MORRISON HERSHFIELD

TECHNICAL APPENDIX

Transportation Master Plan

Town of Hinton 2008 Update

HINTON
Gateway to the Rockies

3084006.00 October 2010

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INTRODUCTION

The Town of Hinton Transportation Master Plan (TMP) Update provides supplementary guidance to the Town's strategic direction for the further development of its transportation networks, programs, and priorities.

The TMP Update –Technical Report / Appendix is a companion document that provides the technical and analytical supporting documentation referenced within the TMP Update.

The Technical report provides the analytical supporting documentation surrounding the TMP Update, the methodologies employed in the analysis, comparisons between the 1983 study parameters and the 2008 update. It also provides the technical mechanisms used to evaluate existing and future truck and dangerous goods route networks. The Technical report also provides the background on alternatives with respect to the potential future river crossings.

2.0 STUDY HORIZONS

2.1 COLLISION ANALYSIS

In December 2007, Alberta Transportation initiated a Safety and Operational Review for the segment of Highway 16 traversing through the Town of Hinton. The report examined Hinton's existing road network and historical traffic data, along with an in-depth review and analysis of collision data collected for the time-period 2000 to 2004. The basic collision information analysed in this report has been updated to reflect the 2005 and 2006 collisions, elsewhere in this chapter.

Within the study period, 136 collisions were recorded within the Town of Hinton limits, 66% of which occurred at intersections. However, the directions of travel of vehicles involved in collisions were not always provided. This would create an intricate problem in the process of analyzing the safety aspects of individual intersections and how they relate to Highway 16.

The report also noted that large portions of recorded collisions consist of rear end, animal strike and right angle type collisions (**Figure 2.3**), with the majority of rear end, and right angle collisions occurring at concentrated commercial areas.

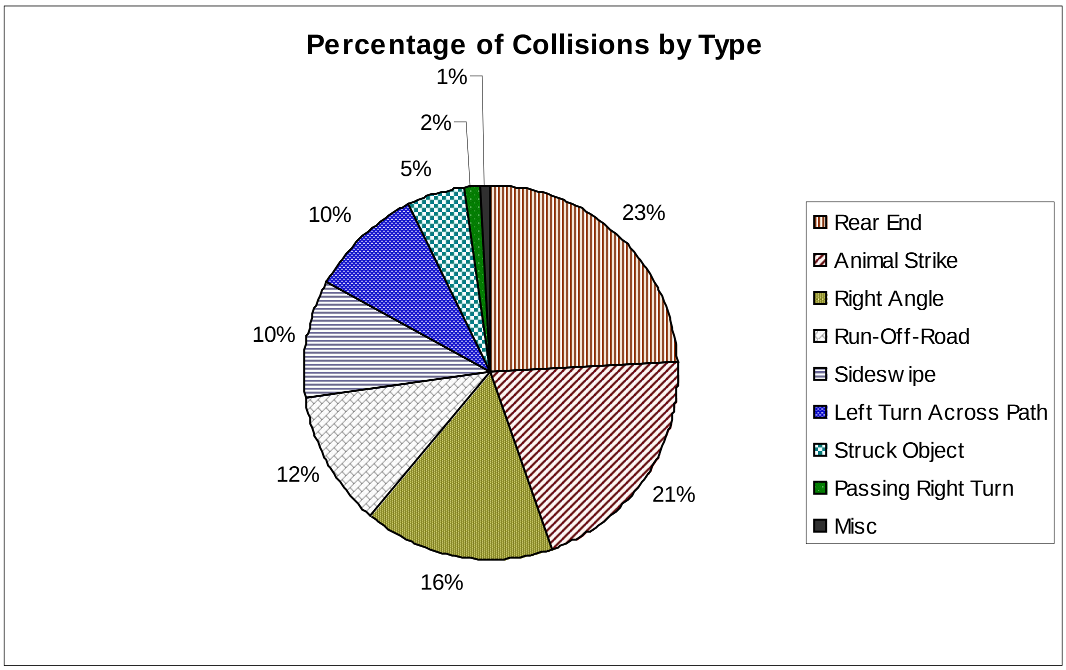


Figure 2.3 Type of Collisions along Highway 16

Table 2.2 Number of Collisions at Key Intersections (2000 – 2004)

Intersection	Total Number of Collisions
Park West Mall, East Access	11
Mountain Street	14
Jasper Street	11
Switzer Drive, West Junction	16
Switzer Drive, East Junction	13

Based upon the EBA analysis of collision data, as presented in the safety and operational report and through supplementary field observations and consultations, several options for the improvement of Highway 16 were produced. The first option involves enhancing the management of through traffic on the highway as well as the traffic entering and exiting the highway. Secondly, there is a need to consider how traffic generated by future developments shall be accommodated by the road network. Lastly, there is a need to improve the safety performance of the key intersections, as identified in **Figure 2.2**. Detailed improvement options are provided for specific intersections and sections of Highway 16 traversing through Hinton within the report.

The EBA report concluded that Highway 16 is performing well, relative to other comparative sections of highways that pass through urban areas. Currently, the highway is able to support existing and immediate future volumes at a high Level of Service. This, however, is largely dependent upon roadside development and future network configuration.

The report identified the improvements required for the existing road network in the Town to accommodate present traffic demands, or to improve traffic operations and safety, and were identified through a review of previous relevant traffic studies and completion of a capacity and Level of Service (LOS) analysis of existing traffic conditions.

2.2 COLLISION ANALYSIS – UPDATE

As part of the TMP – Update a collision review was undertaken. The review consisted of both the original EBA report, and an update to the actual collision data. As noted in the Report, conclusive causative analysis is not possible, however the review concluded the majority of the collisions (>70%) occurred in the proximity of the service roads.

Table 2.3 Number of Collisions at Key Intersections (2005 – 2006)

Intersection	Total Number of Collisions
Park West Mall, East Access (Carmichael Lane)	15
Mountain Street	8
Jasper Street	4
Switzer Drive, West Junction	6
Switzer Drive, East Junction	6
Eaton Road	5
Smith Street	3
Brookhart Street	2

2.3 LEVEL OF SERVICE

A detailed description of the Level of Service concept excerpted from the highway capacity manual is given in **Appendix A**.

The afternoon peak hour capacity analyses summary in **Table 2.5** indicates that the overall intersection Level of Services (LOS) was "A" to "B" and between "A" to "C" for all the approaches at identified key intersections. The analyses also indicate that the volume / capacity (v/c) ratio was 0/88 and lower for all approaches at the key intersections.

Table 2.6 provides a summary of the capacity analyses for the intersections within the site during the afternoon peak hour period for the existing condition. It should be noted that the existing roadways were coded into the Synchro® model. The Synchro® results also show the existing lane configuration for the analyzed intersections for the existing condition.

Synchro® capacity calculation worksheets are provided in **Appendix B**.

2.4 CAPACITY ANALYSIS OF EXISTING ROADWAYS

Results of the detailed capacity analysis are presented in **Table 2.6**. The through-traffic has been segmented into sub-sections between intersections.

Table 2.5 Level of Service Summary for Existing (2008-PM) Traffic Volumes

	Intersection	Type of Intersection Control	Level of Service (LOS) - V/C Ratio by Movement - Control Delay (sec)												
			Eastbound			Westbound			Northbound			Southbound			Overall Intersection LOS - Delay
			Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	
			A	A			A	A				C		C	A
1	Highway 16 & Drinnan Way	Un-signalized	0.21	0.11			0.06	0.04				0.51		0.51	
			8.7	0			0	0				15.6		15.6	6.1
				A	A	A	A		A		A				A
2	East River Road & Switzer Drive / Drinnan Way	Un-signalized		0.31	0.31	0.18	0.18		0.18		0.18				
				9.3	9.3	8.8	8.8		9.1		9.1				9.1
				B			A		B						B
3	Switzer Drive & Hardisty Avenue	Signalized		0.88			0.52		0.36						
				15.2			9.3		18.1						13.9
			A	A	A	A	A	A	B	B	B	C	C	C	A
4	Highway 16 & Felaber Road, Brookhart Street	Un-signalized	0.04	0.13	0.03	0.05	0.11	0.11	0.07	0.07	0.07	0.05	0.05	0.05	
			8.5	0	0	8.9	0	0	12.8	12.8	12.8	16.7	16.7	16.7	1.5
			A	A			A	A				D		D	A
5	Highway 16 &Fleming Drive	Un-Signalized	0.06	0.16			0.15	0.02				0.72		0.72	
			8.9	0			0	0				31.9		31.9	7.2
			B	B	A	C	B	A		A			A		B
6	Highway 16 & Mountain Street	Signalized	0.26	0.58	0.35	0.44	0.59	0.31		0.48			0.38		
			17.2	18	4	20.2	18	4.2		9.6			9		13.3
			B	B	A	C	B			B	A		A		B
7	Highway 16 & Switzer Drive	Signalized	0	0.49	0.6	0.57	0.49			0.51	0.12		0.01		
			14	17.8	4.9	22.1	17.8			10.2	2		5.5		12.5
			A	A	A	A	A	A	C	C	C	C	B	B	A
8	Highway 16 & Keil Drive	Un-signalized	0.01	0.16	0.01	0.02	0.17	0.01	0.15	0.15	0.15	0.09	0.04	0.04	
			9	0	0	8.9	0	0	16.8	16.8	16.8	22.6	11.8	11.8	1.5
			B	B			B	A				A		A	B
9	Highway 16 & Meier Street	Signalized	0.2	0.51			0.34	0.53				0.25		0.02	
			17.9	19.1			18.2	4.5				5.1		2.2	11.9
			A	A	A	A	A	A	B	B	B	B	B	B	A
10	Highway 16 & Highway 40	Un-signalized	0	0.1	0.01	0.06	0.14	0.08	0.11	0.11	0.11	0.04	0.04	0.04	
			8.2	0	0	8.3	0	0	10.5	10.5	10.5	15	15	15	2
			C	C	C	F	B	B	A	A	A	A	A	A	A
11	MacLeod Avenue & Mountain Street	Un-signalized / Stop Controls	0.31	0.23	0.23	0.9	0.35	0.35	0.04	0.12	0.12	0.05	0.05	0.05	
			24.1	15.7	15.7	77	13.6	13.6	35	0	0	4.2	0	0	21.1

Notes

Table 2.6 Existing Term (2008) Mainline Analysis

Roadway	Section From	Section To	Existing No. of Traffic Lanes Per Direction	Median Type Divided (D) / Undivided (U)	Capacity (V/h)	Volume EB/NB	Volume WB/SB	Remarks
Highway 16	Highway 40 S	Access 3 (Future Terrace Heights Access)	2	D	1600-2000	394	397	
	Access 3 (Future Terrace Heights Access)	Access 2 (Woodley Drive)	2	D	1600-2000	376	410	
	Access 2 (Woodley Drive)	Meier Street	2	D	1600-2000	386	389	
	Meier Street	Keil Drive	2	D	1600-2000	562	599	
	Keil Drive	Mountain Street	2	D	1600-2000	703	787	
	Mountain Street	Switzer Drive	2	D	1600-2000	840	857	
	Switzer Drive	McArdell Drive	2	D	1600-2000	564	469	
	McArdell Drive	Brookhart Street	2	D	1600-2000	470	510	
	Brookhart Street	Fleming Drive	2	D	1600-2000	-	-	
	Fleming Drive	Drinnan Way	2	D	1600-2000	516	511	
Switzer Drive	Highway 16	Robb Road	2	U	1600-2000	491	537	
	Robb Road	Kelley Road	2	D	1600-2000	472	630	Middle Turning Lane
	Kelley Road	Hardisty Avenue	1	U	800-1000	729	480	Middle Turning Lane
	Hardisty Avenue	Drinnan Way	1	U	800-1000	461	366	
Hardisty Avenue	Switzer Drive	Drinnan Way	2	U	1600-2000	322	168	Partially Divided (Switzer Drive to Drinnan Way
West River Road / Kelley Road	Terris Road (Yellowhead County)	Switzer Drive	1	U	800-1000	150	259	
Terris Road (Yellowhead County)	Highway 16	CN Railway ROW	1	U	800-1000	21	12	
Access 4 (Wanyandi Avenue Extension)	Keil Drive	MacLeod Avenue	-	-	-	-	-	
Access 3 (Future Terrace Heights Access)	Highway 16	Access 4 (Wanyandi Avenue Extension)	-	-	-	-	-	
Access 2 (Woodley Drive)	Highway 16	Access 4 (Wanyandi Avenue Extension)	-	-	-	-	-	
Keil Drive	Highway 16	Access 4 (Wanyandi Avenue Extension)	-	-	-	-	-	
Mountain Street	Highway 16	MacLeod Avenue	2	U	1600-2000	276	278	
Robb Road	Switzer Drive	Mountain Street	1	U	800-1000	95	241	
	Mountain Street	Town Boundary (South)	1	U	800-1000	13	6	
Sawyer Road	Robb Road	Highway 16	-	-	-	-	-	
McArdell Drive	Highway 16	Sawyer Road	1	U	800-1000	18	71	
Brookhart Street	Highway 16	Sawyer Road	1	U	800-1000	96	90	
Innovista Road	Highway 16	Sawyer Road	-	-	-	-	-	
Drinnan Way	Highway 16	Hardisty Avenue	1	U	800-1000	294	324	
	Hardisty Avenue	Switzer Drive	1	U	800-1000	95	142	
East River Road	Drinnan Way	East Town Boundary	1	U	800-1000	150	117	

Notes: Locations listed with light grey text have not yet been constructed and are listed as future roadways.

3.0 FUTURE STATE

The two planning horizons reviewed include the intermediate horizon, and the long-term or ultimate planning horizon. These scenarios, and not necessarily time-periods include population projections of ***20,500*** people, subject to specified assumptions and ***31,500*** people respectively, at ultimate build-out. By the intermediate planning horizon, traffic volumes are forecast to have doubled and are forecast to triple by the ultimate planning horizon.

The major network change, between the 1983 Transportation master Plan and the 2008 Update Report is the elimination of the East / West connector through Terrace Heights. This decision was made as part of the Terrace Heights Traffic Impact Assessment (TIA).

A supplementary scenario that re-introduces the South Connector, and addresses the points noted above has been included in Section 6.2. Additionally, In Section 6.3 alternate scenarios that explore potential development on the north side of the river, and the potential impacts to the transportation network have been presented.

3.1 POPULATION AND EMPLOYMENT ALLOCATIONS

In order to accurately develop a demand-model used to forecast future traffic volumes, various input data were required from the Town of Hinton as well as the province. One of the initial steps in developing a demand model is to produce a traffic zone system that is reasonably homogeneous with respect to land use.

There are several areas where future development is expected to generate traffic throughout the Town. For the purpose of developing the model, traffic zones were divided into three main land applications: employment, population, and commercial. There are a total of seven traffic zones for population, nine traffic zones for employment and three commercial zones. **Tables 3.1** to **3.3** summarize the traffic zones for each land use and its description, and the geographic distribution is noted in Figure 4.3. The residential, commercial, and industrial traffic distributions were based on the existing and new population and employment.

Table 3.1A Population Traffic Zones and Distribution (2033 / Ultimate)

Traffic Zone	Zone Description	Existing	New	Delcan Distribution	MH Distribution
1	M.V. District	670		2.1	
2	West End Commercial	302		1.0	
3	Terrace Heights	0	8,868	28.0	28
4	M.V. District	1,253		3.9	
5	Hillcrest	2,431		7.7	
6	Eaton	386		1.2	
7	Thompson Lake	802	9,850	33.5	33
8	Hardisty	2,503		7.9	
9	Hardisty	1,450		4.6	
10	Riverside / North Hardisty	0		0.0	
11	West Riverside	206	3,023	10.2	10
Total		**10,003**	**21,741**	**100.0**	
	Total (Existing + New)	**31744**			

Table 3.1B Population Traffic Zones and Distribution (2033 / Ultimate)

Traffic Zone	Zone Description	Existing	New	Percent Distribution (%)
P1	Hill District	5,251	-	17
P2	Valley District	2,505	-	8
P3	East Hardisty	1,261	-	4
P4	Thompson Lake	752	-	2
P5	Terrace Heights	-	8,868	28
P6	Thompson Lake	-	9,850	31
P7	Annexation Area A	-	3,023	10
	Total (Existing + New)	**31,510**		**100**

Notes: 1. Traffic Zone No's. 1 – 4 data was obtained from the Town of Hinton 2006 Census.
2. Traffic Zone No. 5 was obtained from the Terrace Heights TIA Report.
3. Traffic Zone No. 6 was obtained from the Thompson Lake TIA Report.
4. Traffic Zone No. 7 was data provided by the Town of Hinton.

Table 3.2 Employment Traffic Zones and Distribution

Traffic Zone	Zone Description	Existing	New	Percent Distribution (%)
E1	Elk Valley Coal	300	-	10
E2	Meier Street	250	-	8
E3	Hospital / Government	400	-	13
E4	Hinton Saw Mill	350	-	12
E5	Hinton Pulp Mill	460	-	16
E6	South Hardisty	150	-	5
E7	North Hardisty	200	-	7
E8	Annexation Area D	-	554	19
E9	Innovista Eco-Industrial Park	-	300	10
	Total (Existing + New)	**2,964**		**100**

Note: 1. Traffic Zones No. 1 – 8 data was provided by the Town of Hinton.
2. Traffic Zone No. 9 was obtained from the Hinton Eco-Industrial Park TIA Report.

Table 3.3 Commercial Traffic Zones and Distribution

Traffic Zone	Zone Description	Existing	New	Percent Distribution (%)
C1	Terrace Heights	-	1,643	58
C2	Thompson Lake	-	571	20
C3	Annexation Area D	-	608	22
	Total (Existing + New)	**2,822**		**100**

Notes: 1. Traffic Zone No. 1 was obtained from the Terrace Heights TIA Report.
2. Traffic Zone No. 2 was obtained from the Thompson Lake TIA Report.
3. Traffic Zone No. 3 was provided by the Town of Hinton.

4.0 TRAFFIC FORECASTS

4.1 1983 DELCAN & 2008 MHL MODEL COMPARISON

4.1.1 Traffic Counts

Updated 2008 traffic volumes were obtained from Alberta Transportation, no significant differences were observed between the current volumes and the forecasted ones by the original 2008 MHL model update (where a 2% growth rate was applied to the 2005 traffic data used for the original model).

4.1.2 Existing Population and Employment

One of the initial steps in developing a demand model is to produce a traffic zone system that is reasonably homogeneous with respect to land use. In updating the original model, the exercise graphically created a total of 11 internal traffic zones within the Town's boundary, roughly approximating those of the 1983 Delcan model and which corresponded to the AT Transportation Cordon Survey and 1982 Census District boundaries. Further, the zones were consistent with the results generated by the original MHL model.

Socioeconomic data, needed for the model, and which includes population and employment data, was obtained from the most recent (2006) Census (2006/2009 Census Zones) and the population breakdown for the zones was obtained from the Town. Table 6.1 indicates the approximate breakdown and comparison of population within the identified 11 traffic zones, and Table 6.2 provides the breakdown of the .employment.

Table 4.1 Population Distribution – Internal Zones

Zones	*Zone Description*	*Total Dwellings 2008 MHL*	*Estimated Population[1] 2008 - MHL*	*1983 Population (Delcan)*	*Distributions (2008 vs. 1983)*
1	M.V. District	279	670	490	7 / 5.6
2	West End Commercial	126	302	230	3 / 2.6
3	Terrace Heights				0 / 0
4	M.V. District	522	1253	2235	13 / 25.3
5	Hillcrest	1013	2431	1945	24 / 22.1
6	Eaton	161	386	80	4 / 0.9
7	Thompson Lake	334	802	20	8 / 0.2
8	Hardisty	1043	2503	3300	25 / 37.4
9	Hardisty	604	1450	500	14 / 5.7
10	Riverside / North Hardisty				0 / 0
11	West Riverside	86	206	20	2 / 0.2
Total		***4,168***	***10,003***	***8,820***	***100***

Note 1: Occupation rate has been assumed as 2.4.

Table 4.2 Employment Distribution – Internal Zones

Zones	*Zone Description*	*Employment (2008) MHL*	*Employment (1983) Delcan*	*Distributions (2008 vs. 1983)*
1	M.V. District	500	***655***	12 / 18
2	West End Commercial	850	***170***	20 / 5
3	Terrace Heights	30		1 / 0
4	M.V. District	70		2 / 0
5	Hillcrest	75	***25***	2 / 1
6	Eaton	400	***180***	9 / 5
7	Thompson Lake	320	***5***	7 / 0
8	Hardisty	550	***515***	13 / 14
9	Hardisty	20		0 / 0
10	Riverside / North Hardisty	1100	***1170***	25 / 32
11	West Riverside	50		1 / 0
Sub Total:		***3965***	***2,720***	N/A
12		340		*8* *0*
13	Annex D[2]		890	*0* ***9*** *0* *25*
14		40		*1* *0*
15				*0* *0*
Total:		***4,345***	***3,610***	***100 / 100***

Note 2: Annexation Area D has been assumed to be located in zone 13.

The results of the overall comparison are that the 1983 TMP and the 2008 TMP yield similar results; however, there are some significant differences at the micro-level. These differences are the result of differences in the zones used for the models, hence is not directly comparable, and the development occurring within some zones has differed from earlier forecasts. The inevitable result is that recommendations between the two will be different.

The zones and the comparisons are noted in Figures 4.1, 4.2, 4.3, and 4.4.

Figure 4.3 1983 Transportation Zones

Figure 4.4 2008 Traffic Zones

Figure 4.5 2008 Census Districts

Figure 4.6 1983 Transportation Zones / 2007 Population Zones

Forecasting Approach

The previous transportation planning study (Delcan, 1983) was based on developing a model to represent the trips generated by the population currently living in the Town of Hinton, in addition to those represented through externally-based trips (highway trips). It considered trips generated by both the existing (1983) population and the future state population, compared, the trips *estimated*, for the existing (1983) population to the *actual* (1983) volumes, and the model calibrated to these volumes. The model then used to forecast future-year volumes, and subsequently as a basis for establishing the 1983 needs assessment.

The current (Morrison Hershfield, 2008) analysis differs, in that it is based on an incremental approach that uses the existing (2008) traffic levels as a starting point and adds the new trips from expected future development, to arrive at future year traffic volumes on which to base the needs assessment.

The 1983 study assumptions presumed a future ultimate population level of 35,000 persons compared to a derived 31,500-person level used in the 2008 analysis. The current model presumes an ultimate development level representing an <u>added</u> 21,741 persons over the existing (2008 base year) population of 9769.

The estimation of the *through* (bypass or external – to – external) trips was based on a cordon survey conducted by Alberta Transportation in 1978, and used in the 1983 Delcan study, analysis. No such cordon survey data or updated analysis was available or undertaken for the 2008 study.

The 1978 cordon survey identified the following:

- 55 – 60 percent of westbound highway trips are through trips;
- 44 – 75 percent of eastbound highway trips are through trips;
- an average of 57 percent of highway trips are classed as through trips;
- external – internal highway trips to / from the west are 40 – 56 percent;
- external – internal highway trips to / from the east are 25 – 45 percent; and
- an average of 43 percent of highway trips is external – internal or internal – external trips.

Of the 57 percent through trips, approximately 40 percent of the total trips (70 percent of the 57 percent) are through - non-stop trips and 17 percent are through – stop trips. Delcan (1983) noted that the through – stop component would decline to approximately 11 percent (20 percent of the 57 percent) or more, upon completion of the highway bypass.

Additionally, the 1983 Delcan study tied the traffic volume forecasts to a pre-determined ultimate population level. However, the 1983 Delcan study would have to have used an assumed year for reaching the population forecasts for both the intermediate and ultimate year background growth on the highway. These years are indicated as 1995 for the 21,825-population level and 1998 for the 26,250-population level, shown on Exhibit 4.4 in the 1983 Delcan study.

Contrasted with the above noted 1983 Delcan assumptions, the 2008 Morrison Hershfield Limited (MHL) study presumed a forecast year based on the ultimate build-out of ongoing new development within the town.

Forecasting Assumptions

Traffic Zones

The 1983 Delcan study used a 15-zone system for the transportation model development: 11 internal, and four external, zones. The 2008 MHL Update study uses a 7-zone system: all zones being internal zones. However, traffic to / from external areas, was assigned to Highway 16 east and Highway 16 west, external to the town (no formal zone) in actuality representing a 7 + 2 or a 9-zone system.

Trip Generation

The Delcan 1983 study used a PM peak-hour vehicle trip generation of 0.375 vehicle trips per capita, whereas the 2008 MHL study generates trips by individual land use proposed for the town, using rates published by the Institute of Transportation Engineers (ITE Trip Generation, 7th Edition, 2004).

For comparison purposes, the overall 2008-study two-way trip generation is 8,325 vehicles / hour (veh/h) for a population of 21,741. The 1983 Delcan Horizon Year population of 35,000 forecasts a two-way trip generation of 13,929 utilizing the 0.375 vehicle trips per capita, and as indicated in the Delcan Study - Table 4.5: Study Area Trip Generation (1983).

The 2008 corresponding trip generation rate, derived from the current study, for PM peak hour two-way vehicle trips, for the 21,741 population, is 8,325 / 21,741 = 0.383 veh/h, or ***2 %*** higher than that used in 1983, for the equivalent population of 21,741.

The MHL(2008) rates are derived averages from surveys that would include variance for transit usage and vehicle occupancy. No adjustment for this has occurred, as the adjustment would serve only to increase the trip generation rates, as transit usage in Hinton is low (***1 – 2 %*** as established from the 2006 census; mode of transportation).

Trip Distribution

The Delcan study (1983) distributed the traffic generated by the population base by the productions and attractions in each traffic zone. Productions and attractions, for external zones, are accounted for by including a forecast of employment in the resource area and using these to distribute traffic.

Table A–1 & 4.3 Trip Distribution (Delcan 1983)

As indicated in Table A–1 and Table 4.3 of the Delcan (1983) Study:

Internal – to – Internal:	2,868	86.7%
Internal – to – External:	147	4.4%
External – to – Internal:	292	8.8%
Subtotal :	**3,307**	**100.0%**
External – External:	283	
Total Trips :	**3,590**	

Of the 3,307 internally based existing (1982) vehicle trips, ***13.2 %*** are to / from external areas. The remaining ones are internal to the town.

The 2008 MHLstudy uses the population and employment distribution, internal to the town to distribute 90 percent of the total trips generated by ***new*** or added development. External trips were assumed to consist of the remaining ***10 %*** of the total, and distributed equally to the Highway 16 corridor east and west of town.

In the most recent census (Statistics Canada 2006), the following are noted from the Place of Work tabulation:

Internal Workforce:	
Within census subdivision:	4,105
Different subdivision:	215
No fixed workplace:	775
Sub-Total:	**5,095**
External workforce:	
Within census subdivision:	350
Different subdivision:	260
Different province:	35
Sub-Total:	**645**
Total:	**5,740**

Table 4.3 Census (Statistics Canada 2006)

The external workforce represents ***11.2 %*** of the total. Even if the 775 individuals that comprise the *'no fixed workplace'* are split between the internal and external categories, the external percentage might range as high as ***18 %*** (1,032 / 5740).

Mode Split

In the Census - Mode of Transportation tabulation, the following were noted:

Total employed labour force:	**5,525**	**100%**
Auto Driver:	4,175	75.5%
Auto Passenger:	645	11.7%
Transit:	65	1.2%
Walk / Bike:	485	8.8%
All Other Modes:	155	2.8%
Auto Mode:	4,820	87.2%
Non-Auto Mode:	705	12.8%
Auto Occupancy:	**4,820 / 4,175 = 1.154 persons per vehicle**	

Table 4.4 Town of Hinton – Mode of Transportation Census

Trip Assignment

Both, the 1983 Delcan and the 2008 Morrison Hershfield, studies use a manual assignment method to produce the forecast volumes for analysis of capacity.

4.2 FORECASTING METHODOLOGY

The Town of Hinton is expecting moderate growth within the next 25 years. Hinton's strong resource-based industries (mining, forestry, natural gas), the surrounding recreational landscapes, and its close proximity to Jasper National Park makes the Town an ideal place for residential, commercial and industrial development.

Traffic forecasts were made utilizing the existing data collected from the Town of Hinton, and stakeholders such as Alberta Transportation, private developers and West Fraser Hinton.

As part of the Transportation Master Plan Update, one of the main objectives of the study is to forecast traffic to prepare a plan to accommodate the travel demands for a long-term planning horizon and the intermediate horizon. The afternoon peak hour was selected as the basis from which to project future traffic growth, as this period tends to have the most traffic generated by shopping, school and through traffic on Highway 16. An annual traffic-growth rate of 2% was applied to the background through traffic. This percentage is consistent with other related studies conducted by the Town.

The Institute of Transportation Engineers (ITE), Trip Generation 7th Edition was used to generate new trips using the information collected from the Town and other external sources such as the AT website. The methodology and how the trip generation rates were derived are included in **Appendix C**. As described in Section 3.1, existing and future population and employment areas were divided into traffic zones. Traffic was then generated for each of these zones, based on land use, and as summarized in **Tables 4.5** to **4.11** inclusive.

Table 4.5 Thompson Lake and Terrace Heights Residential Trip Generation

Description	Sum	Unit	Fitted Curve Equation	Entering Site	Exiting Site
Thompson Lake Residential Trip Generation					
Single Family Detached (210) (Typical + Large)	1505	Dwelling Units	1230	775	455
Apartment (220)	1259	Dwelling Units	710	462	249
Residential Condominium / Townhouse	779	Dwelling Units	324	217	107
Terrace Heights Residential Trip Generation					
Single Family Detached (210) (Typical + Large)	1888	Dwelling Units	1509	950	558
Apartment (220)	1195	Dwelling Units	675	439	236

Table 4.6 Annexation Area A – Residential Trip Generation

Description	Sum	Unit	Trip Rate	Fitted Curve Equation	Entering Site	Exiting Site
Residential SF-Detached Homes (210)[1]	345	Acres	0.11	38	15	23
Campground / Recreational Vehicle Park (416)[2]	105	Acres	0.98	103	71	32

Notes: 1. Annexation Area A comprises 125.46 Acres – Average Rate Used
2. Based upon occupied campsites (Independent Variable)

Table 4.7 Annexation Area D – Industrial Trip Generation

Description	Sum	Unit	Trip Rate	Fitted Curve Equation	Entering Site	Exiting Site
Industrial Park (130) [11]	554	Emp.	0.92	508	102	406

Notes: 1. Annexation Area D comprises 1600.3 Acres

Table 4.8 Innovista Eco-Industrial Park Trip Generation

Area Ha (ft^2)	FAR[1]	GFA[2] (ft^2)	VPH		AM Peak Hour			PM Peak Hour		
			AM	PM	In	Out	Total	In	Out	Total
12.46 (1,341,183)	0.30	402,355	0.84	0.86	277	61	338	73	273	346

Notes: Traffic Generation was obtained from Hinton Innovista Eco-Industrial Park TIA Table 1.
1. Floor to Area Ratio
2. Gross Floor Area

Table 4.9 Thompson Lake – Commercial Development Trip Generation

Description	Sum	Unit	Fitted Curve Equation	Entering Site	Exiting Site
Shopping Centre (820)	148	1,000 ft^2	608	292	316

Notes: Total includes 25% Pass-By Traffic.

Table 4.10 Terrace Heights – Commercial Development Trip Generation

Description	Sum	Unit	Fitted Curve Equation	Entering Site	Exiting Site
Shopping Centre (820)	667	1,000 ft^2	1643	789	854

Notes: Total includes 25% Pass-By Traffic.

Table 4.11 Annexation Area D – Commercial Development Trip Generation

Description	Sum	Unit	Fitted Curve Equation	Entering Site	Exiting Site
Shopping Centre (820)	135	1,000 ft^2	571	274	297

Notes: Total includes 25% Pass-By Traffic.

Generated trips were then assigned to the future road network. The following assumptions were made for assigning traffic for each traffic zones:

1. For all residential trips, 10% of traffic was assumed external, (outside of the town of Hinton) trips.
2. For all residential trips, 10% of traffic was assumed internal, (within individual traffic zone) trips.

The trips assigned to / from the new development areas were added to the background trips and the total trips were calculated. These traffic volumes were used to undertake capacity and Level of Service analyses of major intersections to identify improvements necessary to accommodate future travel demand.

4.3 Intermediate Term Traffic Forecasts

Projected traffic forecasts for the intermediate planning horizon were based on the data provided for the ultimate year scenario. It was assumed that 40% of Terrace Heights and Thompson Lake residential development would occur by the intermediate planning horizon. While the 40% assumption can be considered an aggressive forecast, it must be noted, that the intermediate horizon relates to traffic volumes, and not a specific year. Hence, a 40% completion of Terrace Heights and Thompson Lake development will result in certain trigger events. This is the case for all of the modelling exercises; certain assumptions have to be made for the purposes of developing the forecast model, and the trigger event will be the associated traffic, and not necessarily assigning the associated traffic to a specific model year.

Annexation Area A, resort residential and recreational development, was assumed to be fully built by the intermediate planning horizon. Industrial development for Annexation Area D was assumed to be 50% built by intermediate planning horizon, while 100% of Eco-Industrial Park Innovista was assumed to be built. Both Terrace Heights and Annexation Area D commercial development were assumed to be 50% built by intermediate planning horizon. It was assumed that all of Thompson Lake commercial development would be built by intermediate planning horizon since this area is currently underway for development.

Figure 4.1 2018 Total Traffic Volumes and Land Configurations summarizes the forecast PM peak hour traffic volumes for the intermediate planning horizon year. [Figure 4.1 located in the Final Report]

4.4 Ultimate Term Traffic Forecasts

With respect to the ultimate-term traffic forecasts, and the associated infrastructure improvement projects identified herein, it should be noted, that the identified improvements may be postponed, or abandoned altogether, subject to as yet, unknown network changes. Due to the ultimate growth in traffic occurring at different points in the network however, improvements in capacity, through the provision of; additional links, lane capacity, and / or changes in the network, will be required and are triggered by the traffic growth. In all cases, the trigger event will be traffic growth, and not the model projection assigned to a particular year. Thus, for example, the highway bypass would be required when the level of service on Highway 16 approaches failure (LOS F). According to the model, this would correspond with traffic volumes in excess of 2,000 vehicles per hour, for the current roadway configuration without network improvement, and not necessarily in the model years of 2018 or 2033.

Trigger events equate to physical roadway capacity. A typical arterial laneway can accommodate 800 to 1,000 vehicles per hour, and capacity is subject to external factors such as access, modal split, vehicle mix, signalization, and grade separation, to name a few. Thus, given the current capacity of Highway 16 at up to 2,000 vehicles per hour, trigger events requiring capacity improvement would consist of traffic volumes approaching this threshold. Alternatives to increasing Highway 16 roadway capacity could therefore include options such as limiting service road access by increasing spacing between access points, converting service roads to one-way operations, limiting parking on service roads, which reduces roadway capacity, and improvements to signal operations.

Should increased capacity of Highway 16 itself be considered, options could include additional lanes and / or turn-bays. The options would need to be discussed with the affected stakeholders.

The projected traffic forecasts for the ultimate conditions were developed using the Town's assumption of a full built-out scenario. This includes the two major residential developments of Terrace Heights and Thompson Lake. In addition, commercial development of Terrace Heights and Annexation Area D was assumed to be fully built by ultimate planning horizon. Industrial land use south of Highway 40, which would be part of Annexation Area D, as well as Eco-Industrial Park Innovista, was assumed to be complete by the ultimate scenario.

Figure 4.2 2033 Total Traffic Volumes and Lane Configurations summarizes the forecast PM peak hour traffic volumes for the ultimate planning horizon year. [Figure 4.2 located in the Final Report]

5.0 LONG RANGE IMPROVEMENT PLAN

5.1 INTERMEDIATE TERM IMPROVEMENTS

5.1.1 Capacity and LOS Analysis

Table 5.1 summarizes the afternoon peak-hour capacity analyses, which are based on the existing condition and existing control types. The overall intersection Level of Service (LOS) is classified as good at LOS of "A" or "B" for only three of the intersections. The remainder of the key intersections will experience extensive delays and will fail, with overall intersection LOS "E" or "F". Improvements are required.

5.1.2 Improvement Requirements

Road improvement is required to rectify the deterioration in traffic operations to Level of Service "D" in some areas. Traffic volumes provided through the forecast model were used in the operational analysis. **Table 5.2** summarizes the operational and physical improvement requirements.

Operational improvements include measures such as traffic control type, cycle length for signalized intersections and turning type (permitted / protected).

Physical improvements include measures such as adding travel lanes, increasing the storage length, and installing traffic signals.

The afternoon peak-hour capacity-analysis for the intermediate planning horizon *with improvements* is further summarized in **Table 5.2**. It should be noted that the new roads and / or extension of existing roadways based on the recommended improvements were coded into the Synchro® model. The Synchro® capacity calculation worksheets, provided in **Appendix B,** show the lane configurations.

The PM peak hour LOS analyses summary in **Table 5.2** notes the recommended improvements and the resulting all-approaches analysis based on them. The overall intersections LOS will improve to a range from "A" to "C."

5.1.3 Through Traffic Capacity Analysis of Roadways for the Intermediate Planning Horizon

A detailed capacity analysis of the roadway segments included in the study area was carried out for the intermediate planning horizon scenario. Capacity of 800 – 1000 vehicles per hour per lane was assumed in the analysis for arterial roads. For collector roads, a capacity of approximately 600 – 800 vehicles per hour per lane has been assumed.

The results of the analysis are presented in **Table 5.3**. The table includes information on the number of lanes in each direction, type of existing median, total available capacity, traffic volume in each direction of travel and recommendation on improvement to the road segment.

Table 5.1 Level of Service Summary for Intermediate Year (intermediate planning horizon – PM) Traffic Volumes without Improvement

	Intersection	Existing Type of Intersection Control	Level of Service (LOS) – V/C Ratio by Movement – Control Delay (sec)												Overall Intersection LOS- Delay
			Eastbound			Westbound			Northbound			Southbound			
			Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	
			B	A	A	A	A	A	F	F	F	F	F	F	D
1	Highway 16 & Drinnan Way	Un-signalized	0.44	0.15	0.14	0.01	0.11	0.05							
			11.2	0	0	9.1	0	0							584.8
				B	B	B	B		B		B				A
2	East River Road & Switzer Drive / Drinnan Way	Un-signalized / Multi-Way Stop Controlled		0.48	0.48	0.45	0.45		0.28		0.28				
				12	12	12.3	12.3		11		11				11.9
				B	A	A	A		B	A					A
3	Switzer Drive & Hardisty Avenue	Signalized		0.6	0.43	0.19	0.45		0.57	0.05					
				10.3	2.1	8	8.2		16.8	7.1					8.7
			A	A	A	A	A	A	F	F	F	F	F	F	E
4	Highway 16 & Fleming Drive	Un-signalized	0.16	0.28	0.28	0.06	0.27	0.27							
			2.4	2.1	0	0.8	0.8	0							Error (Extremely High Delay)
			B	A	A	B	A	A	F	F	F	F	F	F	B
5	Highway 16 & Brookhart Street	Un-signalized	0.14	0.23	0.09	0.21	0.41	0.25							
			12.9	0	0	11.8	0	0							55.6
			B	D	A	D	B			F	A		A		F
6	Highway 16 & Switzer Drive	Signalized	0.06	1	0.63	0.8	0.74			1.86	0.13		0.04		
			17.8	53.5	2.1	44.9	19.4			412.6	0.2		7.8		114.2
			D	F	B	D	E	B		F			D		E
7	Highway 16 & Mountain Street	Signalized	0.6	1.07	0.45	0.74	1.07	0.31		1.15			0.67		
			44.4	83.6	17.9	38.9	78.8	11.9		127.7			43.4		75
			B	A	A	D	A	A	F	F	F	F	F	F	D
8	Highway 16 & Keil Drive	Un-signalized	0.03	0.41	0.05	0.59	0.46	0.01							
			14.8	0	0	27.3	0	0							116
			A	A			B	A				B			B
9	Highway 16 & Meier Street[1]	Signalized	0.33	0.66			0.85	0.44				0.63			
			9.2	8.7			19	3.1				18.5			13.4
			A	A	A	A	A	A	C	C	C	F	F	F	A
10	Highway 16 & Highway 40	Un-signalized	0.01	0.14	0.01	0.23	0.2	0.2	0.49	0.49	0.49	1.58	1.58	1.58	
			9.2	0	0	9.7	0	0	16.1	16.1	16.1	383.4	383.4	383.4	34.5
			F	C	C	F	C	C	A	A	A	A	A	A	B
11	MacLeod Avenue & Mountain Street	Un-signalized / Stop Controls	0.71	0.4	0.4	2.64	0.55	0.55	0.06	0.15	0.15	0.07	0.06	0.06	
			40.7	19	19	365	17.5	17.5	3.8	0	0	1.4	0	0	167

Notes: 1. The Parks West Mall area was assumed as a CBD (Central Business District) area

Table 5.2 Level of Service Summary for Intermediate Year (intermediate planning horizon-PM) Traffic Volumes with Improvement

	Intersection	Existing Type of Intersection Control	Level of Service (LOS) - V/C Ratio by Movement - Control Delay (sec)												Overall Intersection LOS-Delay	Recommended Improvement
			Eastbound			Westbound			Northbound			Southbound				
			Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right		
			B	A		A	B	A		B			B		B	
1	Highway 16 & Drinnan Way	Un-signalized	0.71	0.31		0.04	0.49	0.19		0.29			0.86			Signalized
			17.9	8.1		8.9	17.1	5.7		14.1			16.5		14.3	
				B	B	B	B		B		B				A	
2	East River Road & Switzer Drive / Drinnan Way	Un-signalized / Multi-Way Stop Controlled		0.48	0.48	0.45	0.45		0.28		0.28					N/A
				12	12	12.3	12.3		11		11				11.9	
				A	A	A	A		B	A					A	
3	Switzer Drive & Hardisty Avenue	Signalized		0.6	0.37	0.14	0.44		0.47	0.04						N/A
				9.6	1.8	6.8	7.7		16.1	7.4					8.2	
			B	A			B			B			B		B	
4	Highway 16 & Fleming Drive	Un-signalized	0.45	0.53			0.75			0.26			0.75			Signalized
			12.5	8.2			15.6			13.3			12.8		12.2	
			B	A	A	B	B			B			B		B	
5	Highway 16 & Brookhart Street	Un-signalized	0.4	0.51	0.19	0.51	0.75			0.48			0.3			Signalized
			14.7	0.3	2	13.9	11.9			14.7			11.4		11	
			C	C	A	D	B		D	D	A		C		C	
6	Highway 16 & Switzer Drive	Signalized	0.06	0.88	0.56	0.78	0.67		0.82	0.82	0.11		0.17			Dedicated lane for NBL
			20.6	30.3	1.6	47.2	18.5		35.2	35.5	0.2		27.2		22.1	
			C	C	A	C	C	A	D	D		D	D		C	
7	Highway 16 & Mountain Street	Signalized	0.42	0.85	0.31	0.66	0.9	0.22	0.68	0.82		0.63	0.55			Dedicated lane for NBL,SBL
			23.6	33.4	5	26.6	30.6	6.7	45.1	54.1		39	52.4		31.6	
			B	C	A	C	B	A		C		D	B		B	
8	Highway 16 & Keil Drive	Un-signalized	0.07	0.82	0.11	0.76	0.71	0.02		0.69		0.19	0.14			Signalized
			18.3	23.5	6.1	34.7	14.6	5.4		23.7		39.5	19.4		19.8	
			A	A			B	A				B			B	
9	Highway 16 & Meier Street[1]	Signalized	0.28	0.65			0.84	0.38				0.56				N/A
			8	8.2			17.9	2.8				17.2			12.6	
			B	B	A	A	A			B	A		B		A	Signalized
10	Highway 16 & Highway 40	Un-signalized	0.05	0.49	0.03	0.45	0.39			0.07	0.52		0.42			
			11.9	12.3	7.1	9.1	4.3			12	4.1		14.3		7.9	

Notes: 1. The Parks West Mall area was assumed as a CBD (Central Business District) area

Table 5.3 Intermediate Term (intermediate planning horizon) Mainline Analysis

Roadway	Section From	Section To	No. of Traffic Lanes Per Direction	Median Type Divided (D) / Undivided (U)	Capacity (Veh/h)	Volume EB/NB	Volume WB/SB	Remarks
Highway 16	Highway 40 S	Access 3 (Future Terrace Heights Access)	2	D	1600-2000	846	843	
	Access 3 (Future Terrace Heights Access)	Access 2 (Woodley Drive)	2	D	1600-2000	1001	1079	
	Access 2 (Woodley Drive)	Meier Street	2	D	1600-2000	1179	1334	
	Meier Street	Keil Drive	2	D	1600-2000	1539	1712	Plan for additional capacity improvement*
	Keil Drive	Mountain Street	2	D	1600-2000	1634	1931	Plan for additional capacity improvement*
	Mountain Street	Switzer Drive	2	D	1600-2000	1737	1968	Plan for additional capacity improvement*
	Switzer Drive	McArdell Drive	2	D	1600-2000	1110	1181	
	McArdell Drive	Brookhart Street	2	D	1600-2000	983	1134	
	Brookhart Street	Fleming Drive	2	D	1600-2000	922	1141	
	Fleming Drive	Drinnan Way	2	D	1600-2000	855	873	
Switzer Drive	Highway 16	Robb Road	2	U	1600-2000	902	1025	
	Robb Road	Kelley Road	2	U	1600-2000	788	1049	
	Kelley Road	Hardisty Avenue	1	U	800-1000	768	787	Middle Turning Lane
	Hardisty Avenue	Drinnan Way	1	U	800-1000	455	521	
Hardisty Ave	Switzer Drive	Drinnan Way	2	U	1600-2000	391	224	Partially Divided (Switzer Drive to Drinnan Way
West River Road / Kelley Road	Terris Road (Yellowhead County)	Switzer Drive	1	U	800-1000	262	329	
Terris Road (Yellowhead County)	Highway 16	CN Railway ROW	1	U	800-1000	194	127	
Access 4 (Wanyandi Avenue Extension)	Keil Drive	MacLeod Avenue	1	U	800-1000	48	83	
Access 3 (Terrace Heights - Keil Drive)	Highway 16	Access 4 (Wanyandi Avenue Extension)	2	Divided only at Highway 16 Intersection	1600-2000	249	330	
Access 2 (Woodley Drive)	Highway 16	Access 4 (Wanyandi Avenue Extension)	2	Divided only at Highway 16 Intersection	1600-2000	312	389	
Keil Drive	Highway 16	Access 4 (Wanyandi Avenue Extension)	2	Divided only at Highway 16 Intersection	1600-2000	133	221	
Mountain Street	Highway 16	MacLeod Avenue	2	U	1600-2000	442	433	
Robb Road	Switzer Drive	Mountain Street	2	U	1600-2000	353	508	
	Mountain Street	Town Boundary (South)	2	U	1600-2000	293	131	
Sawyer Road	Robb Road	Highway 16	2	Divided only at Robb Road Intersection	1600-2000	753	197	
McArdell Drive	Highway 16	Sawyer Road	1	U	800-1000	289	331	
Brookhart Street	Highway 16	Sawyer Road	1	U	800-1000	209	247	
Innovista Road	Highway 16	Sawyer Road	1	U	800-1000	79	122	
Drinnan Way	Highway16	Hardisty Avenue	1	U	800-1000	440	522	
	Hardisty Avenue	Switzer Drive	1	U	800-1000	151	259	
East River Road	Drinnan Way	East Town Boundary	1	U	800-1000	150	117	

Notes: Possible alternatives for additional capacity improvement to consider may be widening portions of existing Highway 16 given property availability, improve / additional construction of parallel collector roads or construction of new highway / municipal roadway.

5.2 LONG TERM (ULTIMATE PLANNING HORIZON) IMPROVEMENTS

5.2.1 Capacity and LOS Analysis

Table 5.4 provides a summary of the capacity analyses for the key intersections within the site during the afternoon peak hour period, and includes the recommended improvements. The overall Level of Service for all intersections would be good at LOS of "B" to "D".

5.2.2 Improvement Requirements

Should the bypass route be constructed, and the recommended transportation infrastructure investments also be made, then there would result a surplus roadway capacity, i.e. the local transportation network would be overbuilt. Based upon the traffic engineering analyses for the ultimate year condition, **Table 5.4** also summarizes the operational and physical improvements requirements for the key intersections analyzed in the network.

Operational improvements include measures such as traffic control type, cycle length for signalized intersections and turning type (permitted / protected).

Physical improvements include measures such as adding travel lanes, increasing the storage length, and installing traffic signals.

5.2.3 Through Traffic Capacity Analysis of Roadways for the Ultimate Planning Horizon:

Collector roads have been assumed to have a capacity of approximately 600 – 800 vehicles per hour per lane.

The results of the analysis are presented in **Table 5.5**. Mainline on all roadways has been further divided into sub-sections to represent the areas between crossing roads. **Table 5.5** also includes information on the subsections indicating the number of lanes in each direction, type of existing median, total available capacity, traffic volume in each direction of travel and recommendations on improvements to the road segment.

The sections of Highway 16 from Keil Drive to Meier Street and between Switzer Drive and Fleming Drive will require capacity enhancements, or improvements to the adjacent service roadways to alleviate the expected traffic.

Highway 16 will require capacity improvements from Park West Mall to Switzer Drive; and Switzer Drive will require capacity improvement between Kelley Road and Drinnan Way should the South Connector not be built.

Table 5.4 Level of Service Summary for Ultimate Year (ultimate planning horizon-PM) Traffic Volumes

	Intersection	Existing Type of Intersection Control	Level of Service (LOS) - V/C Ratio by Movement - Control Delay (sec)												Overall Intersection LOS- Delay	Recommended Improvement
			Eastbound			Westbound			Northbound			Southbound				
			Left	Through	Right	Left	Left	Through	Right	Left	Left	Through	Right	Left		
1	Highway 16 & Drinnan Way	Un-signalized	C	A		C	C	A		D			D	B	C	Signalized, Dedicated lane for SBR
			0.86	0.34		0.14	0.78	0.3		0.84			0.81	0.84		
			28	8.7		26.7	33.1	7.6		44.9			38.8	11.1	22.1	
2	East River Road & Switzer Drive / Drinnan Way	Un-signalized / Multi-Way Stop Controlled		A			C		C						B	Signalized
				0.59			0.9		0.73							
				7.4			26.5		21.9						17.5	
3	Switzer Drive & Hardisty Avenue	Signalized		B	A	B	B		C		A				B	N/A
				0.77	0.39	0.29	0.59		0.71		0.05					
				15.9	1.9	12.9	10.3		25.6		9.2				12.8	
4	Highway 16 & Fleming Drive	Un-signalized	C	C		B	D			C			D		D	Signalized, dedicated lane for WBL
			0.74	0.92		0.58	0.97			0.59			0.97			
			31.5	30.6		19.7	39.3			21			47.3		35.4	
5	Highway 16 & Brookhart Street	Un-signalized	B	C	A	C	C			D			C		C	Signalized
			0.36	0.81	0.33	0.7	0.96			0.94			0.39			
			14.7	24.5	3.2	26.8	32.2			54.1			22.7		29	
6	Highway 16 & Switzer Drive	Signalized	C	D	A	D	C		D	C	A		D		C	Additional lane for EBT, WBT, two dedicated lanes for NBL
			0.09	0.94	0.66	0.72	0.65		0.93	0.01	0.09		0.22			
			33.6	50.4	2.3	38.7	25.1		53.3	20.3	0.1		47.5		34.3	
7	Highway 16 & Mountain Street	Signalized		D	A	D	B		D		A				C	Removing the North Leg, Additional lane for WBT, EBT, two dedicated lanes for NBL
				0.99	0.64	0.72	0.83		0.94		0.33					
				43.4	7.3	51.4	14.6		51.6		6.6				29	
8	Highway 16 & Keil Drive	Un-signalized	B	C	A	D	A	A	D	A		D	B		B	Signalized, one more lane for WBT, EBT, additional dedicated lane for WBL, NBL
			0.07	0.89	0.18	0.84	0.74	0.02	0.61	0.62		0.21	0.14			
			12.4	22.7	3.1	54.9	10	3.4	49.1	8.5		40.7	19.3		18.6	
9	Highway 16 & Meier Street[1]	Signalized	D	B			C	A				D			C	Additional lane for WBT, EBT
			0.52	0.71			0.95	0.43				0.79				
			45.3	10			31	4.9				43.7			22.4	
10	Highway 16 & Highway 40	Un-signalized	B	C	A	C	A			B	B		C		B	Signalized
			0.06	0.79	0.03	0.86	0.45			0.13	0.82		0.7			
			17.5	25.1	9.5	28.7	6			16.9	11.6		25.5		17	
11	MacLeod Avenue & Mountain Street	Un-signalized / Stop Controls	F	F	F	F	F	F	A	A	A	A	A	A	F	No Improvements Made
			F	F	F	F	F	F	0.19	0.38	0.38	0.3	0.15	0.15		
			F	F	F	F	F	F	5.2	0	0	8.3	0	0	F	

Notes: 1. The Parks West Mall area was assumed as a CBD (Central Business District) area

Table 5.5 Ultimate Term (ultimate planning horizon) Mainline Analysis

Roadway	Section From	Section To	No. of Traffic Lanes Per Direction	Median Type Divided (D) / Undivided (U)	Capacity (Veh/h)	Volume EB/NB	Volume WB/SB	Improvement
Highway 16	Highway 40 S	Access 3 (Future Terrace Heights Access)	2	D	1600-2000	1440	1344	
	Access 3 (Future Terrace Heights Access)	Access 2 (Woodley Drive)	2	D	1600-2000	1745	1810	Plan for additional capacity improvement*
	Access 2 (Woodley Drive)	Meier Street	2	D	1600-2000	2100	2337	Capacity improvement required*
	Meier Street	Keil Dr	2	D	1600-2000	2521	3015	Capacity improvement required*
	Keil Dr	Mountain St	2	D	1600-2000	2610	3294	Capacity improvement required*
	Mountain St	Switzer Drive	2	D	1600-2000	2512	2770	Capacity improvement required*
	Switzer Drive	McArdell Drive	2	D	1600-2000	1722	1744	Plan for additional capacity improvement*
	McArdell Drive	Brookhart St	2	D	1600-2000	1539	1678	Plan for additional capacity improvement*
	Brookhart Street	Fleming Drive	2	D	1600-2000	1366	1653	Plan for additional capacity improvement*
	Fleming Drive	Drinnan Way	2	D	1600-2000	1248	1334	
Switzer Drive	Highway 16	Robb Road	2	U	1600-2000	1061	1476	
	Robb Road	Kelley Road	2	U	1600-2000	1239	1709	
	Kelley Road	Hardisty Avenue	1	U	800-1000	1178	1270	Capacity improvement required*
	Hardisty Ave	Drinnan Way	1	U	800-1000	735	807	Plan for additional capacity improvement*
Hardisty Avenue	Switzer Dr	Drinnan Way	2	U	1600-2000	438	286	
West River Road / Kelley Road	Terris Road (Yellowhead County)	Switzer Drive	1	U	800-1000	425	426	
Terris Road (Yellowhead County)	Highway 16	West River Road	1	U	800-1000	265	185	
Access 4 (Wanyandi Avenue Extension)	Keil Dr	MacLeod Avenue	1	U	800-1000	75	127	
Access 3 (Future Terrace Heights Access)	Highway 16	Access 4 (Wanyandi Avenue Extension)	2	Divided only at Highway 16 Intersection	1600-2000	542	703	
Access 2 (Woodley Drive)	Highway 16	Access 4 (Wanyandi Avenue Extension)	2	Divided only at Highway 16 Intersection	1600-2000	632	800	
Keil Dr	Highway 16	Access 4 (Wanyandi Avenue Extension)	2	Divided only at Highway 16 Intersection	1600-2000	281	471	
Mountain St	Highway 16	MacLeod Avenue	2	U	1600-2000	960	776	
Robb Road	Switzer Drive	Mountain Street	2	U	1600-2000	635	795	
	Mountain Street	Town Boundary (South)	2	U	1600-2000	662	305	
Sawyer Road	Robb Road	McArdell Drive	2	Divided only at Robb Rd Intersection	1600-2000	753	470	
	McArdell Drive	Highway 16	1	U	800-1000	555	327	
McArdell Drive	Highway 16	Sawyer Road	1	U	800-1000	393	500	
Brookhart Street	Highway 16	Sawyer Road	1	U	800-1000	320	422	
Innovista Road	Highway 16	Sawyer Road	1	U	800-1000	167	272	
Drinnan Way	Highway 16	Hardisty Avenue	1	U	800-1000	580	746	
	Hardisty Avenue	Switzer Drive	1	U	800-1000	302	480	
East River Road	Drinnan Way	East Town Boundary	1	U	800-1000	150	117	

Notes: Possible alternatives for additional capacity improvement to consider may be widening portions of existing Highway 16 given property is available, improve / additional construction of parallel collector roads or construction of new highway / municipal roadway.

5.3 Road Policies

The Town of Hinton Minimum Engineering Design Standards require that roadways be designed in accordance with the functional classification system described by the Transportation Association of Canada (TAC). This system describes a hierarchy of roads based upon the degree to which each serves through movement or land access or some combination of these functions. This type of classification is based on function of the roadway and not specifically on the amount of traffic carried by the road. This is different from the definition of road classification used in the engineering design standards where traffic volume is used as a primary classification criterion, presumably because design standard and pavement structure are determined by traffic volume (loading).

Under the Town of Hinton, Road Classification system, Collector-Standard Roadways, are comprised of roadways designed to accommodate traffic volumes between 1,000 vpd up to 5,000 vpd. Under the TAC classification system, Collector-Standard roadways are expected to accommodate traffic volumes between 1,000 vpd to 12,000 vpd. The primary factors considered in establishing a classification system are; land use, service function, traffic volume, flow characteristics, operating speed, vehicle type / traffic composition, and nature of connectivity. As the TAC guidelines were developed to accommodate the above noted factors for many jurisdictions, it is important to remember that they are a guide only, and jurisdictions are expected to adjust the ranges to meet their local needs. In the case of the Town of Hinton, it appears the roadway classification system, is slightly more restrictive than the TAC guidelines, potentially resulting in roadways with lower capacity levels. However, the classification system as developed typically provides an added benefit, of improving safety by reducing speeds at conflict points.

The Town's current road classification includes the following categories and volume ranges:

Table 2.1 Town of Hinton Road Classification

Road Classification	Sub-Classification	Traffic Volume (Vehicles per Day – v/d)
Local	N/A	Volume < 1,000
Collector	Minor	1,000 < Volume < 2,000
	Major	2,000 < Volume < 5,000
Arterial		Volume > 5,000

Source: Town of Hinton Minimum Engineering Design Standards, September, 2007

5.3.1 Functional Classification

Road classification based on the TAC design guidelines provides a hierarchy of road classes based on the degree to which the roads serve the dual functions of accommodation of through movement and land access. At the one extreme, a freeway class provides optimum mobility to through traffic movement and no access is provided. At the other extreme, a laneway provides land access only and accommodation of through traffic is not a consideration. In between these extremes are local streets where land access is the primary function, collector streets where land access and accommodation of through movement are of equal importance, and arterial roads where through traffic movement is the primary consideration, but there is some degree of access control.

Within this hierarchy, sub-classes within each category are possible that include major and minor classes for both collectors and arterials. Road classification is a function of a number of factors in addition to through movement and land access functions. These factors include:

- Land use
- Service function
- Traffic volume

- Flow characteristics
- Running speed
- Vehicle type
- Road connections

As noted in the TAC guidelines with respect to traffic volume, *"High volumes of traffic are carried by freeways and arterials, while low volumes are associated with collectors and locals. However, the volume range for each classification is wide and overlaps that of other classifications."* This approach to traffic volume in road classification permits traffic volumes to change over time and for the classification to remain the same and be primarily based on function of the road serving through traffic movement and land access.

Within the TAC guideline framework, it is recommended that the Town employ a road classification as described in **Table 5.6**. This table was derived from the information provided in the TAC design guidelines and the Town's Minimum Engineering Design Standards for urban roads. This road hierarchy is applicable to residential and industrial streets. As noted in the table, through truck traffic is primarily limited to arterial streets, with local truck movement occurring on collector and local streets.

Within the categories, it may be desirable in some circumstances to have collector and arterial road sections with a divided cross section. This is noted in the classification table by a range in right-of-way widths for the major collector and minor arterial categories. The primary purpose of a divided cross-section is to separate opposing traffic flows and to control access. This is particularly important at locations with high traffic volumes and the potential for longer standing queues where it would be undesirable and less safe to have vehicles turning from intersecting streets and penetrating these queues. Additionally, the divided cross section separates and controls turning movements at intersections and provides a means for pedestrian refuge and space for streetscape / landscaping elements and installation of illumination and / or traffic signal poles. Median divisions can range in width from 2 m (divisional traffic island) to approximately 5 m. Width in this context is edge of pavement to edge of pavement.

Based on these classification guidelines, future roads in the Town have been classified and are presented in the **Transportation Master Plan Update Report - Figure 5.3**. Main roads within the new residential development areas have been classed as major collector roadways. The sections of these roadways that are expected to carry higher traffic volumes have been shown having a divided cross section for the reasons noted above.

Table 5.6 Recommended Town of Hinton Road Classification (TAC Geometric Design Guide)

Factor	Locals	Collectors		Arterials	
		Minor	Major	Minor	Major
Traffic Service	Traffic movement secondary consideration	Traffic movement and land access of equal importance	Traffic movement emphasis over land access	Traffic movement major consideration	Traffic movement primary consideration
Land Service / Access		Traffic movement and land access of equal importance	Some access control	Some access control	Rigid access control
Traffic Volume (Veh/d)	<1,000	>1,000 and <5,000	>3,000 and <8,000	>5,000 and < 20,000	>10,000 and < 30,000
Flow Characteristics	Interrupted	Interrupted	Interrupted	Uninterrupted flow except at traffic signals and cross walks	
Design Speed (km/h)	30 – 50	50 – 60	50 - 70	50 – 70	60 - 100
Average Running Speed (km/h)	20 – 40	30 – 50	40 - 60	40 – 60	50 - 90
Vehicle Type	Passenger and service vehicles	Passenger and service vehicles	Passenger and service vehicles	All types	All types up to 20 percent trucks
Desirable Connections	Lane, local and collector	Local, collector and arterial	Local, collector and arterial	Collector, arterial, expressway and freeway	
Transit Service	Generally avoided	Permitted	Permitted	Express and local bus service permitted	
Accommodation of Cyclists	No restrictions or special facilities	No restrictions or special facilities	No restrictions or special facilities	Lane widening or separate facilities desirable	
Accommodation of Pedestrians	Sidewalks normally on one or both sides	Sidewalks provided on both sides	Sidewalks provided on both sides	Sidewalks may be provided, separation for traffic lanes preferred	
Parking	No restrictions or restrictions one side only	Few restrictions other than peak hour	Few restrictions other than peak hour	Peak hour restrictions	Prohibited or peak hour restrictions
Minimum Intersection Spacing (m)	60	60	200	200	400
Right-of-Way Width (m)	20	24	30 – 36[1]	30 – 36	45

Notes: 1. Range reflects requirements for undivided and divided cross sections.

5.3.2 Design Standards

The Town has in place a set of geometric design standards used to define the carriageway, right-of-way, utility right-of-way, design speed, and standard cross section details. These standards are presented in terms of residential and industrial streets for the purpose of specifying differences in boulevard widths and features. It is recommended that the road classifications be based on the hierarchy noted in **Table 5.6** above, and not on the specific traffic volume criteria given in the current Town of Hinton minimum engineering standards. Typical Cross Sections are noted in Figures 5.4 and 5.5. In adopting the TAC classification system, the Town of Hinton's technical standards would become more consistent with that employed by the Province of Alberta, and one, which has undergone significant technical reviews by Transportation Engineers throughout Alberta. Further, as the TAC design standards evolve they provide for more adaptable transportation alternatives, such as shared bicycle lanes, and / or designated vehicle (such as high-occupancy vehicle – HOV) lanes.

5.3.3 Intersection Spacing

Table 5.6 presents minimum spacing between different classes of roads. These distances are guidelines only, and the actual intersection spacing is to be determined based on a review of:

- the traffic volume and control employed, the design treatment used for provision of auxiliary lanes (i.e. slot versus conventional separate left turn lane design),
- the requirements to provide back-to-back intersection lane configurations with appropriate storage and taper length requirements, and
- the need to provide sufficient distance between merging and diverging manoeuvres or lane crossing manoeuvres.

This study has examined the service roads adjacent to the highway and has recommended that the Town undertake a more detailed investigation of the feasibility of providing geometric and traffic movement improvements to the service roads to affect increased separation from the highway and improved queuing distances at the intersections. Part of this investigation would be an assessment of the availability of property and the additional requirements to affect these improvements.

5.3.4 Access Management

Access to property is one of the main criteria that determine the road function. As more and more accesses to adjoining properties is provided, the function and character of a road changes. As noted in **Table 5.6**, collectors and arterials have some form of access control to protect the through traffic carrying capability of these roads. It is imperative that the Town adhere to generally accepted practices in terms of permitting local access to collector and arterial streets. In particular, adherence to guidelines for provision of corner clearance on undivided and divided streets is very important, particularly in those areas proximate to Highway 16, where traffic volumes are expected to be high, and where reduced conflicts are desirable

6.0 SUPPLEMENTAL SCENARIOS & POTENTIAL RIVER CROSSING

Two additional scenarios and a potential river crossing were reviewed as part of the Transportation Master Plan Update. These included the inclusion of a south collector (removed under the Terrace Heights TIA), and a desktop geotechnical assessment of existing data in the Athabasca River valley. The additional scenario's were analysed under revisions to the transportation model that accounted for changes in development, to ascertain both the requirement for a potential river crossing, and a potential location for same. A supplementary companion report; Potential Athabasca River Crossing, Hinton AB Desktop Assessment, August 5, 2009 prepared by Thurber Engineering, forms an Appendix to this report.

As a supplementary exercise and to verify the update model results, a comparison of the 1983 Delcan Ltd. model, (with a projected population forecast of 35,000), was made with the 2008 MHL model, (with a projected population forecast of 31,500), reflecting ultimate build-out in both scenario's, and to verify the long term transportation plan policy decisions.

The original update model developed by MHL, forming the foundation of the TMP update consisted of a simple travel demand model associated with seven internal zones and two external. The update is consistent with current data in terms of population and employment distribution to / from the Town of Hinton, revised development scenarios and roadway improvements. In an effort to confirm the requirements for the additional scenarios, and to address both Alberta Transportation's and the Town of Hinton's concerns with the simple travel demand model analysis, a supplementary comparison of the 1983 and 2008 models were made. A detailed review of the 1983 Delcan Transportation study, coupled with the Town of Hinton comments and recommendations, has resulted in minor modifications to both the original calculations and the analysis due to the proposed population and employment data and its distribution as a result of supplemental scenario's.

For this component, MHL completed the following tasks:

- Reviewed the previous 1983 Transportation Study conducted by Delcan De Leuw Cather Western Limited (Delcan) and the original TMP Update analysis conducted by MHL,
- Revised the MHL study, zone location, and analysis,
- Revisions to the traffic generators to reflect the revised population and employment zones,
- Reviewed the 1978 Origin-Destination Cordon Survey conducted by Alberta Transportation, and used for the 1983 Delcan study to identify the through-traffic component and percentage,
- Reviewed the 2006 Town of Hinton census data,
- Reviewed the 2008 traffic volumes provided by Alberta Transportation,
- Established an Origin-Destination trip table to reflect the trip distribution within the Town boundaries and the external zones, Appendix D,
- Updated the traffic demand model to forecast future traffic volumes;
- Modelled three additional scenarios as requested by the Town of Hinton
- Performed capacity analysis at the critical intersections for the existing network; and
- Conducted the capacity analysis, at previously identified intersections, for the intermediate and ultimate planning horizon network for the different scenarios.

To coincide with the supplementary modelling scenarios, revisions were also made to the 2008 model to allow for a more direct comparison with the 1983 Delcan Transportation Master Plan Study.

6.1 HIGHWAY BYPASS COMPARISON

6.1.1 2018 (Population 20,500 Horizon) Highway Bypass

Methodology

- The PM peak-hour vehicle trips for the 2018 Bypass were used from the 1983 Delcan TMP, and re-allocated an average of 60% of the through traffic on the existing Highway 16, to the bypass,
- At the east side of town the through traffic on Highway 16 was 527 EB / 513 WB; and on the west side of town it was higher. The lower east side numbers were then used for the modeling, as the assumption was made that the higher numbers from the west implied that this traffic was destination specific (stopping in Hinton) versus bypass traffic, making a stop in the town then returning west, thus not using the bypass. The result is that 308 vehicles would be subtracted from Highway 16 westbound through, and 316 vehicles from the eastbound through,
- The Highway 16 intersection volumes were adjusted and rebalanced thereby achieving the 2008 configurations while maintaining an acceptable LOS.

Results

- The intersection upgrades as recommended in Section 5 are still required to provide for accesses into the developments,
- The signalization upgrades are as recommended in Section 5 remain required providing gaps to allow for the increased turning volumes, however
- The LOS along the corridor improves to C or better, and as a consequence there is no need to add lanes to the Highway.

In summary, the intersection improvements required for the ultimate build out at approximately 2018 (20,500 population scenario), should be constructed. The additional changes needed will be a requirement to increase the signal timings to compensate for the increased volumes, and some additional capacity will be required on Highway 16 for the Woodley Drive to Mountain Street section by the 2033 (31,500 population scenario).

6.1.2 2033 (Population 31,500 Horizon) Highway Bypass

Methodology

The identical methodology used for the 2018 (21,500 population) was used in the analysis of the 2033 (31,500 population) scenario.

- The PM peak-hour vehicle trips for the 2018 Bypass were used from the 1983 Delcan TMP, and re-allocated an average of 60% of the through traffic on the existing Highway 16, to the bypass,
- At the east side of town the through traffic on Highway 16 was 527 EB / 513 WB; and on the west side of town it was higher. The lower east side numbers were then used for the modeling, as the assumption was made that the higher numbers from the west implied that this traffic was destination specific (stopping in Hinton) versus bypass traffic, making a stop in the town then returning west, thus not using the bypass. The result is that 308 vehicles would be subtracted from Highway 16 westbound through, and 316 vehicles from the eastbound through,
- The Highway 16 intersection volumes were adjusted, and rebalanced thereby achieving the 2008 configurations while maintaining an acceptable LOS.

Results

- At several intersections the south leg does not exist in the 2008 model: [Access 3 (Future Terrace Heights Access), Access 2 (Woodley Drive), and Fleming Drive], and as a result the Highway 16 intersections will require upgrades at these locations regardless of how much traffic migrates to the South Connector (Eastbound Right and Westbound Left auxiliary lanes will be required).
- The increased volumes require signals at some intersections [Highway 40, the Future Terrace Heights Access (Access 3), Woodley Drive (Access 2), Meier Street (Access 1), McArdell Drive, Brookhart Street, and Drinnan Way]. These intersections are un-signalized in 2008 and the increased volumes will require signalization to create gaps.
- Some of the side streets will require auxiliary lanes added to address higher turning volumes (Meier Street, Mountain Street, Switzer Drive, McArdell Drive, and Drinnan Way).

  (Note: These are the same results as those derived from the South Connector scenario, which is expected, as these connections will need to be constructed.)
- At some intersections the combination of higher turning movements and through movements on Highway 16 - the overall effect of the bypass removes less through-traffic than the South Connector) - causes failing movements (LOS E or worse) on Highway 16. This would require six laning of Highway 16 to improve the intersection capacity. The intersections which would require upgrades are all in the highest volume section of the highway (Woodley Drive, Meier Street, and Mountain Street), and so it is expected that this would be the section of Highway 16 that would operationally fail.

In summary, at least a portion of Highway 16 will require six lanes; Woodley Drive to Mountain Street.

6.2 SOUTH TERRACE HEIGHTS CONNECTOR SCENARIO

Overall, the South Terrace Heights Connector will reduce the need to expand Highway 16 beyond building the new intersections, some improvements on the side streets, and some new signals. Moving more of the through traffic to a new highway Bypass to the south will most likely not reduce these improvements further. Some of the intersections need to be upgraded just due to the need to provide adequate access to the new developments, and this cannot be avoided.

Modelling indicates the South Connector is far more efficient at improving the LOS along Highway 16 at all of the intersections. This is due to the turning volumes being reduced substantially, and these same volumes do not go through the next intersection, adding to the through volumes for short sections. The Bypass however, only reduces Highway 16 through movements. For example, at the west end of the Town of Hinton the incoming highway though traffic is 658 vehicles. By Meier Street (Keil Drive), the through volume has increased to 2302; primarily from development volumes turning onto the highway. Providing new development traffic increased options across town, as opposed to moving a percentage of through traffic to a Bypass, allows for a larger overall impact on the network.

6.2.1 2033 South Terrace Heights Connector

Methodology

- The new PM peak-hour trips for the 2033 population horizon from the trip generation tables were used in the analysis for a subsequent determination of what movements, in the transportation network, would be impacted if the South Connector was built. On the west side of town (where the Terrace Heights development would be located), it is the Westbound Left and Northbound Right; while on the east side of town it is the Eastbound Right and Northbound Left. These also have a corresponding impact on the highway through traffic both upstream and downstream from the intersections. We assumed some traffic would be reduced, for the Eastbound Right and Northbound Left for the intersections at Mountain Street and Switzer Drive at both locations along the highway. This would consist of traffic heading to Robb Road and eventually the South Connector. Splits used in the 2033 network, were used to distribute traffic.

- A 50% reduction in the impacted highway intersection traffic movements was assumed,
- The volumes removed from the Highway 16 intersections were added to the intersection of Robb Road and Sawyer Drive, and a west leg was added to this intersection. This appeared to be a logical location for the intersection of the South Connector.
- The intersection configuration was modeled allowing for the generated volumes. The South Connector will therefore need to be a 4-lane arterial with auxiliary lanes and Robb Road will require expansion to four lanes north of this intersection. These changes or volumes, were not modeled through the local street network, as the scenario constraint was to determine impacts to Highway 16. The salient feature of this intersection is to demonstrate proof that the volumes can be taken off Highway 16 and effectively use the South Connector.
- The Highway 16 intersection volumes were adjusted and rebalanced thereby achieving the 2008 configurations while maintaining an acceptable LOS.

Results

- Highway 16 will NOT require lane capacity increases, and the current lane configuration can remain, providing an acceptable LOS.
- At several intersections the south leg does not exist in the 2008 model: [Access 3 (Future Terrace Heights Access), Access 2 (Woodley Drive), and Fleming Drive], and as a result the Highway 16 intersections will require upgrades at these locations regardless of how much traffic migrates to the South Connector (Eastbound Right and Westbound Left auxiliary lanes will be required).
- The increased volumes require signals at some intersections [Highway 40, the Future Terrace Heights Access (Access 3), Woodley Drive (Access 2), Meier Street (Access 1), McArdell Drive, Brookhart Street, and Drinnan Way]. These intersections are un-signalized in 2008 and the increased volumes will require signalization to create gaps.
- Some of the side streets will require auxiliary lanes added to address higher turning volumes (Meier Street, Mountain Street, Switzer Drive, McArdell Drive, and Drinnan Way).

6.3 POTENTIAL RIVER CROSSING LOCATIONS: A, B, & C

The extent of the investigation was restricted to the Athabasca River valley within the corporate limits of the Town of Hinton, and measuring approximately 10 km in length. The review was further limited to existing geotechnical and geological information, and interpretation of aerial photographs. The river valley ranges from approximately 500 m to 1000 m wide, crest to crest, while the river channel extent is up to 300 m. The river channel may shift over time often associated with fold events. The river depth, hence width may also vary due to seasonal flow fluctuations.

There are two main terrace levels within the valley. A low-level terrace at elevation 960 m to 970 m, and located where the existing West Fraser bridge is sited, and a high-level terrace at elevation 980 m to 1010 m located on either side of the valley.

Available data suggest that the low-level terraces consist of primarily of several metres of gravel and sand overlying bedrock. The high-level terraces generally consist of gravel and sand up to 40 m thick with considerable deviations in thickness possible. Based upon the preliminary analysis, landslides in the steeper areas of the valley cannot, be ruled out however the limited assessment indicates that there do not appear to be any major geotechnical impediments to bridge crossings within the study area.

The shortest possible crossings, hence lowest likely cost crossings, would be from low-level terrace to low-level terrace, and therefore there are three most likely locations.

- Downstream of the auto-wrecker site,
- At the existing West Fraser bridge site, and
- In proximity of the northeast extent of the study area, essentially at the boundary of the town.

6.4 POTENTIAL RIVER CROSSING NETWORK IMPLICATIONS

Based on Thurber Engineering's preliminary geotechnical assessment, three potential crossing locations of the Athabasca River were identified:

A. Just downstream of the Auto Wrecker site on Kelley / West River Road
B. At the existing bridge site by the pulp mill, on Willow Creek Road
C. Near the northeast end of Thurber's study area, a location on East River Road just east of Willow Creek Road

Option A would primarily use Kelley Road then proceeding to Switzer Drive, then access Highway 16 or other areas of the Town. Options B and C would primarily use East River Road, then use either Switzer Driver or Drinnan Way to access the highway. Any of these options would therefore require substantial upgrades to these roads to handle the additional traffic. This traffic will also be funnelled to only limited access points to the highway which will place a significant amount of stress on these intersections.

6.4.1 River Crossing Scenario's: A, B, & C Methodology

Methodology

- Morrison Hershfield took the difference between the 2018 (20,500 population) and 2033 (31,500 population) traffic volumes and assumed that 50% of the growth would be moved north of the river for the Terrace Heights and Thompson Lake developments. With 40% of the developments built out at 2018, that allocates approximately 30% of the total development population from these two sources across the river.
- The appropriate turning volumes were removed from Highway 16,
- The relocated volumes were reduced by 10%, assuming that there would be sufficient commercial and employment opportunities north of the river to retain some of the traffic internal to the north side developments as per discussions with the Town.
- A river crossing connection was assumed at the intersection of East River Road / Switzer Drive and Drinnan Way; this creates a north leg to this intersection. The turning volumes from Highway 16 were then assigned to this intersection, either coming south from the developments, or going north back across the river. Based on the current splits in traffic, an assumed 60% would be expected to use Switzer Drive and 40% to use Drinnan Way to get back and forth to town.
- This scenario removes less traffic from the highway than does the South Connector scenario. The South Connector scenario assumes 50% of the traffic generated by these developments will use an alternative to Highway 16. Under the river crossing scenario only 30% are assumed to do so. Under the river crossing scenario the traffic must be again reassigned to Highway 16 to get across town as there is no alternative.
- The scenario results in Switzer Drive and Drinnan Way carrying significantly more traffic, almost doubling the amount of vehicles on them in the peak hour. This creates the need for substantial upgrades to accommodate turning volumes at the intersection where the river crossing enters town to achieve an acceptable LOS, however also strains the intersections all the way to where both roads intersect with the highway. Turning volumes, associated with the new developments, are now distributed among 9 intersections, versus the current distribution between 2 intersections.

- With the addition of the South Connector, the situation does not significantly improve, as the existing and future commercial / employment zones are primarily along Highway 16. It is unlikely that east / west cross vehicle traffic will proceed to / from the north side of the river, far to the south, to use an east / west alternative to Highway 16. This also does not address the additional volumes on Switzer Drive and Drinnan Way hence this problem will remain.

The CN Rail line north of Highway 16 has two crossings; one at-grade crossing and one grade-separated underpass, and this forces traffic traveling to and from the north side of the river to use these two crossings to get to the highway and Town. This is also one of the reasons that traffic is funnelled onto few roads. In the case of Option A, traffic is funnelled onto Kelley Road, and for Options B and C, this entails using East River Road.

Even with the introduction of a Highway 16 bypass south of the Town, insufficient traffic will be removed from the existing Highway 16 to allow for satisfactory level of service operations along this corridor. The traffic accessing and egressing the highway to go north of the river will create much higher turning volumes.

All three options direct traffic onto Switzer Drive, but option C has also presents the option of using Drinnan Way to access Highway 16 and southeast Hinton. This helps to reduce the impact that a river crossing would have the transportation network of the Town.

To determine the effect that the additional traffic from a development on the north side of the Athabasca River the updated origin-destination tables were used. The ultimate population (31,500 - year 2033) horizon was used, and it was assumed that the Highway 16 bypass had been constructed. Zone 15 was assumed to be the new north development. The routes through the Town to the various zones were determined to and from Zone 15. It was assumed that the traffic to and from this zone is split 50% inbound / outbound, as there was only origin data from Zone 15.

The traffic volume splits from Zone 15 to Highway 16 through Hinton's transportation network is shown on Figures 6.4 through 6.6.

The intersection of Highway 16 and Switzer Drive is one of the busiest intersections on the network and is heavily impacted by the additional traffic from north of the river. This intersection is a major constraint within the transportation network, thus will end up failing before other locations.

Using the traffic split, additional volumes were added to the intersection of Highway 16 and Switzer Drive until the east and/or west through movements reached a level of service of E; this indicated when upgrades would be required to Highway 16. These volumes could then be traced back through the network to determine the maximum amount of traffic that could be allocated to / from Zone 15 before these upgrades would be triggered.

6.4.2 Option A

This option would assign traffic on the network through Kelley Road. This results in primary impacts on Highway 16 at the Switzer Drive intersection through the northbound left and eastbound right movements. The additional traffic assigned to the right turn does not impact the operation of the intersection, as this is an un-restricted right turn, however the northbound left turn requires continuous reallocations of green time as the traffic volume increases. This results in reduced levels of service for other movements.

Upon the addition of 300 vehicles to both of these turns, the through movements on Highway 16 were on the cusp of the boundary between levels of service D and E. This translates into an equivalency of 1800 vehicles emanating to / from Zone 15.

Figure 6.4 Proposed Future Scenarios: River Crossing A

6.4.3 Options B and C

These options allow for higher traffic volumes to access Highway 16 via Drinnan Way; however, this traffic eventually has to travel through the intersection at Switzer Drive, adding volume to the northbound left, northbound right, eastbound through, eastbound right, westbound through and westbound right.

Upon the addition of 140 vehicles to the northbound left and eastbound right, 90 vehicles added to the eastbound and westbound through, and 80 vehicles added to the westbound left and northbound right, the intersection was again on the boundary between D and E. This translates into an equivalency of 1400 vehicles emanating to / from Zone 15.

The additional through traffic at the intersection from these options is what creates the lower level of service at a lower volume of traffic. With both Options A and B the northbound left is failing, but this does not impact the level of service of the through movements on Highway 16 until much higher volumes force longer cycle lengths.

Figure 6.5 Proposed Future Scenarios: River Crossing B

Figure 6.6 Proposed Future Scenarios: River Crossing C

6.5 Summary / Results

Based on these results, Options A and B for a bridge crossing of the Athabasca River would trigger transportation network improvements at higher volumes than would Option C. The Town should therefore consider Option C as the most cost effective option subject to costs associated with the River Crossing itself. The bridge costs will need to be generated, however, those can only be determined subject to additional geotechnical investigations, and a functional design of the bridge structure, and roadway alignments.

7.0 Truck and Transportation of Dangerous Goods Routes

The proposed functional classification guidelines accommodate through truck movements on the arterial road system. Truck movements on collector and local streets should however, be discouraged, and restricted to local deliveries only. The current Town of Hinton Traffic Bylaw #1023, generally addresses these issues through Sections; 5 - Truck Routes, 6 - Maximum Weights and Oversize Vehicles, 7 - Pulp Trucks, and 8 - Dangerous Materials. The specific routes allowing truck movements, defined as vehicles in excess of 5,000 kg., are stipulated in the Schedules to the Bylaw; 60 - Truck Routes, 61 - Weight Restrictions, and 62 - Pulp Trucks. Immediate actions to consider include a review of these schedules to ensure that they adequately reflect current developments, and business operations, and that revisions to the Schedules and / or Bylaw be considered as part of the Development Review process.

A secondary consideration is that the Town is fortunate in having routes such as Switzer Drive, Robb Road, and East River Road that partially parallels the highway. This pattern makes it possible to have an *alternate route* in the eventuality of a need for emergency access or temporary diversion of traffic to bypass a traffic incident. Under the classification scheme, Switzer Drive is designated as a minor arterial roadway (primary collector) that connects to both Highway 16 and Robb Road, and subsequently to Highway 40 south via Cold Creek Road. The development of a major collector road system as part of the residential development on the south side of the highway also facilitates the availability of alternative access for emergency purposes where one or more of the other parallel routes are blocked temporarily.

Under the existing Bylaw #1023, Highway 16, Robb Road, Switzer Drive, East River Road, and Kelley Road are designated as truck routes. Robb Road, and segments of both Switzer Drive and Kelley Road, have further designations related to loaded and un-loaded pulp trucks. This specific designation has implications for pulp mill operations, development applications, and need to be addressed as part of the response to associated traffic impact assessments.

7.1 TRUCK ROUTES

7.1.1 Background and Objectives

Many municipalities place emphasis on the efficient movement of people and vehicles without placing much emphasis on the movement of goods. According to Alberta Transportation research[1], urban goods account for approximately half of the provincial freight movement costs.

The profitability, productivity, and competitiveness of commercial businesses depend greatly on their ability to minimize transportation costs. In the development of the truck route framework elaborated upon below, a review of several publications were reviewed. In addition, the truck route practices of other jurisdictions dealing with commodity flow and goods-movements were evaluated. Numerous personnel from a number of jurisdictions were contacted to determine the level of sophistication for two disparate elements; truck-related bylaws, and policies related to the establishment, and maintenance of truck routes. The jurisdictions surveyed, as background in evaluating the policy and bylaws, included Calgary, Edmonton, Saskatoon, Ottawa, and Hamilton. The survey was done to best develop a framework that services both the trucking industry and municipalities.

A key consideration in adopting a policy and / or bylaws similar to those developed because of this study is that the jurisdictions that these were originally developed for are larger by several orders of magnitude; however, the principles and processes developed can be applied ubiquitously.

[1] "Alberta Transportation Urban Goods Movement Project, Phase 1: Inventory of Municipal Bylaws and Urban Goods Movement Studies", Department of Civil Engineering, University of Calgary, April 1980.

7.1.2 Purposes and Goals

Legally, trucks can travel on any public roadway, subject to provincial legislation (Traffic Safety Act, RSA 2000, Chapter T-6). Truck route designation through bylaw is therefore restrictive in nature. Therefore, consideration is necessary to establish which roadways would be most suitable to accommodate truck travel. In developing a truck route framework, it is important to identify the purpose that the framework will serve in the context of the overall transportation network, and focus on the ultimate goals of a truck route within the Town.

Purposes of a Truck Route Framework.

1. Identify the criteria that best evaluates and can be used to mitigate routes for use as a truck route, which balances the economic objectives, urban structure, traffic management, social measures, and environmental measures.
2. Rationalizes the use of truck restrictions to manage and control truck travel.
3. Development of a policy that will guide Administration through a public engagement process, to perpetually review and manage truck routes within the Town of Hinton.

Goals of Intra-city Truck Routes:

1. Provide safe, efficient, and connective routes to best service commercial and non-commercial truck travel while minimizing impact to the community.
2. Provide a seamless transition between external truck traffic and the internal road network. Here, external truck traffic includes both through bypass truck traffic and truck trips that originate outside the town boundary and have a local destination.
3. Ensure the integration of the truck route network into the transportation infrastructure such that it will minimize costs to the Town (e.g. maintenance, infrastructure upgrades, etc.).
4. Provide information to users in the form of consistent, readable and accurate signage, readily available maps and reduced time and weight restrictions.

7.1.3 Alberta Transportation Licenses, Permits and Applications[2]

The movement of commercial vehicles is governed under the Traffic Safety Act Chapter T-6, Part 7, Commercial Motor Transport. Under Part 1, of the Act, Division 3, Section 13, and further subject to the Dangerous Goods Transportation and Handling Act. Municipalities have the authority to restrict classes of vehicles to certain roadways under their jurisdiction. The intention of this provision is to allow municipalities the ability to manage their roadway network as appropriate to local circumstances. Municipalities, however, do not have the legislative ability to prevent commercial vehicles from accessing their points of origin or destination via a public roadway; hence, a truck route bylaw is the preferred mechanism that allows jurisdictions to control how trucks may access their origin and destination points.

Alberta Transportation (AT) establishes maximum vehicle weight and dimension limits to preserve the highway infrastructure and to ensure the safety of the traveling public. With respect to the Town of Hinton, the provincial transportation network includes Highways 16 and 40. Only Highway 16 is included in the provincial Long Combination Vehicle (LCV) network and neither of the roadways is designated as High Load Routes in the province. Highway 16 is however, further designated as a truck route under the Town of Hinton Traffic Bylaw No. 1023.

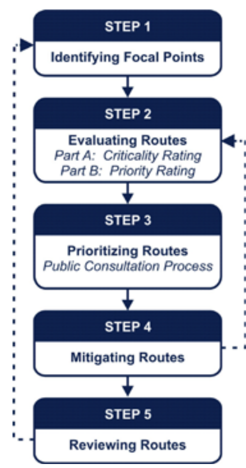
[2] Alberta Transportation web site, http://www.transportation.alberta.ca/3.htm

7.2 TRUCK ROUTE FRAMEWORK

7.2.1 Methodology

The development of a truck route network is predicated upon the identification of *focal* points. Focal points are the locations of the truck origin and destination points within the town. It then becomes an exercise in connecting the focal points through the most direct and efficient manner, while minimizing impact to neighbouring communities, the environment, and infrastructure. The methodology outlined below aims to do this in a systematic and objective manner and the process in defining a truck route network diagrammatically represented below:

Truck Route Framework / Methodology



<u>Step 1: Identifying Focal Points</u>

Identifying focal point locations is one of the most important steps in truck route analysis. This leads to the development of a truck route network that provides more direct connections from the road network to delivery points for trucks, reducing travel time and delays to shipping. Knowing the source of truck origins and destinations also allows routes to be chosen that reduce congestion, optimize road geometry, and reduce impacts to the community.

In order to identify the focal points within the Town, the following information, ideally, is required:

1. Commodity vehicle surveys;
2. Vehicle classification count data for 24-hour period for any high truck traffic area;
3. Truck travel demand models (vehicle-based and commodity-based modeling); and
4. Land use data.

Commodity Vehicle Surveys

Commodity vehicle surveys provide valuable information on truck type, number of axles, occupancy, origin, destination, commodity quantity and value, and location and number of stops for delivery and / or pickup. It provides the planner with an idea of where the external truck movements are going to and coming from. It also provides the commodity type for which the load is transported, which is useful in determining amount of hazardous or other substance transported. The percentage of trucks that are empty is given, which provides information regarding the possible inefficiency of the trucking industry.

Vehicle Classification Count Data

It is important to have full 24-hour count data for all classes of roadways that carry high volumes of truck traffic. This information is important in understanding goods movements within a jurisdiction. Accurate vehicle classification counts are essential in developing reliable models of truck movements.

Truck Travel Demand Models

There are two approaches to travel demand modeling: vehicle-based and commodity-based modeling. In regional models, a combination is used where commodity-based is used for long haul trips, while vehicle-based are used for short haul trips in intra-urban areas. Truck travel-demand models can greatly aid in the identification of focal points within the city and determining a road network to best service these localities.

Land Use Data

Land use information is helpful in both identifying focal points as well as determining the suitability of locating truck routes through an area. It is imperative for determining the affects of a possible truck route through an area. If the area is mostly residential, urban reserve or commercial, with little industrial land uses, and there is another route that can provide connectivity for the planned truck route system then the residential route(s) ***could and should be abandoned.***

Step 2: Evaluate Routes

The evaluation of truck routes is divided into two parts: Part A, Route Criticality; and Part B, Route Priority. Part A is a qualitative evaluation in the form of Go / No Go scenario that deals with the necessity of a route as part of the truck route network. Part B is a more detailed evaluation that rates the routes according to select criteria in order to prioritize them for selection into the final network.

The evaluation of routes should be based on the following criteria:

Table 7.1 Evaluation Criteria

Part A – Route Criticality	Part B – Route Priority
1. Route Purpose	1. Support for Existing and / or Future Land Uses
2. Network Connectivity	2. Network Connectivity
3. Community Impact / Input	3. Road Classification
4. Route Length	4. Road Geometrics
5. Coverage	5. Congestion
	6. Road Surface Conditions
	7. At-Grade Rail Crossings
	8. Traffic Safety
	9. Land Use Impacts
	10. Noise Attenuation

Below, a brief description of each of the criteria used to rate the truck routes, is provided:

Part A – Route Criticality

The analyst must evaluate the candidate route in light of the overall purpose and performance in the network. If the route does not serve any purpose, serves no focal points, does not provide a continuous network, or other alternative routes provide better coverage and shorter travel distances, then there is very little need to continue with the evaluation.

Another important criterion to be considered in this initial evaluation is the Community Impact / Input to the truck route. If the community has expressed an interest to include certain truck routes, and a process was followed to obtain Council direction, then the truck route should be evaluated. Conversely, if the community has taken steps through Council approval to remove a certain truck route, then their decision must be adhered to and incorporated into the latest truck route update.

Table 7.2, outlines the evaluation for the Route Criticality. There are numbers corresponding to each response: zero for No Go, one for Evaluate, and two for Go. If the sum corresponding to the responses totals any number above zero, then the route should be evaluated. In other words, the route will be evaluated unless there is a No Go response to all of the criteria in the Route Criticality evaluation.

Table 7.2 Route Criticality

	CRITERIA	No Go 0	Evaluate 1	Go 2
Criticality Rating	Route Purpose	Serves no focal points	Serves some focal points	Serves many focal points
	Network Connectivity	Route provides no connectivity to truck route system	Route provides indirect connectivity to truck route system	Route provides direct connectivity to truck route system
	Community Impact / Input	Prior Council approved documents indicates route cannot be truck route (i.e. ASP, Community Plans, Outline Plans)	Public awareness that a route is problematic (i.e. Community complaints received on certain truck routes)	Prior Council approved documents indicates route should be evaluated as truck route candidate (i.e. ASP, Community Plans, Outline Plans)
	Route Length	No distance reduction with addition to truck route	Limited improvement to travel distance on truck route	Significantly shortens travel distance on truck route
	Coverage	No reduction of trips off the truck route system	Marginally decreases trips off the truck route system	Significantly reduces trips off the truck route system

Part B – Route Priority

Part B is comprised of criteria divided into 5 main categories: Economic Measures, Urban Structure, Traffic Management, Social Measures, and Environmental Measures. These criteria summarize and aim to balance the interests of the private sector, the public, and the municipality.

<u>Economic Measures</u>

1. Support for Existing and / or Future Land Uses

   This criterion considers the benefit of the truck route to the development of the Town's existing land use or future growth areas within five years. For example, maintaining Highway 16 as a truck route supports the industrial land uses in the annexation area 'D', and developing it west to intersect with Highway 40 will delay the need to construct an east / west bypass route.

2. Network Connectivity

   The proposed route must serve to connect the truck route network. Network Connectivity negates the possibility of having dead end routes that do not serve to connect the truck-route network grid.

<u>Urban Structure</u>

1. Road Classification

   This criterion is based on the suitability of the roadway to handle large truck traffic. Road classification factors deal mostly with roadway geometry such as lane width, shoulder width, presence of a raised median to separate opposing lanes of traffic, unimpeded flow, minimum intersection spacing, and presence of on-street bike routes.

   Classifications of roadways are referenced from the Transportation Association of Canada, Geometric Design Guidelines. Freeway or expressway classifications with a minimum 60.0 m right-of-way, 4 to 8 lanes of traffic, and intersection spacing not less than 800 m are most suitable as part of the truck route network, whereas a residential street with 15.0 m right-of-way, 2 lanes of traffic, and intersection spacing of 60 m is not recommended as a truck route. Roadways acceptable for use as truck routes include Expressways / Freeways, Major roadways, Industrial roadways and Industrial streets.

2. Road Geometry

   The distance that a truck operator has to react to road blockages caused by collisions, construction, or similar occurrences depends on the proper alignment of the road. This is determined by the vertical and horizontal alignment of the roadway. Horizontal alignment is evaluated using stopping sight distance and radius of curvature. Vertical alignment is evaluated on grade of the roadway, K-values, and percentage of super-elevation corresponding to design speeds. If any of these line of sight parameters are in the "desirable" range (for example, a desirable radius of curvature for a Major Urban Arterial Divided (UAD) is 6000 m), then the score given in the risk matrix can be in the Negligible or Low Risk. If these parameters are in the "minimum" or "maximum" range, then the risk assigned is Moderate. Insufficient horizontal and vertical alignment elements constitute a High or Extreme risk. Roadway classifications can be referenced in the Alberta Transportation Geometric Design Manual or Transportation Association of Canada (TAC) Manual.

<u>Traffic Management</u>

1. Congestion (v/c)

   The volume to capacity ratio (v/c) is a measure of capacity sufficiency for each separate traffic movement. Volume or rate-of-flow is a measure of present or forecast future traffic-demand, and measured in units of vehicles-per-hour (vph). Capacity is either a defined value dependent upon the type of facility, or a calculated value for signalized intersections. A v/c of 1.0 indicates that the traffic demand has reached the capacity of the road and improvements need to be made. A maximum threshold, such as a v/c of 0.9, should be determined by the Town of Hinton, before improvements are required. The v/c gives a good indication of congestion or capacity of the roadway. Increased congestion increases the number of vehicles that can safely use the roadway, and therefore increases the risk to heavy vehicles becoming involved in an incident.

2. Road Surface Condition (PQI)

   This rating is equivalent to a PQI rating. PQI refers to a pavement quality index (used by some jurisdictions), and is a combination of a visual inspection number (VIN), and pavement structure. The PQI provides a number between '0' and '10' with '10', indicating a newly finished surface and '1', indicating a surface overdue for upgrade. The PQI is used to provide a quantitative number for risk presented by the road surface.

3. At-Grade Railway Crossings

   The presence of at-grade rail crossings increases congestion as well as the likelihood of collisions. In some instances, at-grade rail crossings cannot be avoided, especially in heavy industrial areas. The railway-crossing criterion is evaluated per kilometre of roadway in order to compare routes of different distances.

<u>Social Measures</u>

1. Traffic Safety

   Collision statistics provide a numerical figure to help validate the conditions of the roadway. The collision statistics can be presented as the average number of collisions per year on a given sector divided by the total length in kilometres of that sector. Alternatively, more sophisticated analysis techniques available, will provide measures of exposure, or otherwise indicate potential risk levels.

2. Land Use Impact

   Land use impact scores are determined by the proximity of certain land use properties to the road right-of-way. *The presence of trucks in residential areas negatively affects the standard of living for residents through noise, vibration, pollution, and safety concerns.* These effects are less of a concern in areas with commercial and industrial land uses. Land use designations are specified in the Towns' planning documents.

<u>Environmental Measures</u>

1. Noise Attenuation

Developments for new residential subdivisions may be accompanied with sound attenuation reports that meet local guidelines. A noise policy may require roads that are classified as designated truck routes to be within a specified design noise level. The Town of Hinton has designated portions of East River and West River Road, as well as Switzer Drive as a truck route. East River Road in particular, has residential land uses adjacent to, or in close proximity to the roadway.

Some jurisdictions have set the noise level at 65 dBA. A typical truck travelling on a roadway will exert a noise level of 65 to 70 dBA at a distance of 15 m. Noise levels within a typical living room will be 40 dBA, whereas typical background vehicle traffic at a distance of 30 metres, will measure 50 dBA.

A noise barrier will make a significant difference to the noise level. A barrier can achieve a five-dBA noise level reduction when it is tall enough to break the line-of-sight from the roadway to the receiver location. After it breaks the line-of-sight, it can achieve 1.5 dBA of additional noise level reduction for each metre of barrier height.

An option for the Town of Hinton is to establish a development requirement, whereby noise level modelling is required. One of the most widely used tools is the Traffic Noise Model (TNM) developed by the Federal Highways Administration. The TNM contains the following components:

- Modeling of five standard vehicle types, including automobiles, medium trucks, heavy trucks, buses, and motorcycles, as well as user-defined vehicles;
- Modeling of both constant-flow and interrupted-flow traffic using a 1994 / 1995 field-measured data base;
- Modeling of the effects of different pavement types, as well as the effects of graded roadways;
- Sound level computations based on a one-third octave-band data base and algorithms;
- Graphically-interactive noise barrier design and optimization;
- Attenuation over / through rows of buildings and dense vegetation;
- Multiple diffraction analysis;
- Parallel barrier analysis; and
- Contour analysis, including sound level contours, barrier insertion loss contours, and sound-level difference contours.

Incorporating the requirement for sound attenuation into development policies, particularly for residential land use adjacent to truck routes, and the use of noise models as noted above should be considered.

Table 7.3, below, outlines the rating for the criteria and provides a basis for a truck-route framework warrant calculation.

Table 7.3 Route Priority

	CRITERIA	Poor 0	Low 3	Moderate 5	Moderately High 7	High 10
Economic Measures	Support for Land Uses	Does not support land use development	-	No impact on land use development	-	Supports land use development
	Network Connectivity	No connectivity to truck route system	-	Indirect connectivity to truck route system	-	Direct connectivity to truck route system
Urban Structure	Road Classification	Residential or Collector	-	Industrial or 4-Lane Major	6-Lane Divided Major	Freeway or Expressway
	Road Geometry	Significantly substandard alignment elements	Substandard alignment elements	Specified minimum or maximum alignment elements	-	> Specified minimum or maximum alignment elements
Traffic Management	Congestion (v/c)	> 1.2	0.9 - 1.2	0.7 - 0.9	0.5 - 0.7	< 0.5
	Road Surface Condition, PQI	< 2	2 – 3	4 – 6	7 – 8	> 8
	At-Grade Rail Crossing (per km)	≥ 2	-	1	-	0
Social Measures	Traffic Safety (collisions per km-year)	> 75	36 – 75	7.5 – 35	2 – 7.4	< 2
	Land Use Impact	Low density residential	Medium density residential	High density residential	Commercial	Industrial
Environmental Measures	Noise Attenuation	Noise attenuation required, none provided	-	Noise attenuation present, but does not meet 65dBA for truck routes	-	Proper noise attenuation provided or not required

Warrant Calculation

A warrant calculation is used to determine the rating of a candidate route for selection as part of the truck route network. Using the Route Priority rating provided in **Table 6.3**, total the scores for each criterion are tallied in the evaluation table below.

Criteria	Points (0 to 10)	Weight (to be determined)
1. Support for Land Uses		
2. Network Connectivity		
3. Road Classification		
4. Road Geometry		
5. Congestion		
6. Road Surface Condition		
7. At-Grade Rail Crossing		
8. Traffic Safety		
9. Land Use Impact		
10. Noise Attenuation		
Total Warrant Points		

Total Score	Category	Evaluation
0 – 32	Poor	Do not consider road for truck route.
33 – 54	Low	Mitigate road before consideration as truck route.
55 – 76	Moderate	Good-candidate truck route. Mitigation can improve the rating as a truck route.
77 – 110	High	Excellent candidate for truck route.

The assumed threshold acceptable value would need to be determined through a detailed analysis, having regard to the average scoring for the routes selected. Scorings above the threshold value are considered to have a moderate to high acceptability, while below the threshold value would be considered low to poor acceptability.

<u>Step 3: Prioritize Routes</u>

After all routes have been evaluated and warrant scores obtained, a network can be created from the different road segments. Existing routes that fall in the Moderate or High category can remain part of the truck route, whereas routes that are in the Low or Fail category should be mitigated or may be eliminated from the network. The necessity of a route to provide access to focal points and / or to provide connectivity to the truck route network (as determined in Step 1 of the evaluation process) will determine if it will remain as a truck route.

If there are several routes that serve a focal point, all routes can be designated as truck routes, depending on the need to provide several alternative routes and the truck volume demand of the area. Alternatively, routes with lower scores can be reserved as secondary or emergency routes.

Public and Stakeholder Consultation Process

A consultation process is a general requirement and should be undertaken to obtain the opinions and input from stakeholders that include carriers, manufacturers and distributors of commercial goods, and the public that include residents and committee members at large. In addition, individual companies may be involved in the public consultation process through interviews and meetings.

Step 4: Mitigate Routes

As determined in Step 3, of the evaluation process, Prioritize Routes, it will become clear as to which routes will require mitigation in order to be maintained as part of the truck route network. Recommended mitigation measures are outlined below:

Cause	Recommended Mitigation (Partial List)
Inadequate intersection geometry	Upgrade inadequate intersection to accommodate truck-turning movements. If this is not possible, provide signage to restrict truck-turning movements at this location. Signage should only be used as a temporary measure until the intersection can be upgraded.
Poor road surface conditions	Repave or repair road surface.
Poor intersection capacity or v/c	Investigate signal timing to ensure optimized phasing is being used.
High collision statistics	Investigate nature of collisions and provide mitigation to improve safety. (i.e.: geometric design, sight distances, visibility and lighting, signal lights, etc.)
Substandard noise attenuation	Perform sound analysis to determine if sound attenuation is warranted and if it will reduce sound and vibration to acceptable levels. Check alternate strategies such as sound attenuating pavements.

As outlined in the purposes of a truck route in Section 6.1.2 of this framework, mitigation measures that improve specific criteria of the priority rating evaluation process are recommended over truck route restrictions in bylaws. This is because restrictions require additional labour to enforce, they can be cumbersome and confusing to drivers, and they decrease the efficiency of carriers translating to lost time and profits. Sometimes these restrictions are the only method of controlling truck transports, but they should be minimized or used on a temporary basis. Restrictions used as mitigation measures include weight and height restrictions; time of day restrictions; slow-moving vehicle restrictions, seasonal and volume restrictions.

Step 5: Review Routes

Currently, there is no legislation regulating the regular review of truck routes within the Town, however there is a Bylaw in place to govern truck travel. The Bylaw requires updating to reflect current development, and truck travel patterns related to that development. Stakeholders should conduct a full review of the route requirements to determine the validity of the network and its rating based on this policy every 5 years. In addition, a review should be undertaken when Council approves strategic policies such as the Hinton Transportation Master Plan (TMP) and Municipal Development Plan (MDP), or when there are major changes to the transportation infrastructure.

7.2.2 Planning for New Truck Routes

Planning is an important step in developing a cost-effective network for truck routes. Design of future routes and upgrading of existing routes is a valuable step in ensuring the network meets current and future expectations. Use of a policy in initial planning would determine if a new route should be considered for inclusion in the network and, if so, what design features should be incorporated. With respect to the annexed lands, areas A, B, and F should be evaluated due to their proximity to existing truck routes when development applications are submitted. Areas D and E are less susceptible to evaluation as they abut Highway 16, which by definition comprises one portion of the provincial truck route. The proposed developments, however, should still be evaluated for possible truck route inclusion subject to the specific land use, and also to determine if sound attenuation is warranted.

The Planning and Technical Services Division should take the initiative to incorporate truck route policy into the design and construction of new routes, as appropriate. The Division should also take into consideration the guiding principles resulting from a Truck Route Policy study when drafting transportation related sections for the new Municipal Development Plan (MDP). Implementation would occur through the detailed local area planning processes. At this planning level, consideration of broader truck route and related network, planning issues (truck route contiguity, employment, and residential area connections etc.) will be evaluated. At more detailed planning policy levels (i.e. development applications, area structure plans, community plans, area redevelopment plans and then subdivision / outline plan) more localized impacts of truck route planning and abutting land use issues (i.e. appropriate land uses, separation distances and buffers) will be considered.

7.2.3 Evaluation & Weighting

The ***Town of Hinton, currently is primarily resource-based***, hence the weighting criteria used in the analysis becomes critical. It is ***not recommended that equal weighting*** be afforded to each of the evaluation criteria based upon the economic requirements of the Town. The factors that relate to 'Economic Criteria, i.e. Land Uses and Network Connectivity have therefore been increased to account for the importance of this particular measure, and should be carefully considered by the Town to ensure a balance between economic growth and social impacts as a consequence of growth. These are value statements, which this analysis cannot answer, however direction is provided by indicating through the following location-specific evaluations, how important previous Town decisions become, particularly with respect to existing land use. The weight assigned to the economic measures has been set at 1.5 for the following reasons. The existing truck route provides a connection across the Fraser River to support economic development and resource based activity. Additionally, the presence of the existing Timber Mills require the maintenance of this route as a result of the existing, and previously approved land uses. Mitigation of the adverse affects of this roadway on residential property should be considered. These activities can include, pavement and roadway improvements, and / or over the long term, a gradual migration from residential use to commercial land uses.

7.2.4 West Fraser Mills: Hinton Pulp Mill Access – Traffic Impact Assessment

Implications for the TMP with respect to the proposed modifications for the access have two distinct aspects. One aspect includes the traffic volume and level of service (LOS) impacts on the intersection and the network from the increased volume of commercial vehicles that will be using the access. The second aspect includes operational and geometric impacts on the intersection and network. As noted in the TIA, the impacts from a volume and LOS perspective will be negligible. Impacts from an operational perspective will potentially impede through traffic requiring geometric changes to obviate these impacts. Off tracking of commercial vehicles will reduce lane capacity during those periods that they are turning into or out of the access. Additionally, the length of the turn-bay will have implications for through traffic capacity, potentially requiring a longer turn-bay. Finally, due to the operational characteristics of commercial vehicles, their reduced acceleration, increased deceleration times, and limited manoeuvrability, introduces potential weaving issues. Recommendations are therefore to increase the length of the turning movement storage-bay, and the length of the acceleration lane.[3]

Further recommendations of the TMP include conducting a pavement analysis on the affected segment of Switzer Drive. This segment is to be considered for inclusion in Schedule 62 of the Traffic Bylaw. This may entail a stipulation as to use of a designated lane to both minimize damage to the roadway infrastructure, and to mitigate LOS impacts. As the commercial vehicles, expected to be used at this facility, are of the Super B Chip Train classification, and allowed under the Traffic Safety Act, Chapter T-6, Commercial Vehicle Dimension and Weights Regulation, AR 315/2002.

[3] Hinton Pulp Mill Access Traffic Impact Assessment, Report No. 4 08 4 035.00, Morrison Hershfield, September 3, 2008

7.2.5 Evaluation of Existing Truck Routes (East River Road / Switzer Drive)

The TMP, in addition to providing strategic direction, entailed another objective, which was to provide some mechanism for evaluating truck routes, as well as some determination on the appropriateness of the existing truck routes. The process outlined above, was used to evaluate the segment of the existing truck route on East River Road / Switzer Drive. The Town provided the following information on a 2 km segment of Switzer Drive with the lowest pavement conditions:

- From the intersection of Drinnan Way to the intersection of Swanson Drive. Pavement condition approximates 1.5;
- From Swanson Drive to the intersection of Kelly Road is approximately 3.5;
- At the intersection of Kelly Road to the Jug-Handle (traffic-signal) is approximately 1.5;
- From the Jug-Handle (traffic-signal) to the Robb Road intersection is approximately 4.5;
- From the Robb Road intersection (westbound) is 3.0 for about 300m to the start of the curve; and
- From the start of the curve to Highway 16 intersection is approximately 1.5 to 2.0.

Based on the above, it was determined the values that should be used for the evaluation are as noted below:

- Pavement condition: is approximately 1.5;
- Surface type is asphalt;
- Noise attenuation includes some wood fencing in the vicinity of the residential land use;
- Roadway geometry includes one lane each direction with a middle turning lane from the Swanson Drive intersection to the Hardisty intersection, and one lane only for each direction from Hardisty to the Drinnan Way intersection;
- Speed limit of 60 km/h; and
- Classification is a 2 lane, urban, arterial, and undivided.

This information has been summarized in the following two tables and is in conformance with the evaluation criteria specified in **Table 6.3**. Due to the presence of the residential land use, the roadway was segmented at Swanson Drive, and results in two different valuations. Based on the valuations noted below, a recommendation is that the portion of Switzer Drive east of Swanson, and transitioning into East River Road can be removed from the truck route (traffic bylaw) schedule, based on a score of 42. Alternatively, steps should be taken to mitigate the adverse impacts of trucks using this roadway. Mitigation measures can include re-surfacing, improving the roadway geometry, or enhancing noise attenuation.

The segment to the west should remain as a truck route with a score of 76. Essentially, the *'objective'* analysis supports this removal. Further, it is possible to establish a cut-off at Jobin Street, however there is insufficient information available to definitively determine the limit. To accommodate the industrial zoning on the north, there are other options available, which would allow commercial vehicles use of this roadway to arrive at their origin or destination points; one option would require some textual revisions to the bylaw. These revisions can be very simple, such as allowing trucks to deviate from the designated truck route, by the shortest path, to reach their destination.

7.2.6 East of Swanson

Criteria	Base Points (0 to 10)	Weight (to be confirmed)	Weighted Points Summary
1. Support for Land Uses	10	1.5	15
2. Network Connectivity	10	1.5	15
3. Road Classification	5		5
4. Road Geometry	3		3
5. Congestion	3		3
6. Road Surface Condition	3		3
7. At-Grade Rail Crossing	10		10
8. Traffic Safety	5		5
9. Land Use Impact	3		3
10. Noise Attenuation	0		0
Total Warrant Points	**52**		**62**

7.2.7 West of Swanson

Criteria	Points (0 to 10)	Weight (to be determined)
1. Support for Land Uses	7	
2. Network Connectivity	10	
3. Road Classification	5	
4. Road Geometry	7	
5. Congestion	5	
6. Road Surface Condition	5	
7. At-Grade Rail Crossing	10	
8. Traffic Safety	7	
9. Land Use Impact	10	
10. Noise Attenuation	10	
Total Warrant Points	**76**	

These processes can be applied to both new and existing truck routes, as a means of ensuring developers are assessed the appropriate costs, particularly with respect to noise attenuation, adjacent to truck routes, and also to facilitate change as zoning changes occur. Subject to the specific direction, or data availability within the Town of Hinton, various weights can be assigned to the scoring, and to ensure the valuations reflect Town policy.

APPENDIX A
LEVEL OF SERVICE AT SIGNALIZED INTERSECTIONS

APPENDIX B
SYNCHRO® CAPACITY ANALYSIS CALCULATIONS

APPENDIX C
TRIP GENERATION METHODOLOGY

APPENDIX D
ORIGIN / DESTINATION MATRICES

P.M. Peak Hour Trip Distribution (31,500 Population Horizon) - 2008 MHL Model

Origin

Destination	Dest \ Origin	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	*Total*
		Internal											*External*				
Internal	**1**	49	57	2	60	113	38	52	140	66	56	12	17	13	2	99	***776***
Internal	**2**	52	43	1	97	187	39	69	204	111	25	17	8	6	1	44	***903***
Internal	**3**	143	198	816	83	148	106	744	318	83	235	178	73	304	9	414	***3853***
Internal	**4**	51	83	3	15	22	41	36	68	11	105	6	32	25	4	185	***685***
Internal	**5**	96	159	6	21	30	76	65	118	13	203	11	63	49	7	358	***1276***
Internal	**6**	34	36	1	47	89	26	38	106	53	32	9	10	8	1	57	***546***
Internal	**7**	169	254	542	80	138	131	444	342	75	311	82	96	331	11	547	***3553***
Internal	**8**	129	180	102	89	161	99	217	255	91	209	55	65	50	8	369	***2078***
Internal	**9**	56	94	3	10	13	45	37	65	5	121	6	37	29	4	214	***739***
Internal	**10**	53	30	0	124	240	38	79	247	143	0	20	0	0	0	0	***974***
Internal	**11**	16	24	19	7	13	12	18	29	7	29	2	9	20	1	51	***258***
External	**12**	16	9	0	38	74	12	24	76	44	0	6	0	0	0	0	***301***
External	**13**	18	8	236	33	65	10	284	67	39	0	86	0	0	0	0	***845***
External	**14**	2	1	0	4	9	1	3	9	5	0	1	0	0	0	0	***35***
External	**15**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	***0***
	Total	***884***	***1176***	***1730***	***709***	***1302***	***675***	***2108***	***2045***	***747***	***1326***	***491***	***410***	***835***	***48***	***2338***	***16824***

Ultimate Population, Existing + New Development Trip Distribution - 2008 MHL Model

P.M. Peak Hour Trip Distribution (35,000 Population Horizon) - 1983 Delcan Model

Origin

Destination	Dest \ Origin	*Internal*											*External*				
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	***Total***
Internal	**1**	154	179	83	27	35	78	229	138	55	138	50	33	0	22	2	***1223***
	2	176	205	95	30	39	90	263	158	63	158	57	36	0	24	3	***1397***
	3	188	218	101	32	42	96	280	168	67	168	61	105	1	71	8	***1606***
	4	56	65	30	10	12	28	83	50	20	50	18	32	0	21	3	***478***
	5	79	91	42	14	18	40	117	70	28	70	26	44	0	29	3	***671***
	6	67	79	36	12	15	34	100	60	24	60	23	29	1	19	2	***561***
	7	334	388	179	57	75	170	497	299	119	298	108	172	1	115	13	***2825***
	8	193	224	104	33	43	98	288	173	69	173	63	74	0	50	6	***1591***
	9	129	150	70	22	29	66	192	116	46	116	42	73	1	48	5	***1105***
	10	94	109	50	16	21	48	139	84	33	84	30	51	0	34	4	***797***
	11	35	41	19	6	8	18	52	31	12	31	11	14	0	9	1	***288***
External	**12**	29	32	41	13	18	21	85	37	28	48	13	0	2	412	0	***779***
	13	2	2	2	1	1	1	4	2	1	2	1	0	0	0	0	***19***
	14	16	17	21	6	9	11	44	19	15	25	6	380	5	0	0	***574***
	15	1	1	2	0	0	1	2	1	1	1	0	3	2	0	0	***15***
	Total	***1553***	***1801***	***875***	***279***	***365***	***800***	***2375***	***1406***	***581***	***1422***	***509***	***1046***	***13***	***854***	***50***	***13929***

P.M. Peak Hour Trip Distribution (2008 MHL Model - 1983 Delcan Model)

		Origin															
		Internal										External					
	Dest \ Origin	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	*Total*
Destination – Internal	1	-105	-122	-81	33	78	-40	-177	2	11	-82	-38	-16	13	-20	97	***-447***
	2	-124	-162	-94	67	148	-51	-194	46	48	-133	-40	-28	6	-23	41	***-494***
	3	-45	-20	715	51	106	10	464	150	16	67	117	-32	303	-62	406	***2247***
	4	-5	18	-27	5	10	13	-47	18	-9	55	-12	0	25	-17	182	***207***
	5	17	68	-36	7	12	36	-52	48	-15	133	-15	19	49	-22	355	***605***
	6	-33	-43	-35	35	74	-8	-62	46	29	-28	-14	-19	7	-18	55	***-15***
	7	-165	-134	363	23	63	-39	-53	43	-44	13	-26	-76	330	-104	534	***728***
	8	-64	-44	-2	56	118	1	-71	82	22	36	-8	-9	50	-42	363	***487***
	9	-73	-56	-67	-12	-16	-21	-155	-51	-41	5	-36	-36	28	-44	209	***-366***
	10	-41	-79	-50	108	219	-10	-60	163	110	-84	-10	-51	0	-34	-4	***177***
	11	-19	-17	-0	1	5	-6	-34	-2	-5	-2	-9	-5	20	-8	50	***-30***
Destination – External	12	-13	-23	-41	25	56	-9	-61	39	16	-48	-7	0	-2	-412	0	***-478***
	13	16	6	234	32	64	9	280	65	38	-2	85	0	0	0	0	***826***
	14	-14	-16	-21	-2	-0	-10	-41	-10	-10	-25	-5	-380	-5	0	0	***-539***
	15	-1	-1	-2	0	0	-1	-2	-1	-1	-1	0	-3	-2	0	0	***-15***
	Total	***-669***	***-625***	***855***	***430***	***937***	***-125***	***-267***	***639***	***166***	***-96***	***-18***	***-636***	***822***	***-806***	***2288***	***2895***

APPENDIX E
POTENTIAL RIVER CROSSINGS – THURBER GEOTECHNICAL REPORT