



Inspiring sustainable thinking

**The Highway 63 / Highway 686 Parsons Interchange  
Challenges in Addressing the Demands of a changing Economic and  
Political Environment**

Prepared by:

Roy Biller, P.Eng., Manager, Highway Design and Construction,  
ISL Engineering and Land Services, Ltd.

Ian Pestano, P.Eng., CPESC, Project Engineer,  
ISL Engineering and Land Services, Ltd.

Paper prepared for presentation at the **Geometric Design** Session

of the 2014 Conference of the  
Transportation Association of Canada  
Montreal, Quebec

## ABSTRACT

Highway 63 is a 433 kilometre long provincial highway that connects the central area of Alberta to the oil sands in and around Fort McMurray. Within Fort McMurray, Highway 63 is a four lane divided Expressway running between Fort McMurray and the various oil sands developments north of Fort McMurray. Highway 686 is a proposed highway that will eventually extend west from of Fort McMurray to Highway 88 providing a connection to the settlements of Red Earth and mineral exploration areas in between. The expansion of the oil sands industry has resulted in the rapid growth of Fort McMurray and the need for expanded residential areas. One of the newly opened residential developments is the Parsons subdivision west of Highway 63, north of the present Fort McMurray and bisected by the proposed Highway 686 alignment. This highway will provide access for a proposed population of 25,000 people from the residential area to the City Centre and the industrial areas to the north. Functional planning for the Highway 63/Highway686 interchange calls for the development of a systems interchange to facilitate access to the proposed development to the west, as well as future development east of the Athabasca River.

This paper will discuss the evolutions of the original highway and interchange concept and examine its metamorphosis into the design that is currently under construction. The paper will examine how the demands of industry, local government, residential developers and local business brought about changes to strict Provincial Highway parameters and how fiscal reality further modified those concepts resulting in a staged facility that will grow with the community and evolved to further incorporate new ideas and community needs. The paper will describe the preparatory work that had to be completed in anticipation of the construction; the challenges to be faced as a result of the delays caused by project redesign and will discuss future challenges to be addressed as future stages develop.

## 1.0 Introduction

In 2009, the North Central Region of Alberta Transportation (AT) retained ISL Engineering and Land Services Ltd. (ISL) and EBA Engineering Consultants Ltd. (EBA), now known as Tetra Tech, to provide design services for a new systems interchange and East/West Connector Road to service the planned Parsons Creek Subdivision located north of the present Fort McMurray north corporate limits. The East/West Connector Road, identified as Highway 686, will provide access to the Parsons Creek Subdivision via two service interchanges.

In 2012, project cost constraints and accelerated timelines for industrial and commercial developments adjacent to the proposed Highway 63:11 and 63:12 Parsons Interchange resulted in a redesign of the interchange configuration in order to better accommodate the revised functional and budgetary requirements.

The redesigned interchange configuration is referred to as the “Hybrid Design” and presents the various required modifications to the original 2011 Parsons Creek design.

### 1.1 BACKGROUND

The functional planning study by Stantec Consulting Ltd. (Stantec) entitled “East/West Connector and Highway 63 Interchange (May 2009)”, identified the requirement for development of additional access and roadways to accommodate the Parsons Creek subdivision, a new mixed use node (residential, commercial, recreational). An analysis of the adjacent Thickwood Boulevard and Confederation Way road network found that there was insufficient capacity to accommodate the Parsons Creek subdivision or any other developments, including the future connection to the planned Highway 686 corridor [1]. The study recommended construction of a new interchange and east/west connector to provide access for the Parsons Creek subdivision and realignment of the proposed Highway 686 corridor to connect to the new interchange.

Highway 63 in the area of the planned interchange is presently a four lane divided facility providing access to several oil sands mining and extraction sites north of Fort McMurray. The interchange will be designed to accommodate high loads running north and south along Highway 63 including additional high load bypass lanes.

Stantec’s functional planning study recommended realignment of approximately 4.5 kilometres of Highway 63 to the east of the existing alignment to reduce the impact of the future interchange ramp construction on the west valley wall and to reduce the amount of excavation required. Highway 63 is currently located at the base of the west valley wall of the Athabasca River, along a ledge that is higher than the lands directly to the east. The top of the west valley wall is approximately 80m higher than the existing Highway 63 elevation.

## 2.0 Design Challenges

### 2.1 Project Constraints

The interchange location, configuration and alignment present a number of technical, logistical and environmental challenges.

The interchange was to be located at the base of the west upper bank of the Athabasca River. In order to reduce the impact of the interchange on the escarpment, approximately 4.5 kilometres of Highway 63 will be relocated east of the present alignment away from the toe of the slope and into a lower wetter area that is crisscrossed by old drainage channels and beaver ponds. Highway 686 will climb from the interchange to the uplands generally along a minor drainage course until it reaches the top of bank. From that point the Highway will traverse the upland wetlands through the proposed Parsons Creek development area. Traversing these areas will result in a considerable amount of environmental mitigation and compensation for lost wetlands and wildlife habitat.

The realignment of Highway 63, along with access managements to the highway will impact the existing ECCO Park industrial area, immediately west of the highway, along with Sunset Salvage and Bishop Auto Salvage. Access to the CBC radio tower and the ET Energy facility will also be affected as a result of the interchange.

Both highway alignments will significantly impact existing utilities resulting in the need to relocate several pipelines, power lines, and communication lines. There may also be an impact on the existing underground services to the developed areas along the highway.

### 2.2 Original Design Criteria

When the project began in 2009 the design was based on Stantec's 2009 Functional Plan. The interchange was to be built in two (2) stages: Stage 1 and the Ultimate. Figure 1 shows the alignment of the 2011 design of Stage 1 and Ultimate Stage.

#### 2.2.1 Stage 1 (2011)

The East/West Connector will be part of the planned Highway 686 corridor between Red Earth and Fort McMurray. Based on traffic projections for the Parsons Creek subdivision, the East / West Connector route and the requirement for local access an interchange configuration with free flow directional ramps for northbound (NB) to westbound (WB) and eastbound (EB) to NB was recommended.

The proposed relocated Highway 63 through this area was to be constructed to a six (6)-lane divided standard in Stage 1 with provisions to widen both northbound and southbound carriageways to the inside by one 3.7m lane in the future. A southbound (SB) collector distributor (CD) road was also proposed in Stage 1 to the west of Highway 63 at a 45m  $\varnothing$  to  $\varnothing$  separation.

The East/West Connector (Highway 686) was to be graded to six lanes and paved to a four lane divided facility in Stage 1. The two proposed loop ramps located on the west side of the proposed interchange were also to be constructed in Stage 1.

The initial stage 1 (2011) of the Parsons Creek Interchange was a cloverleaf hybrid design. Table 1 summarizes the design characteristics.

Table 1: Stage 1 Design Characteristics

Design Criteria	Description
Highway 63 Design Designation	Rural Freeway Divided (RFD) 616.6-130
Highway 686 Design Designation	RFD-412.4-110
Design Speed	
Highway 63 Mainline	130km/h
Highway 686 Mainline	70-110km/h
Direction Ramps	70km/h
Loop Ramps	50km/h

Some notable geometric features of Stage 1 are as follows:

- No CD road between loops in south half of interchange; undesirable
- Steep (6.0%) grade west of interchange
- Critical weaving section on bridge between loop ramps
- 5 Bridge Structures
- High load access accommodated
- Accommodate a population of 18,000 people in the Parsons Subdivision

### 2.2.2 Ultimate Stage (2011)

In the initial Ultimate Stage, Highway 63 will be widened to the inside by a 3.7m lane on both the NBL's and SBL's. The CD road will not require any further expansion in the long term stage.

In the Ultimate Stage, Parsons Road at the interchange is designed be upgraded to an eight lane facility with a bridge constructed to extend Highway 686 to the east across the Athabasca River. The posted speed of Parsons Road through the interchange will also be upgraded to 110km/hr. The Ultimate Stage was also a cloverleaf hybrid design interchange. Table 2 summarizes the design characteristics.

Table 2: Ultimate Stage Design Characteristics

Design Criteria	Description
Highway 63 Design Designation	RFD 820.8-130
Highway 686 Design Designation	RFD-616.6-110
Design Speed	
Highway 63 Mainline	130km/h
Highway 686 Mainline	70-110km/h
Direction Ramps	70km/h
Loop Ramps	50km/h

Some notable geometric features of the Ultimate Stage are as follows:

- Loop in SE quadrant replaced by directional ramp
- Steep (6.0%) grade west of interchange
- 9 Bridge Structures
- High load access accommodated
- Accommodate a population of 30,000 in the Parsons Subdivision

## 3.0 INDUSTRY DEMANDS

### 3.1 Tender 2011

In addition to satisfying Alberta Transportation's guidelines, ISL had to consult with the other stakeholders within the project areas to ensure that the proposed interchange would be able to satisfy their needs. The other stakeholders included the Regional Municipality of Wood Buffalo (RMWB), Alberta Infrastructure (INFRA), and the Oil Sands Secretariat (OSS).

The original functional planning study for this project estimated the costs to be approximately \$339 Million excluding all land except for the property required from the Taiga Nova Industrial Park. ISL held a value engineering session with experts and some modifications were made to improve capacity and reduce future upgrading costs. ISL's preliminary estimate, excluding costs for engineering, utilities, land, clearing, and preload grading, was approximately \$373 Million.

The Parsons Creek Interchange was then tendered in July 2011. The Low Qualified Tender (LQT) cost including contingency, was approximately \$465 million. The LQT was 15% above ISL'S pre-tender estimate. A major contributing factor common to the increased construction costs was the aggregate related components for this project. The Fort McMurray region has a history of marginal and limited aggregate supplies. Due to the significance of the aggregate requirements for this project (ACP, GBC, and concrete), the cost of aggregate supply as determined by the bidders appears to have had a significant influence on pricing.

Even though AT already committed \$100 Million to the project for utility relocations, right-of-way acquisitions, and previous tenders they decided not to award it. The LQT was \$165 Million over the Treasury Board's budget. Table 3 summarizes the cost estimates and budgets.

Table 3: Summary of Cost Estimates

Interchange Cost Estimate	Estimate (Millions)
Stantec's Functional Planning Estimate	\$339
ISL's Preliminary Design Estimate	\$373
Treasury Board Budget	\$300
ISL's Pre- tender Estimate	\$405
2011 Low Tender including 10% contingency	\$444
Low Qualified Tender including 10% Contingency	\$465

### 3.2 Rural Municipality of Wood Buffalo (RMWB) Design

In the fall of 2011, the RMWB indicated a strong desire to have the interchange redesigned to allow more room for a Power Centre on the east side of the interchange. They indicated they wanted design standards reduced to a maximum 90 km/h design speed. This resulted in a major redesign.

RMWB's design consultant produced a design which they estimated would cost approximately \$300 Million, just within the bounds of the original Treasury Department approval.

The RMWB's design was significantly stripped down from the original version, and only provide basic access to Parsons Creek subdivision. The estimated \$300 Million total project cost allowed for a much scaled back interchange. ISL reviewed the RMWB's design and determined many components would not be constructed. Table 4 summarizes the cost analysis of the project components.

Table 4: Summary of Unconstructed Components of RMWB's Design (in Order of Priority)

Number	Item	Cost ( in Millions)	Cumulative Cost (in Millions)
1	Basic interchange	\$300.00	\$300.00
2	Taiga Nova Underpass and local service road and convert Tempo to Right In/Right Out	\$ 13.70	\$313.70
3	Extend undivided Highway 686 from East Parsons Interchange to west intersection.	\$ 11.60	\$ 325.30
4	NB CD Road and NB-WB Loop	\$ 2.70	\$ 328.00
5	Highway 686 EB Divided Lanes & EB Bridge	\$ 53.50	\$ 381.50
6	Bus on Shoulder	\$ 5.00	\$ 386.50

RMWB's design had a basic Interchange (1) and included leaving the existing Tempo intersection with signals in place; 4-lane divided cross section on Hwy 63; over-dimensional bypass (includes temporary NB-WB ramp); SB-WB ramps; 1 bridge across Hwy 63 (future WB bridge, using shoulders for additional lanes); 4 lane undivided urban cross section on Hwy 686 west to East Parsons Interchange. The RMWB's design is shown in Figure 2.

With the RWMB's design the most critical component missed was item 2, which allowed the removal of the signals at the old Tempo intersection (Taiga Nova). With the signals left in place on Highway 63, traffic would continue to be backed up through the two new interchanges recently constructed at Confederation Way and Thickwood Boulevard, and queues would grow even more intolerable.

RMWB's design did not extend the undivided Highway 686 from East Parsons Interchange to the west intersections. By implementing Item 3, it would extend Highway 686 to a local access road being constructed by the RMWB, allowing easier access to the whole subdivision.

In the RMWB's design the NB CD Road and NB-WB Loop would not be constructed (Item 4). Item 4 allows for free flow NB to WB movement from Highway 63, enabling removal of signals at the east intersection, which essentially also makes the EB-NB movement free flow, resulting in considerably better overall capacity and operation of the interchange.

The RMWB's design was missing the Highway 686 EB Divided Lanes and EB Bridge (Item 5). Item 5 allowed for full undivided access between the East Parsons Interchange and the Parsons Creek Interchange, resulting in improved capacity on both interchanges. The RMWB's design did not allow for bus on shoulder operation (Item 6) which was a desire of the RMWB to further implement their bus priority system.

### 3.3 Hybrid Design

Three (3) workshops involving AT, INFRA, RMWB, OSS, Stantec, and ISL were held. From the workshops a design was completed that combined the original and RMWB's. The final redesign was renamed the "Hybrid Design" and the alignment can be seen in Figure 3 to 5. The Hybrid Design was a cloverleaf hybrid interchange. Table 5 summarizes the design characteristics.

Design Criteria	Description
Highway 63 Design Designation	RFD 412.4-90 (Stage 1) RFD 616.6-90 (Ultimate Stage)
Highway 686 Design Designation	RFD 412.4-90 (Stage 1) RFD-616.6-90 (Ultimate Stage)
Design Speed	
Highway 63 Mainline	90km/h
Highway 686 Mainline	70-90km/h
Direction Ramps	70km/h
Loop Ramps	50km/h

Some notable geometric features of the hybrid design are as follows:

- Loop in SE quadrant replaced by directional ramp
- Steep (7.95%) grade west of interchange
- 7 Bridge Structures (3 for Stage 1; 4 for Ultimate Stage)
- High load access accommodated
- Accommodate a population of 18,000 people for Stage 1 and 25,000 people for the Ultimate

The Hybrid Design features a realignment of Highway 63 approximately midway between the existing Highway and the realignment previously designed in 2011. The new interchange configuration, in its ultimate stage will consist of NB and SB CD roads paralleling Highway 63; loop ramps on the NW, SW, and SE quadrants; and a directional ramp for the NB to WB movement. In the initial interchange configuration, the directional ramp would not be constructed and the NB to WB turning movement would be accommodated by a temporary 2-lane loop ramp in the NW quadrant of the interchange. The SE loop ramp would not be constructed either and the EB to NB turning movement would be accommodated by a signalized intersection along Highway 686 to the east of the interchange. As part of budget restraints the two loop ramps on the west side of Highway 63 and the east Highway 63 frontage road connection to the south will not be constructed.

One of the biggest concern with the Hybrid Design was that the existing Highway 63 Tempo Intersection signals would remain in place and the previously designed service road connection between the east and west frontage roads beneath a re-profiled/realigned Highway 63 would not be constructed. However, the profile of Highway 63 was designed and will be constructed to accommodate the construction of the future local grade separation.

Bridge Files (BF) 85178E and 85178W were reduced to 3 span structures for the Hybrid Design. The 3-span structures will accommodate the CD roads in both directions along Highway 63. BF 85180NW1 and 85179NW1 were no longer required in the Hybrid Design.

A reduction in design speed was required for the Hybrid Design. The lower design speed allows for steeper vertical grades, bus lane on shoulders, and shorter curve radii.

To reduce construction costs the construction of the Hybrid Design will be completed in two stages In Stage 1 the Highway 63 project limits be shortened by 2.2 km and on Highway 686 the projects limits will also be shortened by 2.2 km. The revised Stage 1 construction costs will be in line with the Treasury Boards budget of \$300. The Ultimate Stage Hybrid Design had a cost estimate of \$369 Million which includes engineering, ROW acquisitions, utility adjustments, and other contract works.



## 4.0 Preparatory Work

Before construction could begin and to reduce the number of claims during construction several items had to be completed ahead. ISL and EBA completed the utility relocations, geotechnical investigation, environmental assessment, and historical overview.

### 4.1 Utility Relocations

#### 4.1.1 Background

In order to accommodate construction of the Highway 63 Parsons Creek Interchange, existing utilities had to be relocated. These utilities included an Enbridge underground pipeline, ATCO Electric overhead power lines and underground lines of Shaw Cable (Shaw), Suncor Pipeline, and TELUS Communications (TELUS).

Throughout the duration of the project, ISL attempted to get the utility companies to relocate their facilities prior to the highway construction. AT's preference was to have all the utility relocations completed prior to construction to avoid delays and any claims from the Contractor [2]. Some utility companies were willing to relocate prior, but others would not begin until the start of the highway construction.

#### 4.1.2 Pipelines

##### 4.1.2.1 Pipelines Highway 63

Enbridge and Suncor's pipelines were located in their right-of-way (ROW). The new highway fills (up to 22m, average 10m) were extending over the existing pipelines. From the start of discussions with the pipeline companies, it was determined that placing large amounts of fill material over the unprotected pipeline for a 1500m section was not a viable option on Highway 63. If the pipelines were placed under high fills, the pipeline companies would not have access to their pipelines. Enbridge and Suncor decided to relocate their lines to a new pipeline corridor that paralleled the realigned Highway 63 and avoided the new interchange footprint. The pipeline corridor alignment can be seen in Figure 1.

The previous pipeline ROW accommodated one (1) Enbridge 762mm (Line 19) diameter high vapour pressure (HVP) pipeline and one (1) Suncor 273mm diameter. A second Enbridge 762mm diameter pipeline (Line 18) for crude oil was to be installed and in operation prior to October 2012. Enbridge stated many times during that Line 18 had to be operational in October 2012 otherwise they would be facing extreme liquidated damages with Suncor (their client).

Utility coordination was a challenge because of the time restriction. Enbridge and Suncor intended to have the pipeline adjustments on Highway 63 and Highway 686 commence in December 2010 with completion scheduled by December 2012 at the latest. During the pipeline relocation Enbridge and Suncor faced the following challenges:

- Delay of the original June 2011 tender. The tender was not awarded on time and delayed the pipeline relocations
- Enbridge had to tie-in their pipelines during a plant shutdown. A request for a shutdown had to be put in a year ahead.
- The relocation work could only be completed during winter months because of wet conditions during the spring and summer
- More rock drilling than anticipated

Despite being delayed, the pipeline relocations were completed before the start of road construction and completed within 5% of their budget.

#### 4.1.2.2 Pipeline Highway 686

Suncor has two pipelines (273mm and 406mm diameter) that cross the proposed Highway 686 alignment at approximately km 48.780. The 273mm diameter pipeline supplies natural gas to the Suncor Plant and the Fort McMurray area. The 406mm diameter pipeline carries HVP products and is currently not being used.

The construction of Highway 686 required over 24m of excavation and the Suncor pipeline need to be lowered. Suncor lowered the pipelines by directional drill. The lowering of the 273mm pipeline was supposed to be completed during the 2011 summer months when the demand for natural gas was low.

On August 2011, Suncor was late in commencing the relocations because their supply chain had difficulties in their request for proposals from their preferred contractors. The pipeline relocations started in September 2011 and expected to conflict with the highway construction. Suncor completed the relocation in December 2011. Fortunately the highway construction was not yet underway and there were no utility conflicts.

#### 4.1.3 Power Lines

##### 4.1.3.1 Highway 63

ATCO Electric had overhead power lines that paralleled Highway 63 on the west side up to the substation (km 19.600) and up to the Sunset Salvage yard (km 20.100) on the east side. There were twelve (12) underground lines that crossed Highway 63:11 at approximately km 19.600.

The east side overhead power lines were in conflict with the Highway 63 realignment. ATCO Electric rerouted the eastside power lines to the west side of the existing Highway 63 alignment. The intent was to run the lines underground across Highway 63 and continue underground along the west side of the existing alignment to provide a source of power for the interchange lighting requirements.

The ATCO Electric relocations started in November 2012 and were completed June 2013. For ATCO Electric the power line relocations were not a priority because the Highway 63 project had not been tendered. However, the ATCO Electric power line relocations took longer than expected because of cold winter conditions and considerably more rock drilling.

Despite being delayed, the Highway 63 ATCO Electric relocations were completed before the start of road construction and completed within 1% of their budget.

##### 4.1.3.2 Highway 686

The ATCO Electric right-of-way crossed Highway 686 at three locations; at km 45.660, km 47.960, and km 48.780. The ROW has three separate power lines; 25kV, 144kV, and 240kV. The 25kV power lines can be buried at all three locations and the 144kV and 240kV will need to be raised to accommodate a 9.0m high load.

At km 45.660 three power lines cross the highway right-of-way in a general north/south direction. The highway ROW encroaches on the three corner towers located just north of the proposed alignment. The corner towers anchor a shift in the power line alignment to a more northeast/southwest direction. ATCO Electric is considering several alternative alignment options. Approval from Alberta Utilities Commission (AUC) to change the existing power line alignment took longer than 14 months.

At km 47.960 one 25kV and one 144kV power line cross the highway right-of-way at an oblique angle. The addition of the two interchanges on Highway 686 affected the way ATCO Electric will relocate their power lines at km 47.960. At km 48.780 one 25kV power line crosses the highway alignment and was buried to accommodate the highway.

On September 2013, ATCO advised that their relocation cost had increased more than 70%. The cost increased because of the following:

- Geotechnical unknowns
- Construction and material costs
- Missing applications dates
- Staff turnover
- Improper communication

ATCO is currently determining their final power line relocation alignments. In the meantime, ATCO has temporarily relocated their power lines to accommodate the highway and subdivision construction.

#### 4.1.4 Communications

TELUS and Shaw had communications lines within the project area. TELUS had underground fibre optic and copper lines that paralleled Highway 63 on the west and east side. There were four (4) TELUS crossings of the existing alignment within the project limits; Highway 63:11 at approximate km 18.750 and km 20.100 and Highway 63:12 at approximate km 0.470 and km 1.900. TELUS only relocated their east facilities as the west side facilities were not in conflict with the construction.

Shaw Cable had one underground fibre optic line that paralleled the existing Highway 63 alignment on the east side. The fibre optic line conflicted with the Highway 63:11 realignment between km 18.300 and 20.100. TELUS and Shaw decided it would be more efficient if the relocations were completed together as opposed to relocating separately. Relocation started late September 2013 and were completed February 2014. Although, TELUS and Shaw were given several years notice they did not start the relocations until the project was tendered and awarded. They did not make the project a priority until the highway construction began. TELUS was informed that any claims that AT received would be passed onto them.

TELUS and Shaw were delayed by the following:

- Could not obtain a crossing agreement from Suncor to install their facilities above the pipeline
- Did not have a set alignment
- Difficulty working in limestone
- Staff turnover

Despite completing the relocations in February 2014, TELUS and Shaw coordinated their relocations with the highway contractor so there would be no construction conflict.

## 4.2 ENVIRONMENTAL

The project area is located within the Athabasca River valley. An environmental and wetland assessment was required in order to gather information on wildlife usage, rare plants, wetland identification and classification, fish and fish habitat, soils profiles and potential borrow pit locations.

EBA completed the assessment and identified seven watercourses within the project area: Unnamed Creeks 1 through 5, Parsons Creek, and Goats Head Creek. The watercourses were identified as a Class C [3].

In addition to the watercourses, there were 17 wetlands identified. Four wetlands east of the interchange and 13 along the Highway 686 alignment. Fish were found in the four wetlands east of the interchange. The construction of the highway and interchanges required realignment of two creeks and modifications of the wetlands. ISL and EBA had to ensure that the proper approvals were in place from the Fisheries and Oceans Canada, Canadian Environment Assessment Act (CEAA), Water Act Approval, and Alberta Environment [4]. Generally it takes four to six months to receive the proper environmental approvals.

## 4.3 GEOTECHNICAL

### 4.3.1 Site Conditions

EBA completed the geotechnical assessment for the proposed Parsons Road Interchange in 2010 based on the original approved design. A separate geotechnical assessment was conducted and completed in 2012 based on the revised Hybrid design configuration. A background review, field investigation, laboratory testing and preliminary assessment for the proposed interchange were conducted. The project limits were divided into three main areas:

- A lowland area located west of the Athabasca River and east of the Athabasca River valley slope. This area consists primarily of clay with interbedded silt and sand deposits. These clay deposits are typically very soft to firm and have a low shear strength. The clay is generally normally consolidated to lightly over-consolidated and translates into large settlements with embankment construction. Limestone bedrock underlies the overburden soil. The top of bedrock throughout the lowland area is variable, ranging in depth from 3 to 14 m below existing grade. Drastic variations in bedrock elevation can occur over relatively short (i.e., less than 50 m) distances. The limestone bedrock contains pockets of clay shale. The limestone is generally moderately strong to strong, while the clay shale is generally extremely weak to weak. Groundwater is typically between 1 and 2 m below existing grade in this area [5]
- The Athabasca River valley slopes consist of a relatively thin colluvial clay and silt that overlies clay shale bedrock. The clay shale bedrock is extremely weak to very weak and is high plastic [5]
- An upland area is located west of the top of the Athabasca River valley slope. This area consists primarily of clay and clay till overlying the clay shale bedrock. The clay and clay till varies from being firm to stiff and is generally moist [5]

### 4.3.2 Geotechnical Assessment - General

Based on the results of the field investigation and laboratory testing completed, the primary geotechnical concerns within the interchange site are due to the soft, compressible clay and silt located within the lowlands area.

Large settlements, in the range of 300 to 1,400 mm are expected due to the construction of 8 to 22 m high embankments [6]. These settlements could take upwards of 25 years to complete if no precautions are taken to increase the rate of settlement. Additional secondary settlement is also expected to occur over the design life of the interchange. While secondary settlement will be significantly smaller than the primary settlements; secondary settlement estimated over the life of the interchange is in the order of 50 to 180 mm [6]. In addition to the settlement concern with the poor subgrade soils, stability of the high embankments is also a concern, particularly if fill is placed rapidly [6].

During the background review it was observed that foundation design parameters for the limestone bedrock could be increased from values that have historically been used. Laboratory testing and review of rock socket design procedures indicated that pile design resistance parameters could potentially be doubled.

### 4.3.3 Construction

Numerous geotechnical challenges were associated with the design and construction of this interchange. The geotechnical recommendations provided were intended to permit construction of the interchange within the proposed timeline and provide options to be considered in efforts to reduce construction costs.

#### 4.3.3.1 High Embankments

The slope stability of the large cut through the Athabasca River valley is considered an area of geotechnical concern [7]. The greatest concern with respect to the slope stability of the large cut is the stability during the excavation process. Careful planning of the excavation sequence is thus critical.

The fill placement for the embankments within the lowland area will occur as soon as possible, to allow for settlements to begin. A surcharge load should also be placed over the embankments to assist with the settlement process. Settlement that occurs prior to construction will provide increased benefits by decreasing long term

maintenance costs and reducing the risk of slope failures. Settlement monitoring below the high embankments was recommended and considerations for long term settlement monitoring to measure secondary settlement should be accounted for in the design of the monitoring instrumentation installed.

The slope stability required that embankments greater than 5m in height be constructed in a controlled manner. ISL specified that the fill placement not exceed 1m vertically per week and that geotechnical instrumentation be installed to further reduce the potential for developing embankment instability.

#### **4.3.3.2 High Cut Slope through Athabasca River Valley**

Analysis indicated that the backslopes for the large cut may be designed at an angle of 6H:1V. In addition to this slope angle, 5 m wide benches will be installed every 10 m of vertical slope height [7]. The purpose of the benches is to allow access for maintenance equipment if needed and will also provide a location to install slope inclinometers for long term monitoring of this back slope.

#### **4.3.3.3 Highway Construction**

The Highway 63 alignment will be constructed from earthwork material obtained from the Athabasca River Valley cut slopes. The embankment will be constructed using generally accepted construction practices. The material from the cut slopes is mostly clay shale and clay till [5].

For the Highway 686 alignment passing through the uplands area and through the big cut along the Athabasca River valley slope, embankment construction will follow generally accepted construction practice and the Alberta Transportation specifications. As the subgrade is soft and wet throughout this area and generally does not improve with depth, placement of geotextile along the top of the subgrade will be used [7]. Alternatively, attempting to bridge the subgrade with embankment fill placed with bulldozers may also be considered. There is an increased risk with attempting to bridge the material that the subgrade and embankment fill will intermix and the embankment fill will begin to rut and require additional rework prior to being able to continue construction of the embankment.

### **4.4 HISTORICAL**

The undisturbed, forested portions of the project area exhibit high potential for the existence of intact evidence of historic or prehistoric occupation [8]. The section of land is listed as HRV4 and HRV5 on the Government of Alberta's Listing of Significant Historical Sites and Areas and requires historical resource studies [8]. The Historic Resources Management Branch recommended that a Historical Resources Impact Assessment (HRIA) for archaeological resources is necessary for this project prior to development proceeding.

No new archaeological, historical or paleontological sites were discovered during the HRIA. Alberta Western Heritage recommended that no further archaeological investigations or assessments were required for the Parsons Fringe Area provided that the proposed development boundaries were not significantly altered from those identified in their report [8]. They recommend that the proposed development proceeds as planned without further concern for archaeological, historical or paleontological sites.

## 5.0 Challenges Due to the Delays

### 5.1 MULTIPLE CONTRACTS

As expected, the delay of the construction of Highway 63 caused some challenges. With the redesigns and budget constraints the project was separated into 4 different construction contracts.

#### 5.1.1 2011 Contract 10907 Preload

Due to the large fills required for the bridge abutments, Contract 10907 was initiated prior to overall construction to preload the bridge abutment. Contract 10907 started in March 2011 and was completed May 31, 2011. Tree clearings and erosion and sediment control (ESC) installations were also included in the Contract. For Contract 10907 there were two construction sites: the preloading of the future Highway 63/686 east bridge abutments and a new borrow pit west of Highway 63, south of Unnamed Creek 5.

Contract 10907 was not administered by ISL. AT put a request for proposals for the construction administration and Stantec was the successful consultant. Stantec and ISL were to work together to ensure the Preload Contract finished quantities were included in the July 2011 tender. If work were not completed in the Preload Contract, then it would be included in the July 2011 tender. ISL had difficulty receiving fill placements as-constructed quantities and borrow pit sizing which was required in the Highway 63 July 2011 tender.

#### 5.1.2 2012 Contract 13341 Materials Replacement

The original Highway 63 Parson Creek interchange tender had an October 31, 2011 interim completion date for material replacement within the pipeline corridor and Enbridge's new valve station. With the tender not being awarded, and the work not completed, relocation of Suncor and Enbridge's pipeline was subsequently delayed. Enbridge was adamant that their Line 18 had to be installed and in service by October 2012 because of commitments they made to their client (Suncor). Earlier in the relocation process Enbridge wanted to complete the material removal, but AT stated their Highway contractor would remove the material to keep the pipeline relocations cost down.

After many meetings, AT released a Materials Replacement Contract to avoid any further delays to the pipeline relocations. Contract 13341 started March 28, 2012 and was completed June 30, 2012 to the satisfaction of Enbridge.

#### 5.1.3 2012 Contract 13792 Storm Water Management Facility (SWMF)

Since 2010 the project area has been disturbed by tree clearing, borrow pit excavations, and material movement. These construction activities have made the site prone to erosion and sediment release. There was evidence of sediment release to the creeks and wetlands throughout the project area in 2011.

The construction of the SWMF was advanced to reduce the impacts that the spring run-off had on the project site. Contract 13792 for the construction of the SMWF was advertised in the summer of 2012. The scope of work for Contract 13792 included the following and was completed January 31, 2013:

- Construction of interchange storm water management facility and river outfall
- Grading for service road
- Grading for interchange bridge abutment and wick drain pad
- Supply and installation of vertical wick drains and horizontal strip drains

### **5.1.4 2013 Contract 14301 Parsons Creek Interchange at Junction Highway 63 and Highway 686 North of Fort McMurray**

Contract 14301 was for the construction of the hybrid design. Contract 14301 was awarded to Sureway on October 2013 and is currently under construction. Current construction issues:

- Coordinating with other contractors (South Rock and Graham)
- Traffic accommodation
- Weather

## **5.2 Sequencing of Construction**

Highway 63 is a continuous road with multiple contractors working along its length. If the Parsons Creek Interchange Contract had been awarded in 2011 the construction would have been finishing up in 2014. The travelling public will now have to wait until 2016 before traffic patterns return to normal.

The delay of the Parsons Creek Interchange construction has also delayed other projects on Highway 63, Highway 686, and subdivision development.

## **5.3 Coordinating Construction with Other Contractors**

### **5.3.1 Hwy 686 East Interchange Contractor**

With AT's budget restriction, the projects limits for Highway 686 were reduced by approximately 2.20 km which meant the east interchange would not be constructed. INFRA's Parsons Creek Subdivision construction is progressing well and will require Highway 686 be extended to at least to km 47.500 and the interchange to be constructed.

INFRA saw a need for the East Interchange and wanted it constructed so they could proceed with the subdivision development. AT did not have the funding for the construction and INFRA decided they would construct the East interchange. INFRA awarded a Contract for the construction of the East Interchange on Highway 686 to Innovative Civil Constructors Inc. (ICI2). ICI will have to coordinate their construction with Sureway (Contract 14301 Contractor). With the projects so close together this has caused challenges in defining the construction limits (there is the potential for overlap), working space, and surface water management.

### **5.3.2 Thickwood and Confederation Interchange Contractors**

In addition to the East Interchange Contractors, Sureway has to coordinate their work with the Thickwood and Confederation Interchange Contractors. All the Contractors are using the same borrow pit but at different sections. At times there have been disputes between contractors with respect to defining their responsibilities and work areas.

Also there have been discussions to ensure that their construction activities do not affect each other in a negative way. Over the winter of 2013-2014, the other Contractors were to install the proper ESC measures prior to the spring run-off. The other Contractors did not complete the work before they left for the winter break and this made Sureway concerned that they would be responsible for additional ESC measures and would get the blame for sediment releases. Sureway's construction is the closest to the Athabasca River and it is possible authorities could blame just Sureway.

## **6.0 Future Challenges**

### **6.1 Construction of Ultimate Design**

The Construction of the Ultimate design will be challenging because there may not be enough working space for the Contractor to build the service roads and install the future under pass. The fill placement of the underpass will be completed as part of the Stage 1 construction. Constructing an underpass when the fill is already in place and when there is existing traffic above it will be very difficult. The Contractor will have to determine a construction method that will ensure the safety on their workers and the travelling public. Future construction of the underpass will be more costly than if it had been constructed in Stage 1.

During the Ultimate Stage of the Hybrid Design, the six-lane expansion of Highway 63 and the reconfiguration and extension of Highway 686 will be challenging. Construction the Ultimate Stage involve more traffic accommodation than constructing on a green field site. The fills for the Ultimate Stage of Highway 686 will be placed in Stage 1, but constructing it when traffic is already using other parts of Highway 686 will be challenging. As a result it is anticipated that construction costs will be much higher.

### **6.2 Accommodating Expansion of RMWB Development (Industrial/Commercial)**

The RMWB has indicated that they want to develop lands to the east of Highway 63 for an Industrial/Commercial Centre. The Hybrid interchange will allow access to the east, but has a bigger footprint than the RMWB's design. The RMWB will have the challenge of developing an area that is smaller but will meet the needs of their stakeholders.

### **6.3 Accommodating Mining Operation**

The construction of the Hybrid interchange encroaches on lands that were leased by the Graymont Western Canada and In-Land Aggregate Ltd. Limestone Mining (Graymont). The new interchange will it make challenging for Graymont to continue their mining operations. Graymont is used to having a larger undeveloped area to mine, but will have a smaller area to mine with traffic nearby.



## 7.0 Conclusion

The Hybrid Design will cause some future challenges to the construction of the Ultimate Stage interchange, RMWB Industrial Centre expansion east of Highway 63, and the operation of the Graymont and In-Land Aggregate Ltd. Mining. The Hybrid Designs also caused multiple construction contracts to be administered, construction sequencing challenges, and coordination issues with other contractors. In the end, the Hybrid Design gave Alberta Transportation an alignment that could be constructed within a budget of \$369 Million and was satisfactory to the industry demand.

## 8.0 References

1. Stantec. 2009. East/West Connector & Highway 63 Interchange Fort McMurray Urban Services Area Functional Planning Study Final Report. Prepared for Alberta Transportation.
2. Government of Alberta Transportation. 2011. Engineering Consulting Guidelines for Highway, Bridge, and Water Projects Volume 1 – Design and Tender.
3. EBA Engineering Consultants Ltd. 2011. Environmental Risk Assessment Highway 63:11/:12 Interchange at East-West Connector (Parsons Access Road). Prepared for Alberta Transportation.
4. EBA Engineering Consultants Ltd. 2010. Fish and Fish Habitat Assessment Highway 63:11/:12 Interchange at East-West Connector (Parsons Access Road). Prepared for Alberta Transportation.
5. EBA Engineering Consultants Ltd. 2011. Geotechnical Evaluation Highway 63:11/12 Realignment (63:11) km 19.0 to km 20.0 (63:12) km 0.0 to km 3.5 Parsons Road (Hwy 686) Interchange at Hwy 63:11/12 North of Fort McMurray, AB. Prepared for Alberta Transportation.
6. EBA Engineering Consultants Ltd. 2013. Geotechnical Evaluation Design of Parsons Creek interchange (Hwy 63:11/12, Hwy 686 and Interchange Ramps and Loops) Fort McMurray, AB. Prepared for Alberta Transportation.
7. EBA Engineering Consultants Ltd. 2011. Geotechnical Evaluation Hwy 686 Alignment km 46.0 to km 50.76 Parsons Road (Hwy 686) Interchange at Hwy 63:11/12 Fort McMurray, AB. Prepared for Alberta Transportation.
8. Alberta Western Heritage. 2008. Historical Resource Impact Assessment of the Parsons Creek Fringe Area, Fort McMurray, Alberta. Prepared for MMM Group Limited.

## 9.0 Figures

Figure 1: Highway 63 2011 Alignment



Figure 2: Highway 63 Alignment RMWB Design



Figure 3: Highway 63 Hybrid Design Alignment

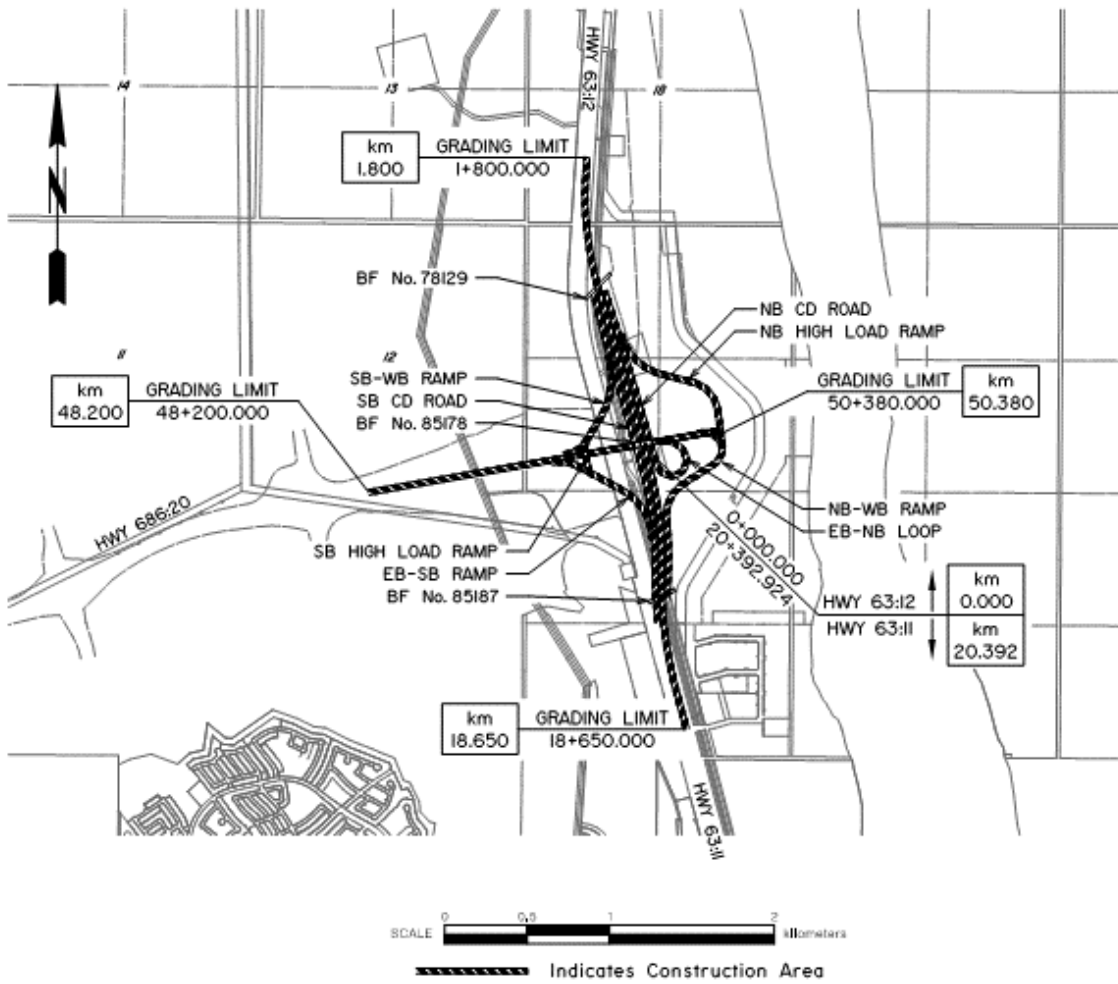


Figure 4: Highway 63 Hybrid Design Stage 1



Figure 5: Highway 63 Hybrid Design Ultimate Stage

