8+500].

Seven collisions were recorded along the Highway 563 corridor:

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14 See Appendix B-2
• two of the seven collisions occurred in the immediate vicinity of the interchange (i.e. within 1 km); and
• five collisions were found to occur along the Hwy 563 corridor within the proximity of the angled portion of the corridor to the east of RR-31.

The 140 collisions that occurred within the study area over the five-year period were analyzed in terms of the type of collisions and resulting severity:

**Type of Collision**

• 107 collisions (76%) involved a single vehicle:
  • 61 accounted for single vehicles that either struck an object or an animal (43%); and
  • 45 accounted for single vehicles that simply ran off the road (33%).
• The remaining 33 (24%) of collisions consisted of:
  • 11 rear-end collisions (8%);
  • 1 head-on collision (1%);
  • 16 sideswipe collisions (11%); and
  • 5 angle collisions (4%).

**Collision Severity**

Approximately 75% of the total collisions resulted in property damage, 24% in personal injuries and 1% in fatalities.

• A total of 33 collisions (24%) resulted in 59 persons being injured over the five-year period analyzed.
• There were two fatalities recorded along the Highway 1 corridor.

**Collision Rate**

In 2012, the average Provincial collision rate for a “rural 4-lane divided freeway, not at grade” facility was 63 collisions per-100-million-vehicle-km.

The average annual collision rate (based on 2006-2010 data) along the Highway 1 corridor for the **6.5 km section** (between Station 7+500 at RR-33 and Station 14+000 at the City of Calgary boundary) of the Hwy 1 corridor was determined to be 53 collisions per-100-million-vehicle-km. The Highway 1 corridor was determined to exhibit an overall collision frequency slightly below the Provincial average for similar facilities.

However, the collision rate over the same period (2006-2010) along only the steep 6.4% **segment of Hwy 1** (Station 11+400-to-12+400) was 120 collisions-per-100-million-vehicle-kilometers, which is over twice the provincial average.
Section 4.4.1 highlights the results of a safety review\textsuperscript{16} that was undertaken to provide an enhanced understanding of the potential effect of the grades on either side of the interchange. While the results were inconclusive, it was thought that the steep 6.4% grade remains a factor that contributes to the high collision rate.

\textsuperscript{15} The stationing referenced in the collision analysis refers to AT’s standard stationing where Km 0.0 relates to Hwy 22 and Km 14.0 relates to the Old City of Calgary/Rocky View boundary. The histogram indicates the relative frequency of occurrences.

2.9 In-Service Safety Review

An independent In-Service Safety Review exercise\(^\text{17}\) was undertaken to determine the existing safety issues within the study area. A brief synopsis of the findings follows:

- **Collision Data:** The findings compared favourably to those detailed in the previous section (Section 2.7). The assessment identified various trends in the collision information:
  - There were a significant percentage of off-road collisions, including a notable number of vehicles in the median;
  - Animal-related collisions were frequent;
  - The 1km section between the Hwy 563/Old Banff Coach Road/RR-31 interchange and the top of the crest hill had a high number of collisions (51 or 36\% of 140), particularly in the eastbound direction (56\%); and
  - Widening the highway in the future without improving the vertical alignment can result in higher operational speeds and frequency of collisions.

- **Highway 1 Corridor:**
  - The pronounced vertical curve along Highway 1, particularly east of the Highway 563 interchange, limits the forward sight distance in both directions;
  - The narrow (7.8m) depressed median can be a potential safety issue, particularly due to the high number of vehicles that run off the road and into the median; and
  - The highway corridor is not lit and located within a “transition” zone, between the City and County limits.

- **Highway 1/Highway 563 Interchange:**
  - The interchange is characterized by: limited sight distance, lateral clearance legibility and traffic separation. There are severe sight limitation to the intersections at the ramp terminals;
  - The interchange is not lit and in a rural area;
  - The pavement is deteriorating and pavement markings are faint; and
  - The low collision rate at the interchange is likely due to the low number of users.

- **Highway 563 Corridor:**
  - The “diagonal” layout of the corridor west of Horizon View Road results in tight curves and unconventional intersections. Safety issues were identified with this segment;
  - The RR-31/Hwy 563/OBCR intersection is unconventional and the layout can be misleading to drivers, particularly at night. Drivers wishing to follow Highway 563 can easily be mistaken and drive southbound on RR-31;
  - Improvements to the Twp Rd 245 intersection offer the potential for sight line improvements in the southbound direction. In the northbound direction, the intersection is obscured because of elevation changes;

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\(^{17}\) See Appendix A-5: “In-Service Road Safety Review”, J Rozental Consultancy Ltd. & G. Ho. Engineering Consultants Inc.
• The Horizon View Road intersection configuration is also unconventional and confusing to motorists. The southbound and westbound approaches have “see-through” issues, where drivers can be mislead regarding the direction of traffic; and

2.10 Environmental Evaluation

An initial Environmental Evaluation was undertaken to identify areas of potential environmental concern within the vicinity of the existing Highway 1 corridor and at the existing Highway 563 interchange. The evaluation consisted of an overview of existing conditions and potential environmental impacts (inclusive of: landforms/soils, vegetation, wildlife, wetlands, fisheries, water quality and navigation). The evaluation18 included a desktop/literature review, two field investigations (undertaken in August 2012 and October 2013 after the production of the functional plans), a determination of potential impacts and identification of preliminary mitigation measures and areas requiring further assessment.

In general, the study area has been heavily disturbed by human activity.

The following points are intended to provide a brief synopsis of the environmental findings:

• Study Area: The study area is located in the Foothills Parkland Natural Subregion of the Parkland Natural Region of Alberta.

• Landforms/Soils: A desktop review indicated that soils within this area are generally Black Chernozems with some Dark Grey Chernozems. The region is generally characterized by sloping lower foothills and hummocky uplands. The site visit identified:
  • The soils in the vicinity of the interchange were identified as Maycroft soils with miscellaneous eroded soils, which are well drained Orthic Black Chernozel soils;

• Vegetation: A field assessment identified naturally occurring vegetation species, such as: sedges, rushes, milfoil and foxtail barley in wetland areas and rose, Canada thistle, sage bush, aspen, mint, lowbush cranberry, etc. within the natural valley and pasture lands. Various parcels within the study area are cultivated farmland. The Alberta Conservation Information Management System (ACIMS) database indicated seven occurrences of vegetation species of concern within the general study area.

• Wildlife: Wildlife observations during the field assessment included mallards, pocket gophers, teals and mule deer. Referenced19 sources of information identified the Peregrine Falcon listed as “at risk” according to Alberta Species at Risk (2010) and six other species (Board-Winged Hawk, Swainson’s Hawk, Prairie Falcon, Sora and Least Flycatcher) as “sensitive” that could potentially be found within the study area.

Wetlands: Sloughs and wetlands are scattered along the length of the project area in agricultural fields and in aspen forest areas.

18 See Appendix “A-1”: Environmental Report
19 The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) website and the Alberta Fish and Wildlife Management Information System (FWMIS)
- **Fisheries:** The Bow River and the Bearspaw Reservoir were both identified as fish bearing water bodies. However, there are also smaller waterbodies within the greater study area that connect up to the Bow River, such as the Sprinbank Creek and Cullen Creek, which may also have fish. References\(^{20}\) have identified ten fish species within the area. According to *Alberta Species at Risk* (2010), Rainbow Trout was listed as “at risk”, Lake Trout and Bull Trout were listed as “sensitive”, Brown Trout was listed as “exotic/alien” and the remainder of fish species (White Sucker, Longnose Sucker, Burbot, Mountain Whitefish, Fathead Minnow and Brook Stickleback) were listed as “secure”.

- **Hydrology, Groundwater and Water Quality:** Water quality measurements within a water well, pond and creek were collected on October 12\(^{th}\) 2013 to provide baseline water quality data. Approximately 75 groundwater wells identified within the study area. Water wells in the area obtain water from deeper bedrock sandstone aquifers and there appears to be no direct apparent connection between the surface water and the aquifers.

- **Navigation:** The Bow River and Glenbow Lake are the only two navigable water bodies within the study area.

### 2.11 Historical Resources Overview

A Historical Resources Overview\(^{21}\) was undertaken to identify areas of potential historical concern within the study limits and to determine if a Historical Resources Impact Assessment (HRIA) would be required as part of this initiative.

The majority of the study area has been previously developed (country residential developments, farming activities that affect the upper 20-25 cm by cultivation, etc.) and a search of previously recorded archaeological sites identified 15 sites within the study area.

Of the fifteen sites, all but three sites were assigned a Historic Resource Value (HRV) of zero. The remaining three sites were found to have an HRV of 4\(^{22}\).

- Site EgPn-85 was identified as a “prehistoric campsite” and was located northeast of the OBCR/Twp Rd 250 intersection.
- The other two sites were located in the southeast quadrant of the interchange between Hwy 1 and RR-31/OBCR, with one (EgPn-606) identified as “prehistoric multi-component site” and the other (EgPn-609) as a “prehistoric campsite”.

### 2.12 Preliminary Geotechnical Assessment

A Preliminary Geotechnical Assessment\(^{23}\) inclusive of a desktop study indicated that:

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\(^{20}\) “The Committee on the Status of Endangered Wildlife in Canada” COSEWIC and the “Alberta Fish and Wildlife Management Information System” (FWMIS)

\(^{21}\) See Appendix A-2: Statement of Justification for Historical Resources Act, August 2013

\(^{22}\) “HRV 4” indicates a historic resource that may require avoidance. The three sites were designated as sites EgPn-85, EgPn-606 and EgPn-610.

\(^{23}\) See Appendix A-3: Preliminary Geotechnical Assessment Report, June 2012
The area surface geology is generally covered by draped (thin) glacial till of Balzac drift (heterogeneous mixture of sand, silt and clay-sized particles with trace amounts of gravel, cobbles and boulders). The thickness can vary from 4m to 20 m. The area may also contain some deposits of glaciofluvial and/or glaciolacustrine gravel, sand and/or silt.

Bedrock in the study area is most likely comprised of Cretaceous and lower Tertiary (Paleocene) sedimentary rocks (Paleocene rocks of the Paskapoo Formation, which is composed of nonmarine calcareous, cherty sandstones, siltstones and mudstones).

Within the vicinity of the existing Highway 563 interchange, the reported soils included stiff to very stiff silty clay or sandy clay overlying bedrock (reported approximately 12m below the previous existing grade).

Within the vicinity of the Valley Ridge residential development, the reported soils included a thin layer of lacustrine silty clay overlying the stiff to very stiff silty clay. The bedrock depth was approximately 23 m below the previous existing grade.

At a preliminary desktop level, the surface and subsurface conditions were considered suitable to support the proposed work along the Highway 1 corridor and the new interchange.

The following preliminary comments have been segmented into geotechnical issues related to the future widening and options related to the interchange and a potential tunnel at Location “B”.

**Highway 1 Widening Geotechnical Issues**:

- Excavation to accommodate a 3% or 4% grade along Highway 1 appears to be feasible with a uniform side slope of 3:1. (Further evaluation would be required to determine if the soil can support an excavation of a steeper slope.) Alternately, a retaining wall structure could be considered if space restrictions for excavation are apparent.

- The surficial soils along Highway 1 generally consist of silty clay, silt to sandy clay tills. However, there may be some areas of weak silt, clay and/or organics that would require mitigation measures and stabilization (particularly in low-lying areas).

- Bedrock may be encountered at shallow depths along Highway 1, particularly near the crest of vertical curves. Blasting may be required.

**Highway 1 Overpass Geotechnical Issues**:

- Approach embankments constructed with engineering (structural) fill (provided acceptable compaction methods are applied) can be constructed to a height of 23m (if necessary) at a slope of 2.5:1 without benching.

- Excessive long-term settling should not be experienced. It is anticipated that most of the settlement of native ground and compacted earth embankments would occur within the first few years post-construction of the approach embankments.

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24 The geotechnical information inclusive of actual subsurface soil/bedrock and groundwater conditions remains to be verified at the time of detailed design.

25 The functional plans accommodate a barrier free design with 4:1 side slopes, see Section 5.
• The subsurface soil conditions were considered suitable for deep foundations to support bridge structures. Driven steel piles and/or bored cast-in-place concrete piles would be suitable foundation types.

• All three potential interchange locations were determined to be suitable from a geotechnical perspective. However, Alternatives A and C may require the removal of unsuitable materials in low lying areas. In addition, temporary groundwater control may also be required during construction. Alternative B is located at the crest of the hill and avoids any issues with low-lying areas.

**Highway 1 Interchange – NOT RECOMMENDED - Geotechnical Issues:**

• A 22 m deep cut is considered suitable at a slope of 3:1. Benching may be required.

• Permanent groundwater control would likely be required because of the shallow groundwater in the vicinity of the interchange.

• Bedrock (sandstone bedrock) may be encountered at shallow depths along Highway 1, particularly near the crest of vertical curves. Blasting may be required.

• The subsurface soil conditions were considered suitable for deep foundations to support bridge structures. Driven steel piles and/or bored cast-in-place concrete piles would be suitable foundation types.

2.13 **Existing Hydrology Patterns**

A hydrological overview\(^{26}\) was conducted as part of this functional planning study. There are natural watercourses occurring within the project study area, including small tributaries to the Bow River, which forms part of the natural drainage system.

Drainage of Highway 1 is accomplished mainly by ditches along the existing corridor and the natural landscape that flows to either a natural watercourse, a low point along the highway or pond areas. Within the vicinity of the existing Highway 563/Old Banff Coach Road/RR-31 interchange, the area is segmented into two basic drainage zones that are characterized as follows:

• *Drainage Zone 1 (Station 9+200 to 12+500)*: The direction of drainage within this zone is from south to north towards the Bow River. The existing Highway 563/Old Banff Coach Road/RR-31 interchange is located within this zone in a low-lying area, surrounded by several small ponds located north and south of the interchange. Zone 1 contains two sub-drainage courses\(^ {27}\) within the vicinity of the interchange, which contain small tributaries to the Bow River crossing Highway 1 (at Stations 11+162 and 11+878).

• *Drainage Zone 2 (Station 12+500 to 14+000)*: The drainage direction within this zone is also from south to north towards the Bow River. A drainage pond was identified south of Highway 1 in the vicinity of the Crestmont development. Zone 2 has a two tributaries to

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\(^{26}\) See Appendix A-3: Highway 1 Interchange at Highway 563 Preliminary Hydrological Assessment, November 2013

\(^{27}\) ibid – See areas M1-A and M1-B
the Bow River that cross Highway 1 (at Stations 13+480 and 13+791) and connect together just to the west of the Valley Ridge development.

2.14 Bridge Investigation of Existing Structures

A preliminary assessment\textsuperscript{28} of the existing bridge structures within the study area was conducted. The assessment included a review of existing drawings, BIM Inspection Reports and a site inspection. A brief synopsis of the existing structure assessment follows:

- **Highway 563 over Highway Interchange Bridge** [BF 75933]: The existing bridge structure crosses over the Highway 1 through-lanes. The structure is approximately 48 years old and is scheduled for full deck replacement (2012 BIM inspection). The bridge has four spans of 12.5, 22.9, 22.9 and 12.5 m in length (a total bridge length of 70.9 m) and 9.1 m clear roadway width. The bridge crosses Highway 1 at a skew of 90 degrees and the RR-31 alignment is on tangent. The anticipated replacement year indicated within the BIM report is 2017/18, in approximately 5 years. The bridge report recommends reviewing long term plans for the overpass and highway prior to scheduling any major maintenance or rehabilitation.

Two additional local bridges were identified within the greater study area. These were not found to be impacted as part of this functional planning study.

- **Twp Rd 250 over Tributary** [BF 13644]: Two existing (round) bridge culverts crosses over an unnamed tributary to the Bow River approximately 250 m west of the Twp Rd 250/OBCR at-grade intersection. There are two pipes, one 2.1 m in diameter with an invert length of 56.7 m and the other 0.9 m in diameter with an invert length of 60 m. Both pipes were installed in 1964. A BIM inspection (conducted in 2013) indicated that the smaller pipe appears stable, that the cattlepass/drainage pipe is in poor condition with floor rust and perforations and provided an anticipated replacement year of 2023 (in approximately 10 years). The structure was designed as a stockpass but is not used.

- **Twp Rd 245 over Animal Trail** [BF 13644]: An existing (pipe arch) bridge culvert crosses over an unnamed tributary to the Bow River approximately 220 m west of the Twp Rd 245/RR 31 at-grade intersection. The culvert is 1.98 m in diameter, with an invert length of 17.9 m and was installed in 1965. A BIM inspection (conducted in 2011) indicated an anticipated replacement year of 2035 (in approximately 22 years).

2.15 Geometric Overview of Existing Highway 1:08 Corridor

The design review of the existing Highway 1 corridor involved a desktop assessment and an evaluation of the corridor based on a site overview. The review of existing conditions served to identify the following geometric and access management issues:

- **Horizontal Alignment**: There are no horizontal curves along Highway 1 within the study area.

\textsuperscript{28} See Appendix A-4: Conceptual Bridge Planning Assessment, November 2013
- **Vertical Alignment**: The Highway 1 corridor consists of numerous sag and crest vertical curves and highway grades that vary from 0.0% to 6.4% (where a 3% grade is desirable for a freeway facility\(^{29}\)). Generally the existing geometry of the Highway 1 vertical alignment can be characterised as follows:
  - The west end of the corridor within the vicinity of Highway 22 consists of a series of vertical crest curves and an 800m long highway segment constructed on a 5.5% grade. This section of Highway 1 is generally consistent with the remaining segment of Highway 1:06 (west of Highway 22) which can be characterized as an undulating vertical alignment with numerous segments exceeding a 4% grade;
  - Approximately 3km east of Highway 22 the Highway 1 grade is reduced to a range of 0-to-2.2%, which continues for a 9.2km length. This level segment of the highway represents 67% of the total Highway 1:08 corridor length;
  - On approach to the Calgary City limits the Highway 1 profile forms a crest vertical curve (K value 77 located at approximately Hwy 1:08 km 12+600) which cuts through an existing ground escarpment sloping from south to north towards the Bow River. The profile grades approaching the vertical curve consist of 6.4% (west side of the vertical curve) and 5.1% (east side of the vertical curve) with an approximate 12m high cut section (with 3:1 back slope) through the existing ground; and
  - East of the vertical crest curve (towards Stoney Trail) the profile of Highway 1 is generally level with grades not exceeding 3%. As such the steep 6.4% and 5.1% highway grades can be interpreted as a design anomaly that is inconsistent with the remaining Highway 1:08 corridor.

- **Pavement Width**: The current standard for new rural twinned highway surface (inclusive of travel lanes and shoulders) requires a 12.4m pavement width\(^{30}\) for each direction of travel. The existing shoulder width along the Highway 1 corridor ranges from 2.0-to-2.6m and the overall paved surface width is as follows:
  - 11.6m [Station 9+150 to 13+885 EBL];
  - 12.8m [Station 13+885 to 15+750 EBL];
  - 11.8m [Station 9+150 to 11+249 WBL];
  - 11.4m [Station 11+249 to 13+884 WBL]; and
  - 12.6m [Station 13+884 to 15+750 WBL].

Hence, approximately 78% of the existing corridor can be considered to have substandard shoulder widths according to current standards for new construction. For 3R/4R projects, the existing shoulder widths along Hwy 1 (from 2.0 to 2.6 m) are acceptable and meet AT’s 3R/4R standards.

- **Highway 1 Median Width**: Approximately 800m west of Hwy 563, the Hwy 1 center median transitions from a rural 22.6m width to an urban 7.8m width. The median width has a direct impact on the interchange design including design speed, ability to accommodate a barrier free configuration and construction costs.

\(^{29}\) ATHGDG: Table A-7, Section A.7: General Design Contronls and Standards for Rural Highways, Chapter A: Basic Design Principles  
\(^{30}\) ATHGDG: Table A-7, Section A.7: General Design Contronls and Standards for Rural Highways, Chapter A: Basic Design Principles
• **Access Management:** The intersection spacing along Highway 1:08 is consistent with AT access management guidelines for expressways facilities, while the private access spacing is not. The existing access management can be characterized as follows:
  - The spacing between the existing interchange ramps along the Highway 1:08 corridor within the project study area ranges from approximately 2.6km to 3.0km. The existing interchange spacing is well above the “urban” interchange spacing criteria of 1.6km as outlined within AT’s standards but below “rural” guidelines; and
  - There are two existing private accesses along the Highway 1:08 corridor within the study area. The first location is a private residence at an approximate station 12+442 and the second is a subdivision emergency entrance/exit at station 13+932. Both accesses are an exception/variance to the AT standard.

2.16 **Geometric Overview of Existing Highway 563 Corridor**

The design review of the existing Highway 563 corridor involved a desktop assessment and an evaluation of the corridor based on a site overview. The review of existing conditions served to identify the following geometric and access management issues:

• **Horizontal Alignment:** A review of the geometry of the 12 horizontal curves along the existing Highway 563 alignment indicated that only 6 of the curves meet current highway standards.

• **Vertical Alignment:** The Highway 563 corridor consists of 22 vertical curves (12 sag and 10 crest), with sag curves ranging from K19-to-K153 and crest curves in the range K13-to-K53. The Highway 563 grades vary from 0.0% to 7.2% (where a 6% grade is desirable for this highway facility). A comparison of these curves to the permitted Kmin values (required to accommodate stopping sight distance) was undertaken:
  - Assuming the existing 70 km/hr design speed, the current permitted Kmin on sag curves would be K25 and on crest curves K25. Five of the existing curves (roughly 23%) can be further improved to comply with the current design guidelines for minimum stopping sight distance criteria;
  - Approximately 23% (5 of 22) of the existing Highway 563 vertical curves satisfy design criteria for 3R/4R projects that are applied to improvements proposed along existing paved highways;
  - Three segments of the Highway 563 corridor, over a total length 0.6km (or 10% of the length of the corridor in both directions), exceed the 6% desirable maximum gradient for a rural 2-lane undivided highway (a 200m segment has a grade of 7.2%, a 125m segment has a grade of 6.1% and the remaining 275m segment has a grade of 7.2%)37; and

31 ATHGDG: Table I.5, Section I.5.1: Access Management by Design Classification, Chapter I: Access Management Guidelines
32 ibid
33 ATHGDG: Table B.3.6b, Section B.3.6: Rates of Superelevation for Design, Chapter B: Alignment Elements
34 ATHGDG: Table B.4.4, Figure B-4.4.2a & Figure B-4.4.3, Section B.4.4: Vertical Curves, Chapter B: Alignment Elements.
36 ATHGDG: Table A-7, Section A.7: General Design Controls and Standards for Rural Highways, Chapter A: Basic Design Principles
37 Hwy 563:02 EBA Survey, Km 0.3-6.2
• A thorough survey of the vertical profile should be performed to more accurately determine areas for further improvement.

• *Pavement Width:* The current minimum standard for an undivided rural highway surface (exclusive of shoulders) requires a 7.0m pavement width. The existing Highway 563 pavement width along its entire length within the study area is 6.9m (Station 0+000 to 6+407). Hence, the entire corridor can be further improved to comply with the current design guidelines for lane and shoulder widths.

• *Access Management:* The intersection and private access spacing along Highway 563 is inconsistent with AT's access management guidelines for collectors and can be characterised as follows:
  • spacing between the existing public road intersections varies from 1.9-to-3.8km;
  • private access spacing ranges from 100m-to-425m; and
  • access to intersection spacing ranges from 22m-to-440m.

The existing private access locations do not meet AT’s standards for a collector highway. The existing Highway 563 currently functions as a local road according to the standards outlined in ATHGDG.

### 2.17 Existing Utilities

Eleven utility providers were found to be listed along the Highway 1 corridor.

Each of the following utility providers were contacted as part of this functional planning study:

- Alberta Supernet (Cable)
- Atco Gas (Gas)
- Atco Gas & Pipeline (Gas)
- Bell West
- City of Calgary Roads
- Enmax Corp. (Gas)
- Fortis Alberta (Power)
- Rocky View County
- Alberta Supernet (Cable)
- Telus (Cable)
- City of Calgary Water Services

Section 8 provides additional information and outlines the location of all utilities impacted by the functional plans.

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38 Ibid
39 ATHGDG: Section I.5.6: Collectors, Chapter I: Access Management Guidelines
40 Alberta One Call
3.0 TRAFFIC FORECASTING AND ANALYSIS

3.1 The Growth in Highway 1 Thru-Traffic

Subsequent to a review of the historical traffic count information (See Section 2.5) along the Highway 1 and Highway 563 corridors within the study area, an annual rate of 2 percent traffic growth was determined to be appropriate to be applied to simulate the growth in Hwy 1 “thru-traffic” (traffic traveling through the highway corridor between Stoney Trail and Hwy 22) that would be independent of the growth in land uses within the study area. Adoption of this growth rate was deemed to result in roughly a doubling of the current “thru-traffic” volumes along the Hwy 1 corridor over the next half-century. The 2 percent value was thought to be representative of a continued moderate growth scenario for those lands outside of the immediate study area and was applied to determine the “ultimate” build-out horizon period for study area.

3.2 Land Use & Traffic Forecasting Methodology

Traffic forecasts were created using a superposition methodology whereby various layers of traffic were aggregated to produce travel demand forecasts for the Hwy 563/Old Banff Coach Road/RR-31 interchange. These traffic layers included:

- existing (2012) traffic volumes;
- site generated traffic for identified study area land uses; and
- background traffic growth assumptions along the Hwy 1 corridor.

Horizon Years

The initial stage of analysis involved the development of an “ultimate” build-out horizon period for the lands within the study area.

- Appendix C-2 documents the adopted land use assumptions used to simulate the “ultimate” build-out of the study area, inclusive of applied traffic generation rates, historical traffic volume information and infrastructure assumptions; and
- Appendix C-3 details the methodology that was used to determine “interim” (Stage I, Stage II) horizon year forecasts.

3.2.1 Land Use Assumptions and Traffic Generation

It is critical to appreciate that over the last two decades (1991 to 2011), both Rocky View County and the City of Calgary population have both experienced considerable growth (in

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1 Appendix C-2: “Technical Memorandum #2”: Sect: 4 Note: Values in Table 4-1 includes additional areas not illustrated in Exhibit 3-1.
2 See Appendix C-3: “Technical Memorandum #3”: Section 8.
3 “County Plan” Rocky View County - Bylaw C-7280-2013, Nov. 15, 2013: Page 6
The City of Calgary over the last decade (1998 and 2007) led the nation in both total population growth (26.1%) and average annual growth (27%)\(^5\) and over the recent 5 year period (2006-to-2011) has grown by approximately 11 percent. A question remains as to these levels of growth being sustainable into the future and hence this study incorporated a process that involved the development of alternative growth scenarios.

The initial stage of this process involved a comprehensive list of planning initiatives and impact studies\(^6\) within the study area that were reviewed as part of the study area familiarization process. Estimates of the number of dwellings and the gross-floor-area (SF GFA) of commercial/industrial development for each land use were developed by referencing both the available land use information for individual sites and assumptions documented in previous studies\(^7\).

Exhibit 3-1 illustrates the existing and future land use assumptions within the immediate study area that were consolidated into an overall land use plan\(^8\). Other adjacent development initiatives beyond the immediate study area were also accounted for, which included the impacts associated with Bingham Crossing, Harmony Developments, Springbank Airport Expansion, Padera Springs, Central Springbank ASP, North Springbank ASP, West View ASP, etc.

Estimates of future residential development densities were obtained from both literature and existing densities measured within similar communities/sub-divisions and applied to provide estimates of future land use densities. In a similar manner, density (SF GFA-per-acre) information was gathered from commercial/industrial/retail sub-divisions (inclusive of Calgary and the surrounding areas) which were thought to be similar in scope and characteristic to what could be envisioned for the lands within the study area.

\(^5\) “City of Calgary, Calgary & Region Economic Outlook, 2011-2021”, Statistics Canada, Volume 2
\(^6\) See Section 1.3 of this report.
\(^7\) ibid: The Land use estimates were forwarded to the City of Calgary (Mr. Shawn Small) and Rockyview County Staff (Mr. Vince Diot) and were corroborated as of July 6\(^{th}\), 2012. As well the land use estimates incorporate the Feb. 2012 land use concept of the proposed Bingham Development.
\(^8\) See Appendix C-2: “Technical Memorandum #2”: Annex B
### Exhibit 3-1: Study Area Land Use: (Major Generators Only)

<table>
<thead>
<tr>
<th>Major Land Use Area</th>
<th>Land Use</th>
<th>Units</th>
<th>Assumed</th>
<th>Low</th>
<th>High</th>
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<td>Low Density Residential</td>
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<td>120</td>
<td>200</td>
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<tr>
<td></td>
<td>Office/Business Park</td>
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<td>500</td>
<td>500</td>
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<td>Dwellings</td>
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<td>200</td>
<td>300</td>
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<td>1,025</td>
<td>800</td>
<td>1,100</td>
</tr>
<tr>
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<td>400</td>
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<td>152</td>
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<td>750</td>
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<td>1,200</td>
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<tr>
<td></td>
<td>Commercial/Retail</td>
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<td>338</td>
<td>200</td>
<td>400</td>
</tr>
<tr>
<td></td>
<td>Office/Business Park</td>
<td>1000 SF GFA</td>
<td>484</td>
<td>300</td>
<td>550</td>
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<tr>
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<td>500</td>
<td>750</td>
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<tr>
<td></td>
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<td>1,625</td>
<td>1,350</td>
<td>1,900</td>
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<td>3</td>
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<td>400</td>
</tr>
<tr>
<td></td>
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<td>484</td>
<td>300</td>
<td>550</td>
</tr>
<tr>
<td></td>
<td>Industrial</td>
<td>1000 SF GFA</td>
<td>636</td>
<td>500</td>
<td>750</td>
</tr>
<tr>
<td></td>
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<td>1,625</td>
<td>1,350</td>
<td>1,900</td>
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<td>357</td>
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<td>Commercial/Retail</td>
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<td>338</td>
<td>338</td>
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<td></td>
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<td>3,173</td>
<td>2,414</td>
<td>3,661</td>
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<tr>
<td>Total</td>
<td>Low Density Residential</td>
<td>Dwellings</td>
<td>11,463</td>
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<tr>
<td></td>
<td>Office/Business Park</td>
<td>1000 SF GFA</td>
<td>3,173</td>
<td>2,414</td>
<td>3,661</td>
</tr>
</tbody>
</table>

Note: The table includes potential locations for Hwy 1/Hwy 563 Interchange, with specific focus on land use areas and assumed potential growth across various categories such as residential, commercial, and industrial.
**Sensitivity Analysis: Land Use Ranges**

Sensitivity analysis for the potential “ultimate” build-out horizon period of the study area was undertaken which assumed a “high” range, a “moderate” (labelled “assumed”) range and a “low” range of potential development intensity. The “moderate” range depicted a scenario that was positioned roughly at 60%-to-65% of the variance between the “low” and “high” range development scenarios. The inset table within Exhibit 3-1 indicates the values determined for each range and sub-area for those regions in the immediate proximity of the Hwy 563/Old Banff Coach Road/RR-31 interchange.

The results indicate that the forecast growth potential for the lands within the immediate proximity of the interchange is anticipated to result in:

- an additional 6,000-to-7,500 homes;
- a business park/office/industrial development potential of an additional 3.0-to-4.6 million square feet;
- a retail expansion of 1.4-to-2.2 million square feet; and
- public institutional development (including schools, community centres, parks, etc.).

**Sensitivity Analysis: Traffic Generation**

Subsequent to traffic generation rates being applied to each of the future land use scenarios (residential, industrial, and commercial development), estimates of site generated traffic volumes were developed. These results indicate that the forecast traffic growth of the lands within the study area would generate approximately 7,500-to-10,600 and approximately 9,500-to-13,500 new vehicle trips in the morning and afternoon peak hour of travel demand, respectively.

**Sensitivity Analysis: Traffic Distribution**

The development of travel demand forecasts used in this study also incorporated sensitivity to the potential for greater rates of “internalization”. As the growth in land use matures beyond the initial residential development, initiatives that augment and service residents, inclusive of new employment and services (such as retail, commercial and entertainment services and institutions, e.g. schools, hospitals, clinics, community centers, etc.), will afford greater opportunities to travel less by combining trips, commute over shorter distances and remain within closer proximity to the home community. Trips outside of the community would be anticipated to become less frequent and the need for longer distance travel diminishes.

The travel demand simulation tool developed for travel distribution analyses involved the ability to simulate the relative attractiveness between two areas (based upon forecast population...
and employment forecasts) through the application of an inverse relationship incorporating the separation or travel distance between the zones. (The closer two land uses were to one another, the greater the potential for generating travel between the two areas. Conversely, the further separated the areas were from one another, the less likelihood there would be of generating travel between the two areas.) Although somewhat theoretical, the sensitivity of this relationship has a direct impact upon travel demands on the Highway 1 corridor. In the absence of commercial/institutional/industrial development opportunities within the study area, the greater the travel demand from/to Greater Calgary and the greater the need for additional east-west capacity along the Hwy 1 corridor.

The extent of this “internalization” relationship is clearly dependent upon the emphasis placed upon the separation between traffic zones. As a sensitivity test, two parameters were tested:

- **“Low Internalization”:** This traffic distribution scenario applied the absolute value of distance as a factor. This was labelled “Direct Inverse” since the method distributed trips in an inverse relationship to the absolute value of separation between zones. (This implies a stronger attraction/production of traffic between the study area and Greater Calgary.); and

- **“High Internalization”:** This traffic distribution scenario applied the value of distance-squared as a factor, since this method distributed trips in an inverse relationship to the absolute value of separation-squared between zones. This was labelled “Inverse Squared”. (This implies a stronger degree of internalization and frequency of “internal” trips within the study area itself and greater reluctance to travel longer distances.)

Traffic Forecasts

Exhibit 3-2 illustrates the forecast traffic volumes for the various development horizons.

Comparative Evaluation

The City of Calgary 2039 (approximately 25 year horizon) and 2076 (approximately 65 year horizon) travel demand forecasts9 were generated for the Hwy 1 corridor west of Stoney Trail and reviewed for comparison purposes with the traffic forecasts prepared for this study. In general the travel demand forecasts produced within this study compare favourably with estimates produced within the City of Calgary model.

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9 City of Calgary “LUN” (Land Use and Network) assumptions and “TARGET” (Accounts for Desired Mode Share) assumptions were made available for each horizon year [2039 Population = 2M / Empl = 1.04M; 2076 Population = 2.8M / Empl = 1.31M] and included infrastructure network improvement assumptions for 2019, 2029 and 2039.
Stage I: Ramp Terminal Volumes

Assumptions:
- Morning (afternoon) peak hour
- Diamond configuration
- Interchange in existing location
- Direct inverse (low internalization)
- \( R_{60} \) – Assumed traffic volumes

See Stage I for lane configuration.

Stage II: Ramp Terminal Volumes

Assumptions:
- Morning (afternoon) peak hour
- Diamond configuration
- Interchange in existing location
- Direct inverse (low internalization)
- \( R_{60} \) – Assumed traffic volumes

See Stage II for lane configuration.

Exhibit 3-2: Forecast Traffic Volumes for Stage I, Stage II and the Ultimate Stage
Ultimate Stage: Ramp Terminal Volumes

Assumptions:
- Morning (afternoon) peak hour
- Parclo “A” configuration
- Interchange in existing location
- Direct inverse (low internalization)
- R₆₀ – Assumed traffic volumes
See Stage III for lane configuration.

![Diagram of freeway interchange with traffic volumes](image)

Exhibit 3-2: Forecast Traffic Volumes for Stage I, Stage II and the Ultimate Stage (cont’d)
3.2.2 Key External Infrastructure Assumptions

One of the leading conclusions associated with the “ultimate” build-out horizon period traffic volumes was that several key pieces of freeway/highway infrastructure could be considered to be required from a network operations perspective to accommodate the “ultimate” build-out level of growth, independent of which scenario is considered.

The analysis findings concluded that:

- a Regional Ring Road located west of the Highway 1/Springbank (RR-33) interchange (exact location to be determined) and east of the Highway 22/Highway 1 interchange would be required;
- the ultimate configuration of the Stoney Trail/Highway 1 interchange to the south of the existing Hwy 1 corridor through to Hwy 22X would be required;
- A RR-31 (Old Banff Coach Road) structure over Hwy 1 must consist of at least 4 thru-lanes;
- A ten-lane Highway 1 corridor west of the interchange site will ultimately be required;
- The Highway 1 corridor east of the interchange site must transition to a 4-lane eastbound and westbound Hwy 1 corridor over the Hwy 1/Valley Ridge Blvd interchange bridges; and
- Roundabout control at the ramp terminals could not be recommended for the Hwy 563/Old Banff Coach Road/RR-31 “ultimate” ramp terminal configuration due to the unacceptably poor levels of service that would be offered. Nevertheless, roundabouts can be considered as an “interim” operational solution.10

3.3 Diversion Effects of Interchange Location

Exhibit 3-1 also serves to illustrate three alternative locations that were evaluated for a future interchange site that would replace the existing Hwy 563/Old Banff Coach Road/RR-31 interchange.

- Location “A”: 2.2 km west of Valley Ridge Blvd;
- Location “B”: 2.7 km west of Valley Ridge Blvd; and
- Location “C”: Current Hwy 1/Hwy 563 interchange location.

In terms of travel demand characteristics, the alternative sites indicated a variance of only 40-to-110 vehicles-per-hour (from any one movement to another) that would actually divert to either a different movement or an alternate interchange location (Valley Ridge or Springbank/RR-33) as a result of shifting the interchange location. The diversion effects were determined to be marginal11 as concerns traffic operations. However, the City of Calgary may view Location “C” as being undesirable given that traffic from the City’s new developments would have to

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10 See Appendix C-2: “Technical Memorandum #2”
11 A travel time analysis indicates that an additional 4 minutes of travel time (measured from the furthest easterly dwelling) would be incurred for Location “C” as compared to Option “A”.

Highway 1 Interchange (Between Range Road 33 and Stoney Trail) Functional Planning Study  
June, 2014  
Alberta Transportation
use the County roadway network to access the Hwy 1 corridor. Conversely, with the advent of Location “A”, existing and new County residents would have to use portions of the new City roadway network to access Hwy 1.

3.4 Timing of Related Infrastructure Improvements

A key factor in determining required infrastructure is timing. A planning analysis was undertaken to provide additional insight into the timing requirements from the perspective of meeting forecast travel demands to provide answers to the following questions:

- *When would Highway 1 require widening?* The answer to this question provides the duration when the existing interchange bridge will need to be replaced to accommodate forecast travel demands (The bridge presently spans six lanes, four Hwy 1 through lanes and two auxiliary outside lanes connecting to the existing loop ramps); and

- *When would RR-31/Old Banff Coach Road require widening?* The answer to this question affects the timing when additional capacity for the RR-31 arterial over the Hwy 1 corridor will be required.

This section provides a summary of analyses undertaken to determine the timing requirements of associated infrastructure that would influence the proposed interchange improvements and potential staging within the study area.

3.4.1 When does Highway 1 require widening?

Current (2012) daily traffic volumes on Highway 1 under the bridge deck are approximately 24,440 vehicles-per-day. It was determined\(^\text{12}\) that from a traffic volume perspective (assuming continuation of the Parclo “A” configuration) that the Highway 1 corridor in the vicinity of the Hwy 563/Old Banff Coach Road/RR-31 interchange is anticipated to warrant widening:

- to 6-lanes within 7-to-10\(^\text{13}\) year time horizon when 31,000 vpd would be reached; and
- to 8-lanes within the 20-to-30\(^\text{14}\) year time horizon when 50,000 vpd would be reached.

The above thresholds are based upon “desired” design guideline intended to ensure that operational levels-of-service (LOS) would remain at “C-or-higher”.

However, adopting lower standards of operation could well extend the time period before widening of Hwy 1 is required. Traffic volumes (2012) on the QEII (which is 6-lanes between Calgary and Airdrie) currently accommodates 75,000 AADT. The Hwy 1 corridor could potentially see this same level of growth in the 40-to-45 year time horizon implying that a 6-

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\(^{12}\) See Appendix C-3: “Technical Memorandum #3”; Section 4 & 5 Annex “B”

\(^{13}\) 7 years is associated with the existing Parclo configuration, 10 years is associated with the Diamond configuration

\(^{14}\) 20 years is associated with the existing Parclo configuration, 30 years is associated with the Diamond configuration
lane configuration could potentially last for an additional 40-to-45 years rather than 20-to-30 years.

In terms of financial considerations, the above point is critical in that the net present worth of considering rehabilitating the existing structure is maximized the longer AT can prolongs the life of the existing Hwy 563 (rehabilitated) structure. It was determined that extending the life of the existing structure to last for as long as 40-to-45 years and accepting lower-than-desirable level-of-service operations in the latter years of this time period results in a rehabilitation option being far superior to that option of bridge replacement. The issue of replacement versus rehabilitation can be revisited at the time where the Hwy 563 structure rehabilitation is warranted.

### 3.4.2 When does RR-31 require widening?

Traffic on RR-31 going over Highway 1 was evaluated by determining forecast traffic demands in the northbound and southbound directions.

The warrant for twinning of 5,000 vehicles-per-day-per-lane was adopted. It was determined that from a traffic volume perspective, the RR-31 corridor traveling over Highway 1 is anticipated to warrant:

- Widening to 4-lanes (two northbound and two southbound lanes) within approximately 20 years; and
- Additional capacity would be required to accommodate a double loop ramp in the southwest quadrant in the “ultimate” time horizon.

### 3.4.3 What is the Preferred Ultimate Interchange Configuration?

Traffic operational analyses were undertaken assuming the Hwy 1/Hwy 563 interchange ramp terminals under various intersection configurations using Synchro™ and Sidra Intersection 5.1™ traffic analysis software packages. The analyses assumed the forecast “ultimate” build-out travel demand conditions for the study area. The intersection capacity analysis results assessed the following configurations and concluded:

- **Diamond Configuration**: Unsatisfactory operational characteristics (LOS “F”) for both ramp terminals were forecast assuming traffic control signals at the north and south ramp terminals.

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15 The warrant of 5,000 vpd was derived from AIHGDG, Figure A-9, which would apply to the Highway 563 corridor. Rocky View County, Infrastructure and Operation Services, Typical Cross Section exhibit (See Annex “D”, Exhibit D-1) indicates a lower threshold of 10,000 vehicles-per-day (2-way) or (5,000 vehicles-per-day-per-lane) that would apply to City Arterial, Major Streets and Local Major Streets. Hence, the 5,000 vpdpl warrant applies independent of the jurisdiction and classification of the future N-S corridor.

16 See Appendix C-2: “Technical Memorandum #2”: Section 6, Annex “E” & “G”
• **Parclo “A”**: This interchange configuration assumed traffic signal control at both the north and south ramp terminals and resulted in satisfactory (LOS “C” or better) operational characteristics for all turning movements at both ramp terminals;

• **Parclo “B”**: This interchange configuration assumed traffic signal control at both the north and south ramp terminals. The south ramp terminal was found to exhibit unsatisfactory traffic operations (LOS “F”); and

• **Parclo “AB”**: This configuration produced overall satisfactory intersection operational characteristics (LOS “D” or better) at both the north and south ramp terminals, however a weaving analysis indicated weaving constraints between the two loop ramps on the bridge structure.

Roundabout configuration were also analyzed and indicated that all of the above interchange configurations considered (Diamond, Parclo “A” and Parclo “B”) assuming roundabout control at each of the ramp terminals would result in unsatisfactory operational characteristics at one or both of the ramp terminals assuming the ultimate build-out travel demand. Nevertheless, roundabouts were still considered as an interim operational solution (assuming less traffic) given the “ultimate” time frame associated with these land use forecast.

In summary, the above indicated that the “preferred” Hwy 1/Hwy 563 interchange:

• would be best configured as a Parclo “A” interchange configuration with a single lane loop ramp in the NE quadrant and dual lane loop ramp in the SW quadrant of the future interchange;

• a 7-Lane RR-31 bridge structure over the Highway 1 corridor [four through lanes (two northbound and two southbound), two lanes leading to the S-E Loop Ramp and a single lane leading to the N-W Loop-Ramp]; and

• would be traffic signal controlled at both the north and south ramp terminals.

3.5 Staging the Preferred Ultimate Configuration

Additional traffic operational analysis was undertaken to confirm the timing and configuration of interim infrastructure improvements to the Hwy 563/Old Banff Coach Road/RR-31 interchange. The analyses evaluated the performance characteristics of ramp terminal operations (assuming STOP-control, traffic signals and roundabout configurations) over three different horizon years (Stage I: 10-Year, Stage II: 20-Year, and Stage III: 50-Year) and for two different interchange configurations. (Appendix C-317 assumed a Parclo “A” configuration for the future interchange and Appendix B-3 assumed a Diamond configuration for the future interchange.)

3.5.1 Stage I: Two Alternative Options

Development of the Stage I functional plans considered two alternatives:

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17 See Appendix C-3: “Technical Memorandum #3”: Section 8, Table 3.
18 See Appendix B-3: Table B-1.
- **Rehabilitating the existing interchange bridge** and converting the associated ramps to a *diamond* configuration with the objective of making use of the full 6-lane Hwy 1 cross section currently under the existing structure to accommodate three lanes of freeway thru-traffic in the eastbound and westbound directions; and

- **Replacing the existing interchange bridge with a new bridge** capable of spanning the ultimate Hwy 1 cross-section.

**a) Replacing the Existing Interchange Bridge with a New Bridge**

This scenario would involve an early replacement of the existing (2-lane) Hwy 563/Old Banff Coach Road/RR-31 bridge structure with a new bridge capable of spanning the ultimate Hwy 1 cross-section. This scenario responds to a 2012 BIM\(^1\) report, which indicated that the existing bridge deck was in “poor condition and requires replacement within the next 5-to-10 years (2017-2022)” and assumed that the initial configuration for the Hwy 563/Old Banff Coach Road/RR-31 interchange would consist of:

- a Parclo “A” interchange configuration (with single-lane loop ramps in NE and SW quadrants); and

- A *new bridge* structure capable of spanning a 10-lane Hwy 1 cross-section (by cutting back the slope protection) with initially two core through lanes (1 NB and 1 SB) which could be easily expanded to three core lanes or more when required.

Analyses determined that the simulation of a replacement bridge scenario (assuming a Parclo configuration) would best be configured with ramp terminals as follows:

- **North Ramp Terminal:** Either traffic signals (with single auxiliary lanes for each movement: WB-LT, channelized WB-RT, channelized SB-RT) or a single lane round-about would provide for adequate traffic operations; and

- **South Ramp Terminal:** Either STOP-control (with single auxiliary lanes for each movement: EB-LT, channelized EB-RT, channelized NB-RT) or traffic signals would provide for adequate traffic operations. (A single lane roundabout provided unsatisfactory traffic operations.)

**b) Rehabilitating the Existing Interchange Bridge**

This scenario assumed that during the Stage I horizon year the interchange would be configured as a diamond interchange (with the existing loop ramps being removed) and new ramps being developed as close as possible to their ultimate location. The life of the existing bridge would be prolonged (through bridge maintenance activities estimated at $2M) well beyond the next two decades and assumes that Hwy 1 thru-traffic volumes would not require an 8-lane widening for perhaps a 40-to-45 year time horizon. (See Section 3.4.1)

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19 Bridge Inspection and Maintenance (BIM) System Report addressing the existing Hwy 1/Hwy 563 bridge structure BF75933: 14-Feb-2012
Initially the rehabilitation option was rejected recognizing the following longer-term issues.20

- Rehabilitation may lack public acceptability (given that residents have become used to the existing free-flow traffic operation provided by the existing loop ramps) and that the conversion to a diamond interchange configuration may last well beyond a 25-year time frame;

- The life of the existing bridge must be prolonged (through bridge maintenance activities estimated at $2M) well beyond the next two decades to be cost effective against the replacement option. Achieving this by delaying the 8-laning of the Hwy 1 corridor beyond a 50,000 AADT warrant implies accepting lower-than-desirable levels-of-service freeway operations in the latter years;

- During the Stage II horizon when the Hwy 563/Old Banff Coach Road/RR-31 bridge structure requires twinning to accommodate four thru-lanes, the advent of a “new” bridge structure spanning an ultimate Hwy 1 corridor immediately adjacent to the “existing” structure would require the ramp terminals on either side of the interchange to be completely re-constructed; and

- Throughout the time period before 8 Hwy 1 thru-lanes are required21 the vertical profile of the “existing” bridge beside a “new” longer span twinned bridge would present design constraints and be incongruent with desired design standards.

Analyses22 determined that the ramp terminals assuming rehabilitation of the existing interchange bridge would best be configured as follows:

- North Ramp Terminal: Traffic signals with single auxiliary lanes for each movement (NB-LT, WB-LT, channelized WB-RT, channelized SB-RT) would provide for adequate traffic operations. (A single-lane roundabout assuming the “high” range growth scenario for the Stage I forecast exhibited failure levels-of-service during the afternoon peak hour of travel demand, but satisfactory operations for the “moderate” growth scenario. The performance characteristics of a single lane roundabout will be required to be monitored.); and

- South Ramp Terminal: Either STOP-control with single auxiliary lanes for each movement (SB-RT, EB-LT, channelized EB-RT, channelized NB-RT) or traffic signals would provide for adequate traffic operations. (A single-lane roundabout assuming either “high range” or “moderate” growth scenarios for the Stage I forecast exhibited failure levels of service during the morning peak hour of travel demand.)

**Conclusion: Stage I Horizon Ramp Terminal Configuration**

For the purpose of this functional planning study, it was concluded that bridge rehabilitation option would be preferred (despite the longer term issues of the strategy). As illustrated in the Stage I functional plans the ramp terminals would initially be configured as single-lane roundabouts.

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20 See Appendix C-3: “Technical Memorandum #3”: Section 7
21 This could be as long as 40-to-45 years if one were to endure 75,000 AADT accommodated on six Hwy thru-lanes similar to the QEII experience south of Airdrie.
22 See Appendix B-3, Table B-1, Diamond Configuration Analysis
The rationale for recommending single-lane roundabout configurations for the Stage I horizon (despite the related findings regarding the issue of performance) was two fold:

1. **Property Protection:** Roundabouts require significantly more property than traffic signal controlled intersections. Protecting sufficient property would provide AT with the flexibility to respond with the appropriate intersection treatment (STOP-control, traffic signals or roundabout) closer to the time of detailed design and closer to the time of actual development occurring in the study area, without having to acquire additional property at a later time; and

2. **Flexibility in Design:** Although single-lane roundabouts exhibited poor performance characteristics assuming the worst-case development assumptions (“high” growth scenario, “low internalization” relationship), the single-lane configuration could easily be converted to a double-lane roundabout configuration as part of future intersection modifications to address poor operational performance.

### 3.5.2 Stage II Horizon

By the Stage II time horizon, the Hwy 563/Old Banff Coach Road/RR-31 corridor was found to require widening that would accommodate a total of four north-south thru-lanes (two NB and two SB). The analysis assumed the development of a new bridge (capable of spanning the ultimate Hwy 1 cross-section) located to the east of the existing bridge structure that would accommodate NB traffic.

Various traffic control configurations were assessed. It was determined that both traffic signal and 2x2 roundabout configurations at the north and south ramp terminals of the interchange during the Stage II time horizon would offer satisfactory traffic operations.

- **Traffic Signals:** Satisfactory (LOS “C” or better) operational characteristics for all turning movements at the north and south ramp terminals were forecast assuming traffic signal control; and

- **Roundabout Control:** Satisfactory (LOS “C” or better) operational characteristics for all turning movements at both ramp terminals could be achieved assuming 2x2 roundabout control and the “moderate” growth scenario. (Note: This configuration did not accommodate the “high” growth scenario and resulted in failure levels of service to the SB thru movement during the afternoon peak hour Stage II horizon year traffic forecast.)

Provision for double-lane 2x2 roundabouts are illustrated on the Stage II functional plans at each of the ramp terminals on either side of the interchange. This concept was found to provide for flexibility of design and represents a prudent approach to property protection.

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23 See Appendix B-3: Table B-1, 20Year Forecast (R60 / Rmax). Note: Values of left side of bracket represent the “Moderate” growth forecast while values to right of bracket represent the “High” growth scenario.
3.5.3  “Ultimate” Horizon

At the time of “ultimate” development build-out of the study area, the Hwy 563/Old Banff Coach Road/RR-31 interchange was determined to require:

- a Parclo “A” interchange configuration with a single lane loop ramp in the NE quadrant and dual-lane loop ramp in the SW quadrant;
- a 7-Lane RR-31 bridge structure over the Highway 1 corridor [four through lanes (two northbound and two southbound), two lanes leading to the S-E Loop Ramp and a single lane leading to the N-W Loop-Ramp] capable of spanning the ultimate cross-section; and
- traffic signal controlled intersections at both the north and south ramp terminals. (It was concluded that, roundabouts did not provide for satisfactory traffic operations for the “ultimate” ramp terminal configuration due to the unacceptably poor levels of service that would be offered. Nevertheless, roundabouts can be considered as an interim operational solution, which assumes less traffic)

The results of the analysis indicated that sufficient residual capacity to accommodate the “High Land Use”, “Low Internalization” scenario. The sole exception to this was found to be the NB-RT movement at the Hwy 1 N-E On-Ramp at the south ramp terminal. A dual N-E On-Ramp could be implemented to address this constraint should future demands warrant such a requirement.

This configuration was found to be appropriate since:

- forecast “ultimate” travel demand at the Hwy 563/Old Banff Coach Road/RR-31 interchange site could be accommodated, regardless of interchange location;
- the configuration was found to satisfy the “High Land Use” and “Low Internalization” scenario (assuming a dual N-E On-Ramp at the south ramp terminal would be in place); and
- the configuration was found to exhibit preferred and satisfactory levels-of-service at each of the ramp terminals.

3.6  Traffic Operations: Interchange Separation Constraints

The location of a future Hwy 563/Old Banff Coach Road/RR-31 interchange was evaluated in terms of identifying the required separation characteristics between adjacent interchanges (RR-33/Springbank and Valley Ridge). This involved an assessment of lane balancing, weaving and merge/diverge characteristics associated with the “ultimate” configuration of the Hwy 563/Old Banff Coach Road/RR-31 interchange.

3.6.1  Basic Core Lanes and Lane Balancing

The required number of core Highway 1 lanes (between the Hwy 1/RR-33 interchange and Hwy 1 Valley Ridge interchange) required confirmation. Previous studies\(^\text{24}\) indicated the following:

- Hwy 1 at Range Road 33\(^\text{25}\): ten basic Hwy 1 lanes, five eastbound and five westbound.

\(^{24}\) See Appendix C-1: Technical Memorandum No. 1 – Section 4.2 for list of Previous Studies
• **Hwy 1 at Highway 563**\(^{26}\): ten basic Hwy 1 lanes, five eastbound and five westbound

• **Hwy 1 at Valley Ridge Boulevard**\(^{27}\): seven basic Hwy 1 lanes, three westbound and four eastbound

With the advent of an “ultimate” Parclo A interchange configuration (with a double S-E Loop-Ramp) at/or within the vicinity of Highway 563, the number of lanes in the eastbound Highway 1 direction must be reduced from six lanes (four Hwy 1 EB Thru lanes, one S-E Loop-Ramp lane and one N-E on-ramp lane at Hwy 563) to four Hwy 1 thru-lanes (Valley Ridge interchange) according to the above studies.

Several lane balancing options\(^{28}\) and sub-options were evaluated to determine the required lane transitions for the Hwy 1 corridor in the eastbound direction. Initially, it was thought that eliminating a total of 3 basic thru-lanes along the Highway 1 corridor between the Highway 563 and Valley Ridge Blvd interchanges would be required\(^{29}\). By design convention this would require a minimum distance of 3.2 km\(^{30}\) to assure sufficient length to eliminate all three lanes. Adoption of this concept (dropping three lanes along the Hwy 1 corridor and the required 3.2 km separation requirement) would imply that the closest location for a new Highway 1 interchange west of the Valley Ridge interchange would be a point approximately 500m east of the existing Hwy 563/Old Banff Coach Road/RR-31 interchange location.

However, a closer overview of the basic core lane strategy subsequent to review with AT’s Planning Group\(^{31}\) resulted in a revised concept (See Exhibit 3-3) which accounted for:

• **West of Interchange**: The advent of establishing a dropped lane directly onto the Hwy 1 E-N/S Off-Ramp at the proposed Hwy 563/Old Banff Coach Road/RR-31 interchange, leaving four EB-thru lanes under the bridges;

• **EB On-Ramps at Interchange**: The advent of consolidating the double (2-lane) S-E Loop-Ramp and the double (2-lane) N-E On-Ramp to single lanes before they enter the Hwy 1 EB traffic stream;

• **East of Interchange**: The advent of establishing a dropped lane directly onto the Hwy 1 E-N/S Off-Ramp at the Valley Ridge interchange; and

• **Valley Ridge Interchange**: Establishing four EB Hwy 1 basic core thru-lanes at the Valley Ridge interchange.

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\(^{25}\) Hwy 1/Range Road 33 (Springbank) Interchange Functional Planning Study (CastleGlenn, 2010)

\(^{26}\) Hwy 1 Interchange Technical Memorandum # 2 (CastleGlenn, April 24, 2012)

\(^{27}\) “Calgary Ring Road Stoney Trail – Trans Canada Highway to Deer Foot Trail Functional Planning Study (Earth Tech, 2003)

\(^{28}\) See Appendix C-5: Technical Memorandum No. 5 - Section 6

\(^{29}\) See Appendix C-1: Technical Memorandum No. 1: Exhibit 1-3 Pg 8 which illustrates the dropping from 6 to 3 Hwy 1 EB thru-lanes

\(^{30}\) Appendix C-1, Technical Memorandum No. 1: Appendix C Highway 1 Basic Lane Reduction Exhibit

\(^{31}\) See Appendix F-1: Communications with Alberta Transportation
Exhibit 3-3 illustrates the above refinements and indicates the lane balancing on either side of the Hwy 563/Old Banff Coach Road/RR-31 interchange. The concept:

- maintains the objective of assuring five Highway 1 thru-lanes between adjacent interchanges;
- requires motorists to transition from each of the double lane ramps (eastbound) on the south side of the interchange to a single lane prior to entering the Hwy 1 eastbound traffic stream;
- results in fewer mainline highway lanes having to be added and then sequentially having to be dropped\(^{32}\); and
- results in a reduction in the required separation distance between the Hwy 563/Old Banff Coach Road/RR-31 interchange and the Valley Ridge interchange.

The adoption of this concept must also satisfy lane merging/diverging requirements. The following section serves to summarize the merge, diverge and weaving requirements associated with the ultimate Parclo A configuration\(^{33}\).

### 3.6.2 Operational Analysis: Lane Balancing Assumptions

Exhibit 3-3 illustrates the following merge, diverge and weaving areas of interest.

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\(^{32}\) This does not follow proper lane balancing principles, however, this does meet the requirement to transition four through lanes under the Valley Ridge interchange structure.

\(^{33}\) See C-5 Technical Memorandum No. 5 Addendum for detailed merge/diverge and weaving analysis.
**Eastbound Direction**

The lane balancing in the eastbound direction between the Hwy 563/Old Banff Coach Road/RR-31 interchange and the Valley Ridge interchange assumed:

- The ultimate double (two-lane) S-E Loop ramp in the south-west quadrant of the Hwy 563/Old Banff Coach Road/RR-31 interchange would transition to a single lane prior to the gore of the S-E Loop ramp (to act as a metering to Hwy 1) with the Hwy 1 thru lanes (Transition No.1). The four Hwy 1 EB-thru lanes would be augmented by an auxiliary 5th lane that extends from the S-E Loop ramp eastward all the way to the Valley Ridge interchange;

- The ultimate double (two-lane) N-E On-Ramp in the south-east quadrant of the Hwy 563/Old Banff Coach Road/RR-31 interchange transitions to a single EB lane prior to the gore at Hwy 1. Traffic from the N-E On-Ramp lane would have to merge with traffic on the five Hwy 1 EB-thru lanes\(^\text{34}\) (EB Merge);

- Traffic wishing to continue eastbound on Hwy 1 would then sequentially merge with the inside Hwy 1 EB thru-lanes; or alternatively

- Hwy 1 eastbound traffic wishing to exit onto the E-N/S Off-ramp at the Valley Ridge interchange would diverge to the auxiliary outside 5th lane west of the Valley Ridge overpass structure (EB Diverge).

Hence, the EB direction of travel between the Hwy 563/Old Banff Coach Road/RR-31 interchange and the Valley Ridge interchange consists of a merge (EB Merge) and diverge (EB Diverge) movement.

**Westbound Direction**

The lane balancing in the westbound direction between the Hwy 563/Old Banff Coach Road/RR-31 interchange and the Valley Ridge interchange assumed:

- Two lanes from Stoney Trail transition onto the three Hwy 1 WB thru-lanes under the Valley Ridge interchange bridges. The inside lane from Stoney Trail extends westward to form a new Hwy 1 4th lane. The outside lane merges onto the Hwy 1 WB thru lanes over a distance of 185 m. This results in four Hwy 1 WB thru lanes approaching the Hwy 563/Old Banff Coach Road/RR-31 interchange from a point immediately west of the Valley Ridge interchange bridges.

- A single lane WB On-Ramp from the Valley Ridge interchange combines with the above four Hwy 1 westbound through lanes to result in five continuous Hwy 1 westbound lanes west of the gore point; and

- The functional plans depict the W-N/S Off-ramp in the north-east quadrant of the interchange configured as a double lane W-N/S Off-Ramp formed by the outside 5th lane (WB Weave) that would lead to the outside ramp lane (Lane 1) combined with the 4th Hwy 1

\(^{34}\) This traffic includes any remaining traffic from the upstream S-E Loop ramp that has not yet merged with inside Hwy 1 thru lanes.
thru-lane configured as a shared through-and-slip lane forming the inside lane (Lane 2) to the W-N/S Off-Ramp.

This configuration would result in a weaving movement (WB Weave) between the Valley Ridge S-W On-Ramp and the Hwy 563/Old Banff Coach Road/RR-31 double lane W-N/S Off-Ramp.

3.6.3 Operational Analysis: Merge/Diverge Characteristics

Merge and diverge analysis was undertaken using the Highway Capacity Manual (HCM) software assuming the lane configuration illustrated in Exhibit 3-3.

**Eastbound Direction**

The merge/diverge analysis for the eastbound direction assumed:

- A worst-case “high” growth scenario, with low internalization, where travel to/from Calgary’s urban area is emphasized and traffic volumes on the ramps is the greatest;
- The afternoon peak hour of travel demand, which represents the worst case forecast for this segment of Hwy 1; and
- A desirable merging level of service LOS “C” for design purposes.

It was determined that the EB direction of travel between the Hwy 563/Old Banff Coach Road/RR-31 interchange and the Valley Ridge interchange consist of merge and diverge movements that operate under acceptable levels of service. The functional plans provide for up to 2.74km of separation between the gore of the S-E Loop-Ramp and the gore of the E-N/S Off-Ramp to the Valley Ridge interchange.

**Westbound Direction**

The two lanes from Stoney Trail transition onto the three Hwy 1 WB thru-lanes under the Valley Ridge interchange bridges. The inside lane from Stoney Trail extends westward to form a new Hwy 1 4th WB thru-lane and the outside Stoney Trail lane merges onto the 4th Hwy 1 WB thru lane (previously the inside Stoney Trail lane) over a distance of 185m.

Consideration should be given to modifying the design in such a way that:

- the outside Stoney Trail lane would become the 5th WB thru-lane (therefore having the two lanes from Stoney Trail join with the three lanes from Hwy 1 to form five WB thru-lanes); and
- the S-W On-Ramp from the Valley Ridge interchange would merge onto the 5th Hwy 1 WB thru lane.

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35 See C-5 Technical Memorandum No. 5 Addendum for detailed merge/diverge analysis.
3.6.4 Operational Analysis: Weaving

Literature\textsuperscript{36} indicates that weaving segments in excess of the “maximum weaving length” no longer have an impact on operations. The maximum weaving length for the “high” growth development and low internalization scenario was determined to be 1.66km\textsuperscript{37}.

The weaving section in the WB direction between the Valley Ridge and the Hwy 563/Old Banff Coach Road/RR-31 interchanges (\textit{WB Weave}) was determined to be 1.9km\textsuperscript{38} long and therefore exceeds the “maximum weaving length” and is considered acceptable.

An analysis\textsuperscript{39} indicated that the available weaving lengths associated with other alternative interchange locations “A” and “B” that were closer to the Valley Ridge interchange resulted in available weaving lengths much shorter than the 1.66 km maximum weaving length (the weaving lengths are 0.47 km for Location “A” and 0.90 km for Location “B”) required to avoid any impact on traffic operations and hence the resulting weaving length for other locations (\textit{“A”} and \textit{“B”}) were found to result in unsatisfactory levels of service\textsuperscript{40}.

The weaving analysis results indicated that:

- greater internalization of travel demand would result in the need for less infrastructure. A single lane on-ramp at the Valley Ridge interchange linking to a single lane off-ramp at the RR-31/OBCR interchange would be require;

- When a greater dependence on travel demand to/from the Calgary urban area (low internalization) is assumed the configuration requirement result in the need for a single lane on-ramp at the Valley Ridge interchange linking to a two-lane off-ramp at the Hwy 563 interchange being required and hence a greater weaving lengths; and

- Only the Alternative “C” (existing) location could meet the weaving distance operational requirements and result in satisfactory weaving distances in terms of level-of-service and v/c ratio\textsuperscript{41}.

\textsuperscript{37} Ibid: Equation 12-4
\textsuperscript{38} The weaving segment was measure from the gore where the single lane Valley Ridge S-E On-Ramp transitions onto what becomes a 5\textsuperscript{th} outside Hwy 1 WB lane and the point where the taper commences to the double (two-lane) W-N/S Off-Ramp to the Hwy 563/Old Banff Coach Road/RR-31 interchange.
\textsuperscript{39} See Appendix C-5: “\textit{Technical Memorandum 5}”: Section 6, Table 6-2, Pg. 9.
\textsuperscript{40} See C-5 Technical Memorandum No. 5 Addendum for detailed weaving analysis.
\textsuperscript{41} The analysis assumed four WB Hwy 1 thru lanes between the Valley Ridge and Hwy 563/OBCR/RR-31 interchange. The analysis determined the inadequacy of the available weaving length afforded by Locations “A” and “B” even when a “high-internalization” and “moderate” growth scenario is assumed. Unsatisfactory V/C ratios is excess of 0.9 for Locations “A” and “B” were determined. This scenario concluded that the Location “C” (existing interchange location) was preferred as it served to maximize the weaving separation distance between the two interchanges and resulted in the only satisfactory operations addressing weaving concerns.
3.6.5 Conclusions and Recommendations

Based upon the analyses of lane balancing, merge/diverge and weaving characteristics associated with the “ultimate” configuration of the Hwy 563/Old Banff Coach Road/RR-31 interchange, the following conclusions were made regarding the segment of Hwy 1 between Valley Ridge Blvd and Hwy 563:

- **Eastbound Direction:** As indicated by the merge/diverge analysis, the eastbound segment of Hwy 1 has been designed to provide the maximum flexibility for AT to accommodate merge/diverge movements onto and off of the Hwy 1 corridor, providing for up to 2.74 km of separation between the gore of the S-E Loop-Ramp and the gore of the E-N/S Off-Ramp to the Valley Ridge interchange.

- **Westbound Direction:** The westbound segment of Hwy 1 was analyzed under several ramp and lane balancing configuration options. These analyses concluded that the preferred concept (Location “C”) was the only concept that provided the maximum flexibility to AT, while avoiding any traffic operational concerns related to weaving between the Valley Ridge interchange and the Hwy 563/Old Banff Coach Road/RR-31 interchange.

Given the above, Location “C” was found to demonstrate the best traffic operational characteristics.

3.7 Traffic Input into Potential Staging

From the perspective of the traffic operation results obtained from the preceding sections, the following findings were derived:

*Within the Stage I time frame:*

- The Highway 1 corridor within the vicinity of the interchange would be widened to accommodate 6-lanes at a time when the capacity of the existing 4-lane Hwy 1 configuration will be exceeded (6 lanes are required for Hwy 1 EB-WB through traffic; 8-lanes if the auxiliary ramp parallel lane and approach tapers are to be considered);

- Bridge rehabilitation is preferred over bridge replacement when the longevity of the rehabilitation and the adequacy of the 6-lane cross-section beneath the interchange can be extended well into the future\(^{42}\);

- The Stage I horizon was assessed for the suitability of a diamond interchange configuration (to avoid requiring 8-lanes underneath the structure); and

- Ramp terminal operational analysis indicated that during the Stage I horizon traffic signals at both ramp terminals (with auxiliary turning lanes) could perform adequately. Single lane roundabouts (as depicted in the Stage I functional plans) may result in deficient traffic operations depending on the level of development growth achieved. AT would retain the

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\(^{42}\) This assumes that the 6-lane Hwy 1 cross-section will be adequate well beyond the 50,000 AADT threshold suggested by design guidelines. This implies a willingness to accept lower-than-desirable levels-of-service operations for a period prior to 8-lanes being initiated. The net present worth of considering rehabilitating of the existing structure is maximized the longer AT can delay the need to accommodate an 8 lane span.
flexibility at that time to either revert to traffic signals or consider 2x2 roundabouts at the ramp terminals.

**Within the Stage II time frame:**

- The Hwy 563/Old Banff Coach Road/RR-31 corridor will require four thru-lanes and additional north-south capacity will be required necessitating an additional overpass structure and approaches; and

- Assuming the continuation of the diamond interchange configuration, traffic-signal controlled ramp terminals were found to provide satisfactory traffic operations (augmented by additional auxiliary turning lanes). Double-lane 2x2 roundabouts (as illustrated on the Stage II functional plans) at each of the ramp terminals on either side of the interchange were found to provide for flexibility of design and represents a prudent approach to property protection.

**Within the Ultimate time frame or before:**

- Hwy 1 would be required to be widened beyond the 6-lane configuration to accommodate 8 continuous thru-lanes beneath the interchange structure;

- The RR-31/Old Banff Coach Road corridor would require 6-lanes north and south of the interchange ramp terminals;

- A single N-W Loop-Ramp is required in the NE quadrant;

- A third bridge would be required that would lead to a 2-lane S-E Loop-Ramp providing access into Calgary; and

- The N-E On-Ramp could potentially require widening to accommodate 2-lanes assuming a “high” growth development scenario and “low” internalization.
4.0 **HIGHWAY 1 CORRIDOR AND HIGHWAY 563 INTERCHANGE: PLANNING**

The “Highway 1 Interchange (Range Road 33 to Stoney Trail)” FPS is intended to address the “ultimate” requirements of the Highway 1 corridor. This includes determining the preferred location and configuration of a new interchange that will replace the existing Hwy 563/Old Banff Coach Road/RR-31 interchange. The following sections provide a summary of the planning that was undertaken to reach the preferred Highway 1 corridor and the preferred interchange location.

4.1 **Identified Issues and Constraints**

Three constraints and issues were identified within the study area, which were determined to have a direct impact on the proposed location and design of the replacement interchange. These include achieving desirable design standards in term of:

- Hwy 1 median width;
- Hwy 1 design speed; and
- Hwy 1 vertical alignment and topography.

The following sections elaborate on each of these constraints and issues, which were used to consider and determine the preferred location for the interchange site.

4.2 **Desirable Interchange Design Standards**

The design philosophy reflected in the layout and configuration of the new Hwy 563/Old Banff Coach Road/RR-31 interchange incorporated:

- AT standards, guidelines, policies and best practices. In general: “Provincial design standards are generally more conservative as compared to municipalities and the standard practice in urban settings is to transition to the County/City standards at the next intersection(s) outside the ROW.”
- Maximum design flexibility into the interchange ROW footprint. It was recognized that at the time of interchange construction traffic patterns may well change, design standards could be revised/refined and future development may warrant a different or higher-standard of facility/configuration. To accommodate this flexibility, the interchange ROW boundaries have been designed to protect for loops in the north-east and south-west quadrants of the interchange, roundabouts at ramp terminals, and a rural Hwy 1 overpass cross-section.

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1 See Appendix C-1: Technical Memorandum No. 1
2 E-mail from Caroline Watt, January 19, 2012
3 Protection for maximum flexibility will come at a significant cost. Recent property value information (provided by AT) indicated that adjacent properties could well be within the range of $75k/acre to $100k/acre for a full 1/4 section (160 acres); and $750k/acre and up for 4-to-20 acre parcels for properties within the City of Calgary’s municipal boundary.
4.3 Initial Proposed Design Solutions

4.3.1 Highway 1 Median Width

The existing median in the immediate vicinity of the Hwy 563/Old Banff Coach Road/RR-31 interchange is characterized by a 7.8m width, however approximately 800m to the west of the interchange the median is rural and 22.6m wide. The evaluation of alternatives considered two median options which included:

(a) maintaining the existing 7.8m cross-section through the interchange site; or
(b) extending the rural cross-section through the median area to achieve a barrier free design and develop a transition to an urban median width on the east side of the interchange.

It was recognized that the proposed width of the Hwy 1 center median in the vicinity of the interchange site has a direct impact upon the design of the future interchange in terms of design speed through the interchange site, the potential to implement a “barrier free” design, the length (required span) of any new structure, the required right-of-way and construction costs.

Appendix C-1 served to evaluate each of these factors and determined that:

- extending the rural cross section, Option (b), through the interchange site would result in a cost premium of about $15M (accounting for the longer span structure, a central pier and wider clear zone, increased ROW width and additional roadwork) if the interchange was to be located in its present location; and
- other location options further to the east would increase this cost premium.

Consideration of the above led to the conclusion that maintaining the existing 7.8m median width through the interchange site represented the preferred option.

4.3.2 Design Speed

Appendix C-1 served to evaluate the design speed along the Hwy 1 corridor and determined that:

- the existing Hwy 1 vertical profile within the area generally limits the alignment design speed to 110 km/hr; and
- the close proximity to the City of Calgary urban municipal boundary was perceived as justification in favour of a reduced design speed.

Consideration of the above led to the conclusion that maintaining the existing design speed of 120 km/hr through the interchange site would compliment the preferred urban median width.

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4 See Appendix C-1: Technical Memorandum No. 1: Section 4.1
5 ibid
of 7.8m, serve as an appropriate indicator for motorists as they enter the municipal urban gateway to the City of Calgary, and compliment the vertical topography of the area to the east of the interchange (which generally limits the alignment design speed to 110 kph).

4.4 Highway 1 Corridor Grade

AT’s design standards\(^6\) indicate that the “desirable maximum gradient” for a divided freeway facility is three percent (3%). The following sections serve to:

- describe the vertical profile characteristics of the existing Highway 1 corridor inclusive of a review of geotechnical and historical collision information;
- identify the options that were considered to achieve the desired vertical alignment standard;
- present the results of an economical analysis that was undertaken to determine the suitable maximum gradient;
- determine the grade impacts upon Highway 1 level-of-service;
- assess the grade impacts related to each of the alternative interchange locations; and
- present the conceptual construction cost associated with the grade improvement.

4.4.1 The Existing Highway 1 Corridor

The Highway 1:08 corridor (from the Highway 22 interchange to just west of the Hwy 1/Valley Ridge Blvd interchange) is approximately 13.9 km in length. Section 2.1.3 served to describe the vertical alignment associated with the existing corridor. The review\(^7\) of the vertical alignment for this section of the Highway 1 indicated that:

- the west end of the corridor within the vicinity of Highway 22 consists of series of vertical crest curves and an 800m long highway segment constructed on a 5.5% grade\(^8\). This section of Highway 1 is generally consistent with the remaining segment of Highway 1:06 (west of Highway 22) that can be characterised as an undulating vertical alignment with numerous segments exceeding a 4% grade;
- approximately 3km east of Highway 22 the Highway 1 grade is reduced to a range of 0-to-2.2% that continues for a 9.2km length. This level segment of highway represents 67% of the total Highway 1:08 corridor length;
- on approach to the Calgary city limits, the Highway 1 profile forms a crest vertical curve (K value 77 located at approximately Station 12+600) that cuts through an existing ground escarpment sloping from south to north towards the Bow River.

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\(^6\) ATHGDG: Table A-7, Section A.7: General Design Controls and Standards for Rural Highways, Chapter A: Basic Design Principles

\(^7\) See Appendix C-4: “Technical Memorandum #4: Section 1.1

\(^8\) The “Highway 22 and Highway 1 Functional Planning and Access Management Study” (ISL) study recommendations include a realigned Hwy 1 centreline, a proposed new profile for the Hwy 1 corridor (max 3% grade) to improve sight lines and provide moderate climbing lanes.
The profile grades approaching the vertical curve consist of 6.4% (west side of the vertical curve) and 5.1% (east side of the vertical curve) with an approximate 12m high cut section (with a 3:1 backslope) through the existing ground; and

- east of the vertical crest curve (towards Stoney Trail) the profile of Highway 1 is generally level with grades not exceeding 3%.

When assessed over the entire length of the 13.9 km long Highway 1:08 corridor, the steep 6.4% and 5.1% highway grades east of the exiting Hwy 563/Old Banff Coach Road/RR-31 interchange can be interpreted as a design anomaly or inconsistency.

**Safety Review Associated with Existing Grade**

A safety review was undertaken to address the 6km Highway 1 corridor (between RR-33/Springbank at Station 7+781 and the Valley Ridge interchange at Station 13+864) that indicated:

- a spatial distribution of collisions along the corridor indicated that 59 collisions (or 48% of the total 124 collision) occurred along the steep 6.4% segment of Highway 1 (Station 11+400 to 12+400). This translates to a collision rate of approximately 120 collisions-per-100-million-vehicle-kilometers, which is over twice the provincial average. A more detailed review of this Highway 1 segment indicated that:
  - the majority (56%) of the collision occurred in the EB (uphill) Highway 1 direction;
  - platoons of EB vehicles were evidenced returning to the City of Calgary; and
  - motorists were observed to exhibit aggressive “getting home” driving tendencies, which is not an unusual phenomenon. (Motorist “horse-returning-back-to-the-barn” behaviour could well represent another contributing factor accounting for high collision rates.)

While the collision information was thought to be inconclusive, it was thought that the steep 6.4% grade (which results in speed differentials between vehicles navigating the uphill slope) remains a factor that contributes to the high collision rate. (The combination of the steep 6.4% grade and the existing lower-standard Hwy 1/563 interchange entrance/exit terminals may combine as factors influencing the higher collision rate.)

**Geotechnical Conditions Associated with Grade Improvements**

A geotechnical assessment, which consisted of a site reconnaissance and desktop study, served to identify existing soil conditions as well as potential geotechnical issues that could have an impact on the project and/or costs. Particular attention was given to the sections of the Highway 1 corridor where grade reductions could potentially result in cut section sections

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10 The collision rate along the steep segment of Hwy 1 differs from the collision rate for the entire 6.5 km section of Hwy 1 described in Section 2.8
11 See Appendix “A-3”: “Preliminary Geotechnical Assessment” Golder & Associates
12 See Appendix “C-4”: “Technical Memorandum No. 4”: Section 1.3
of up 15m in height (The geotechnical assessment assumed a 27m depth of excavation in the vicinity of the Highway 1 crest curve between the proposed highway profile and existing ground). The assessment indicated that:

- the soils along Highway 1, and within the vicinity of the corridor, are likely suitable to support a 27m high excavation with a uniform side slope of 3:1\textsuperscript{13} although there may be some areas of weak, silt, clay and organics (low lying areas or sloughs) overlaying the till that will require stabilization; and

- bedrock may be encountered at relatively shallow depths along the proposed Highway, particularly near the crest vertical curve and may consist of sandstone bedrock. If bedrock is exposed in cuts it is generally expected to be rippable, though local blasting may be required.

Site specific geotechnical investigations would be required to determine the actual subsurface soil/bedrock conditions should grade improvements proceed to the detailed design stage.

4.4.2 Vertical Alignment Improvement Options

The following three alternative options were considered to address the existing Highway 1 vertical alignment:

- The “Do Nothing” Scenario: This option assumed that existing grades for the “ultimate” Highway 1 configuration on either side of the K 77 vertical crest curve would remain unchanged;

- The “3 Percent” Solution: This option assumed that the “ultimate” Highway 1 grades would adhere to the desirable maximum gradient of 3%, consistent with a freeway corridor, and would provide for a new K 150 vertical crest curve; and

- The “4 Percent” Solution: This option assumed that the ultimate Highway 1 grades would permit a maximum of 4% representing a 1% grade increase over the “desirable maximum 3% gradient” and would provide for a new K 130 vertical crest curve.

4.4.3 Gradient Economic Analysis

AT’s design standards\textsuperscript{14} indicate that:

“the desirable maximum percentage gradient category (of 3%) should not be exceeded wherever practical; however the maximum gradient is site specific. In situations where costs increase substantially depending on the maximum gradient, an economical analysis should be undertaken to determine the suitable maximum gradient for this section of roadway. This economic analysis should consider road user costs as well as construction costs.”

\textsuperscript{13} The functional plans accommodate a barrier free design with 4:1 side slopes, see Section 5.
\textsuperscript{14} ATHGDG: Table A-7, Section A.7: General Design Controls and Standards for Rural Highways, Chapter A: Basic Design Principles
Any economic analysis is highly dependent upon the base assumptions. Regarding the Hwy 1 vertical profile improvements, the base assumptions included:

- the timing of capital expenditures;
- the traffic volumes forecast to occur at the time of capital expenditure\(^{15}\);
- the interaction with other adjacent interchange improvements; and
- the sequential timing and warrants for the widening of the Highway 1 corridor from its existing 4-lane divided configuration to the “ultimate” Highway 1 cross-section.

A benefit-costs (B-C) analysis\(^{16,17}\) was undertaken to evaluate the “Do Nothing”, “3 Percent” and “4 Percent” grade options. For the purpose of the B-C analysis:

- the existing Highway 1 vertical alignment was selected as the “base case” given that this alternative requires the least upfront capital costs while providing for continued operation of a multilane highway facility;
- the 3% and 4% grade options were compared to the base case in terms of annual capital, maintenance and road user costs over several time horizons;
- the difference between the two streams was calculated, which included the cumulative sum of the present value of expenditures assuming a 4% discount rate consistent with AT’s Benefit-Cost Manual (Section 2.4.4 Page 23); and
- the internal rate of return (IRR) was calculated for each year to provide an indication of the break-even point when positive benefits yield a positive rate of return over previous expenditures.

In terms of quantifiable road user costs\(^{18}\), a reduction in Highway 1 grades was found to result in lower vehicle running costs, time costs and collision rates. The analysis quantified the benefits that would be accrued by road users from reduced grades along the highway and compared these benefits to the cost of the proposed infrastructure.

**The Result of the Economic Analysis**

A sensitivity analysis was incorporated into the benefit cost calculations that accounted for variation in the following capital and road user costs: rock excavation, reduction in collisions and increase in truck traffic.

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\(^{15}\) Forecast traffic volumes were based upon proposed development initiatives and community land use plans both within and outside of the study area and historical traffic growth rates along the Highway 1 corridor.

\(^{16}\) See Appendix “C-4”: “Technical Memorandum No. 4”: Section 4

\(^{17}\) The B-C procedure was referenced from AT’s “Benefit-Cost Analysis Manual” (K.E. Howery, 1998), which presents the analysis results in terms of cumulative net present values (discounted benefits minus discounted costs) and internal rate of return for each analysis year.

\(^{18}\) Input values used to calculate the road-user costs in the analysis included: traffic volumes, operation costs, time value cost and collision costs. In addition, roadway geometry of each alignment options was compared, as well as calculated road users cost, capital costs and future widening costs.
The B-C analysis summary for the following three capital cost and road user scenarios\(^{19}\) was determined:

- *Average estimated capital and road user costs* achieve a 4% IRR by the year 2077 for both the 3% and 4% Highway 1 grade options;
- *Increased capital costs* that account for additional rock excavation result in a 4% IRR being achieved approximately 15 years later (Year 2090) as compared to the average estimated capital cost scenario; and
- *Alternative assumptions for road user costs* that assume up to a 50% reduction in collision rates and 7% increases in heavy vehicle traffic will reduce the time span for achieving a 4% IRR by approximately 22 years (year 2055) for a 3% Highway 1 grade and 28 years (year 2049) for a 4% Highway 1 grade.

AT’s B-C analysis guidelines suggest that an IRR of at least 4% must be produced in the design life of a project for the project to be considered cost effective. Assuming the design life of the Highway 1 grade improvements is 50 years+ after construction (estimate to occur in year 2022), the analysis would indicate that, from an economic perspective, reducing the existing Highway 1 grades remains economically beneficial and worthwhile.

Taking into account highway geometry and design standards, the 3% Highway 1 option represents the desirable maximum grade for a multilane highway and as such is preferred over the 4% grade option.

### 4.4.4 Impacts of Grade Reductions on the Highway 1 Level of Service

The capacity and level-of-service along the Highway 1 corridor (with in the vicinity of the crest vertical curve) was reviewed\(^{20}\) for both the existing and 3% Highway 1 grades. The purpose of the analysis was to determine how the grade reductions will improve traffic operations along the corridor at various time horizons.

The results indicate that when compared to the existing Highway 1 vertical alignment, the 3% “desirable maximum gradient” would provide for a 5% and 9% improvement\(^{21}\) in the service levels for the eastbound and westbound Hwy 1 lanes, respectively.

### 4.4.5 Impacts of Grade Reductions on the Future Highway 1 Interchange

The impacts of the Highway 1 grade reductions on the available interchange ramp decision sight distances (DSD) was reviewed\(^{22}\) for the three potential Highway 1 interchange locations.

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\(^{19}\) As acknowledged in Section 3.4.1, the timing of the widening to 8-lanes could potentially occur in the 40-to-45 year time frame assuming 75,000 AADT as warrant (which is analogous to current QE2 traffic volumes). The effect of postponing the grade improvement to a longer implementation time would not impact the overall conclusion that the 3% grade improvement remains economically desirable as the benefits would still take the same length of time to accrue.

\(^{20}\) See Appendix “C-4”: “Technical Memorandum No. 4”: Section 7

\(^{21}\) As measured in density expressed as passenger-vehicles-per-mile-per-lane.
The results indicate that when compared to the existing Highway 1 vertical alignment:

- **Location “A” (Interchange at 133rd St):** The DSD for EB Hwy 1 is improved by:
  - 65m, for a total 195m DSD for the 3% grade option; and
  - 50m, for a total 180m DSD for the 4% grade option.

  The 180m-to-195m DSD is less than the required 360m minimum DSD\(^{23}\).

  The WB Highway lanes remain unaffected by the grade improvement with 600m+ of DSD being available.

- **Location “B” (Interchange located 500 m west of 133rd S.):** The DSD remains unaffected by the both the 3% and 4% grade options, with more than 600m of DSD available in both Highway 1 directions.

- **Location “C” (Interchange at the existing Hwy 1/Hwy 563 site):** The DSD for WB Hwy is improved by:
  - 120m, for a total 280m DSD for the 3% grade option; and
  - 50m, for a total 210m DSD for the 4% grade option.

  The 210m-to-280m DSD is less than the required 360m minimum DSD\(^{24}\).

  The EB Highway 1 direction remains unaffected by the grade change with 170m of DSD being available. However, the 170m DSD can be improved to 500m+ by re-grading the existing 5.2% Highway 1 grade on the west side of the interchange to 3.0% at an estimated cost of $2.7M.

### 4.4.6 The Cost of Hwy 1 Grade Improvements

The net cost for developing a 3% grade improvement in advance of the 6-laning of Hwy 1 was estimated to be in the order of $50. However, a large portion of this cost (50%) was attributed to the value of additional property\(^{25}\) required to achieve the 3% grade improvement, which was estimated at $600K/acre given its location within the urban area of the City of Calgary. Excluding property, the cost of the 3% grade improvement was determined to be $27.1M, of which $6.9M was allocated for a temporary 4-lane by-pass facility both east and west of the interchange\(^{26}\).

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\(^{22}\) See Appendix “C-4”: “Technical Memorandum No. 4”: Section 6

\(^{23}\) Assumes a 120 kph design speed.

\(^{24}\) Assumes a 120 kph design speed.

\(^{25}\) Ibid. The analysis indicated that to achieve the 3% desired grade improvement a total of 51.4 acres of additional property would be required, whereas to achieve a 10-lane widening without the grade improvement would require 11.3 acres of additional property. Using a $600K/acre unit cost resulted in a net cost difference of $24M ($24M - $6.9M = $27.1M) representing 59% of the net cost of $40.8M.

\(^{26}\) Consideration could also be given to upgrading Springbank Road and RR31 and/or Hwy 8 and Hwy 22 to four lanes as a temporary diversion (assuming the SW ring road is in place) rather than building a temporary 4-lane bypass facility.
4.4.7 Conclusions

For the purpose of the cost-benefit analysis, the widening of the Hwy 1 corridor to accommodate six Hwy 1 thru lanes (three in each direction) in the vicinity of the RR-31/OBCR corridor is anticipated to be required by the year 2022 (within the next 10-years). The analysis indicated that reducing the existing Highway 1 grades to a 3% grade remains a worthwhile endeavour given that the grade modifications will:

- provide for a 4% IRR between the year 2055 and 2090. The 4% IRR of the grade improvement would be achieved before the end of the project design life, with savings continued for the life of Highway 1 horizon;
- the decision sight distance would be improved for Location “C” (the existing location) of the interchange; and
- a 5% to 9% improvement in the overall level-of-service for traffic operations along the Hwy 1 corridor would result.

With the advent of 6-laning Highway 1 and the current desire to develop lands adjacent to Highway 1, it remains prudent from a cost-benefit perspective to protect for sufficient property to accommodate an improved 3% Hwy 1 grade.

4.5 Selecting the Preferred Interchange Location

4.5.1 Review of Interchange Location Options

Three alternative interchange locations were evaluated along the Highway 1 corridor. In all cases, the interchange design assumed an “ultimate” Parclo “A” configuration (which was found to provide the best overall LOS as compared to alternative interchange configurations):

- Location “A” (interchange at 133rd Street) was found to be consistent with the City of Calgary’s vision for an interchange that would provide access to the “Sweet Lands” developments as part of the West View ASP and the West Annexation Regional Context Study. This location would:
  - provide for a 2.2km separation to the Valley Ridge Blvd interchange and a 4.9km separation to the RR-33 interchange;
  - provide a weaving distance of 0.48km separation from the Valley Ridge Blvd interchange; and
  - require fill embankments for the interchange overpass approach a maximum height of up to 10m on the north side of Hwy 1.

- Location “B” (interchange located 500 m west of 133rd Street) would place the interchange on the top of the Highway 1 crest curve. This location would:

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27 See Section 3.5.3 of this report
provide for improved exit/entrance decision sight distance by placing the ramp gore points outside of the vertical crest curve;

provide for a 2.7km separation to Valley Ridge Blvd interchange and a 4.4km separation to the RR-33 interchange;

provide a weaving distance of 0.9km separation from the Valley Ridge Blvd interchange; and

require embankments for the interchange overpass with a maximum height of up to 23m on the north side of Hwy 1.

Location “B” was also evaluated in terms of a tunnel or underpass configuration to take advantage of the exiting topography of the vertical crest.

Location “C” (interchange at the existing Hwy 1/Hwy 563 site) assumed the existing interchange location and would:

result in sightline constraints along the existing Hwy 1 vertical alignment in terms of reduced DSD at the exit ramp gore points for the new interchange;

provide for a 3.8km separation to the Valley Ridge Blvd interchange and a 3.2km separation to the RR-33 interchange;

provide a weaving distance of 1.9km separation from the Valley Ridge Blvd interchange; and

require fill embankments for the interchange overpass with maximum height of up to 14m on the north side of Hwy 1.

4.5.2 Interchange Location Comparison

The three interchange locations were compared taking into account the:

interchange costs, including structure and roadwork costs, earthworks and property requirements;

connecting roadway costs, including roadwork, earthworks and property requirements;

traffic operational characteristics of each location;

available decision sight distances to each interchange exit ramp gore point. (The required decision sight distance based on a 120 km/hr design speed warrant of 360-to-470m); and

area impacts, including geotechnical, environmental and historical conditions.

The above factors also incorporate:

required ROW area based on cut/fill requirements for each interchange location assuming the “ultimate” Parclo “A” configuration;

overpass/ramp grades and height-of-fill required for embankments; and

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28 See Appendix C-6: Technical Memorandum No. 6 - Appendix “A”
29 See Appendix C-6: Technical Memorandum No. 6 - Section 2
• the required estimated amount of earth work volumes.

The results of the interchange comparison (utilizing conceptual cost estimates which differ from the costs presented in Section 9 of this report) are summarized as follows:

• **Cost, interchange spacing and required ROW:** Location “C” (existing location) is the preferred location for the interchange resulting in significant cost saving and reduced ROW requirements. Location “C” was estimated at a cost of $85.1M and was found to be:
  - $49M and 50 acres less than Alternative “A”;
  - $37M and 34 acres less than Alternative “B-Underpass”; and
  - $29M and 38 acres less than Alternative “B-Overpass”. The overpass option would require significant fill embankment for the overpass road (estimated at a maximum 23m fill height).

The existing site (Location “C”) also provides for a balanced interchange separation along the Hwy 1 corridor (3.2km to RR-33 and 3.8km to Valley Ridge).

• **Sight lines along Hwy 1:** Location “B” (top of crest curve) results in similar sight distances regardless of the reduction in the Highway 1 vertical alignment. The specific sight lines for the overpass and underpass options are as follows:
  - **Overpass:** provides for the longest sight lines and exceeds desirable decision sight distance criteria. The interchange structure is also visible up to 2km from both the eastbound and westbound Hwy 1 lanes, which provide motorists with significant visual notice of the upcoming interchange.
  - **Underpass:** provides for the same ramp decision sight distance as the overpass design, however the underpass configuration provides no visual indication of the interchange bridge structure.

Location “C” (existing location) provides for 160m/170m of DSD to the exit ramp gore points and an adequate 1km visibility of the Highway 1 structure (from both eastbound and westbound). The available DSD is 200m/190m short of the minimum 360m sight distance required for a 120km/hr design speed. With the advent of a Hwy 1 grade reduction to a 3% maximum, the DSD would be improved to 500m for eastbound and 280m for westbound Hwy 1.

Location “A” (133rd Street) provides for the shortest sightlines in both the ramp decisions sight distances and interchange visibility criteria.

• **Area Impacts:** No major geotechnical, environmental nor historical issues are foreseen at any of the three interchanges sites that would prohibit the construction of an interchange at that location.

From the perspective of geotechnical and historical impacts, Location “C” offers the least potential for geotechnical issues (related to rock/organic soil excavation) as well as conflict with archaeological sites. Environmentally, the interchange location furthest away from the valley/ravine located on the west side of RR-31 (and crossing under Twp Rd 250) is preferred.
• **Traffic Operations Comparison:** Based upon the analyses of lane balancing, weaving and merge/diverge characteristics associated with the “ultimate” configuration of the Hwy 563/Old Banff Coach Road/RR-31 interchange, Location “C” was found to offer the maximum flexibility to AT to accommodate EB merge/diverge movements onto and off of the Hwy 1 corridor and provide for up to 2.74 km of separation. In particular Location “C” was the only concept that provided the maximum flexibility to AT to avoid any traffic operational concerns related to weaving between the Valley Ridge interchange and the Hwy 563/Old Banff Coach Road/RR-31 interchange in the westbound direction by providing a weaving length of 1.9 km (which is greater than the “maximum weaving length” of 1.66km).

• **Jurisdictional Impacts:** The City of Calgary may view the Location “C” as being undesirable given that traffic from the City’s developments will have to use the County’s roadway network to access the Highway 1 corridor. A travel time analysis indicated that an additional four minutes of travel time (measured from the furthest easterly dwelling) would be incurred for Location “C” as compared to Option “A” (133rd Street). Although the additional travel time is minor, the point still stands that residents living in the City of Calgary (particularly on the north side of the Hwy 1 corridor) would be forced to use the County’s roadway network to access the Highway 1 corridor.

### 4.5.3 Conclusions

The comparative analysis of the three interchange options indicates that, with the exception of reduced DSD at exit ramp gore points, the existing interchange site (Location “C”) was found to provide more numerous advantages in terms of cost savings, minimal requirements for a supporting service road networks, reduced right-of-way requirements, balanced interchange spacing and preferred traffic operations, as well as affording AT the greatest flexibility to respond to changing development patterns, intensity and travel demand configurations.

### 4.6 Highway 563 Corridor Planning

#### 4.6.1 Function and Form

The functional planning of the Highway 563 corridor (between RR-31 on the west and Springbank Road on the east) indicated that:

- with the advent of the Stoney Trail south extension, the Hwy 563 corridor would no longer function as a Provincial Highway under any AT highway classification;
- AT has long expressed interest in transferring the responsibility for this facility to a local municipal jurisdiction; and
- The majority of Rocky View County residents in the Artist View and Horizon View communities located to the south of the City of Calgary newly annexed lands:
• wish to achieve a reduction in “cut-through” traffic along the existing Hwy 563 corridor; and
• wish to prohibit any internal continuous roadways that would connect their existing rural country developments with the newly developing West View community to their north.

As regards the function and form of the Hwy 563 corridor, functional planning has indicated that the existing corridor will, over time, function much less as a Provincial Highway.

The future form of the Highway 563 corridor remains unclear as the various segments of the corridor are dependent upon the constituent jurisdiction and the planned land uses along the corridors length, which remain to be confirmed. The following descriptions serve to provide additional insight into the various functions of the five unique segments of the Highway 563 corridor and the potential impacts as concerns the existing 6.9m wide paved surface width.

1. **Highway 563 (From RR-31 to Twp Rd 245/OBCR/Hwy 563 intersection)**: The existing RR-31/Hwy 563 intersection is located 150m south of proposed location of the interchange south ramp terminal and as such the RR-31/Hwy 563 intersection would be cul-de-sac’d. Traffic would be diverted to the Twp Rd 245/RR-31 intersection. Hence, this westerly segment of the existing Hwy 563 corridor would no longer be a connecting roadway.

   - In the shorter-term, this existing segment of roadway is envisioned as a service road intended to service the existing acreages by providing access to Twp Rd 245.
   - In the ultimate time frame, the lands bounded by Hwy 1, RR-31, Twp Rd 245 and the current inter-municipal (Rocky View County/City of Calgary) boundary may experience complete redevelopment and as such may be characterized by a very different roadway system, serving completely re-developed parcels. Hence, the long-term classification and design standard for this segment of the Hwy 563 corridor remains unclear.

2. **Highway 563 (From Twp Rd 245/OBCR/Hwy 563 intersection to NE-25-24-3-5)**: This east-west portion of the corridor follows the Twp Rd 245 alignment. Although the entire Hwy 563 corridor lies within Rocky View County, the current inter-municipal (Rocky View County/City of Calgary) boundary results in the adjacent land uses bisecting the functionality of this segment of Hwy 563 corridor. The lands on either side of this corridor for the westerly 470m of this segment fall completely within the jurisdiction of Rocky View County. However, from a point 550m east of the inter-municipal boundary, the lands to the north of the corridor fall within the City of Calgary’s jurisdiction. Ultimately, the City’s urban development will be the catalyst for new traffic having to travel on County’s roadways to reach their destination.

   - In the shorter-term, the Stage I plans associated with the Hwy 563/Old Banff Coach Road/RR-31 interchange necessitate the closure of the existing Hwy 563/RR-31 intersection (which is 150m south of the south ramp terminal). This would require local traffic to divert to the RR-31/Twp Rd 245 intersection (located 500m south of the south ramp terminal). The east leg of the intersection is unpaved and
characterized by grades that exceed 7% (See Section 2.15). As a result, improvements to this intersection and the east leg of the intersection (paving) may be warranted by the proposed closure.

- In the ultimate time frame, the required roadway classification along this segment of the corridor is highly dependent upon the permitted land uses that will develop. This section of the corridor was envisioned potentially as an Urban Primary Collector (UPC) classification requiring a minimum 14m pavement surface width. However, this classification is dependent upon the permitted land uses that would develop on the westerly segment of the corridor. As well, the development of the West View (Qualico) community plays a significant role in the intended function of the Hwy 563 corridor. Currently, there are no City of Calgary Area Structure Plans detailing the roadway pattern for the West View community and as such the requirements and role for entire east-west segment of Hwy 563 corridor between RR-31 to the eastern limit of NE 25-24-3-5. The current position of the inter-municipal boundary and potential land uses may well necessitate a wider 4-lane or 6-lane facility along this segment of the Highway 563 corridor which could potentially result in significant roadway modifications including re-grading.

3. **Highway 563 (From East Limit of NE-25-24-3-5 to N Limit of Horizon View Road):** This 500m segment of the Hwy 563 corridor traverses the north-east portion of NE 25-24-3-5 on a diagonal alignment. Public consultation indicated that representatives of the Horizon View and Artist View communities within Rocky View County wished to eliminate any potential for “through” traffic between what will be the urban West View (Qualico) community to the north and the existing country residential County communities to the south.

- In the longer-term, as the West View community develops, a portion (390m) of this existing segment of Hwy 563 is envisioned to be redeveloped as a walking, bike, recreational pathway separated by two cul-de-sacs at either end. This pathway would create a discontinuity along the length of the corridor for motor-vehicle traffic and eliminate all potential of the corridor being a continuous roadway.

4. **Highway 563 (From N Limit of Horizon View Road to Artist View Road):** This 2.1 km long segment of the Highway 563 corridor lies completely within the country residential lands of Rocky View County. This segment of the roadway has four internal intersections that provide access to multiple country residential dwellings.

- In the longer-term, it was perceived that the current 6.9m width would have to be modified to comply with Rocky View County’s current Country Collector (CC) roadway design standard, which would require an 8m wide paved surface width.

5. **Highway 563 (From Artist View Road to Springbank Road):** This 1.2 km long segment of the Highway 563 corridor also lies within Rock View County and traverses through lands (to the north) which are designated for mineral extraction purposes (Burnco Rock Products) and lands to the south that provides access to three country residential acreages.

- In the shorter-term, and dependent upon the realignment of 101st Street, it is desired that the Highway 563/Springbank Road/101st Street intersection be reconfigured such that Hwy 563 would be cul-sac’d and the Springbank...
Road/101st Street intersection be reconfigured as a “T” intersection with provision for a north leg access directly into the Burnco site. Access to the three country residential acreages would be provided via Artists View Drive and the existing Hwy 563 corridor. The County roadway design standard required would likely be Country Residential (CR) with a surface width of 7m. This for all intents and purposes is assumed to be provided by the existing 6.9 m pavement width.

- In the longer term, the complete Burnco Site could well be redeveloped as a residential community and as such a more formal access to the site may be required which could well see the Springbank Road/101st Street intersection be reconfigured as a 4-leg or roundabout intersection. The Hwy 563 corridor could form part of this potential community and as such the requirements and appropriate design standards to be applied in the future remain to be clarified.

Given, all of the above, the existing Highway 563 corridor would function primarily as a discontinuous local County roadway over the majority of its length. Although short-term improvements have been identified, the longer term requirements are highly dependent on adjacent development initiatives.

4.6.2 Factors Influencing Timing

Several factors will influence the timing of this transition, some of which are under Provincial control, where others may be under municipal control as regards local development initiatives.

The timing of the following improvements are under Provincial authority:

- **The timing of the Stoney Trail South Extension and the proposed Stoney Trail/Springbank Road Interchange**: The Stoney Trail Provincial project would catalyze the requirement for the realignment of the 101 Street which in turn would result in the need for improvements to the 101st Street/Springbank Road intersection. These intersection modifications would require a decision as regards the development of a cul-de-sac at the north leg of the intersection that would truncate the old Hwy 563 corridor. Such a cul-de-sac would render the Hwy 563 corridor discontinuous; and

- **The Timing of the Proposed Stage I Hwy 563/Old Banff Coach Road/RR-31 Interchange Improvements**: Stage I involves the conversion of the existing interchange to a “Diamond” configuration with new ramp terminal locations. The new south ramp terminal would trigger the need to close the existing angled Hwy 563/RR-31 intersection and divert traffic to Twp Rd 245. (Note: The closure of this intersection would require local traffic to divert to the RR-31/Twp Rd 245 intersection (located 500m south of the south ramp terminal), the east leg of which is unpaved and characterized by grades that exceed 7% (See Section 2.15). As a result, improvements to this intersection and the east leg of the intersection may be warranted by the proposed closure.)
The timing of the following improvements is subject to the pace of land development initiatives (involving primarily the municipal approval authority). These development projects are for the most part independent of the Province:

- Development of the West View (Qualico) Community Lands could trigger the need for improvements of the Twp Rd 245 corridor as RR-31 will be a primary entranceway to the site;
- A condition of development may well be the closure of the existing angled Hwy 563/RR-31 intersection and improvements to the Twp Rd 245 corridor east of RR-31 intended to meet the needs of the development with the corridor constructed to meet both the City of Calgary and Rock View County agreed upon standards; and
- The consequences of development of the West View (Qualico) Community Lands could well trigger the desire to protect the Horizon View and Artist View communities from through-traffic concerns by way of the development of cul-de-sacs separating the country residential acreages from the proposed commercial development.

4.6.3 Planning Challenges

Rocky View County may object to having to bear the cost of improving Twp Rd 245 and Twp Rd 250 east of RR-31 since any local roadway improvements would only benefit future City of Calgary residents and not County residents. Similarly, the City of Calgary may object particularly to the location of the interchange site as it would require their future residents to use County roadways and be dependent on County maintenance and design standards for roadways serving future residents of the City. A multi-party agreement will have to be reached involving the City, the County and the development community as regards infrastructure financing and appropriate design standards necessary to accommodate the urban designation of the new communities to the west of Valley Ridge and Crestmont communities.
5.0 **FUNCTIONAL DESIGN OF CORRIDORS AND INTERCHANGE**

The technical characteristics of the proposed Highway 1 corridor and the Hwy 563/Old Banff Coach Road/RR-31 interchange improvements are presented in Annex “A” in the form of Functional Plans that address:

- staging;
- the plan and profile views of the Highway 1 corridor widening;
- the Highway 1 cross-sections;
- the plan and profile views of the Hwy 563/Old Banff Coach Road/RR-31 interchange;
- the interchange cross-sections; and
- proposed services roads and intersection locations.

The property requirements associated with the “ultimate” improvements are presented in Annex “B” in the form of right-of-way request plans that outline:

- right-of-way (ROW) required for the “ultimate” Highway 1 improvements and the Hwy 563/Old Banff Coach Road/RR-31 interchange (measured in acres and hectares); and
- landowner information (for each impacted property) that outlines the Certificate of Title with landowner names and address.

5.1 **Design Criteria**

Table 5-1 provides a comprehensive summary of the adopted design criteria parameters for the Highway 1 and Highway 563 corridors.

5.2 **Design Vehicle**

The design vehicles selected for the Hwy 1 corridor and the Hwy 563/Old Banff Coach Road/RR-31 interchange account for Long Combination Vehicles (LCVs).

- *Highway 1* is designated as a “Long Combination Vehicle Route”. As such, Exhibit 5-1 illustrates the “modified” WB-36 (Turnpike Double) design vehicle, which is characterized by a maximum length of 41 m.

- *Highway 1* is not a designated “High Load Corridor”. As such, above standard vertical clearance under the proposed interchange bridges and/or modified interchange ramp configurations are not required.

- *Old Banff Coach Road* is a Level 4 road (under the November 2008 Service Classification Map). A standard WB-23 truck was selected as the design vehicle for the highway.
<table>
<thead>
<tr>
<th>CRITERIA</th>
<th>Highway 1</th>
<th>Hwy 563/Old Banff Coach Road*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>AT Level 4 Highway Standard¹</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(200-2,000 vpd)</td>
</tr>
<tr>
<td>Speed</td>
<td>130 kph</td>
<td>70 kph</td>
</tr>
<tr>
<td>Vehicle</td>
<td>WB-36</td>
<td>WB-21, WB-23</td>
</tr>
<tr>
<td>Horizontal Alignment</td>
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<td></td>
</tr>
<tr>
<td>Min. Horizontal Curve Radius</td>
<td>R 950m, A 300</td>
<td>R 170m, A110</td>
</tr>
<tr>
<td>Max. Super elevation</td>
<td>6%</td>
<td>8%</td>
</tr>
<tr>
<td>Vertical Alignment</td>
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<td></td>
</tr>
<tr>
<td>Min. “K” Value (Crest Curves)</td>
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</tr>
<tr>
<td>Min. “K” Value (Sag Curves)</td>
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</tr>
<tr>
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<td>110</td>
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<tr>
<td>Min. D.S.D.</td>
<td>390m – 500m</td>
<td>330-430m</td>
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<tr>
<td>Max. Desirable Gradient</td>
<td>3%</td>
<td>6%</td>
</tr>
<tr>
<td>Cross - Section</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of Through Lanes</td>
<td>6 - Interim 10 - Ultimate⁴</td>
<td>2</td>
</tr>
<tr>
<td>Through Lane Width</td>
<td>3.7 m</td>
<td>3.5 m</td>
</tr>
<tr>
<td>Shoulder Width Outside</td>
<td>3.0 m</td>
<td>0.5 m</td>
</tr>
<tr>
<td>Shoulder Width Inside</td>
<td>2.5 m - Interim 3.0 m - Ultimate</td>
<td>n/a</td>
</tr>
<tr>
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<td>23.2 m (rural) 6 m (semi-rural)</td>
<td>n/a</td>
</tr>
<tr>
<td>Side Slope</td>
<td>3:1 max⁵</td>
<td>3:1 max</td>
</tr>
<tr>
<td>Basic R/W Width</td>
<td>100m</td>
<td>40m - desirable</td>
</tr>
</tbody>
</table>

¹ The design criteria for the Hwy 563/Old Banff Coach Road as presented within this table is representative of a Level 4 Highway corridor. However, as indicated Section 4.6 and 5.4 the corridor will likely no longer function as a Provincial Highway and municipal roadway criteria are more applicable. The future vision of the corridor during the “ultimate” time frame will likely be that of a local municipal collector roadway.

² Source: Standard referenced “County Servicing Standards – 2013” Rocky View County – Referenced from “Country Collector (CC)” 25, R/W 8.00. Road – Figure 400.6 Rocky View Standard Drawings & Table 400-F [See Appendix D-1] Section 4.6 indicated that the various segments of the Highway 563 corridor may each require different design standards given that each segment will likely serve a different function and form.

³ Ibid. Table 400E Site Distances.

⁴ This functional planning study designed an 8-lane corridor. The functional plans remain flexible in that the span of the ultimate bridges can be modified to accommodate an outside fifth lane as a “barrier-ed” lane, by cutting into the head-slope or clear-zone to accommodate a 10-lane cross-section.

⁵ The functional plans accommodate a barrier free design with 4:1 side slopes.

### 5.3 Highway 1 Functional Design

Annex “A” Sheet 2 serves to illustrate the proposed improvements for the first stage of roadway modifications intended to prepare the way for development of the “ultimate” Highway 1, Highway 563 and Hwy 563/Old Banff Coach Road/RR-31 interchange configurations.
Exhibit 5.1: Turning Template: WB-36 Turnpike Double.

Note: The modified WB-36 has a maximum overall length of 41 m. (See Alberta Transportation, “Attached Conditions for the Operation of Long Combination Vehicles”, Page 8, Version 4.3, Modified March 30, 2012)
The Stage I objectives include:

- rehabilitation of the existing interchange bridge;
- a 6-lane Highway 1 cross-section under the Hwy 563/Old Banff Coach Road/RR-31 interchange;
- reconfiguration of the interchange on- and off-ramps on an alignment consistent with the “ultimate” location;
- reconfiguration of the ramps terminals to support a “diamond” Hwy 563/Old Banff Coach Road/RR-31 interchange configuration in the form of single lane roundabouts; and
- closure of the existing angled Hwy 563/RR-31 intersection.

5.3.1 Stage I: Improvements

The Stage I plans are illustrated on Sheets 2, 4 and 14 (See Annex A). The plans include:

- **Rehabilitation of Existing Bridge:** The “interim” interchange design would consist of a rehabilitating the existing overpass bridge structure. The bridge rehabilitation would be undertaken to allow for future expansion into subsequent (Stage II) phases of construction;

- **Ramp Re-configuration:** The “interim” interchange design would be reconfigured as a “spread diamond”. This would require closure of the existing loop-on-ramps and slip-on-off-ramp arrangement through the construction of four new ramps. The W-N/S and E-N/S ramps would be set wider from the interchange to accommodate the provision in the “ultimate” time frame for loop-ramp infrastructure when warranted;

- **Six-Lane Highway 1 Corridor:** The removal of the existing loop ramps permit the conversion of the outside Hwy 1 lanes to thru-lanes and would be used to form 6-lane Highway 1 thru lanes under the bridge structure. The existing four Hwy1 thru-lanes would then be widened to a 6-lane cross-section. The 6-lane cross-section would provide for three 3.7 m wide lanes, a 2.5 m inside shoulder and a 3.0 m outside shoulder;

- **Centreline Spacing:** West of the interchange (Station 10+088) the existing 30m centerline (22.6 m wide depressed median) separation would be maintained. In the interchange area (Station 11+876) a 15.2 m centerline-to-centerline cross-section (7.8 m median with a concrete barrier) would be maintained. Within the transition zone (Station 10+088-to-Station 11+876) a high tension cable barrier would be provided in the median;

- **Ramp Terminals:** The ramp terminal intersections would be relocated to their ultimate positions about 250m from the centre of the bridge structure. Single-lane roundabout configurations are illustrated for Stage I. (It should be noted that protection for a roundabout configuration was considered a conservative approach in terms of property acquisition. A subsequent review at the time of detailed design would be required to confirm this configuration.) The roundabouts consist of a single circulatory lane with an inscribed diameter of 60 m that accommodates the turning movements of a WB-36 vehicle;

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1 The requirements for crash attenuation at the median pier on Highway 1 for both the existing and twinned structures should be reviewed at the time of detailed design.
• **RR 31 Improvements**: The existing RR-31 profile would be raised to provide for adequate grades to meet the transition requirements needed to accommodate the new ramp terminals and bridge approaches and facilitate the integration with proposed new infrastructure needed in future stages; and

• **Twp Rd 245 Improvements**: The existing Twp Rd 245 profile (east leg of the RR-31/Twp Rd 245 intersection) would require improvement to meet local design standards. Rehabilitation of 1200 m of 7.2% vertical grade in the vicinity of the OBCR intersection would be required to be reconstructed to a 4% vertical grade. This could be warranted by either the closure of the existing angled Hwy 563/RR-31 intersection, or potentially form part of the local roadway improvements made necessary to accommodate the development of the West View Community.

### 5.3.2 Stage I: Access Management

Highway 1 is designated as a freeway and as such adjacent properties should only be accessed by way of the grade separated interchanges along its length. (There are three grade-separated structures along the 8 km segment within the study area at RR-33 (Springbank), Hwy 563 (OBCR) and Valley Ridge). Two existing at-grade private accesses represent exceptions to this design criterion, which include a residential acreage access (located at Station 12+442) and an emergency access (located at Station 13+932).

• The residential property [Station 12+442] would be directly impacted in the short-term time horizon by the widening of the Hwy 1 corridor to accommodate six through lanes and in the ultimate time horizon by the proposed grade improvements along the Highway 1 corridor (See Section 5.5.1). However, it is recommended that the property be acquired at Stage I when the highway is widened to six lanes (the purchase of the property would likely offset the cost of constructing a service road to/from the parcel).

• The emergency access [Station 12+442] out of the Valley Ridge development could remain until such time as an alternate emergency access route separate from the Hwy 1 corridor can be provided.

• No service road requirements were identified as part of the Highway 1 widening plans.

RR-31 in the vicinity of the Hwy 563/Old Banff Coach Road/RR-31 interchange is a local roadway. The RR-31 plans are presented on Sheet 2 (Annex A). The Stage I plan depict the closure of the following two accesses:

• The existing residential access [Station 11+550] serving the property [NW 36 24-3-5] located on the west side of the RR-31 corridor north of Hwy 1 would be closed and relocated to Twp Rd 250. Discussions with the resident indicated that the development of the new access could potentially impact their septic treatment system (tanks and settlement bed).

• The existing industrial access [Station 10+270] serving the property [Lot 1 of SE 35 24-3-5] on the west side of the RR-31 corridor south of Hwy 1 would be closed. An existing access through the adjacent property [SE 35 24-3-5] that connects to Twp Rd 245 could be further
developed or potentially a service road could be developed along the west side of RR-31 connecting to Twp Rd 245.

5.3.3 Stage II Improvements

The proposed improvements during Stage II include achieving a 4-lane RR-31 cross-section over the 6-lane Highway 1 corridor. The concept illustrates the proposed improvements for the second stage of roadway modifications. The Stage II objectives include:

- the development of a new 2-lane overpass bridge to the east of the existing bridge intended to accommodate northbound traffic;
- the 4-laning of RR-31 north and south of the interchange; and
- reconfiguration of the ramps terminals on both sides of the interchange to support double-lane 2x2 roundabouts.

Stage II may also include local municipal improvements, such as the twinning of Twp Rd 245 and Twp Rd 250. The timing of these improvements remain to be confirmed by Rocky View County in concert with the City of Calgary and are a function of the timing of adjacent development initiatives.

Annex “A” - Sheets 3 and 4 illustrate the Stage II plans, which include:

- **RR-31 Improvements**: RR-31 would be widened to accommodate 4-lanes of travel within the study area. A 17 m depressed median would be provided both north and south of the interchange;

- **Interchange Configuration**: The Stage II interchange design would modify the initial spread diamond configuration by providing for the 4-lane RR-31 corridor;

- **New Second Bridge**: A new (116 m out to out fills) bridge located to the east of the existing bridge would be developed to accommodate the RR-31 twinning. The new bridge would facilitate future expansion (by allowing for an 8-lane span over Highway 1) to accommodate the “ultimate” stage of development. Provision for a pedestrian 2.5m wide sidewalk has been illustrated on the new structure;

- **Six-Lane Highway 1 Corridor**: During Stage II it is assumed that Highway 1 corridor would continue to be characterized by 6 continuous thru-lanes;

- **Centreline Spacing**: Within the interchange area [at Station 11+876] the 15.2 m centerline-to-centerline cross-section (7.8 m median with a concrete barrier) would be maintained complimented by the median high tension cable barrier within the transition zone [Station 10+088-to-Station 11+876];

- **Highway On-/Off-Ramps**: The W-N/S and E-N/S Off-ramps would be widened to accommodate 2-lanes from a point approximately midway along the ramp extending to the approach of the ramp terminals; and

- **Ramp Terminals**: The roundabout configuration ramp terminals would be widened on the inside to accommodate the twined 4-lane RR-31 cross-section. The double-lane 2x2
roundabouts consist of two circulatory lanes with an inscribed diameter of 60m that would accommodate the turning movements of WB-23 & WB-36 heavy vehicles. (It should be noted that protection for a roundabout configuration remains conservative in terms of property acquisition should alternative traffic controls be desired at the time of detailed design.)

5.3.4 Ultimate Stage Improvements

The Ultimate Stage functional plans are intended to accommodate:

- a new (116 m out to out fills) overpass structure to accommodate SB traffic on RR-31 that would replace the existing bridge overpass;
- eight Highway 1 continuous thru-lanes at an improved 3% grade along the Highway 1 corridor;
- a reconfigured “Parclo A” Hwy 563/Old Banff Coach Road/RR-31 interchange inclusive of loop ramps in the north-east and south-west quadrants of the interchange;
- additional widening of the northbound structure to accommodate access to the loop ramp in the north-east quadrant of the interchange;
- an (116 m out to out fills) overpass structure to accommodate SB traffic destined to the S-E Loop-Ramp within the south-west quadrant of the interchange; and
- Widening of RR-31 north of Twp Rd 245 and south of Twp Rd 250 to a 6-lane cross-section to accommodate improvement to the Parclo “A” configuration.

Local improvements, such as additional widening and auxiliary lanes associated with Twp Rd 245 and Twp Rd 250 (required beyond the 4-lane cross-section envisioned in Stage II) may be required and are to be confirmed by Rocky View County in concert with the City of Calgary as regards the segments east of RR-31.

Annex “A” - Sheets 5-to-12 depict the ultimate stage of development of the Highway 1 corridor and the Hwy 563/Old Banff Coach Road/RR-31 interchange. The plans include plan-view, cross-sections and profile for the relevant elements of the Highway 1 corridor and interchange and illustrate:

- **Ultimate Interchange Configuration**: The ultimate interchange design consist of a Parclo “A” configuration that would provide for a 4-lane RR-31 corridor over an 8-lane Highway 1 corridor (assuming two new bridges and the bridge developed during Stage II);
- **Ultimate Lane RR-31 Improvements**: The RR-31 corridor has by way of auxiliary lanes, provisions for expansion to an ultimate 6-lane divided arterial roadway on either side of the interchange;
- **Eight-Lane Highway 1 Corridor**: The design provides for eight continuous Highway 1 thru-lanes by widening to the outside (north and south) of the existing lanes. The cross-section would provide for four 3.7 m wide lanes and 3.0 m wide inside and outside shoulders in the EB and WB directions under the structure;
• **Improved Highway 1 Grade**: An improvement to a 3% maximum grade profile along the Highway 1 corridor is envisioned;

• **Centreline Spacing**: The 15.2 m centerline-to-centerline cross-section (7.8 m median with a concrete barrier) is maintained and complimented by the median high tension cable barrier within the transition zone;

• **Highway On-/Off-Ramps**: The interchange would be reconfigured as a Parclo A configuration. The ramps would be configured as follows:
  - **W-N/S Off-Ramp**: Two-lanes are provided off of Highway 1, with a ramp split [Ramp Station 0+834] to accommodate a single lane auxiliary WB-RT. Two lanes approach the north ramp terminal (providing 180 m total storage length).
  - **N-W Loop-Ramp**: A single-lane loop ramp is provided.
  - **S-W On-Ramp**: A single-lane slip ramp is provided. The ramp gore point (for both the S-W ramp and S-E loop) occurs prior to the north ramp terminal intersection. The ramp split for the S-W ramp occurs [at Ramp Station 0+265] on RR 31.
  - **E-N/S Off-Ramp**: A single-lane ramp is provided off Highway 1, a ramp split [Ramp Station 0+749] accommodates a single lane EB-RT and two eastbound lanes approaching the south ramp terminal (260 m total storage length).
  - **S-E Loop-Ramp**: A two-lane loop ramp is provided. The ramp gore point (for both the S-W ramp and S-E loop) occurs prior to the north ramp terminal intersection along RR 31. The two lanes merge together [at Ramp Station 1+016 (on the loop)] to act as a metering to Hwy 1 and the single lane merges onto Highway 1. (The functional plans indicate a distance of 225m has been provided along the length of the on-ramp to achieve this transition which satisfies current design standards.)
  - **N-E On-Ramp**: A two-lane slip ramp is provided. The two lanes merge together [at Ramp Station 0+791 (on the ramp)]. [The functional plans indicate a distance of 218m (inclusive of the spiral) has been provided along the length of the on-ramp to achieve this transition which satisfies current design standards.]

• **Ramp Terminals**: The ramp terminal intersections would be converted to traffic signal controlled intersections in the Ultimate Stage with two lanes on each approach. Traffic destined to the S-W and N-E On-Ramps and the S-E Loop-Ramp would be diverted away from the traffic stream prior to reaching the intersection ramp terminals.

5.4 **Highway 563 Functional Design**

5.4.1 **Stage I: Improvements**

Highway 563 currently functions primarily as a rural local collector roadway rather than a Provincial highway and is currently accessed by way of several at-grade intersections and accesses. The functional plans (See Annex A: Sheets 14 and 15) illustrate the preferred vision for a

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2 AITHGDG “Design Standards of Exit and Entrance Terminals for Divided Highways at Interchanges”, Page E-5 indicates the minimum requirement for a design speed of 50 kph (ramp speed) is 200m at 20:1

3 AITHGDG “Design Standards of Exit and Entrance Terminals for Divided Highways at Interchanges”, Page E-5 indicates the minimum requirement for a design speed of 70 kph (ramp speed) is 200m at 20:1
discontinuous corridor that was developed as part of this functional planning study. Achieving this vision would require the transfer of this Provincial corridor to a municipal jurisdiction. For the purposes of this functional planning study it was assumed that the timing of the municipal jurisdictional transfer of the Highway 563 corridor should preferably take place in advance of the Stage I interchange improvements. The rationale behind a desire for early transfer of jurisdiction of Hwy 563 is two fold:

• *The Province Builds Highways not Urban Classified Collector Roadways*: As the pace of development pressures increase upon the West View (Qualico) Community Lands, the final role and function of the Hwy 563 corridor will become increasingly important to determine. It is clear that much of this roadway will function as a municipal roadway. Highway standards are no longer applicable to the fabric of the adjacent development which is being proposed. As such, the local municipality is far better equipped to respond to the applicable design and construction standards that would best meet the needs of the developing community; and

• *The Pace of Land Development will Likely Trigger the Need for Hwy 563 Modifications before Provincial (Hwy or Stoney Trail) Initiatives*: As such, it would serve all jurisdictions involved to develop a pro-active approach to respond to the development pressures. It may not be in the municipalities’ (City and County) best interest to have AT sign-off on improvements regarding the Hwy 563 corridor.

Sheet 14 indicates the local roadway improvements that may be made necessary by the advent of development of the West View (Qualico) Community. These could include:

• corridor improvements to the RR-31 corridor south of the ramp terminal;
• intersection modifications to the existing Twp Rd 245/RR-31 intersection;
• grade improvements to the east leg of the Twp Rd 245/RR-31 intersection; and
• modifications to the Hwy 563 corridor east of RR-31.

Depending on the pace of development of the West View Community such local improvements could be advanced within the Stage I time frame. The following components could each be catalyzed by different initiatives:

• *A Potential Crestmont Boulevard-Twp Rd 245 Connection*: Sheet 14 illustrates a “possible future internal link” through the future West Village lands. The alignment of the Crestmont Boulevard-Twp Rd 245 connection is presented for conceptual visualization purposes only. The alignment has no status and serves only to illustrate the potential east-west connectivity between Twp Rd 245 and the Crestmont community. (The City of Calgary has encouraged the westerly extension of Crestmont Boulevard across the ravine/tributary as a development initiative.)

• *Closure of Hwy 563/OBCR intersection at RR-31 (Sheet 14)*: The existing OBCR/RR-31 intersection (is located 150m south of the south ramp terminal). The Stage I plans require this intersection to be closed due to its proximity to the new south ramp terminal.
• **North Segment of the Hwy 563 Corridor Converted to an Access Road:** The former Hwy 563 corridor east of RR-31 and north of Twp Rd 245 would be realigned to form a local access road connecting the three adjacent properties [located within SW 36 24-3-5] to Twp Rd 245. The realigned access roadway as illustrated would be approximately 900m in length (650 m of the service road would be new alignment, with 250 m of existing alignment to be used) and extend to the quarter-line separating the urban and rural municipal boundaries. Given the extent of the potential development within the West View Community and the grade approaching RR-31, it was thought best, in the short-term, not to entertain additional intersections/accesses within 800m proximity east of the Twp Rd 245/RR-31 intersection.

• **Twp Rd 245 / RR-31 Intersection Improvements:** The closure of the existing Hwy 563/RR-31 intersection would require local traffic to divert to the RR-31/Twp Rd 245 intersection (located 500m south of the south ramp terminal). The east leg of the intersection is unpaved and characterized by grades that along some segments exceed 7% (See Section 2.15). As such, improvements to this intersection, inclusive of auxiliary turning lanes, and improvements to the east leg of the intersection (paving) would be warranted by the closure of the Hwy 563/OBCR/RR-31 intersection.

• **Realigned 101st SW and Reconfigured Springbank Road/101st SW Intersection:** Depending on the timing (assumed within the next 10 years) of the Stoney Trail South Extension (and the proposed Stoney Trail/Springbank Road interchange), the following modification may also occur in Stage I. A realignment of 101st Street corridor is envisioned as part of the Springbank Road/Stoney Trail interchange plans. This would have the effect of shifting the Springbank Road/101st SW Intersection approximately 450m west of the current 101st SW alignment. The functional plans illustrate the new Springbank Road/101st SW Intersection as a “T”-intersection with a north access provided into the existing Burnco Quarry site, and Hwy 563 cul-sac’d with access only by way of Artist View Drive.

5.4.2 **Later Stage: Improvements**

The existing paved roadway width of the Highway 563 corridor is 6.9m throughout its length (See Section 2.3), whereas Table 5-1 indicates that the desired paved surface width of the Rocky View County’s country residential collector (CC) standard would be 8m. However, as indicated in Section 4.6.1 the various segments of the old Highway 563 corridor are anticipated to differ in form and function. Hence, widening requirements along the corridor’s 4.8km length (from Twp Rd 245/OBCR/Hwy 563 intersection to Springbank Road) are anticipated to differ along the various segments and are highly dependent upon future land uses.

The functional plans depict the following improvements associated with the later stages of development, all of which are perceived as local municipal initiatives that are dependent upon development.

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Standard referenced “County Servicing Standards – 2013” County of Rocky View – Referenced from “Country Collector (CC)” 25, R/W 8.00. Road – Figure 400.6 Rocky View Standard Drawings & Table 400-F [See Appendix D-1]
• **Twp Rd 245 Grade Improvements**: The existing grade along the Twp Rd 245 alignment east of RR-31 involves a 1,200m section of roadway with a vertical profile of 7.2% (See Section 2.16). Should development requirements warrant this section of corridor to be widened to accommodate the West View Community, grade improvements of 4%\(^5\) may be necessary and merit consideration.

• **Creation of a Walkway-Bike Recreational Pathway**: The functional plan illustrates the creation of a walking/bike/recreational pathway separated by two cul-de-sacs at either end on the section of the Hwy 563 corridor south of the Twp Rd 245 alignment at the northern terminus of Horizon View Road. This pathway would create a discontinuity of the roadways formed by a 390m long segment of the former Hwy corridor. The intent of this discontinuity would be to eliminate any potential for “cut-through” traffic between the future urban West View Community and Calgary through the Horizon View and Artist View communities. All travel between the future West View Community and Calgary would be constrained to either the Hwy 1 corridor or the Springbank-RR-31 corridor.

• **Realigned 101st SW and Reconfigured Springbank Road/101st SW Intersection**: The functional plans (Sheet 15) illustrate the new Springbank Road/101st SW Intersection as a “T”-intersection with a north access provided into the existing Burnco Quarry site\(^6\). However should the Burnco site re-develop the ultimate provisions for the north leg of this intersection (beyond a simple access into the existing quarry site) would trigger the Rocky View County approval process. Infrastructure improvements should take place as part of the Area Structure Plan approvals process.

• **Highway 563 (From N Limit of Horizon View Road to Artist View Road)**: This 2.1 km long segment of the Highway 563 corridor provide access to multiple country residential dwellings. The current 6.9m surface width would be required to be widened to comply with the Rocky View County’s current Country Collector (CC) roadway design standard that requires a minimum 8m wide paved surface width.

### 5.5 Sub-Consultant Review of Functional Plans

Subsequent to the selection of the preferred alignment and preparation of the functional plans, the historical, environmental, geotechnical and hydrological conditions for the impacted study area were evaluated. As well, a Road Safety Audit of the functional plans was undertaken. (See Appendices “A” and “D-2”.)

The following sections serve to summarize the findings of the review of the functional plans undertaken by each of the sub-consultant disciplines.

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\(^5\) It is assumed that Twp Rd 245 would revert to a Urban Primary Collector (UPC) 14m wide roadway design standard, consistent with Rocky View County’s Servicing Standards – Table 400-F which permits a 7% maximum gradient, However, discussion of appropriate/applicable standards may well be subject to consultation with the City of Calgary.

\(^6\) The public involvement activities (See Public Consultation Report) included communication with representatives of the Burnco Springbank Quarry site (located north of Springbank Road) regarding the proposed modifications to the site access and the north leg of the future Springbank Road/Realigned 101st Street intersection. (See Annex “A” - Sheet 15)
5.5.1 **Historical Evaluation**

As indicated in Section 2.11, 15 archaeological sites were identified within the vicinity of the interchange. Due to the location of the sites (particularly EgPn-606 which is closest to the interchange), it remains highly possible that undiscovered archaeological sites and/or deeply buried intact cultural components could be present in the area.

The Historical Resources Overview concluded that:

“A Historical Resources Impact Assessment (including deep-testing) is recommended for the Option C-1 Highway 1/Highway 563 Interchange [Location “C”] and Highway 563 upgrade/realignment Functional Planning Study area” (See Appendix A-2).

At the time of preparation of this report, a HRIA could not be undertaken due to weather conditions (i.e. frozen ground, snow cover, etc.). Prior to construction, and preferably at the time of detailed design, an archaeological HRIA will be a requirement.

5.5.2 **Environmental Evaluation**

The general finding of the environmental evaluation undertaken in October 2013 (subsequent to a review of the functional plans) indicated that no major issues or concerns were identified that would pose significant obstacles for the Functional Planning of the Highway 1 corridor and interchange. The following points are intended to provide a brief synopsis of the environmental findings for specific environmental components of the evaluation.

- **Landforms/Soils**: Three test pits were dug, which identified an “A” horizon with soils ranging from sandy loam to clay loam, a “B” horizon of loam, clay loam, sandy clay loam, and a “C” horizon with a clay to clay loam texture;

  A detailed soil survey to delineate soil units and depth of topsoil and detailed mitigation for any soils of concern is recommended prior to construction.

- **Vegetation**: Three species (Smooth Cliffbrake, Donn’s Grimmia moss and Small Limestone moss) may be within the immediate study area and could potentially be affected by interchange construction and highway twinning. The two moss species were identified as “secure” and the Smooth Cliffbrake was identified as “may be at risk” based on the ASRD Provincial Status. Recognizing this a rare plant survey and detailed vegetation mapping is recommended prior to construction to ensure that no provincially rare vegetation species are impacted.

- **Wildlife**: Recognizing the “at risk” and other species listed as “sensitive” that could potentially be found within the study area a detailed wildlife survey, including amphibians and reptiles, should be conducted prior to construction to determine the presence or absence of special status species.

- **Wetlands**: A wetland (Class III, near the northwest loop), one potential wetland (Class II, near the southeast loop) and one waterbody (near the southeast loop, potentially manmade) in close proximity to the interchange were all identified. It is expected that the low areas will be
impacted during the construction of the Hwy 1/RR-31 interchange and as such impacts could include changes in drainage patterns and loss of habitat for wildlife and vegetation. It is recommended that a Qualified Wetland Aquatic Environment Specialist be retained to undertake a detailed site assessment of existing and planned wetland areas (water retention ponds) to classify each wetland and delineate area of impact for compensation associated with the Water Act approval purposes.

- **Fisheries:** Improvements to the Highway 1 corridor and construction of the new interchange have the potential to disrupt natural drainage patterns, affect ephemeral draws, risk contamination (leaks or spills) and sedimentation of water courses. Recognizing the presence of “at risk”, “sensitive” and “exotic/alien” fish species (See Section 2.10) a fish habitat assessment is recommended for watercourses and the waterbody within the study area.

  *Hydrology, Groundwater and Water Quality:* It is not anticipated that construction should have an adverse effect on water wells within the area. The hydrological resources in the vicinity of the future Hwy 1/RR-31 interchange should be evaluated prior to construction with special attention paid to increased run-off attributed to the larger paved surface associated with the proposed interchange. Mitigation measures should be applied to account for greater surface area run-off. Groundwater wells within the area should be confirmed and groundwater quality and groundwater well water quality monitoring should be undertaken pre- and post-construction.

- **Navigation:** The site is located sufficiently far enough away from the Bow River and Glenbow Lake navigable water bodies that there are no impacts to navigation.

The environmental evaluation concluded that the potential does exist for residual effects medium (1-to-3 years) to long-term (over 3 years) in duration to the biophysical resources in the study area, during and after highway widening and interchange construction. However, applying the suggested mitigation measures (detailed within Appendix “A-1” for each eco-system component), adverse impacts can be alleviated with no further residual impacts on most resources.

### 5.5.3 Geotechnical Evaluation and Boreholes

The functional plans depicting the “ultimate” stage of development indicate a 3% maximum grade improvement along the length of the Highway 1 corridor in the vicinity of the RR-31 interchange. It was recognized that the depth to bedrock would remain an important consideration in achieving the grade improvement. As such, the functional planning study undertook a geotechnical evaluation involving the drilling of two test boreholes to identify the overburden soil types and groundwater levels for conceptual design purposes.

The boreholes were drilled (on August 29th 2013), one on the north side of Highway 1 just east of a microwave tower and one on the south side of Highway 1, 100 m west of the other borehole. The results indicated that the overburden soils consist of clayey-silt to silty-clay till
to a depth of 13.1 to 13.4 m below the ground surface. Weathered siltstone bedrock was identified below the clayey deposits and stronger, more competent bedrock (i.e. auger refusal) was met at depths of 17.1 m (north of Highway 1) and 21.0 m (south of Highway 1). Groundwater seepage was identified at 13.4 m below ground level north of Highway 1 and was not encountered on the south side.

It was determined that re-grading of Highway 1 corridor at the vertical curve with excavation approximately 25 m deep is considered to be possible. For structures to be constructed within the location, deep foundations (driven steel or cast in place concrete piles) were recommended. At the time of detailed design, a more thorough detailed site geo-technical investigation is considered essential.

5.5.4 Hydrological Evaluation

The functional plans were evaluated in terms of hydrological and drainage impacts. A groundwater investigation was undertaken in the vicinity of the interchange to confirm the presence of underground springs and to determine the effect of the interchange upgrade on the springs, seeps and water wells within the area.

The hydrological evaluation indicated that:

- The area is underlain by silts and clays and small sand lenses may be present;
- The groundwater within the area feeds numerous springs and seeps north of Highway 1. The springs are within a coulee type drainage pattern and converge to an active creek flow. Seeps that supply small ponds in the area were identified in the north-east quadrant of the interchange in the vicinity of the proposed N-W loop.
- Shallow ground water is expected to be encountered during construction, especially in the vicinity of the N-W loop. No large scale springs should be encountered, however sand lenses may be found that would result in short term water seepages and soft soil issues. Channelling of groundwater from the small drainage courses will likely be necessary at the time of construction. [Section 7 outlines two potential channelling initiatives involving realignment of tributaries that are to be considered at the time of detailed design.]
- The source for water wells is from deep bedrock sandstone aquifers, which have no direct connection to surface water. Therefore construction activities should have no impact on water wells within the area.

7 See Appendix “A-3” for details regarding excavation and mitigation measures to be undertaken for slope stability.
8 See Section 7 of this report for additional information concerning drainage.
5.5.5 **Road Safety Audit of Functional Plans**

An independent Road Safety Audit was undertaken as part of this functional planning study to provide an evaluation of the functional plans\(^9\) (depicting each of the three proposed stages) from a safety perspective. Each of the identified issues raised as part of the road safety audit were reviewed and responses were prepared. Appendix “D-2” provides tables that serve to summarize the relevant concerns submitted as part of the Road Safety Audit (RSA) and the response from the functional planning design team. (The numbering system contained within the tables coincides with the numbering system within the Safety Audit Report.)

Almost all of the issues raised within the safety audit have either already been addressed, or have been deemed to be best dealt with at the time of detailed design.

Since the time of the audit several modifications to the roundabout and sidewalk designs were made, which include increased deflection angles of the RR-31 north and south approaches to each roundabout, modifications to the N-E ramp and S-W ramp approaches to provide for a second egress lane originating from the roundabouts that would taper to a single lane along the ramp, a realigned sidewalk, and yield markings at the ramp approaches to the roundabout.

One of the outstanding issues raised within the safety audit was that the available westbound design sight distance of 305m associated with the W-N/S Ramp at the time of the ultimate stage of development (despite the Highway 1 grade improvement to 3%), is less than the desirable 375 meters. This deficiency was deemed best addressed through the advent of adequate guide signage.

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\(^9\) See Appendix D-2.
6.0 BRIDGE PLANNING

A bridge planning report\(^1\) was commissioned as a component of this functional planning study. The following sections address the proposed modifications, new construction requirements and identified issues\(^2\) for bridge structures within the study area, including the:

- existing interchange overpass structure (BF 75933), referred to as the “Existing Interchange Bridge”; as well as
- New and replacement grade separated interchange bridges referred to as “New SB Interchange Bridge”, “New NB Interchange Bridge” and the “New Loop Ramp Bridge”.

6.1 Existing Interchange Bridge (BF 75933)

The Existing Interchange Bridge structure:

- was constructed in 1965;
- provides for a grade separation of the RR-31 corridor over Highway 1;
- consists of four spans (12.5-22.9-22.9-12.5 m);
- is positioned at a 90° angle with Highway 1; and
- provides an existing clear roadway width on the structure of 11m, that accommodates two 3.7 m lanes, two 0.9 m shoulders and a 1.8 m painted median separating each direction of travel. A median guide rail is located over the length of the structure.

A 2012 BIM report indicated that the 48-year old structure is in “fair-to-poor” condition and is “schedule for a full deck replacement in 2017/18”.

6.2 Proposed Stage I Structure Requirements

6.2.1 Existing Interchange Bridge

Extending the life of the existing structure through rehabilitation was found to be far superior to the option of bridge replacement\(^3\). Hence, Stage I was envisioned as the time period where the rehabilitation of the existing overpass (BF 75933) bridge deck would take place. The existing spans (12.5-22.9-22.9-12.5 m) and clear roadway width (11m) would remain unchanged. Ramp reconfiguration was envisioned during this stage to permit the interchange to function in a diamond configuration. In this way the widening of the Highway 1 corridor (to provide for six continuous highway-thru lanes) could be achieved without triggering the need for replacement of the existing structure.

\(^{1}\) See Appendix “A-4” for the Bridge Planning Report – Note: The cost estimates within the Bridge Planning Report differ from Section 9 of this report. The Bridge Planning Report assumes an out-to-out fills of 99m, whereas the functional plans, and associated cost estimates in Section 9 assume an out-to-out fill length of 116m.

\(^{2}\) See Appendix F-2 for correspondence related to Bridge Planning Report

\(^{3}\) See Section 3.4.1
A 2007 report indicates that bridge rehabilitation had an estimated cost of $1.5M\(^4\). Recent communications with AT\(^5\) indicated that the cost to replace the bridge deck would be in the order of $2M\(^6\) in current (2012) dollars. The deck replacement was anticipated to add approximately 30 years to the life of the structure.

6.3 Proposed Stage II Structure Requirements

The second stage of the interchange development would see the addition of a new NB interchange overpass bridge located to the east of the existing bridge. The trigger for this new structure would be the required additional north-south capacity of RR-31. The traffic operations on the existing structure would convert to accommodate only SB traffic.

6.3.1 Existing Interchange Bridge

The Existing Interchange Bridge would be converted from its two-way configuration to accommodate two southbound lanes of traffic. The existing 1.8m painted median and centre guide rail would be removed and the additional width (made available by the removal) would be reallocated to provide for wider (1.8m wide) shoulders along the length of the structure\(^7\). The existing clear roadway width of 11m on the RR-31 overpass bridge would remain the same.

6.3.2 New NB Interchange Bridge

A new grade separated structure\(^8\) would be constructed to accommodate two lanes of northbound traffic to allow twinning of Highway 563/Old Banff Coach Road/RR-31. The structure would be constructed to accommodate the ultimate scenario (accommodating 8 Highway 1 through-lanes). The New NB Interchange Bridge would:

- provide for an overall RR-31 width (inclusive of bridge railings and sidewalk separation) of 16.4m;
- provide for a clear roadway width of 12.4m (which would accommodate two 3.7 m NB lanes and two 2.5 m shoulders);
- provide for a 2.5 m pedestrian sidewalk;
- consist of two spans (50-50 m);
- provide a 5.4 m vertical clearance\(^9\);

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\(^4\) See Appendix A-4, Bridge Planning Report  
\(^5\) See Appendix F-1, E-mail from Mr. Jason Russell, July 11\(^{th}\), 2013.  
\(^6\) See Appendix E Cost Estimates for all costs associated to structures within this section.  
\(^7\) The costs associated with the improvements described (i.e. lane painting, guide-rail removal etc.) were assumed for the purposes of this functional planning study to be part of yearly maintenance costs.  
\(^8\) See Annex A, Sheet 4, Illustrations D-4 “Highway 1 6-Lane Cross-Section Under New Structure (BF75933)” and E-4 “Proposed 4-Lane Range Road 31 Cross-Section At Highway 1 Structure”  
\(^9\) In recognition of the high load hit history within the BIM report dealing with the existing Hwy 1/Hwy 563 interchange structure, it is considered worthwhile at the time of detailed design to increase the vertical clearance associated with new structures to 5.6m. Whether this is accomplished through achieving the 3% grade improvements along the existing Hwy 1 corridor or through the vertical profile improvements associated with the structure itself is to be determined at the time of detailed design and is subject to Provincial priorities and funding. Additionally, high load vehicles can utilize the ramps at the interchange to avoid traveling under the structure. Appropriate signage should be provided.
• provide for a 3.0 m structure depth; and
• be characterized by an approximate 116 m out-to-out fill length.

The cost associated with the New NB Interchange Bridge was estimated at $11.4M, assuming a unit cost of $4,799/m² (out to out of fills of 116 m x width of 16.4 m) and 25% contingency.

Given that the New NB Interchange Bridge is to be ultimately widened (by 4.3m on the south side and 10.8m on the north side) to accommodate the transition onto the future N-W Loop Ramp, consideration should be given during Stage II to construct the required abutments to support the future widening.

6.4 Proposed Ultimate Stage Structure Requirements

6.4.1 Existing Interchange Bridge

At the ultimate stage of the interchange development:
• the Existing Interchange Bridge would be demolished and replaced with a New SB Interchange Bridge;
• a New Loop Ramp Bridge, located to the west of the New SB Interchange Bridge, intended to provide direct access to the S-E Loop On-ramp would be implemented; and
• the New NB Interchange Bridge would be widened to provide for a transition onto the proposed N-W loop ramp.

6.4.2 New SB Interchange Bridge

The Existing Interchange Bridge would be demolished and replaced with a new grade separated structure¹⁰ to permit a lengthened span over the Highway 1 corridor that would accommodate an 8-lane Highway 1 cross-section. The replacement bridge would continue to accommodate two SB lanes of traffic. The New SB Interchange Bridge would for the most part mirror the NB interchange Bridge developed in Stage II. The replacement bridge would:
• provide for a clear roadway width of 12.4m (which would accommodate two 3.7 m NB lanes and two 2.5 m shoulders);
• represent an overall bridge width (inclusive of bridge railings) of 13.4 m;
• consist of two spans (50-50 m);
• provide a 5.4 m vertical clearance¹¹;
• provide for a 3.0 m structure depth; and
• be characterized by an approximate 116 m out-to-out fill length.

¹⁰ See Annex A, Sheet 6, Illustrations A-6 “Highway 1 8-Lane Cross-Section Under New Structure (BF75933)” and B-6 “Proposed 4-Lane Range Road 31 Cross-Section With Loops At Highway 1 Structure”
¹¹ See footnote No. 9.
The cost associated with the removal of the existing structure was estimated at $0.8M. The cost associated with the New SB Interchange Bridge is estimated at $9.3M\textsuperscript{12}, assuming a unit cost of $4,799/m\textsuperscript{2} (out to out of fills of 116 m x width of 13.4 m) and 25% contingency.

### 6.4.3 NB Interchange Bridge

The NB Interchange Bridge (constructed in Stage II) would be required to be widened at the ultimate stage to accommodate a transition onto the proposed N-W Loop On-ramp\textsuperscript{13}. The bridge width for the widening would vary along the structure’s length, such that the bridge width would be 20.7 m on the south side of the structure and 27.2 m on the north side. This would result in a tapered widening ranging from of 4.3m (20.7m less 16.4m) on the south side to 10.8m (27.2m less 16.4m) on the north side. The widening is intended to transition to the new N-W Loop On-ramp.

The cost associated with the widening of the NB Interchange Bridge is estimated at $7.9M, assuming a unit cost of $7,199/m\textsuperscript{2} (out-to-out of fills of 116 m x width of 4.3 to 10.8 m) and 25% contingency.

### 6.4.4 New Loop Ramp Bridge

An additional interchange bridge is envisioned to the west of the SB structure that would provide access directly onto the proposed 2-lane S-E Loop On-ramp\textsuperscript{14}. The New Loop Ramp Bridge would:

- provide a clear roadway width of 11.9m (which would accommodate two 3.7 m lanes, a 2.5 m outside shoulder and a 2.0 m inside shoulder);
- represent an overall bridge width (inclusive of bridge railings) of 12.9 m;
- consist of two spans (50-50 m);
- provide for a 5.4 m vertical clearance\textsuperscript{15};
- provide for a 3.0 m structure depth; and
- be characterized by an approximate 116 m out-to-out fill length.

The cost associated with the New Loop Ramp Bridge is estimated at $9.0M, assuming a unit cost of $4,799/m\textsuperscript{2} (out to out of fills of 116 m x width of 12.9 m) and 25% contingency.

At the time of detailed design, consideration should be given to constructing a single lane loop initially and then widen to a two-lane loop when warranted.

\textsuperscript{12} The replacement SB structure is slightly cheaper ($9.3M) than the NB structure ($11.4M) due to the narrower width
\textsuperscript{13} See Annex A, Sheet 6, Illustrations B-6 “Proposed 4-Lane Range Road 31 Cross-Section with Loops at Highway 1 Structure” and D-6 “Typical One Lane Ramp”
\textsuperscript{14} See Annex A, Sheet 6, Illustrations B-6 “Proposed 4-Lane Range Road 31 Cross-Section With Loops At Highway 1 Structure” and C-6 “Typical Two Lane Ramp”
\textsuperscript{15} See footnote No. 9.
7.0 DRAINAGE ASSESSMENT

Drainage of the existing Highway 1 corridor is generally accommodated by parallel roadside ditching that channels stormwater along the corridor’s length and drains to lower points of elevation. This includes tributaries that ultimately flow to the Bow River. In areas where the highway embankments are elevated, stormwater runoff flows away from the Highway 1 corridor toward adjacent natural retention ponds.

Exhibit 7-1 illustrates that the Highway 1 corridor can be sub-divided into two distinct drainage areas:

- **Drainage Zone 1 (Station 9+200-to-12+500):** This drainage zone spans the area from the western study limit to approximately 1.1 km east of the Highway 563/Old Banff Coach Road/RR-31 interchange. The existing interchange is in a low-lying area within this drainage zone where runoff generally flows in a south-to-north direction towards the Bow River. There are currently several small natural ponding areas located north and south of the interchange that act as runoff storage. Zone 1 contains two sub drainage courses within the vicinity of the interchange (M1-A and M1-B)\(^1\) that contain small tributaries to the Bow River crossing Highway 1 [at Stations 11+162 and 11+878].

- **Drainage Zone 2 (Station 12+500-to-14+000):** The drainage direction within this zone is also from south-to-north towards the Bow River. A natural drainage pond was identified south of Highway 1 in the vicinity of the Crestmont development. Zone 2 has a two tributaries to the Bow River that cross Highway 1 [at Stations 13+480 and 13+791] and connect together just to the west of the Valley Ridge development.

The proposed widening of the Highway 1 corridor (from 4-lanes to ultimately 8-lanes) is not expected to significantly alter the hydrological conditions nor change the existing drainage patterns within the study area. Some minor flood peak increases are anticipated as a result of the increase in impermeable road surface; however these flows can be mitigated by installing new culverts or increasing the size of existing culverts.

The existing ditch width (that would be utilized during the 6-lane stage) should provide sufficient capacity to handle the additional flow; however this should be confirmed at the time of detailed design to confirm ditch depth-of-flow and flow-velocities. The detailed design for the widening will need to ensure stormwater capacity is maintained and that culverts along the highway corridor are extended to accommodate the widening of the highway.

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\(^1\) See Appendix A-3, “Highway 1 Interchange at Highway 563 Preliminary Hydrological Assessment”, Page3, Figure 2.
Improvements to the Highway 563/Old Banff Coach Road/RR-31 interchange are proposed at the current location and may have significant impact to drainage if no mitigation measures are applied. To ensure that post-development drainage meets pre-development drainage, additional storage volume for storm-water runoff will be required. A post-development drainage plan was prepared that simulated the required expansion to the existing ponding areas south of Highway 1 to provide sufficient storage, ensuring that post-development runoff rates and runoff volumes do not exceed pre-development levels. This was intended to ensure that there will be no impact to peak flow rates downstream of the interchange (i.e. in the vicinity of Twp Rd 250).

Exhibit 7-2 depicts alternative realignment options for the unnamed tributary in the vicinity of the interchange for the N-E and S-W interchange quadrants.

- **W-N/S Ramp Terminal - Realignment of Un-Named Tributary**: This option (dashed red line) would result in a realignment of approximately 350 m in length and would result in crossing of the W-N/S Ramp only once within the vicinity of the Highway 1 corridor (instead of three crossings). A culvert below the W-N/S ramp would be required.

- **E-N/S Ramp Terminal - Realignment of Un-Named Tributary**:  
  - **Option 1**: This option (dashed green line) would result in a realignment of approximately 350m in length and would cross the E-N/S ramp where the ramp is more narrow (single lane). This option would also realign the tributary to avoid the S-E loop ramp. A culvert below the E-N/S ramp would be required.
  - **Option 2**: This option (dashed red line) would result in a realignment of approximately 250m in length and would cross the E-N/S ramp where the ramp is more narrow (single lane). This option would also realign the tributary to avoid the S-E loop ramp. The majority of this realignment would be placed within future right-of-way lines. A culvert below the E-N/S ramp would be required.

A preliminary review of the two options indicated that:

- maintaining the existing alignment of the watercourse generally results in less environmental impacts as compared to a new tributary alignment;

- at the time of detailed design, input may be required from Fisheries and Oceans Canada and Sustainable Resources Development (SRD) to secure the necessary approvals and to further identify impacts upstream and downstream of the future interchange;

- all culverts and realigned sections of the tributary must be designed to withstand a 1:100 year flood. The flow path will have to be equivalent to the existing natural channel to avoid erosion concerns and rate of flow variations; and

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2 See Appendix A-3, Figure 4: It should be noted that the existing storage ponds located south of Highway 1 would be impacted by grading and interchange construction; therefore alternative storage will be required.

3 See Appendix A-3, “Highway 1 Interchange at Highway 563 Preliminary Hydrological Assessment”, Page 9, Figure 4.
Exhibit 7-2: Ultimate Stage Potential Tributary Realignments
• The realignment length of the unnamed tributary is, at a minimum, as long as the existing length of the tributary. The requirements for substituting a minimum length of realignment remain to be determined.

For the purposes of this functional planning study both options were determined to be feasible. The preferred option would need to be selected at the time of detailed design.
8.0 **EXISTING UTILITY ASSESSMENT**

A review of existing utilities located within the study area was undertaken with the purpose of:

- identifying the approximate location\(^1\) of all existing aboveground and underground utilities;
- determining which utilities conflict with the proposed Hwy 1 widening, the Hwy 563/Old Banff Coach Road/RR-31 interchange and Hwy 1 grade improvements; and
- estimating the cost of relocating/protecting utilities that conflict with the proposed infrastructure. (For the purpose of this study, it was assumed that utilities located within the existing Highway 1 right-of-way are the responsibility of the utility companies and will be relocated at no cost to AT. At the time of detailed design, existing cost sharing agreements involving AT, utility companies and Rocky View County should be reviewed.)

The utility assessment included contacting “Alberta One-Call” who provided the following list of utility companies (See Appendix “F-3”) located with the greater study area:

- Alberta Supernet (Cable)
- Atco Gas (Gas)
- Atco Gas & Pipeline (Gas)
- Bell West
- City of Calgary Roads
- Enmax Corp. (Gas)
- Fortis Alberta (Power)
- Rocky View County
- Alberta Supernet (Cable)
- Telus (Cable)
- City of Calgary Water Services

Efforts to identify the location of the utilities included: undertaking a site visit, reviewing pipeline location databases (Abacus Datagraphics) and contacting utility companies directly\(^2\).

Exhibits 8-1 and 8-2 provide a conceptual illustration of the approximate location of identified utilities in relation to the proposed highway improvements. With reference to the exhibits, the following utilities were identified as being located outside of the existing highway right-of-way and as such protection/relocation costs of the utilities may be incurred by AT:

**Gas Pipelines (various companies):** Estimated relocation cost is estimated at $116K.

- **Highway 1 corridor:**
  - Approximately 85 m of low pressure gas pipelines located on the south side of Highway 1 (Plan 081 3793, Block 2, Lot 1) will have to be relocated as a result of the proposed highway widening; and
  - Approximately 120 m of high pressure gas (60.3mm) crossing Highway 1 (east of the Hwy 1/Valley Ridge interchange) will have to be protected/relocated dependant upon the burial depths of the existing pipeline.

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\(^1\) Prior to the commencement of detailed design, the location of all utilities should be confirmed by contacting the appropriate utility agencies and requesting a marking of buried utilities within the proposed construction site.

\(^2\) See Appendix F-3: Communications with Utilities
• **Highway 1/Old Banff Coach Road Interchange:**
  - Approximately 75 m of low pressure gas pipeline located just south of the intersection of OBCR and Twp Rd 250 will have to be relocated due to conflicts with the OBCR realignment during Stage I of the interchange construction; and
  - Approximately 235 m of low pressure gas pipelines located just north of the intersection of OBCR and Twp Rd 245 will have to be relocated due to conflicts with the OBCR realignment during Stage I of the interchange construction. Fill sections are proposed over the pipeline crossings at these locations, however depending on the burial depth of the pipelines, age of the pipelines, protection/relocation or replacement of the utilities may be required;
  - Approximately 630m of low pressure gas pipeline located on the north side and parallel to Highway 1 next the west project study limit in quarter section NE34 24-3-5 would have to be protected/relocated; and
  - Approximately 121m of low pressure gas pipeline crossing the proposed service road in lot 2 of plan 031 3363 would have to be protected/relocated.

**Buried Cable (Telus Communications):** Estimated relocation cost is estimated at $753K.

• **Highway 1 corridor:**
  - Approximately 7885m of buried cable parallel to Highway 1 (both north and south sides of Highway 1, adjacent to the existing lanes) will have to be protected/relocated as a result of the Highway widening.

• **Highway 1/Old Banff Coach Road Interchange:**
  - Approximately 4660m of buried cable parallel to the Hwy 1/OBCR interchange ramps (in all four quadrants) will have to be protected/relocated as a result of the interchange improvements.

**Overhead Power lines (Fortis Alberta):** Estimated relocation cost is estimated at $345K.

• **Highway 1 corridor:**
  - Approximately 2614 m of 14.4kv and 25kv power line located on the north side of Highway 1 (Power line extended from 133 ST Northwest to service Plan 911 0188, Lot 2) and along Range Rd 31 (Power line runs from Township Rd 250 to Township Rd 245 along Range Rd 31) will have to be relocated/removed as a result of the new highway lanes encroaching onto the power line.

The total estimated cost for utility relocation has been estimated at $1.21M.
9.0 **COST ESTIMATES**

A conceptual construction cost estimate (excluding contingency, mobilization and property costs) was prepared for the proposed improvements, which include:

- The Hwy 1/RR-31 interchange improvements (Estimated at $83M in total);
- The widening of the Hwy 1 corridor over a 5.5 km length to accommodate an 8-lane cross-section (below the RR-31 overpass structures) and 10 approach lanes on either side of the interchange (Estimated at $21.8M);
- The Hwy 1 profile improvements necessary to achieve a desired maximum 3% grade (Estimated at $27.1M); and
- Highway 563 corridor improvements (Estimated at $400K).

The above construction costs sum to $132M, however, this construction cost estimate was adjusted by a 20 percent contingency and engineering fee and a 5 percent mobilization fee (the sum of which was estimated at $33.1M) resulting in an overall total of $165M for construction budgetary purposes. The value of property (inclusive of the lands required to achieve the desired 3% grade improvements at the time of 6-laning of the Hwy 1 corridor) was estimated at an additional $42.5M (See Section 9.6). Hence the conceptual cost of the entire project was determined to be approximately $208M.

9.1 **Costing Assumptions**

The following items merit review and consideration before accepting the cost estimates provided within this functional planning study:

- estimates are based on the improvements depicted in the study Functional Plans and correspond to the study limits outlined in the functional plans;
- interchange costing limits were assumed to occur at the taper end of entrance and exit terminals;
- all earthwork estimates are based upon approximations of required cut and fill materials and remain to be refined at the time of detailed design;
- the cost of protecting and/or relocating existing utilities has been estimated, however, this should be refined at the time of detailed design by a detailed utility audit intended to identify the exact location and burial depth of utilities;
- unit prices used to determine the project cost estimates were referenced from the *Alberta Infrastructure and Transportation Southern Region, Weighted Unit Price Averages Report* based on 2012 construction prices (Costs not listed in the Provincial data were referenced from other sources including contractors and previous projects.).

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1 See Appendix “E”: Cost Estimates
2 See Annex “A”: Functional Plans
• the estimate provided to meet the Hwy 1 grade improvement assumes that it will be undertaken at the time prior to 6-laning of the Hwy 1 corridor. The cost of delaying the Highway 1 grade improvements to the time of 8/10 lane widening would be significantly higher given future property values at the time of widening, the need to remove and later reconstruct two additional freeway lanes and the additional costs (including property) associated with developing a 6-lane temporary by-pass;

• due to the proximity to the City of Calgary urban area within the study limits, property costs can represent a significant component of overall project costs. The value of property merits careful review at the time of detailed design as the impact could well effect project viability; and

• a 20% contingency and engineering fee and a 5% mobilization fee are to be applied to the cost estimates in the following sections.

9.2 Hwy 1/RR-31 Interchange Improvements - Estimated Construction Cost: $83M

The total cost of achieving the ultimate Hwy 1/RR-31 interchange through each of its consecutive development stages has been estimated at $83M (excluding contingency, mobilization and property costs). As indicated in Section 5.3, the improvements to the Hwy 1/RR-31 interchange have been envisioned to take place over three distinct stages. The following provides the estimated construction costs associated with each of the individual stages of development of the Hwy 1/RR-31 interchange.

9.1.1 Stage I (Immediate) Improvements - Estimated Construction Cost: $33.4M

Stage I involves rehabilitating the existing Highway 1/RR-31 interchange bridge deck and converting the existing interchange to a diamond configuration (i.e. removing existing loop ramps, constructing new on- and off-ramps to Highway 1 and constructing new ramp terminals). The primary purpose of the improvements is to increase the capacity of the Highway 1 corridor, while extending the life of the current interchange structure to meet the requirements of the Stage I horizon forecast.

The Stage I costs were estimated at a total construction cost of $33.4M (excluding contingency, mobilization and property costs). The Stage I costs include:

• rehabilitation of the existing interchange bridge (Estimated at $2M);
• installation of a 790m long high tension cable barrier along the length of the median transition (Estimated at $95K);
• interchange reconfiguration (to provide for 6 Highway 1 thru-lanes under the Hwy /1RR-31 interchange), which includes ramp modifications, new ramp terminals (single lane roundabouts), alignment and profile modifications, associated earthworks, culverts, tributary relocations and required stormwater management facilities (all to be consistent with the “ultimate” ramp alignments and locations) (Estimated at $30.3M);
• closure of the existing angled Hwy 563/RR-31 intersection (Estimated at $75K);
• Twp Rd 245/RR-31 intersection improvements and paving 370m of the east leg of the unpaved Twp Rd 245 corridor resulting from the closure of the angled Hwy 563/RR-31 intersection (Estimated at $54K);
• Closure of the access located on the west side of RR-31 and assuring alternate service road accesses to the affected properties (Estimated at $20K); and
• 0.9 km of highway service roadways (which involves conversion of the eastern portion of old Hwy 563 to function as a local service road and the alternative access for the property west of RR-31 south of Hwy 1) (Estimated at $830K).

9.1.2 Stage II (Interim) Improvements - Estimated Construction Cost: $19.4M

Stage II improvements focus on upgrading the RR-31 corridor to a divided 4-lane configuration (between Township Road 245 and Township Road 250). This includes construction of a new bridge structure over Hwy 1 to the east of the existing bridge overpass, converting the existing structure to one-way operation and upgrading the ramp terminals to accommodate a 4-lane cross-section (with consideration to 2x2 roundabouts). The primary purpose of the improvements is to increase the capacity of the RR-31 corridor to meet the requirements of the Stage II horizon-year travel demand forecast.

The Stage II costs were estimated at a total construction cost of $19.4M (excluding contingency, mobilization and property costs). The Stage II costs include:
• achieving a 4-lane RR-31 cross-section over the 6-lane Highway 1 corridor:
   • the development of a new 2-lane overpass bridge to the east of the existing bridge intended to accommodate NB traffic (Estimated at $9.1M); and
   • the 4-laning of 1.7 km of RR-31 on either side of the interchange (Estimated at $9.3M).
• reconfiguration of the ramps terminals on both sides of the interchange to potentially support double-lane 2x2 roundabouts (Estimated at $657K);
• additional widening of the W-N/S and E-N/S Off-ramps to accommodate two approach lanes (Estimated at $295K); and
• integration with local municipal improvements, such as the widening of Twp Rd 245 and Twp Rd 250. The costs of these facilities are dependant upon infrastructure requirements and the timing of development related roadway improvements.

9.1.3 Stage III (Ultimate) Improvements - Estimated Construction Cost: $30.3M

The Stage III improvements are intended to upgrade the Hwy 1/RR-31 interchange to accommodate an 8-lane cross-section under the overpass structures and 10-lanes on either side of the interchange. The interchange would see its final transition to an ultimate Parclo “A” configuration.

The Ultimate Stage costs were estimated at a total construction cost of $30.3M (excluding contingency, mobilization and property costs). The Ultimate Stage costs include:
• demolition of the existing bridge structure (Estimated at $800K);
• construction of a replacement overpass structure to accommodate SB traffic on RR-31 that would replace the existing bridge (Estimated at $7.5M);
• reconfiguration and upgrading of the interchange including a reconfigured Parclo “A” Hwy 1/RR-31 interchange inclusive of loop ramps, drainage provisions (tributary realignments) in the north-east and south-west quadrants of the interchange and widening of RR-31 (north of Twp Rd 245 and south of Twp Rd 250 to the ramp terminals on either side of the interchange) to a 6-lane cross-section to accommodate the Parclo “A” configuration (Estimated at $8.5M);
• additional widening of the NB structure to accommodate access to the loop ramp in the north-east quadrant of the interchange (Estimated at $6.3M);
• an overpass structure to accommodate SB traffic destined to a double E-N/S loop ramp within the south-west quadrant of the interchange (Estimated at $7.2M); and
• integration with local municipal improvements such as additional widening and auxiliary lanes associated with Twp Rd 245 and 250 (required beyond the 4-lane cross-section envisioned in Stage II).

9.3 Highway 1 Widening Improvements - Estimated Cost: $21.8M

The widening of the Highway 1 corridor was envisioned to take place over two phases with the first phase aimed at achieving a continuous 6-lane freeway cross-section (coinciding with the Stage I and II timing of the Hwy 1/RR-31 interchange improvements) and the later phase achieving a further widening to a continuous 8/10 lane Hwy 1 cross-section (coinciding with the Ultimate Stage Hwy 1/RR-31 interchange improvements). The Highway 1 widening improvements include:
• An $11.8M (excluding contingency, mobilization and property costs) upgrading of the Hwy 1 corridor from a 4-lane freeway to a 6/8-lane freeway over a 5.5 km long section [Station 9+160-to-Station 14+585] inclusive of the following two auxiliary lanes:
  • 1.3km [Station 9+136-to-Station 10+460] extending easterly from the N-E ramp; and
  • 2.0km [Station 12+413-to-Station 14+458] extending westerly from the S-W ramp.
• A $10M (excluding contingency, mobilization and property costs) further upgrading of the Hwy 1 corridor from a 6/8-lane freeway to a 8/10-lane freeway over a 5.5 km long section [Station 9+160-to-Station 14+585].

9.4 Highway 1 Grade Improvement - Estimated Construction Cost: $27.1M+

The cost for developing a Highway 1 cross-section with a 3% maximum grade is highly dependent upon assumptions regarding:
• The timing and phasing of the grade improvement; and
• The amount and value of the property necessary to develop an appropriate construction by-pass alignment throughout the duration of construction on the Highway 1 main-line.
The net cost of achieving the 3% grade improvement in advance of the 6-lane widening of the Highway 1 corridor to address the 6.4% and 4.8% grades east of the interchange and the 5.2% grade west of the interchange was determined to be approximately $50M³. However, a large portion of this cost (50%) was attributed to the value of additional property⁴ required to achieve the 3% grade improvement, which was estimated at $600K/acre given its location within the urban area of the City of Calgary. Excluding property, the cost of the 3% grade improvement was determined to be $27.1M, of which $6.9M was allocated for a temporary 4-lane by-pass facility both east and west of the interchange.

It is important to appreciate that:

- The grade improvement associated with the 4.7% grade immediately west of the Valley Ridge interchange has not been estimated as this improvement is highly dependent upon the plans for developing the Valley Ridge interchange site;
- The costs associated with property acquisition to develop temporary by-pass routes used for constructions purposes have not been estimated. The property costs would be a function of the necessary by-pass alignment routes and the potential of negotiating a temporary easement throughout the duration of construction; and
- The cost of delaying the Highway 1 grade improvements to the time of 8-lane widening would be significantly higher (estimated at approximately $75M, inclusive of property) given future property values at the time of widening to 8 lanes⁵, the rate of development encroaching on adjacent lands, the need to remove and later reconstruct two additional freeway lanes and the additional cost of having to develop a temporary by-pass strategy that would have to provide for six directional lanes instead of four.

9.5 Highway 563 Interim Improvements - Estimated Construction Costs: $400K

The cost for developing the interim stage Highway 563 improvements was determined. The costs were identified as follows:

- Paving of approximately 370m (7m cross-section) of Twp Rd 245 from RR-31 to a new service road intersection (Estimated at $35.7K);
- Intersection modifications (auxiliary lanes) at RR-31/Twp Rd 245 (Estimated at $53.5K);

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³ See Appendix “C-4”: “Technical Memorandum No. 4”, Table I-3. The analysis indicated that the total cost associated with achieving a 3% grade improvement at the time of 6-laning was estimated at $49.56M assuming that the grade improvements take place at the time when Highway 1 is widened to a 6-lane cross-section. The total cost of 6-laning without the grade improvement was estimated at $8.83M. The net cost was therefore determined to be $40.8M for the grades to the east of the interchange. The costs of addressing the grades to the west of the interchange was determined to be $9.3M of which $1M was allocated for additional property related to the grade improvement.

⁴ Ibid. The analysis indicated that to achieve the 3% desired grade improvement a total of 51.4 acres of additional property would be required, whereas to achieve a 10-lane widening without the grade improvement would require 11.3 acres of additional property. Using a $600K/acre unit cost resulted in a net cost difference of $24M (51.4 - 11.3 = 40.1 acres x $600K = $24M) representing 59% of the net cost of $40.8M.

⁵ As this may occur anywhere from 20-to-45 years (depending if one adopts a 50,000 or 75,000 AADT warrant) from today, these costs can be significant.
- Intersection modifications (new access) at Springbank Road/Burnco Site (Estimated at $47.1K); and
- Cul-de-sac of Old Banff Coach Road at Springbank Road and closure of road (Estimated at $200.8K).

The closure of the Old Banff Coach Road/RR-31 intersection and development of the cul-de-sac and service road from RR-31 to Twp Rd 245 have been included in Stage 1 and were estimated at $784K.

9.6 Property Requirements - *Estimated Cost: $42.5M*

The total amount of land required to implement the above improvements was determined to be 134.5 acres, with roughly 29% located within the jurisdiction of the City of Calgary and the remainder within Rocky View County.

The land acquisition costs were determined based on property values within the City of Calgary urban limits (estimated as $600,000/acre) and rural lands value within Rocky View County’s Springbank community (estimated as $200,000/acre).

Land acquisition costs were estimated to be approximately $42.5M calculated as follows:
- City of Calgary: 39.03 acres x $600,000/acre = $23.42M; and
- Rocky View County: 95.47 acres x $200,000/acre = $19.09M.

The required lands between RR-31 and the existing City/Rocky View inter-municipal boundary [SW 36-24-3-5 and NW 36-24-3-5] which are largely associated with the interchange were determined to be 47.1 acres. It can be argued that the value of these lands could be perceived to be more consistent with the City of Calgary estimate than typical rural county lands given their proximity to the City of Calgary’s urban boundary.
10.0 SUMMARY OF PUBLIC INVOLVEMENT

The following provides a synopsis of each of the public involvement activities undertaken as part of this functional planning study. The public involvement process followed standard guidelines and provided for three public open houses (POH) and three sets of focus group (FG) meetings (six focus group meetings in total). All events were held within the Springbank community on the following dates and times:

- **Public Open Houses:**
  - POH No. 1: June 13th 2012, 5:00 to 8:00 pm, Springbank Park for All Seasons;
  - POH No. 2: February 13th 2013, 5:00 to 8:00 pm, Springbank Heritage Hall; and
  - POH No. 3: June 27th 2013, 5:00 to 8:00 pm, Springbank Heritage Hall.

- **Focus Group Meetings:**
  - FG No. 1: June 12th 2012, 10:30 am and 1:00 pm, Springbank Park for All Seasons;
  - FG No. 2: February 12th 2013, 5:30 and 7:30 pm, Springbank Heritage Hall; and
  - FG No. 3: June 26th 2013, 5:30 and 7:30 pm, Springbank Park for All Seasons.

Public Open Houses were intended to inform the general public about the study in an open house format that included a presentation addressing the study area constraints/existing conditions, evaluated options/alternatives and the consultant’s recommended designs. To inform the public about the open house sessions, an advertisement was placed in the Rocky View Weekly local newspaper up to two weeks prior to each open house.

Focus Group Meetings were held with landowners located within the vicinity of the Highway 1 corridor. The meetings provided an opportunity to meet with individual residents and business owners that would be directly impacted by the proposed highway improvements and interchange location alternatives being considered. The meetings allowed the consultant to gain feedback on specific project issues, constraints and alternative solutions. For each meeting, approximately 90 letters of invitation were sent to individuals located adjacent to the study corridors to inform them of the Focus Group Meetings and approximately 370 letters were sent for the Public Open House.

Land ownership information was obtained from Rocky View County and from the City of Calgary. In addition to canvassing property owners and residents, the Crestmont and Valley Ridge Community Associations were contacted.

1 Further information regarding the Public Consultation Program for the Highway 1 Functional Planning Study can be found in a separate document entitled “Summary of Public Involvement, Public Consultation Report, Highway 1 Functional Planning Study” (July 2013). The document provides a detailed account of the public consultation activities and includes all feedback provided by the public regarding the functional planning study.

2 Appendix “D” of “AT’s Engineering Consultant Guidelines for Highway and Bridge Projects” (May 2002)
10.1 **June 2012: Focus Group Meetings and Public Open House No. 1**

Focus Group Meetings No. 1 and Public Open House No. 1 provided the opportunity to present the study objectives, Highway 1 and Highway 563 existing conditions and potential interchange locations and configurations. Approximately 158 individuals attended the first public open house, while 56 individuals attended the focus group meetings (18 and 38 individuals for the “A” and “B” Focus Groups, respectively). For the most part, residents were thought to be reacting to the loss of rural agricultural lands and the conversion of County lands to urban land uses. The following issues and concerns were raised at this first meeting.

- A desire was overwhelmingly expressed to keep the existing location for the Old Banff Coach Road interchange location;
- The issue of reduced property values along the RR-31 corridor was raised as a concern;
- Loss of agricultural/country lifestyle was raised as a concern;
- Concerns were raised regarding the amount of land required and its associated cost to build a new interchange east of the existing structure to respond to urban sprawl;
- It was suggested that service roads parallel to the Highway 1 corridor should be built;
- A desire was expressed to explore the concept of developing two interchanges, one at Old Banff Coach Road and one at 133rd Street;
- Increased traffic volumes on Horizon View Road and Twp Rd 250 were expressed as concerns;
- The opinion was expressed that the cost of highway and interchange infrastructure should be born by the development community since the need for the improvements is development-driven;
- There were concerns regarding Calgary traffic using the local roads within the County, such as Horizon View Road, Springbank Road and Lower Springbank Road, as a shortcut to reach the City and to reach Highway 8; and
- Many residents expressed a need to get a “big picture” analysis of the entire study area.

10.2 **February 2013: Focus Group Meetings and Public Open House No. 2**

Focus Group Meetings No. 2 and Public Open House No. 2 were held to present the consultants recommended Highway 1/Highway 563 interchange location and configuration. Approximately 110 individuals attended the second public open house while 38 individuals attended the focus group meetings (24 and 14 individuals for the “A” and “B” Focus Groups, respectively). The following issues and concerns were raised at the meetings:

- The steep grades along the Hwy 1 corridor need to be addressed in the short-term and should not be ignored as part of longer-term recommendations;
Residents expressed concern regarding cut-through traffic using Horizon View Road to access Lower Springbank Road;

In general, residents supported the study findings recommending the existing location for the interchange;

Comments received at the events concurred that the recommended location for the interchange was cost-effective, responsible, practical, locally preferred, accommodates development options, makes the maximum use of the existing public right-of-way, provides for an equa-distant separation between interchanges and would have less impact on the environment;

A concern was raised that the future development plans would negatively impact Springbank residents and funnel traffic onto rural roads that are not designed to handle heavy traffic;

Concerns were expressed regarding City traffic having to use the County’s roads;

A desire was expressed to proactively develop the supporting roadway network prior to traffic becoming unbearable from development in the area;

An opinion was expressed that Highway 563/OBCR cannot handle more traffic and that it is under-designed without shoulders and is already used as a cut-through route linking SW Calgary to Hwy 1. It was desired that Hwy 563 no longer connect to Hwy 1; and

The developers should play a larger role in providing money for roadway system improvements when they are building. A statement was made that the roadway infrastructure should be in place before the housing is built.

10.3 June 2013: Focus Group Meetings and Public Open House No. 3

Focus Group Meetings No. 3 and Public Open House No. 3 were held to present the consultants recommended Highway 563 improvements. Approximately 45 individuals attended the third public open house while 13 individuals attended the focus group meetings.

In general, residents were please with the recommendation to limit access along Old Banff Coach Road. However some residents expressed concern with the increase traffic along RR-31 and Springbank Road as a result of the proposed cul-de-sacs along Highway 563;

A concern was expressed with the conceptual link that connected RR-31 to Crestmont Boulevard; and

A concern was expressed with passenger vehicles and motorcycles speeding along the Old Banff Coach Road/Hwy 563 alignment.
11.0 **ANCILLARY CONCEPTS**

Several alternatives were suggested somewhat late in the study process which merited consideration. The alternatives involved:

- Reconsideration of the required number of Highway 1 thru-lanes under the Highway 1/Old Banff Coach Road/RR-31 interchange bridges;
- Reconsideration of the option of rehabilitating the existing RR-31 overpass bridge;
- Consideration of a partial diamond interchange to the east of the future RR-31 interchange; and
- Consideration of a nested interchange concept involving a new interchange to the east in concert with the future RR-31 interchange.

The following sections serve to highlight the evaluation that was undertaken addressing each of the above alternatives.

11.1 **Eight Highway 1 Thru-Lanes under RR-31 - RECOMMENDED -**

The initial assumptions adopted for this functional planning study involved developing a 10-lane cross-section under the Highway 1/Old Banff Coach Road/RR-31 interchange. Additional discussions with AT indicated a desire to plan for eight continuous Highway 1 thru-lanes under the interchange overpass bridges:

> “Our plan to protect for a 10-lane cross section still remains; although for the short section entering Calgary; -recognizing- the planned developments, interchange spacing; the resultant interchange traffic entering and exiting, and the final laning available at Stoney Trail, -it was concluded - that a maximum of 8 core lanes and the auxiliary lanes as shown represent the best plan to achieve the best long term operation along this section of highway.”

The functional planning evaluation indicated that it remained feasible to maintain the integrity of the 10-lane Highway 1 cross-section by dropping a lane prior to the interchange bridge structures, maintaining 8 lanes under the bridges and then adding a lane on the other side of the interchange. Forecast traffic analysis indicated that the outside Hwy 1 through lanes would not be required from a capacity perspective under the interchange bridges. The functional plans were then developed assuming 8 continuous Highway 1 thru-lanes under the interchange bridges.

It should be noted that the functional plans remain flexible in that the span of the ultimate bridges can be modified to accommodate an outside fifth lane as a “barrier-ed” lane, by

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1 See Appendix “C-1”, Exhibit 3-1, Page 8
2 See Appendix “F-1” Oct 22nd, 2012 E-mail from Stan Turner along with lane balancing schematic.
3 See Annex “A”, Sheet 6 and Section 3.6.1
cutting into the head-slope or clear-zone. This provides the flexibility to accommodate a 10-lane cross-section under the Highway 1/Old Banff Coach Road/RR-31 interchange structures were it to become warranted in the future.

11.2 A Diamond Interchange: Interim Stage - RECOMMENDED -

In August 2012, a Technical Memorandum was produced\(^4\) which concluded that rehabilitation of the existing structure could not be recommended.  

[This conclusion was reached subsequent to a cost-benefit analysis that concluded that the rehabilitation would only last 15-to-20 years before the traffic volumes along the Highway 1 corridor would reach a level where the 6-lane span would have to be abandoned in place of a longer span structure.]

Almost a year later (July, 2013), the question of bridge rehabilitation was once again raised in recognition of the financial challenges and constraints being faced throughout the Province. Bridge planning indicated that deck replacement on the existing bridge could be anticipated to add approximately 30 years to the life of the structure. As well, it was recognized that traffic (2012) volumes on the QEII (which is configured as 6-lanes between Calgary and Airdrie) currently accommodates 75,000 AADT. The Hwy 1 corridor could potentially reach this traffic level in the 40-to-45 year time horizon implying that a 6-lane configuration could potentially last 20-to-30 years rather than the 15-to-20 years that was assumed earlier.

The rehabilitation diamond interchange scenario was re-evaluated from a cost-benefit perspective and it was determined that extending the life of the existing structure to last for as long as 40-to-45 years (from 2012 assuming the rehabilitation takes place in 2022 along with continued maintenance) results in the rehabilitation option being considered superior to that option of bridge replacement.

The proposed concept would involve:

- rehabilitation of the existing structure, which currently travels over 6-lanes of traffic (two through-lanes and one loop ramp per direction);
- converting the interchange to a diamond configuration;
- utilizing the existing 6-lane span to satisfy the requirement for six Hwy 1 thru-lanes; and
- retaining the flexibility to address the 3% grade improvement along the Highway 1 corridor independent of the timing of the interchange improvements.

However, accepting this concept is not without risks and would involve:

\(^4\) See Appendix “C-3” Technical Memorandum #3 (August 2012): A scenario was considered that examined rehabilitating the existing structure in “Year 10” assuming the interchange would remain in the existing location, and reconfiguring the interchange ramps to a diamond configuration to meeting the interim 6-lane requirement for the Highway 1 corridor. The result of the evaluation indicated that rehabilitation of the existing structure could not be recommended and the structure should be replaced when warranted in the 7-to-10 year horizon assuming the need for an 8 lane cross-section (50,000 AADT) would be reached within the 20-to-30 year time horizon.
• accepting lower-than-desirable levels-of-service operations in the latter years of this time period beyond 50,000 AADT levels on Hwy 1;
• recognizing that local residents may object to substituting roundabouts or traffic signal controls where free-flow loop-ramps once existed;
• recognizing that AT could be seen to be inconsistent in that the Province would be seen to be advocating:
  • removal of the existing loop ramps (to achieve the diamond configuration) while still providing for the loop ramps in the ultimate time frame; and
  • a reduction in ramp capacity during the very time that development is increasing in the surrounding area.
• recognition that significant longer range throw-away costs will be incurred, including costs associated with ramp modifications, ramp terminal modifications and RR-31 vertical profile adjustments at each stage of construction.

Recognizing the above risks, it was decided to adopt the above-mentioned rehabilitation concept and interim diamond interchange configuration strategy.

11.3 Alternative: Partial Diamond Interchange - NOT RECOMMENDED -

A concept was proposed for evaluation that would see, in addition to the Parclo “A” interchange, the development of a partial diamond interchange with ramps heading from and to Calgary. The partial diamond interchange would be intended to service the area within the City of Calgary annexation lands while the Parclo “A” interchange would continue to service Rocky View County residents. The envisioned concept would see a partial diamond interchange served by a westbound off-ramp (providing access from the City) and an eastbound on-ramp (providing access to the City).

A Technical Memorandum5 was produced that highlighted the following study conclusions that were reached during the analysis phase of the study

• A Single Interchange is Sufficient: Analysis of the “ultimate” forecast traffic volumes indicated that a single Parclo “A” interchange would offer sufficient capacity to accommodate a “high land use” growth scenario for the study area (See Section 3.4);
• The Existing Location of RR-31 Interchange is the Preferred Site for a Replacement Interchange: The comparative evaluation of three candidate locations for a new interchange indicated that maintaining the existing Highway 563 interchange site represents a preferred location for a single interchange site (See Section 4.5.3); and
• It Remains Worthwhile to Improve the Grade of the Highway 1 Corridor: A benefit-cost analysis indicated that reducing the existing Highway 1 grades to a 3% grade is a worthwhile endeavour (See Section 4.4.7). This finding implies that even if an additional interchange was to be considered, the Highway 1 grades would have to be improved prior

5 See Appendix “C-7” “Technical Memorandum No. 7 Additional Partial Interchange at Highway 1”
to the interchange being developed. (Alternatively, this concept would result in the need to improve the grade along Highway 1 in the initial stage, therefore increasing the initial capital cost.)

In addition, lessons learned from the Public Involvement exercise were also considered:

- **Management of Public Expectations would be a Concern**: The public involvement process (Public Open House No. 2 February 12, 2013) formally acknowledged the study findings that an interchange at the existing RR-31/OBCR/Hwy 563 location would be the consultant’s recommended solution as the single interchange site.

- **Traffic Spill-over Concerns**: Presenting an additional partial interchange concept would raise community concerns regarding spill-over traffic from the new interchange onto Horizon View Road and Old Banff Coach Road (which currently operate as local roads) will be of particular concern to residents and require traffic mitigation measures.

Independent of the above conclusions, a conceptual level review of two potential locations for a partial diamond interchange concept was undertaken. The locations included the 133rd Street alignment and a location at the top of the Highway 1 crest vertical curve. It was concluded that both sites:

- do not satisfy the minimum 2 km\(^6\) interchange separation from a RR-31 interchange;
- presents weaving, merge/diverge manoeuvres, traffic operations and ramp storage requirement concerns between the conceptual partial diamond and the Valley Ridge interchange;
- if developed prior to the Highway 1 grade improvement, would require:
  - that sufficient property be protected to accommodate a partial interchange design that would conform to a 3% Highway 1 grade; and
  - total reconstruction at the time of the grade improvement. These future costs would be significant and should not be incurred by AT (because the request for the partial-diamond interchange is development driven);
- would likely have the beneficial effect of diverting traffic away from the RR-31 interchange site and potentially reducing the overall interchange infrastructure requirements, property impacts and construction costs of the RR-31 interchange. With the advent of an additional partial-diamond interchange (at a conceptual cost of $60M\(^7\)), a possibility exists to eliminate the requirement for some components of the RR-31 infrastructure resulting in savings that could be in the order of $10-to-$20M.

The conceptual review of the two locations for a partial-diamond interchange indicated that the 133rd Street location would be preferred over the alternative in that the location would provide for greater separation from the RR-31 interchange, greater flexibility in staging the Highway 1 grade reduction, improved local road spacing and improved interchange visibility.

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6 “Best Practices For Planning and Design of Freeway Facilities”
7 The estimated cost of a partial diamond interchange was referenced from “Highway 2 & Twp Rd 265 Partial Interchange Functional Planning Study”.
Based on the high-level conceptual review, an additional partial diamond interchange in the vicinity of 133rd Street:

- appears to be feasible from a physical infrastructure perspective;
- is not required from a capacity perspective;
- is costly and would require reconstruction if developed in advance of a Highway 1 grade improvement;
- presents merge/diverge/weaving constraints which remain to be mitigated;
- presents risks related to accommodating the future Highway 1 grade improvement; and
- would require additional public consultation/involvement with regard to the future interconnectivity with the surrounding community.

11.4 Alternative: Nested Diamond Interchange - NOT RECOMMENDED -

A nested diamond interchange concept was presented that would combine the Hwy 563/Old Banff Coach Road/RR-31 interchange with a second interchange at 133rd Street. The concept:

- Removed ramps between the two interchanges thereby avoiding any concerns regarding merging/diverging and weaving between the two interchanges; and
- would require WB vehicle traffic destined to the Hwy 563/Old Banff Coach Road/RR-31 interchange to egress at the 133rd Street interchange and, similarly, EB vehicle traffic destined to the 133rd Street interchange would be required to exit at the Hwy 563/Old Banff Coach Road/RR-31 interchange.

The conceptual level review of the concept raised the following findings:

- Vehicles wishing to exit at either location would need to know ahead of time that the interchanges are nested, this could result in the potential for late breaking and erratic manoeuvres;
- This concept would be constructed in the interim stage (with the existing grades along Highway 1). At the time of grade improvements, the 133rd Street interchange would need to be entirely re-constructed. (Alternatively, this concept would result in the need to improve the grade along Highway 1 in the initial stage, therefore increasing the initial capital cost.);
- The concept was based on a high level review and assumed traffic forecasts that are representative of what currently exists. The concept has not been evaluated for ultimate traffic volume forecasts and hence the circulation on the ramps linking the two interchanges and the connecting roadways remains to be determined;
- AT does not support having freeway ramps serve as slip ramps into developments. Pressure will no doubt be placed to develop accesses/intersections along the ramps extended length of 1.3 km that separate the two interchanges;

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8 See Appendix “F-4”, Communications with the City of Calgary for e-mail (dated January 24th 2012) and ISL concept.
• AT’s interchange spacing guidelines\(^9\) indicate that a maximum of one interchange can be located along the 3.8 km segment between Hwy 563/Old Banff Coach Road/RR-31 and Valley Ridge Blvd. The Province would generally not support an additional interchange in this location; and

• The concept would likely have the beneficial effect of diverting traffic away from the RR-31 interchange site and potentially reducing the overall interchange infrastructure requirements, property impacts and construction costs of the RR-31 interchange. A possibility exists to eliminate the requirement for some components of the Hwy 563/Old Banff Coach Road/RR-31 infrastructure.

Based on the high-level conceptual review, the nested interchange concept involving an additional overpass in the vicinity of 133\(^{rd}\) Street:

• requires greater motorists awareness in terms of accommodating the absence of ramps between the interchanges;

• presents an inconvenience factor for Rocky View residents in that rural motorists would be required to travel along the parallel roadways linking RR-31 to 133\(^{rd}\) Street to travel to-and-from Calgary as access would not be provided at the RR-31 interchange to/from the east;

• appears to be feasible from a physical infrastructure perspective and a mainline highway traffic operations perspective;

• is not required from a capacity perspective;

• is costly and would require reconstruction if developed occurs in advance of a Highway 1 grade improvement;

• presents concerns regarding access to the 1.3 km long ramps between the interchanges;

• presents risks related to accommodating the future Highway 1 grade improvement; and

• would require additional public consultation/involvement with regard to the future interconnectivity with the surrounding community.

11.5 **Alternative: 133\(^{rd}\) Street Tunnel - NOT RECOMMENDED -**

A concept was proposed early in the study process that would take advantage of the existing topography at the crest of the Hwy 1 corridor in the vicinity of the 133\(^{rd}\) Street corridor by developing a tunnel interchange option beneath the Highway 1. AT generally views underpass interchanges from an operational perspective as being less desirable given the reduced visibility of the interchange and counter-intuitive operations (i.e. acceleration on upward sloped on-ramps and deceleration on downward sloped off-ramps.). It was recognized that a Parclo “A” tunnel configuration would have significant property consumption impacts\(^{10}\) upon the

\(^9\) AITHGDG: Section I.5.1: Access Management by Design Classification, Freeways, Chapter I: Access Management Guidelines

\(^{10}\) See Appendix “C-1” “Technical Memorandum No. 1”, Section 4c and the attached Sub-Appendix D-Interchange Option Profiles and Grading Exhibits
adjacent lands, which for the most part are being prepared to support development initiatives. As well, analysis\(^{11}\) was undertaken that concluded that reducing the Highway 1 grade to a 3\% grade as part of the widening of Highway 1 corridor to accommodate 6-lanes is recommended, subject to Provincial priorities and available funding. Should a tunnel option be developed prior to the Highway 1 grade improvement (which was determined to result in a 15m change in the elevation of the existing Hwy 1 corridor below the current crest at the 133\(^{rd}\) alignment), the tunnel design would have to provide for sufficient depth to protect for the ultimate desired grade improvement. This would require a depth of tunnel of approximately 25m below current elevation (the equivalent of an 8 story building). Aside from the significant drainage and geotechnical challenges, this concept was deemed to have unacceptable property impacts on the location and alignment of adjoining ramps and result in needless property consumption, which could otherwise be used to accommodate adjacent development initiatives.

\(^{11}\) See Appendix “C-4” “Technical Memorandum No. 4”, Section 8
12.0 FINDINGS AND RECOMMENDATIONS

12.1 Findings

The following sections summarize the findings of this Functional Planning Study.

12.1.1 The Highway 1 Corridor

- The study area incorporates approximately 8 km of the Highway 1 corridor from (500 meters west of) Range Road 33 (Springbank Interchange) to (500 meters east of) the Valley Ridge interchange.
- The section of Highway 1 within the study area is classified as a “Level 1” highway within the National Highway System (NHS) and is classified as a Long Combination Vehicle (LCV) route posted at 110kph. The study area includes a center median transition from a rural 22.6m width to an urban 7.8m width.
- Hwy 1 is characterized by an undulating profile consisting of a sag curve (K 115) at Hwy 563 and a crest curve (K 75) located approximately 500m west of the 133rd Street alignment. The vertical profile along this segment of the highway corridor ranges from approximately 0-to-6.4% and presents limitations upon the available design sight distance at interchange gore points.

12.1.2 Study Area and Land Uses

- Over the last two decades both Rocky View County and the City of Calgary population have both experienced over 90 percent growth.
- The municipal boundary between the City of Calgary and Rocky View County was changed through a 2007 Provincial annexation process that resulted in portions of Rocky View County’s Springbank area being incorporated within the City of Calgary’s urban boundary.
- The land uses on the western portion of the study area are best described as a mixture of country residential with some commercial and industrial uses. The eastern portion of the study area is characterized by urban developments (Valley Ridge and Crestmont communities).
- The municipal boundary is situated approximately 800m east of the RR-31 corridor and 800m south of the Highway 1 corridor. Hence, the lands immediately east of the Hwy 563/Old Banff Coach Road/RR-31 interchange and the lands south of the Hwy 563 corridor remain within the jurisdiction of Rocky View County’s rural Springbank community (which includes the Artist View and Horizon View rural country residential acreage communities).
- The Highway 1 corridor within the study area will be influenced by other adjacent developments such as the proposed Harmony residential development, the Bingham Crossing commercial development, and the West Calgary Marketplace commercial development.
12.1.3 Highway 1 Existing Conditions

- **Classification:** Highway 1 is a “Level 1” highway that accommodates the movement of people, goods and services inter-provincially and internationally and is a core route in the NHS.

- **Vehicle Designation:** Highway 1 is a “Long Combination Vehicle Route” but is not a “High Load Corridor”.

- **Posted Speed:** The current posted speed limit along Highway 1 is 110km/hr.

- **Cross-Section:** The existing 4-lane divided cross-section consists of:
  - highway grades that vary from approximately 0-to-6.4 percent;
  - pavement widths from 11.4-to-12.8 m;
  - shoulder widths from 2.0-to-2.6m;
  - a median transition from rural (22.6m) to urban (7.8m); and
  - a vertical sag curve (K155) and crest curve (K77).

- **Intersections with Other Provincial Highways:** The Highway 1 corridor, within the vicinity of the study area, intersects with the Highway 563 corridor.

- **Collision Information:** Between 2006 and 2010, a total of 140 collisions were reported along the Highway 1 corridor (within the 6.5km segment in the vicinity of the RR-31 interchange). Over the entire corridor, the collision rate of 53 collisions per-100-million-vehicle-km was only slightly lower than the 2012 Provincial average of 63 collisions per-100-million-vehicle-km (for a rural 4-lane divided freeway not at-grade facility). However, along the steep Hwy 1 grade (6.4%) east of the interchange the collision rate was almost double the Provincial average, with 120 collisions per-100-million-vehicle-km.

- **Traffic Volumes:** Existing (2012) traffic volumes (AADT) along Highway 1 were approximately 23,000-to-24,000 vehicles-per-day (vpd) west of the RR-31 corridor, 28,000-to-29,000 vpd east of the RR-31 corridor, and 39,000-to-40,000 west of the Stony Trail/Hwy 1 interchange. Approximately 6% of the Highway 1 vehicle traffic in the vicinity of the RR-31 interchange is heavy vehicle traffic.

- **Historical Traffic Growth:** The 10-year average annual growth rate in the vicinity of the RR-31 interchange was found to be in the order of 2.0-to-3.0 percent.

- **Accesses:** Two at-grade intersections exist along the corridor (one country residential access and an additional at-grade fenced access exists nearest the western edge of the Crestmont development which provides alternate access to the adjacent water retention pond.)

12.1.4 Highway 563 Existing Conditions

- **Classification:** Highway 563 is a “Level 4” rural highway.

- **Vehicle Designation:** Highway 563 is a “Double Trailer Combination (WB-23) Route” but is not a “High Load Corridor”.

- **Posted Speed:** The current posted speed limit along Highway 563 is 60km/hr.

- **Cross-Section:** The existing 2-lane undivided cross-section consists of:
  - highway grades that vary from approximately 0-to-7.2 percent;
  - a consistent 6.9m pavement width along its length;
  - there are no shoulders along the length; and
  - vertical sag curves (ranging from K12-to-K123) and crest curve (ranging from K24-to-K153), where 6 of the 22 vertical curves and 5 of the 12 horizontal curves could be improved.
• **Intersections:** The Highway 563 corridor has 9 intersections between RR-31 and Springbank Road.

• **Traffic Volumes:** Existing (2012) traffic volumes (AADT) along Highway 563 were approximately 1,500-to-2,000 vpd.

• **Historical Traffic Growth:** The 10-year average annual growth along the Hwy 563 corridor east of RR-31 was found to be in the order of just over 5.0 percent.

### 12.1.5 Public Involvement

The public consultation/involvement activities associated with this functional planning study included three public open houses and six focus group meetings.

- The first set of meetings provided the opportunity to present the study objectives, existing conditions and potential interchange locations and configurations, the second set permitted the presentation of the consultant’s recommended interchange location and configuration. The last meetings were held to present the consultants recommended Highway 563 improvements.

- The 1st public open house was attended by 158 individuals and 56 persons attended the 1st set of focus groups. The 2nd public open house was attended by 110 individuals and the 38 individuals attended the second set of focus groups. The third set of focus groups was attended by 13 individuals and the 45 individuals attended the 3rd public open house.

- Throughout the entire process comments and concerns were recorded and responses provided.

### 12.1.6 Environmental Evaluation

The environmental evaluation undertaken on behalf of this functional planning study concluded that a potential exists for residual impacts to the biophysical resources within the study area during, and after, Highway 1 widening and the Hwy 1/RR-31 interchange construction. It should be kept in mind that the tributary realignments associated with the ramp reconstruction as well as the new water retention ponds all have specific environmental impacts. Mitigation measures\(^1\) can be use to alleviate the impacts on most resources. However, the following additional environmental work is recommended prior to construction:

- A detailed soil survey is necessary to delineate soil units and depth of topsoil and provide more detailed mitigation for any soils of concern;

- A rare plant survey and detailed vegetation mapping is recommended to ensure that impacts to Provincially rare vegetation species are minimized;

- A detailed wildlife survey, including amphibians and reptiles, should be conducted to determine the presence (or absence) of special status species;

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\(^1\) See Appendix “A-1”: The Environmental Report details mitigation measures addressing each eco-system component.
• A Qualified Wetland Aquatic Environment Specialist detailed site assessment for wetland areas is recommended to classify each wetland and delineate area of impact for compensation and Water Act approval purposes;
• A fish habitat assessment is recommended for watercourses and the waterbody within the study area; and
• Mitigation measures should be applied to account for greater surface area run-off identified in the drainage plans. Groundwater wells within the area should be confirmed and groundwater quality and groundwater well water quality monitoring should be undertaken both pre- and post-construction.

12.1.7 Historical Resources Overview (HRO)

The HRO concluded that due to the presence of “prehistoric campsites” a Historical Resources Impact Assessment (including deep-testing) is recommended.

12.1.8 Preliminary Geotechnical Assessment

The preliminary geotechnical assessment concluded that:
• The area surface geology is generally covered by draped glacial till of Balzac drift with a thickness that varies from 4-to-20m. There may also be some deposits of glaciofluvial and/or glaciolacustrine gravel, sand and/or silt. Bedrock in the study area is most likely comprised of Cretaceous and lower Tertiary sedimentary rocks.
• Within the vicinity of the existing RR-31 interchange, the reported soils included stiff to very stiff silty clay or sandy clay overlying bedrock (at depth of approximately 12m below the previous existing grade).
• Within the vicinity of the Valley Ridge development, the soils included a thin layer of lacustrine silty clay overlying the stiff to very-stiff silty clay overlying bedrock (at a depth was approximately 23m below the existing grade.)
• At a preliminary desktop level, the surface and subsurface conditions were considered suitable to support the proposed work along the Highway 1 corridor and the new interchange.
• With regard to the potential Hwy 1 grade improvement, bedrock may be encountered at shallow depths along Highway 1, particularly near the crest of vertical curves, and hence blasting may be required. Excavation was assumed to accommodate a 3% grade along Hwy 1 with a uniform side slope of 3:1\(^2\).
• The subsurface soil conditions were considered suitable for deep foundations to support the bridge structures. Driven steel piles and/or bored cast-in-place concrete piles would be suitable foundation types. The existing interchange location may require the removal of unsuitable materials in low lying areas. In addition, temporary groundwater control may also be required during construction.

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\(^2\) The functional plans accommodate a barrier free design with 4:1 side slopes.
12.1.9 Drainage and Hydrology

The preliminary hydrology assessment concluded that:

- Drainage of Highway 1 is accomplished mainly by ditches along the existing corridor and the natural landscape that flows to either a natural watercourse, a low point along the highway or pond areas.
- Within the vicinity of the existing RR-31 interchange, the area is segmented into two basic drainage zones.
- The proposed widening of the Highway 1 corridor (from 4-lanes to ultimately 8-lanes) is not expected to significantly alter the hydrological conditions nor change the existing drainage patterns within the study area. Some minor flood peak increases are anticipated as a result of the increase in impermeable road surface, however these flows can be mitigated by installing new culverts or increasing the size of existing culverts.
- The existing ditch width (which would be utilized during the 6-lane stage) should provide sufficient capacity to handle the additional flow, however this should be confirmed at the time of detailed design to confirm ditch depth-of-flow and flow-velocities.
- The detailed design for the widening will need to ensure stormwater capacity is maintained and that culverts along the highway corridor are extended to accommodate the widening of the highway.
- The ultimate interchange configuration will have significant impact to drainage. Existing drainage infrastructure must be expanded so as to be capable of accommodating the additional storage volume from storm-water runoff. The peak flow rates and volumes associated with the ultimate interchange configuration downstream of the interchange should have no impact upon municipal roadway corridors and be accommodated within either new or expanded storm water retention ponds3.
- The proposed RR-31 interchange will require realignments of the unnamed tributaries in the vicinity of the W-N/S Ramp and the E-N/S ramp. Realignment options were evaluated and options aligned around the interchange were preferred.

12.1.10 Bridge Structures Assessment

The existing RR-31/Hwy 1 interchange overpass bridge (BF 75933) assessment indicated:

- an original construction year of 1965;
- an arrangement consisting of 4-spans (12.5-22.9-22.9-12.5 m) positioned at a 90° angle with Highway 1;
- an existing clear roadway width on the structure of 11m, accommodating two 3.7 m lanes, two 0.9 m shoulders and a 1.8 m painted median along with a median guide rail separating each direction of travel over the length of the structure;
- a 2012 BIM report indicated that the 48-year old structure is in “fair-to-poor” condition and is “schedule for a full deck replacement in 2017”; and
- extending the life of the existing structure through rehabilitation was found to be far superior to the option of bridge replacement. A deck replacement estimated at $2M was anticipated to add approximately 30 years to the life of the structure.

3 See Appendix A-3 – Figure No. 4: For modifications to existing storage ponds.
12.1.11 New Bridge Structures

Bridge planning calls for an *interim* stage at the time when four RR-31 lanes are required or when six Hwy 1 thru-lanes are required that would include:

- the development of a new (16.4m wide, 116m long, 2 span, 5.4m vertical clearance) NB interchange bridge that would be provided with a 2.5m pedestrian sidewalk;
- the conversion of the existing structure to accommodate 2 SB lanes (which for the most part was assumed to be undertaken by maintenance activities including the removal of the centre median guide rail.); and
- the continued use of six Highway 1 thru-lanes under the two bridges.

Bridge planning calls for an *ultimate* stage at the time when eight Hwy 1 thru-lanes are required that would include:

- the development of a replacement bridge (13.4m wide, 116m long, 2 span, 5.4m vertical clearance) capable of accommodating 2 SB thru traffic lanes over an 8-thru-lane Hwy 1 corridor;
- the development of a third bridge (12.9m wide, 116m long, 2 span, 5.4m vertical clearance), when and if warranted, that would provide access to the 2-lane S-E Loop On-Ramp; and
- widening of the NB Interchange bridge (by 4.3 on the south and 10.8m on the north) to accommodate access to the N-W Loop On-Ramp.

12.1.12 Forecast Development Plans

- Adjacent development initiatives beyond the immediate study area were accounted for that included the impacts associated with Bingham Crossing, Harmony Developments, Springbank Airport Expansion, Padera Springs, Central Springbank ASP, North Springbank ASP, West View ASP, etc.
- The potential “ultimate” build-out horizon period of the study area was evaluated using sensitivity analysis which assumed a “high”, “moderate” and “low” range of potential development intensity.
- In total, the forecast land use Melcor and Qualico lands and the lands within the immediate study area were determined to result in:
  - an additional 6,000-to-7,500 dwellings;
  - a business park/office/industrial development potential of an additional 3-to-4.6M SF;
  - a retail expansion of 1.4-to-2.2 million square feet; and
  - public institutional development (such as schools, community centres, parks etc.).

12.1.13 Other Related Highway Initiatives

Key pieces of infrastructure are required from a network operations perspective to accommodate the “ultimate” build-out level of growth aside from the infrastructure envisioned within this functional planning study. This infrastructure includes:

- a Regional Ring Road located west of the Highway 1/Springbank (RR-33) Interchange (exact location to be determined) and east of the Hwy 22/Hwy 1 interchange;
- the ultimate configuration of the Stoney Trail/Highway 1 interchange;
• the ultimate Stoney Trail southerly extension to Hwy 22X;
• a widening of RR-31 (Old Banff Coach Road) structure over Hwy 1 must consist of at least four thru-lanes; and
• a ten-lane Highway 1 corridor west of the RR-31 interchange site.

12.1.14 Planning Forecasts

The forecast growth potential for the lands within the immediate proximity of the interchange is anticipated to result in:
• an additional 6,000-to-7,500 homes;
• a business park/office/industrial development potential of an additional 3.0-to-4.6 million square feet;
• a retail expansion of 1.4-to-2.2 million square feet; and
• public institutional development (including schools, community centres, parks, etc.).

12.1.15 Traffic Forecasts

These results indicate that the forecast traffic growth of the lands within the study area would generate approximately:
• 7,500-to-10,600 new vehicle trips in the morning peak hour; and
• 9,500-to-13,500 new vehicle trips in the afternoon peak hour of travel demand.

12.1.16 When does Hwy 1 Require Widening?

The Highway 1 corridor in the vicinity of the RR-31 Interchange is anticipated to warrant widening:
• to 6-lanes within 7-to-10 year time horizon when 31,000 vpd would be reached; and
• to 8-lanes within the 20-to-30 year time horizon when 50,000 vpd would be reached, however, it is recognized that 6-lane freeway corridor (such as the QE II south of Airdrie accommodate up to 75,000 AADT) can extend this period up to 40-to-45 years if necessary.

12.1.17 When does Range Road 31 Require Widening?

The RR-31 corridor traveling over Highway 1 is anticipated to warrant:
• widening to 4-lanes (2 northbound and 2 southbound lanes) within approximately 20 years; and
• additional capacity will be required to accommodate a double loop ramp in the southwest quadrant in the “ultimate” time horizon.

12.1.18 What is the Preferred Ultimate Hwy 1/RR-31 Interchange Configuration?

The “preferred” Hwy 1/RR-31 interchange:
• would be best configured as a Parclo “A” interchange configuration with a single lane loop ramp in the NE quadrant and dual lane loop ramp in the SW quadrant of the future interchange;
• a 7-Lane RR-31 bridge structure over the Highway 1 corridor [four through lanes (two northbound and two southbound), two lanes leading to the S-E Loop Ramp and a single lane leading to the N-W Loop-Ramp]; and

• would ultimately best be traffic-signal controlled at both the north and south ramp terminals, however in the interim would function with roundabout control.

12.1.19 What is the Preferred Location for an Interchange?

• The existing OBCR interchange site (Location “C”) was found to provide advantages in terms of cost savings, minimal requirements for a supporting service road networks, reduced ROW requirements, balanced interchange spacing and preferred traffic operations (inclusive of lane balancing, weaving and merge/diverge characteristics associated with the “ultimate” interchange configuration).

• The existing OBCR interchange location will afford AT the greatest flexibility to respond to changing development patterns, intensity and travel demand configurations.

12.1.20 The Highway 1/Rge Rd-31 Interchange: A Conceptual Staging Strategy

The functional plans envision an economical three stage approach to the development of the ultimate “preferred” Hwy 1/RR-31 interchange:

The Stage I objectives include:
• rehabilitation of the existing interchange bridge;
• within the Hwy 1 rural-urban transition zone install a high tension cable barrier along the length of the median (the requirements for crash attenuation at the median pier on Highway 1 for both the existing and twinned structures should be reviewed at the time of detailed design);
• reconfiguration of the interchange on- and off-ramps on an alignment consistent with the “ultimate” location;
• relocation and reconfiguration of the ramps terminals to support a “diamond” Hwy 563/Old Banff Coach Road/RR-31 interchange configuration in the form of single lane roundabouts;
• raise the existing RR-31 alignment/profile to provide adequate grades to meet the transition requirements needed to accommodate the new ramp terminals and bridge approaches and facilitate the integration with proposed new infrastructure (needed in the subsequent Stages);
• assure a 6-lane Highway 1 cross-section under the Hwy 563/Old Banff Coach Road/RR-31 interchange;
• closure of the existing angled Hwy 563/RR-31 intersection;
• undertake improvements to the Twp Rd 245/RR-31 intersection and west leg of the unpaved Twp Rd 245 corridor resulting from the closure of the angled Hwy 563/RR-31 intersection;
• conversion of the eastern portion of the Hwy 563 corridor to a local service roadway; and
• closure of the two accesses along RR-31 (one north and one south of the interchange) and assure alternate access to the properties.

The Stage II improvements include:
• achieving a 4-lane RR-31 cross-section over the 6-lane Highway 1 corridor;
• the development of a new 2-lane overpass bridge to the east of the existing bridge intended to accommodate NB traffic;
• the 4-laning of RR-31 north and south of the interchange;
• reconfiguration of the ramps terminals on both sides of the interchange to potentially support double-lane 2x2 roundabouts;
• widening of the W-N/S and E-N/S Off-ramps to accommodate two approach lanes; and
• integration with local municipal improvements such as the twinning of Twp Rd 245 and 250.

The **Ultimate Stage** improvements include:
• removal and reconstruction of a new overpass structure to accommodate SB traffic on RR-31 (that would replace the existing overpass bridge);
• a new overpass structure to accommodate SB traffic destined to the double E-N/S loop ramp within the south-west quadrant of the interchange;
• additional widening of the NB structure to accommodate access to the loop ramp in the north-east quadrant of the interchange;
• eight Highway 1 continuous thru-lanes below all RR-31 bridge structures;
• ramp improvements accommodating the improved 3% grade along the Highway 1 corridor;
• a reconfigured “Parclo A” Hwy 1/RR-31 interchange inclusive of loop ramps in the north-east and south-west quadrants of the interchange;
• widening of RR-31 north of Twp Rd 245 and south of Twp Rd 250 to a 6-lane cross-section north and south of the ramp terminals to accommodate improvement to the Parclo “A” configuration; and
• integration with local municipal improvements such as additional widening and auxiliary lanes associated with Twp Rd 245 and 250 (required beyond the 4-lane cross-section envisioned in Stage II).

12.1.21 **Highway 1 Widening and Grade Improvements**

- The widening of the Highway 1 corridor to 6-lanes is anticipated to be required within the 7-to-10 year time horizon when 31,000 vpd would be reached.

- A cost-benefit analysis determined that with the advent of 6-laning of the Highway 1 corridor and the current desire to develop lands adjacent to Highway 1, it remains prudent from a cost-benefit perspective to protect for sufficient property to accommodate a 3% maximum grade. The grade improvement would:
  - provide for a 4% IRR before the end of the project design life, with savings continued for the life of Highway 1 horizon;
  - result in an improved decision sight distance in advance of the interchange; and
  - result in a 5-to-9 percent improvement in the overall LOS.

- However, the cost of improving the vertical profile of the Highway 1 corridor to adhere to a 3% maximum grade at the time of the widening to a 6-lane cross-section was determined to be approximately $50M. For the purpose of this functional planning study,
it was assumed that the 3% grade improvement along the Hwy 1 corridor would precede the 6-lane widening.

- It is important to appreciate that the cost of delaying the Highway 1 grade improvements to the time of 8-lane widening would be significantly higher given future property values, the rate of development of the adjacent lands and the additional cost of having to develop wider by-passes to accommodate much higher traffic volumes instead of 2-lane by-passes during construction.

12.1.22  The Future of Highway 563/Old Banff Coach Road

- The following factors will, over time, result in Highway 563 ceasing to function as a Provincial Highway:
  - the development of future Stoney Trail South extension would see Calgary West residents divert to the Stoney Trail and Hwy 1 corridors rather than using the lower service Highway 563 corridor;
  - rural residents from the Artist View and Horizon View communities complain of cut-through traffic and wish to prohibit any traffic from the developing community to the north from using the OBCR/Hwy 563 corridor to cut through their community; and
  - Plans for the Stoney Trail/Springbank Road interchange and the Hwy 1/RR-31 interchange call for the closure of Springbank Road/Hwy 563 and RR-31/Hwy 563 intersections respectively by way of cul-de-sacs rendering the Hwy 563 corridor discontinuous.

- This functional planning study serves to suggest a future function and form for the various segments of the Hwy 563/OBCR corridor along its length; however, longer term infrastructure requirements are driven by adjacent development initiatives.

- Ultimately, the Province has control over the timing of the closure of the Hwy 563/RR-31 intersection and the Hwy 563/Stagecoach Road intersection and can, at its discretion assure the future function of the corridor as a local roadway. However, the development of the West View Community Lands (Qualico) may precede the infrastructure initiatives necessary to justify the intersection closures. As such multi-agency coordination may be necessary to address infrastructure financing and appropriate design standards for both the Twp Rd 245 and Hwy 563 corridors necessary to accommodate the urban designation of the newly developing communities.

- For the purposes of this functional planning study it was considered prudent for the Province to have discussions with the County to affect the transfer of the Hwy 563 corridor to the local municipal jurisdictions in advance of the Stage I Hwy1/RR-31 interchange improvements.

12.1.23  The Entire Project Summarized

The entire project when completed would have involved the development of:

- A reconfigured Hwy 1/RR-31 interchange in its existing location consisting of:
  - a replacement overpass bridge structure to accommodate SB traffic;
  - replacement of the interchange ramps, loops and ramp terminals as warranted;
  - a new overpass bridge structure to accommodate NB traffic; and
- a new overpass bridge structures to access a future S-E double loop ramp.
- Accommodation of pedestrian access on the east side of the interchange;
- Approximately one kilometre of former Hwy 563 being converted to a local service road;
- Improvements to the RR-31 corridor consisting of:
  - an improved horizontal radius south of the Twp Rd 250 intersection;
  - closure of all existing accesses along RR-31 [between Twp Rd 245 and 250] in the proximity of the new interchange; and
  - 1.7km of 4-lane twinning of RR-31 [between Twp Rd 250 and 245] with provision for an ultimate 6-lane cross section [between the ramp terminals and the Twp Roads].
- Improvements to the Highway 1 corridor, consisting of:
  - improvement of the vertical profile to meet a desired 3% maximum grade;
  - widening to meet an interim 6/8-lane freeway design; and
  - widening to meet an ultimate 8/10-lane freeway design.
- The ultimate transfer of the Hwy 563 corridor to local municipal jurisdictions and the conversion of the corridor to an infrastructure form compatible with local municipal development initiatives.

12.1.24 Conceptual Cost

The conceptual cost of the entire project was determined to be approximately $208M, inclusive of property. The components of this overall total were determined as follows:

- $ 83M allocated to Hwy 1/RR-31 interchange improvements with:
  - $33.4M – allocated to Stage I;
  - $19.4M – allocated to Stage II; and
  - $30.3M – allocated to the Ultimate Stage.
- $ 21.8M allocated to Hwy 1 corridor improvements with:
  - $11.8M – allocated to widening to a 6/8 lane freeway standard; and
  - $10.0M – allocated to widening to a 8/10 lane freeway standard.
- $ 27.1M allocated to the Hwy 1 vertical profile improvements (3% desired grade) with:
  - $ 6.9M – allocated to a 4-lane by-pass corridor during construction; and
  - $20.2M – allocated for removal of approximately 2km of the existing Hwy 1 corridor and replacement to meet a 6/8 lane freeway standard.
- $ 33.1M allocated as a 25% estimate for contingency, engineering and mobilization.
- $ 42.5M allocated for the cost of property acquisition involving 134.5 acres.

The net component of the costs related solely to the 3% grade improvement on either side of the interchange was determined to be $25M in construction costs and $25M for property, resulting in a total cost of approximately $50M.

In addition approximately $400K of improvements were related to the Highway 563 corridor associated with the adjacent Hwy 1/RR-31 and the Stoney Trail/Springbank interchange improvements.
12.2 Recommendations

It is recommended that…

1. The infrastructure improvements consistent with the *Highway 1 Interchange (Between Range Road 33 and Stoney Trail) Functional Planning Study* be received and approved by Alberta Transportation.

2. The City of Calgary and Rocky View County be informed that *Highway 1 Interchange (Between Range Road 33 and Stoney Trail) Functional Planning Study* represents a planning document and Highway 1 improvements are not currently scheduled.

3. The City of Calgary and Rocky View County be requested to incorporate the *Highway 1 Interchange (Between Range Road 33 and Stoney Trail) Functional Planning Study* within their planning documents (Municipal Development Plans and Area Structure Plans).

4. Subsequent to Alberta Transportation’s endorsement of the Highway 1 corridor and Hwy 1/RR-31 interchange functional designs, as recommended in the *Highway 1 Interchange (Between Range Road 33 and Stoney Trail) Functional Planning Study*, Alberta Transportation is encouraged to pursue those initiatives necessary to confirm the detailed engineering feasibility of the proposed “interim” and “long term” improvements. These activities would likely include, but are not limited to:
   a. Presenting to Rocky View County with the goal of seeking endorsement of those components of the functional plan that would proceed to detailed design.
   b. Initiating discussion regarding the jurisdictional transfer of Highway 563 corridor to Rocky View County.
   c. Responding to development driven initiatives to assure that access provisions are in accordance with the access management strategy presented within the Functional Plans.
   d. Developing individual detailed construction staging plans that would offer the flexibility to implement improvements along Highway 1 corridor when warranted.