OPUS HAMILTON

BRITISH COLUMBIA MINISTRY OF TRANSPORTATION

ALASKA HIGHWAY #97N CORRIDOR IMPROVEMENT STUDY

DAWSON CREEK TO FORT ST. JOHN, BC

FINAL REPORT

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FINAL REPORT

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EXECUTIVE SUMMARY

The British Columbia Ministry of Transportation (Ministry) has identified the need to conduct a comprehensive corridor improvement study on Highway 97 to identify current and future safety and service issues, and to develop feasible improvements and solutions.

The study corridor of Highway 97 is experiencing continued growth and pressures, and the Ministry needs the area to be studied and reviewed to the year 2022 (15 year horizon), with additional short term recommendations for the year 2012 (5 year horizon).

The study corridor is defined as the section between the Dangerous Goods Route intersection near Dawson Creek and Swanson Lumber Road intersection near Fort St. John. The sections through South and North Peace Hills are excluded from this study. In relation to the Ministry's Landmark Kilometre Inventory (LKI), the study area is defined as: Segment 1175, kilometre 2.36 to 47.40, 52.63 to 58.44 and 59.83 to 67.20.

The following tasks were completed in this study:

1. A start-up meeting with the client was held in Fort St. John on October 16, 2007.
2. A site visit was conducted on October 16, 2007 to identify issues with regards to traffic operations and safety, and conditions of the existing infrastructure.
3. Available information was collected, reviewed and organized. The available information included:
    - Traffic volume data at short-count stations along the study corridor, including season variations, growth trends and modal splits;
    - Crash data (Ministry Traffic Accident System);
    - As-built drawings for some intersections; and,
    - Background reports related to the Alaska Highway.
4. Stakeholder consultation was conducted.
5. Analysis was conducted for existing operations at corridor intersections and midblock segments (passing lanes and climbing lanes).

6. A second (findings) meeting was held in Fort St. John on January 14, 2008. Based on Tasks 1 to 5, existing issues were identified and were discussed during the meeting. A projected traffic growth rate was also established.
7. Analysis was conducted for future operations in years 2012 and 2022 at corridor intersections and midblock segments (passing lanes and climbing lanes). Potential future operational and safety issues were identified.
8. Mitigation measures which would improve future traffic operations and safety conditions were developed.
9. A third progress meeting was held on Tuesday March 11 to present recommended improvements.
10. Evaluation was conducted for the recommended improvements.
11. This report was prepared to document all of the above.

Based on the results of the capacity analysis, traffic operations, collision history, site visits and stakeholder consultation, numerous issues were identified.

Intersections along Highway 97 are operating at acceptable levels of service, now and in the future. Collision rates are high, but collision frequency is low. The predominant collision type is wildlife collisions.

The issue of most concern to stakeholders was the lack of passing opportunities along the highway. Respondents all mentioned that motorists are making dangerous manoeuvres when it comes to passing in order to get past slower moving commercial vehicles. Other significant issues identified include:

- Speeding;
- Heavy commercial vehicle traffic;
- Drinking/drugs and driving;
- Narrow shoulder widths and grades;
- Wildlife collisions; and,
- Winter road conditions.

Minor issues were identified relating to:

- Low visibility signage;
- Poor transitions with added lanes.

Site specific issues were identified for numerous intersections. Some issues were identified for chain-up areas, particularly the lack of a signed area to remove chains prior to driving on the metal surface of the Taylor Bridge.

Analysis was conducted to confirm locations for future passing lanes, climbing lanes and turning lanes at intersections.

Based on this analysis, the following corridor-wide improvements were recommended:

- Alcohol and speed enforcement should be conducted on a routine basis.
- Shoulder and median rumble strips should be implemented with any repaving.
- Improved signage on cross streets.
- Improved side slope with any reconstruction
- Wildlife countermeasures such as signage, reflectors or fencing for locations with higher frequencies of animal collisions.

Short-term improvements were recommended for specific intersections, mainly consist of improving signage, delineation, illumination, and access management. Long term improvements include ten climbing lanes, one passing lane, and three left-turn lanes at intersections.

The economic analysis of the proposed long term improvements was conducted using ShortBEN analysis, and many showed a positive return. A summary of the improvements ranked according to the benefit/cost ratio is presented in TABLE ES-1. The improvements were then ranked using the results of the economic analysis. The identified improvements are expected to improve the safety and operations of the corridor. This document can be used to help prioritize improvements for the present and the future for the Alaska Highway between Dawson Creek and Fort St. John.

TABLE ES-1 RANKINGS OF IMPROVEMENT MEASURES

IMPROVEMENT MEASURE	FROM	TO	B/C	RANK
Northbound Climbing Lane	13.5	15	5.3	1
Southbound Climbing Lane	11.8	10.25	1.8	2
NB Left Turn Lane at Farmington Store Intersection			1.6	3
Southbound Climbing Lane	41.61	39.5	1.6	3
Northbound Climbing Lane	7.75	9.6	1.5	4
Northbound Passing Lane	39.5	41.6	1.4	5
Northbound Climbing Lane	5.3	6.8	1.0	6
Northbound Climbing Lane	24.1	25.6	1.0	6
SB Left Turn Lane at Old Alaska Hwy, North access			1.0	6
Southbound Climbing Lane	38	36.5	1.0	6
Southbound Climbing Lane	20.3	17.5	0.98	7
Southbound Climbing Lane	23.3	21.5	0.74	
SB Left Turn Lane at Taylor-Birch			0.70	9
Southbound Climbing Lane	47.08	45.5	0.58	10

1.0 INTRODUCTION

1.1 Background

The British Columbia Ministry of Transportation (Ministry) has identified the need to conduct a comprehensive corridor improvement study on Highway 97 to identify current and future safety and service issues, and to develop feasible improvements and solutions.

The study corridor of Highway 97 is experiencing continued growth and pressures, and the Ministry needs the area to be studied and reviewed to the year 2022 (15 year horizon), with additional short term recommendations for the year 2012 (5 year horizon).

1.2 Study Location

The study corridor is defined as the section between the Dangerous Goods Route intersection near Dawson Creek and Swanson Lumber Road intersection near Fort St. John. The sections through South and North Peace Hills are excluded from this study. In relation to the Ministry's Landmark Kilometre Inventory (LKI), the study area is defined as: Segment 1175, kilometre 2.36 to 47.40, 52.63 to 58.44 and 59.83 to 67.20. An aerial of the study corridor is shown in FIGURE 1.1.

1.3 Method

The following tasks were completed in this study:

1. A start-up meeting with the client was held in Fort St. John on October 16, 2007.
2. A site visit was conducted on October 16, 2007 to identify issues with regards to traffic operations and safety, and conditions of the existing infrastructure.
3. Available information was collected, reviewed and organized. The available information included:
    - Traffic volume data at short-count stations along the study corridor, including season variations, growth trends and modal splits;
    - Crash data (Ministry Traffic Accident System);
    - As-built drawings for some intersections; and,

   - Background reports related to Highway corridor for the Alaska Highway.

4. Stakeholder consultation was conducted.
5. Analysis was conducted for existing operations at corridor intersections and midblock segments (passing lanes and climbing lanes).
6. A second (findings) meeting was held in Fort St. John on January 14, 2008. Based on Tasks 1 to 5, existing issues were identified and were discussed during the meeting. A projected traffic growth rate was also established.
7. Analysis was conducted for future operations in years 2012 and 2022 at corridor intersections and midblock segments (passing lanes and climbing lanes). Potential future operational and safety issues were identified.
8. Mitigation measures which would improve future traffic operations and safety conditions were developed.
9. A third progress meeting was held on Tuesday March 11 to present recommended improvements.
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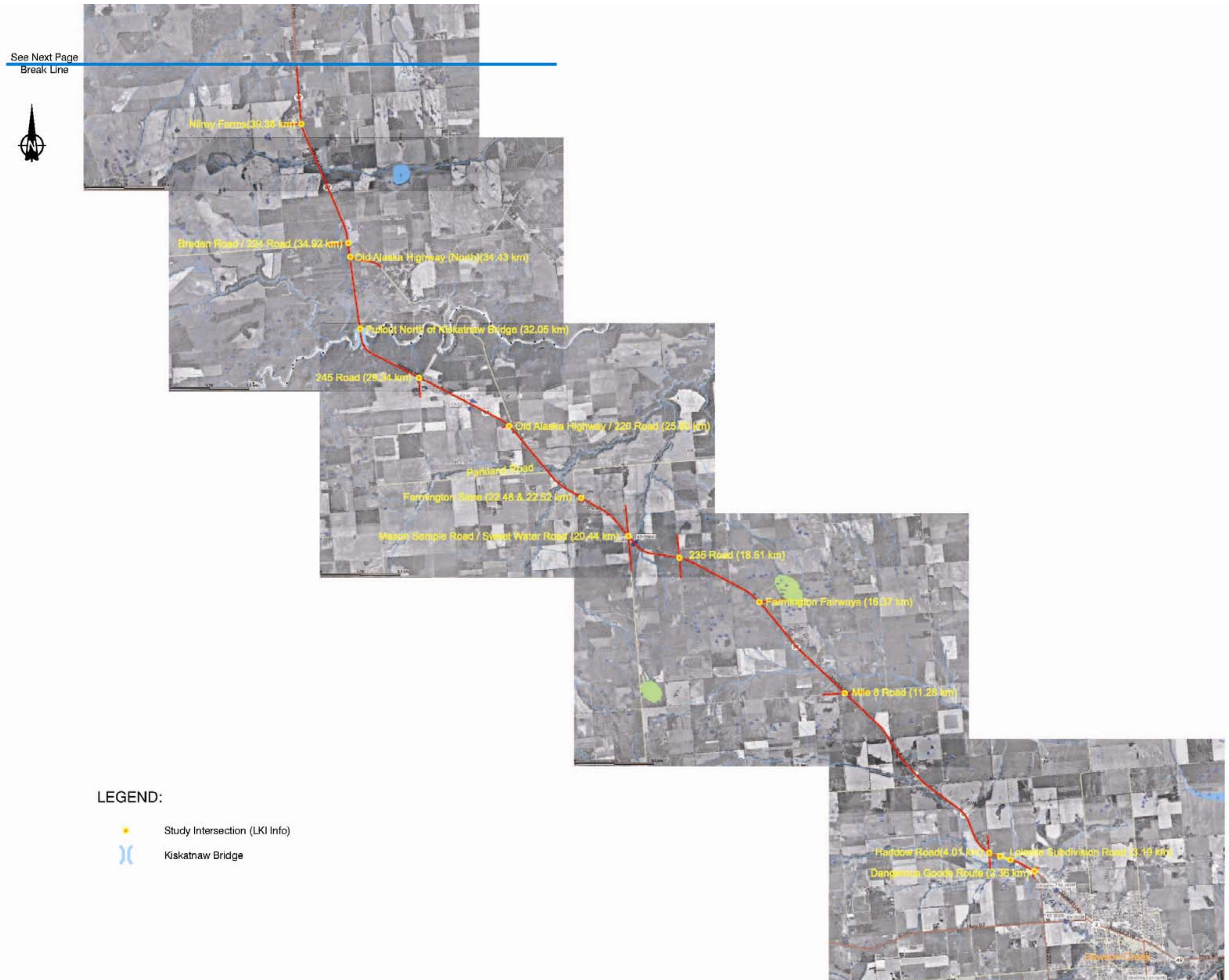

FIGURE 1.1 STUDY AREA (SOUTH SECTION)

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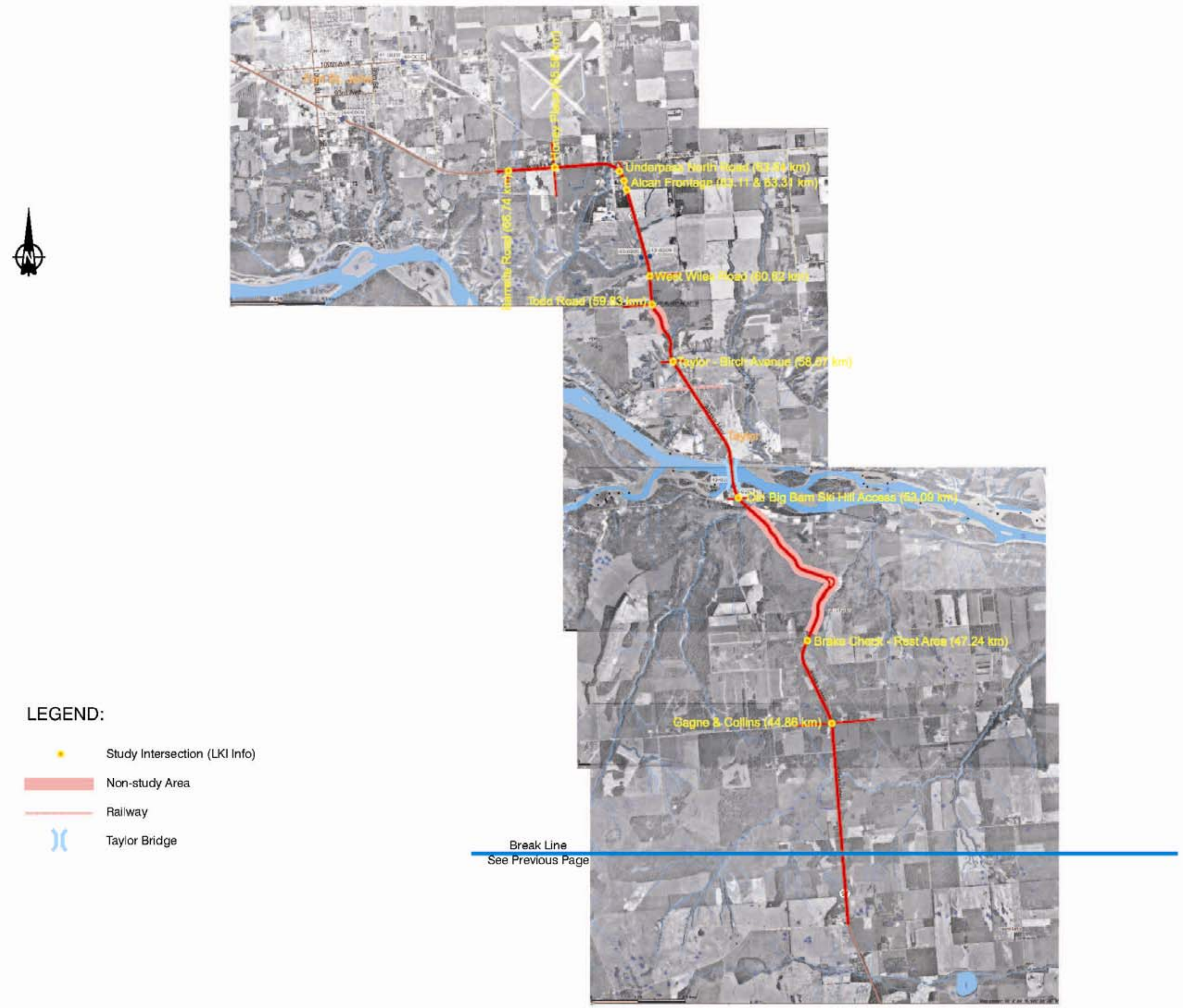

FIGURE 1.1 STUDY AREA (NORTH SECTION)

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2.0 EXISTING CONDITIONS

2.1 Review of Background Documents

Several documents related to the study area were provided by the Ministry. These documents were reviewed. Improvements that are relevant to the study corridor are summarized in TABLE 2.1 and TABLE 2.2.

TABLE 2.1 REVIEW OF BACKGROUND DOCUMENTS

TITLE (AUTHOR / DATE)	STUDY LOCATION	IMPROVEMENT LOCATION	RECOMMENDATIONS	IMPLEMENTED?
Corridor Planning Study (Ministry of Transportation and Highways- Jerry Lau, P. Eng. / March 1994)	North Peace District, Highway 97, Taylor Bridge to Mile Post 83	Hyw 97- Taylor Bridge to Mile 83	The need for four laning will to likely to be required within the 20 years horizon period (from year 1994)	No
		Segment 1175, Km 57.9-58.5 (Birch Ave)	Extend northbound passing/climbing lanes (time frame of 10-15 years)	No
		Segment 1175, Km 60.2-60.9 (West coast Energy Access Rd)	Extend northbound passing/climbing lanes (time frame of 10-15 years) Completed in November 2000	Yes
		Segment 1175, Km 63 to 66, south of Fort St. John	70 km/h speed zone should be increased to 80km/hr or 90 km/hr	No
		Km 55.32, Access Left	Eliminate the access	No
		Km 55.36, Access Left	Eliminate the access	No
		Km 56.66, Pine Ave	Realign to correct skew	No
		Km 57.24, Cherry Ave	Provide school crosswalk, turning movement and geometric improvements, and realign to correct skew	Yes
		Km 58. 06 Birch Ave	Provide northbound left turn slot	No
		BC Rail Underpass (km 63.95)	Installation of barriers and flares	Yes
Todd Rd Intersection Upgrades, Re-Alignment / Left Turn Lane (B. Maksymchuck / August 2005)	Todd Road and Alaska Hwy Intersection (LKI 59.83)	At the intersection	Removal of culverts, removal of pavement, removal of gravels and grade to match the topography, remove sign, relocate power pole and total telecom junction boxes, redirect roadside ditch to central ditch	Yes

TABLE 2.2 REVIEW OF VALUE ENGINEERING DOCUMENTS

TITLE (AUTHOR / DATE)	STUDY LOCATION	IMPROVEMENT LOCATION	RECOMMENDATIONS
Hwy. 97/Bessborough Road Intersection Upgrade VE Study (Infrastructure Systems Ltd. / November 2004)	Hwy 97 between Dawson Creek and Fort St. John	Blackstock Rd / Bessborough Road	Wildford Rd would remain in place and paving of Blackstock Rd section would be deferred until safety issues make it necessary for the Wilford Rd intersection to be closed.
			Removal of the three islands and tightening of the intersections to improve visibility for stopped vehicle from the sidestreets
			Eliminate the right turn tapers
			Reduce the shoulder width on tapers from 2 meters to 1 meter
			Eliminate southbound left turn
			Remove the proposed riprap to eliminate a potential future maintenance problem
			Revise the geometry of the SW corner island and radius to improve visibility for right turners from bessborough Rd to Hwy 97, revising geometry of SE corner island as there is little traffic
			Construct Bessborough intersection as a T intersection and eliminate Blackstock Rd Hwy Access. Improve access at Wilford Rd/Hwy 97
			Add left turn lanes onto Hwy 97, add right turn tapers onto Hwy 97, improve approach to Hwy 97 from Blackstock Rd

Based on the review of background documents, including value engineering documents, it is apparent that some improvements have already been made to the study corridor. For the Value Engineering report, it is unclear which recommendations were implemented. However, any cost-saving recommendations identified in that report could also be considered for implementation with other construction projects on the Alaska Highway.

2.2 Inventory of Existing Infrastructure

The study area of Highway 97 is a two-lane highway that provides access between Dawson Creek and Fort St. John. It also accommodates through traffic, both within the province, and intra-provincial. Along the stretch of the highway, there are numerous local roads that provide access to residential homes and some industrial developments in the surrounding area. The key characteristics of existing infrastructure along the highway are described below. The study area includes two Ministry Districts – the South Peace District and the North Peace District. The dividing line between the two districts is the Taylor Bridge at about LKI 54.

Land Use

The land use in the immediate vicinity of the highway is primarily agricultural. Connecting roads provide access to rural communities and to oil and gas industry sites. The study area begins on the outskirts of Dawson Creek and ends at the outskirts of Fort St. John. It passes through the District o Taylor, as shown in FIGURE 1.1.

Laning

Highway 97 is a two-lane highway along most part of the study area. The lane width is generally 3.5 metres in each direction. Existing climbing lanes are provided along some sections (details are described below). At some intersections, designated turn lanes are provided. Frontage roads are often provided in developed areas, particularly through Taylor.

Shoulders

For most sections of the highway, the paved shoulder is approximately 2.0 metres wide.

Structures

Two major structures are provided in the study area, the Taylor Bridge (LKI 53.7 to 54.4) and the Kiskatnaw Bridge (LKI 31.7 to LKI 32). Taylor Bridge has a metal bridge deck.

Posted Speed Limit

The posted speed limit varies from 70 to 100 kilometres per hour (km/hr). For the majority of the study area, the posted speed limit is the same in both directions; however, between LKI 10.04 to LKI 32.94, northbound traffic has a posted speed limit of 90 km/hr while the southbound direction has a posted speed limit of 100 km/hr. The lower posted speed limit of 70 km/hr is in effect near the municipalities of Fort St. John, Taylor, and Dawson Creek.

Rumble Strips

Both centreline rumble strips and shoulder rumble strips are provided along some sections. They have been added with any reconstruction projects in the South Peace District. They help to alert drivers in the case that they are steering away from the travel lane into the shoulder or crossing into the opposing traffic lane. During the site visit it was also noted that the rumble strips were useful in providing additional delineation when the pavement markings were obscured.

Illumination

Illumination is provided at a few intersections and in urban areas such as Dawson Creek, Fort St. John and Taylor, but is otherwise absent along most of the study corridor.

Climbing Lanes

In addition to the marked passing zones, where passing opportunity is provided, there are also climbing lanes provided at specific sections of the highway. These climbing lanes are additional lanes provided in the uphill direction where the grade of the vertical curve is steep enough to slow heavy vehicles significantly and would cause significant delays to traffic following such vehicles.

Currently, there are two climbing lanes in the northbound direction and three in the southbound direction. However, one northbound and two southbound climbing lanes are located in the excluded sections of the study corridor. Therefore, this study only evaluates one northbound climbing lane and one southbound climbing lane.

The existing northbound climbing lane within the study area is located between LKI 32.36 and LKI 36.31. This climbing lane begins immediately after the rest area located north of the Kiskatnaw Bridge and ends between Braden Road and Tower Lake Road in the north.

The existing southbound climbing lane within the study area is located between LKI 31.55 and LKI 28.04. This climbing lane begins south of the Kiskatnaw Bridge and ends at the crest of the vertical curve before Road 220 / Kiskatnaw Road in the south.

There is an at-grade railway crossing for BC Rail at LKI 2.76, north of the Dangerous GoodsRoute and there is a BC Rail Underpass at LKI 63.5, north of Underpass Road.

2.3 Site Observations

Site visits were conducted on the following days:

- Tuesday, October 16, 2007
- Monday, January 14, 2008
- Tuesday, January 15, 2008
- Tuesday, March 11, 2008

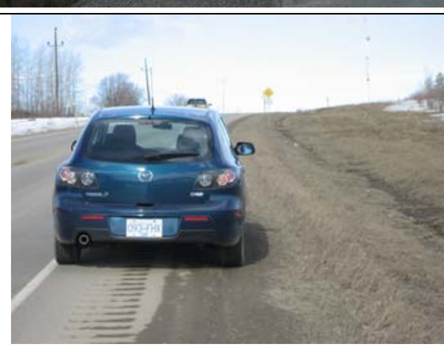
During the site visits, observations were made to identify existing infrastructure and issues related to traffic operations and safety. The indentified issues were divided into corridor-wide issues and intersection-specific issues.

2.3.1 Corridor-Wide Issues

Corridor-wide issues, with photos to illustrate where available, are described in TABLE 2.3.

TABLE 2.3 CORRIDOR-WIDE ISSUES

Heavy truck traffic and congestion Truck traffic was observed to be significant. Some risky manoeuvres were observed being taken by drivers while trying to pass heavy vehicles. The lack of passing opportunities also contributes to the frequencies of such dangerous manoeuvres. Along hill sections where one travel lane is provided, significant delays are experienced by vehicles following behind heavy vehicles. Numerous "wide loads" were observed, further contributing to delay.	
Signing issues Some issues were noted with respect to the conspicuity and location of signs. . Street name signs were small, and not in the current "white on green" standard. Some street name signs were visible from one direction only Advance street name signage was not provided at all locations. Low	

<table>
<tr><td>visibility signage makes it more difficult for wayfinding. Resulting last-minute turns may contribute to collision risk.</td><td>
</td></tr>
<tr><td>Delineation issues
Pavement markings along some sections were observed to be faded. Clear delineation to clarify travel lanes and other transitions such as merging areas may improve guidance for drivers.</td><td></td></tr>
<tr><td>Speeding and lack of police presence
Speed data was not available. However, during several drive-throughs of the corridor, it was noted that vehicles speeds are generally high and often in excess of the posted speed limit. Speeding may contribute to increased severity of collisions.</td><td>Photo not available</td></tr>
<tr><td rowspan="2">Narrow / steep side slopes at some locations
While a wide shoulder is provided along the corridor for the most part, some locations have narrow and steep side slopes. This does not allow a larger vehicle with sufficient area to pull over, and may contribute to the severity of collisions.</td><td></td></tr>
<tr><td></td></tr>
<tr><td>Winter Driving Conditions
In addition to making the pavement surface more slippery, winter weather also makes the delineation, signage and even the roadway more difficult to see, adding to the driver’s workload.</td><td>
</td></tr>
</table>

2.3.2 Intersection-Specific Issues

Based on the results of the collision and operational analysis, 19 intersections and brake-check areas were selected for site visits. It was noted that many intersections had inadequate lighting and signage. The limited intersection visibility and restricted sight distances were also common issues at many of the intersections. These common issues, noted to occur at multiple locations, are identified in TABLE 2.4 A detailed description of the observations made during the site visits were noted and are included in APPENDIX A.

TABLE 2.4 SUMMARY OF INTERSECTION ISSUES

INTERSECTION	ISSUE				
	SIGHT DISTANCE	SIGNANGE	INTERSECTION VISBILITY	LIGHTING	OTHER ISSUES
Dangerous Goods Route	☆		☆		☆
Loiselle Subdivision Road		☆		☆	
Haddow Road					☆
Mile 8 Road			☆	☆	
Mason Semple Road					☆
Farmington Store Access				☆	☆
Parkland Road	☆				☆
Road 245	☆		☆	☆	☆
Old Alaska Highway	☆			☆	☆
Braden Road	☆		☆		☆
South Peace Farm	☆			☆	
Collins Rd / Gagnes Road	☆			☆	
Birch Avenue					☆
Tod Road	☆	☆			☆

Underpass / Road 255					☆
Alcan Frontage Road			☆	☆	☆
Barrett Road			☆	☆	☆

2.4 Stakeholder Consultation

As part of the study, numerous stakeholders were contacted and interviewed to gain insight into some of the areas in need of improvement, safety issues and perceptions of safety.

Interviews were conducted with organizational representatives based on a contact list provided by the client and supplemented with consultant research. Fifteen representatives were contacted in early January 2008 with 13 respondents reached by telephone and two respondents completing the questions via email. Interviews lasted approximately 10 minutes long depending on how much detail the respondent could provide. A list of agencies and their representative areas that participated in the interviews is shown in TABLE 2.5

TABLE 2.5 LIST OF INTERVIEWEES

No.	AGENCY	AREA
1	ICBC	FSJ/DC
2	RCMP	FSJ
3	RCMP	DC
4	District of Taylor	Taylor
5	City of Fort St. John	FSJ
6	City of Dawson Creek	DC
7	Peace River Regional District	FSJ
8	Peace River Regional District	DC
9	School District #59	DC
10	School District #60	FSJ
11	Yellowhead Road and Bridge	---
12	Caribou Road Services	---
13	Oil and Gas Commission	---
14	North East Working Committee	FSJ
15	Northern BC Truckers Association (NBCTA)	---

General comments that were received are:

- Road maintenance crews do a good and timely job of keeping roads clear in bad weather and clearing the carcasses of animals injured by vehicles;
- Centreline rumble strips in the Peace area are good;
- Recent stabilization work on Taylor Hill was needed and should continue on a more regular basis;
- The turning lane out of Kiskatnaw is good.

The issue of most concern to interviewees was the lack of passing opportunities along the highway. Respondents all mentioned that motorists are making dangerous manoeuvres when it comes to passing in order to get past slower moving commercial vehicles. Other significant issues identified include:

- Speeding;
- Heavy commercial vehicle traffic;
- Drinking/drugs and driving; and
- Narrow shoulder widths and grades.

General locations of most concern to respondents included the Taylor Hill, Taylor Bridge and Kiskatnaw Bridge. Issues here include:

- Insufficient sight distance;
- Steep grades;
- Slippery bridge decks;
- Speeding; and
- Lack of safe passing opportunities.

Several intersections were identified as requiring safety improvements mostly related to turning and merging lanes as well as signage and visibility. Those intersections include Highway 97 and:

- Braden;
- 226 Road;
- Old Alaska Highway;
- Bell Donald;
- Farmington Store;

- 94 Road (Dangerous Goods Route intersection);
- 237 Road;
- Birch Avenue;
- 146 Road; and
- Todd Road.

Other safety related concerns include:

- Wildlife;
- Fog and ice;
- RV Traffic (seasonal);
- Road geometry and grades;
- Lighting and signage;
- Chain up areas, particularly the lack of a signed area to remove chains prior to driving on the metal surface of the Taylor Bridge; and
- Maintenance of lane painting.

2.5 Traffic Operations Analysis

Four short count stations are located along Highway 97in the study area, however, no permanent count stations are currently functioning. Traffic trends that can be obtained from permanent count stations, such as monthly variations, were obtained from permanent count stations on Highway 97 near Willow Flats and on Highway 2 near Tupper. The locations of the count stations are shown in FIGURE 2.1.

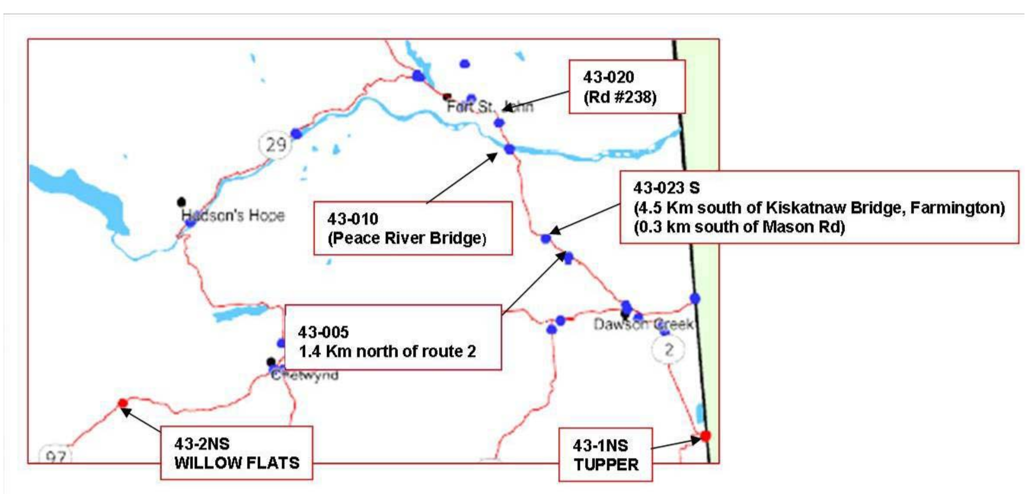


FIGURE 2.1 TRAFFIC COUNT STATIONS LOCATION

Traffic volume trends were identified using available data from the count stations and turning movement counts and are described below.

- Traffic volumes are highest during the months of June, July and August. In additional to industrial traffic, the corridor experiences seasonal recreational vehicles during the summer season.
- The vehicle classification at four locations along the study corridor is shown in FIGURE 2.3. The percentage of truck and RV traffic is high along the corridor, making up about thirty percent of all traffic.

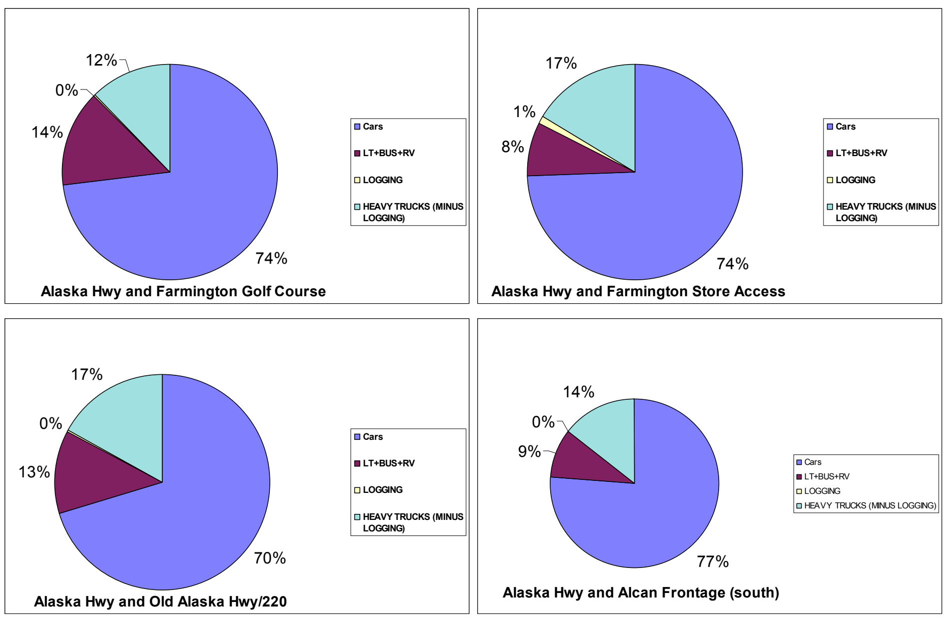


FIGURE 2.2 VEHICLE CLASSIFICATIONS

- The total daily traffic volumes, obtained from the four short count locations, are summarized in FIGURE 2.4. The two-way daily traffic volumes indicate that Friday is the peak day, and that traffic peaks between 1700 and 1800 hours. The southbound evening peak hour volumes range from 200 to 450 vehicles from south to north. Traffic flows are generally relatively balanced in the evening peak hour, particularly in the south. The analysis of the traffic count data also shows that the AADT of the corridor ranges from 5,000 to 9,000 vehicles from south to north.

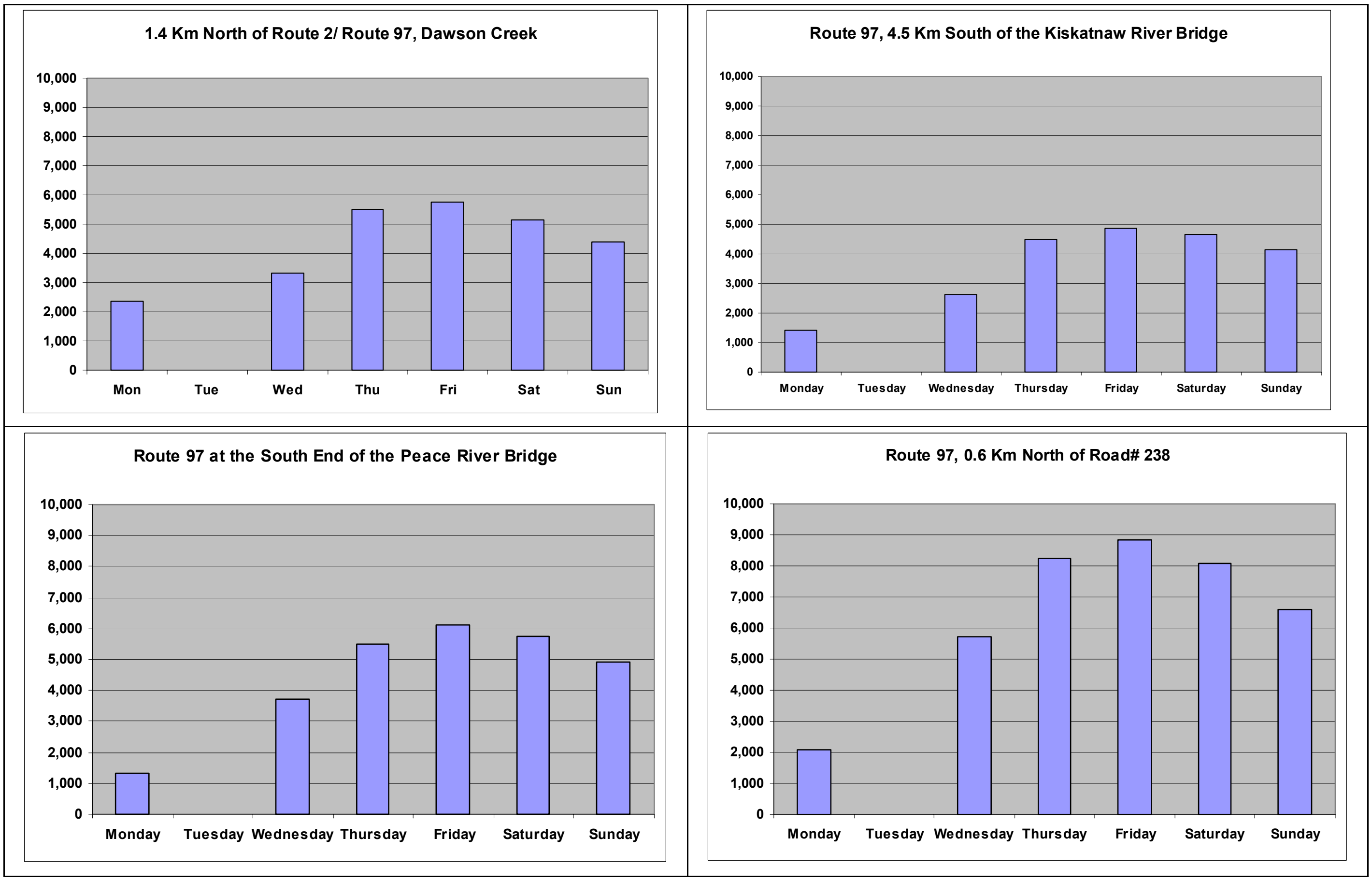


FIGURE 2.3 TOTAL DAILY TRAFFIC VOLUME
(Complete data unavailable for Mondays and Tuesdays)

- The hourly volume trends for a day in August are shown in FIGURE 2.5. Two-way daily traffic volumes also indicate that traffic in the southbound direction (towards Dawson Creek) is higher than the northbound direction (towards Fort St. John) throughout most of the day.

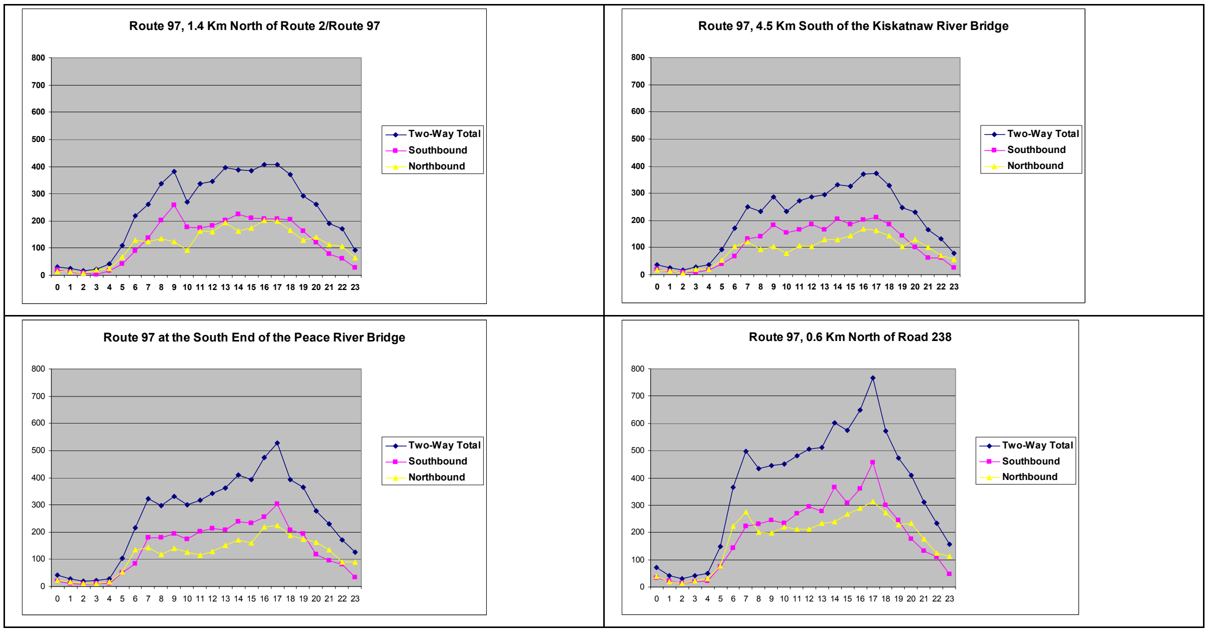


FIGURE 2.4 HOURLY VOLUME TRENDS

2.5.1 Intersection Capacity Analysis

Turning movement counts were conducted by the Ministry of Transportation for twenty-four intersections in summer 2007. These counts therefore represent peak conditions. The volumes provided are summarized in FIGURE 2.5. Using the volumes provided, traffic operations analysis was conducted using Synchro software and indicates that all study intersections operate at a level of service A, with all movements operating at level of C or better. The Synchro outputs for the intersections are provided in APPENDIX B.

To assist in quantifying the need for improvements, the queue lengths on the Highway approaches were reviewed to identify intersections where queues longer than ten metres (two vehicle-lengths) are experienced as a result of left turn traffic. The Farmington Store Access currently experiences a queue length of seventeen metres in the northbound direction during the afternoon peak hour. The Ministry Left Turn Lane Warrant, presented in APPENDIX E, was used to evaluate the need of left turn lanes for future horizon years.

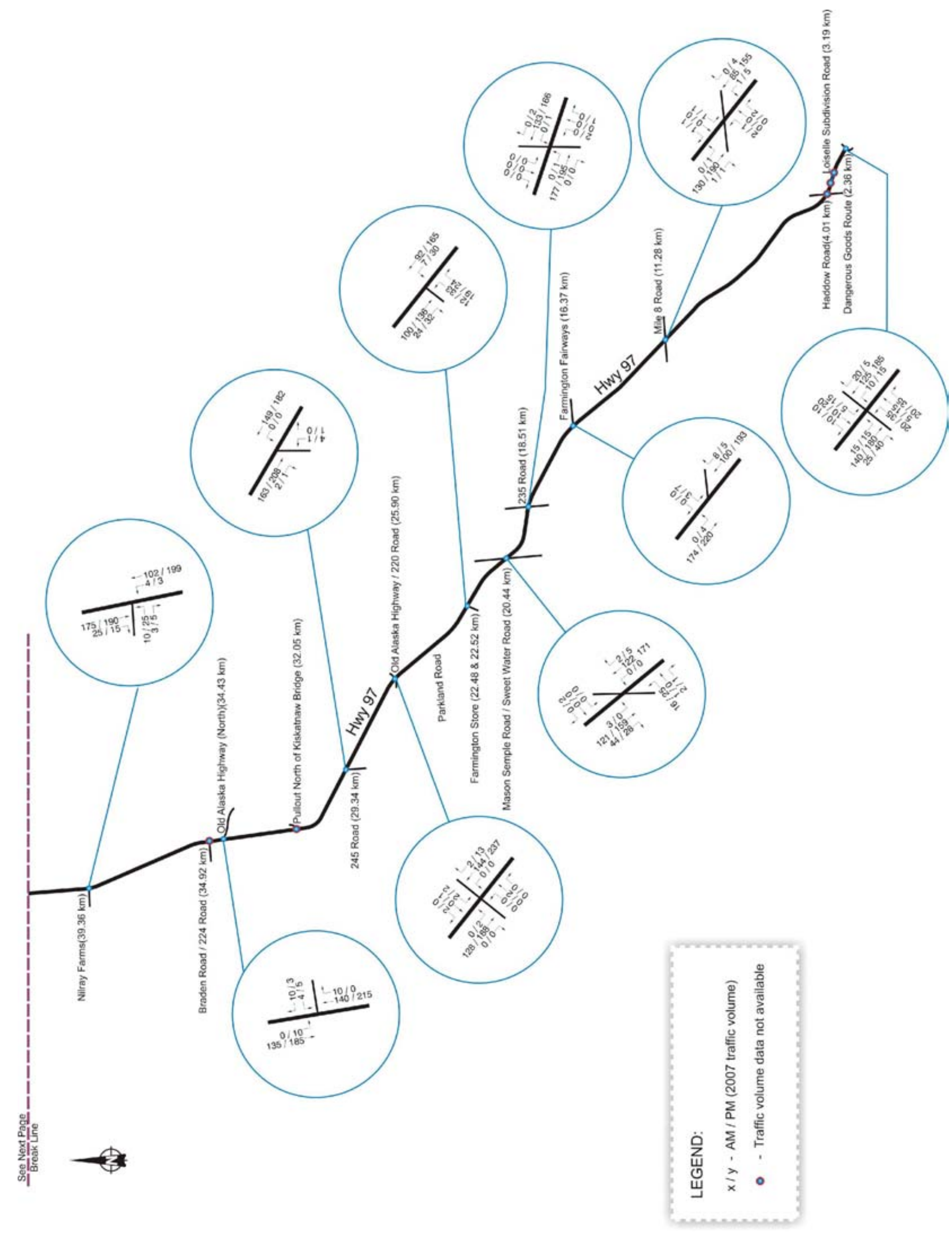


FIGURE 2.5A TURNING MOVEMENT COUNTS—SOUTH SECTION

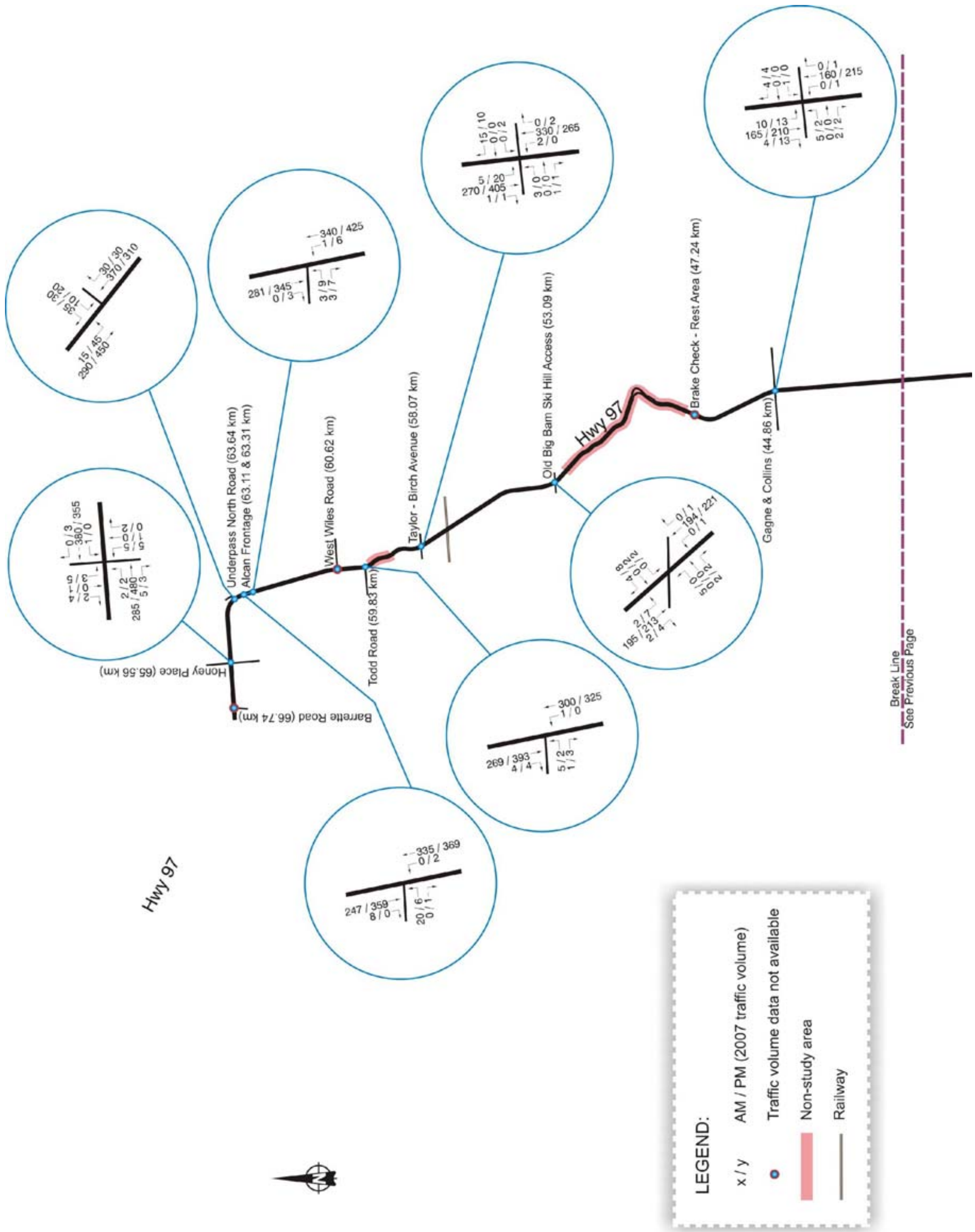


FIGURE 2.5B TURNING MOVEMENT COUNTS—NORTH SECTION

2.5.2 Midblock Segments Capacity Analysis

Corridor capacity analysis was conducted on the study area of Highway 97 for existing conditions using HSC2000. Existing volumes were obtained from the four count stations located at LKI 1.3, LKI 27.23, LKI 53.53, and LKI 67.20. The HSC2000 outputs are provided in APPENDIX C.

In order to obtain a representative capacity analysis of Highway 97, the corridor was divided into 18 segments of various lengths based on the terrain type and the posted speed limit. HCS2000 analysis of corridor capacity requires that segments be evaluated as either two-way or directional. Two-way analysis was performed on sections with level or rolling terrain and with the same posted speed limit for both directions of travel. For sections of the highway with steeper grades or different posted speed limits for each direction of travel, directional analysis was used. Directional analysis was also used for sections with existing passing lanes. For the study corridor, five segments were analyzed as two-way segments while thirteen segments were analyzed as directional segments. The results of the analysis are summarized in TABLE 2.6.

According to the analysis, all segments currently operate at level of service C or better. Capacity analysis also found that the two segments with existing passing lanes, between LKI 27.6 and LKI 31.7 in the southbound direction and between LKI 31.7 and LKI 36.5 in the northbound direction, operate at level of service A. Therefore, under existing conditions, there are no capacity issues along the study corridor. The analysis also verified that the passing lane alleviates congestion and results in a better level of service.

TABLE 2.6 EXISTING LEVELS OF SERVICE FOR TWO-WAY SEGMENTS

Segment			Level of Service
From	To	Direction	Existing
2.36	3.779	2 - WAY	C
3.779	7.500	NB/SB	C/C
7.500	8.730	NB/SB	C/C
8.730	10.039	NB/SB	B/C
10.039	17.5	NB/SB	B/B
17.500	21.000	NB/SB	C/C
21.000	24.100	NB/SB	C/C
24.100	27.600	NB/SB	B/B
27.600	31.700	NB/SB	C/**A**
31.700	36.500	NB/SB	**A**/C
36.500	39.000	NB/SB	B/B
39.000	44.229	NB/SB	C/B
44.229	47.400	NB/SB	B/C
52.630	57.000	2 - WAY	C
57.000	58.440	NB/SB	B/C
59.830	63.000	2 - WAY	C
63.000	64.300	2 - WAY	C
64.300	67.200	2 - WAY	C

2.6 Collision Analysis

Collision data was provided by the Ministry from their Highway Accident System (HAS) database for the ten-year period between January 1st, 1997 and December 31st, 2006.

In total, there were 681 collisions with an average of 68 collisions per year. Of these 681 collisions, 178 collisions occurred at intersections (26 percent of total) and 503 occurred at midblock locations (74 percent of total).

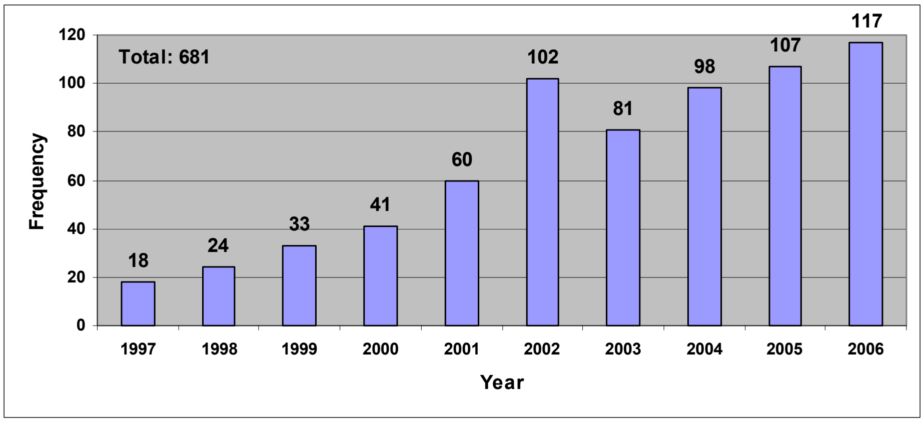
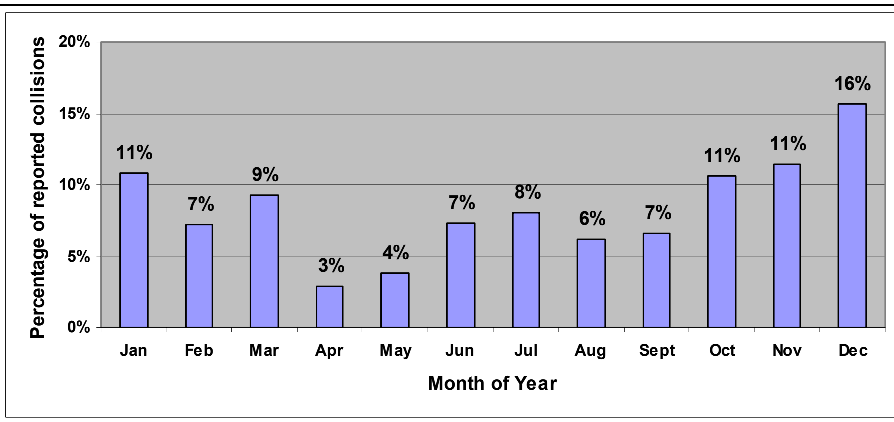
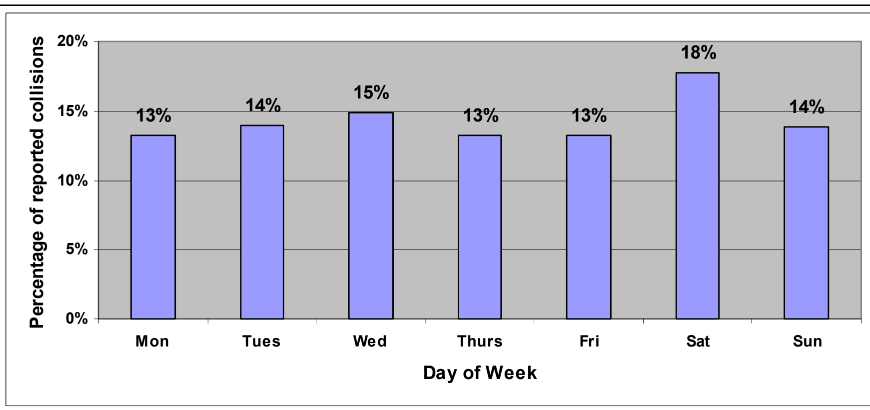
In Section 2.61 below, corridor-wide collision trends are presented, followed by discussion of intersections collision trends in Section 2.6.2. Section 2.6.3C includes a discussion of midblock collision trends.

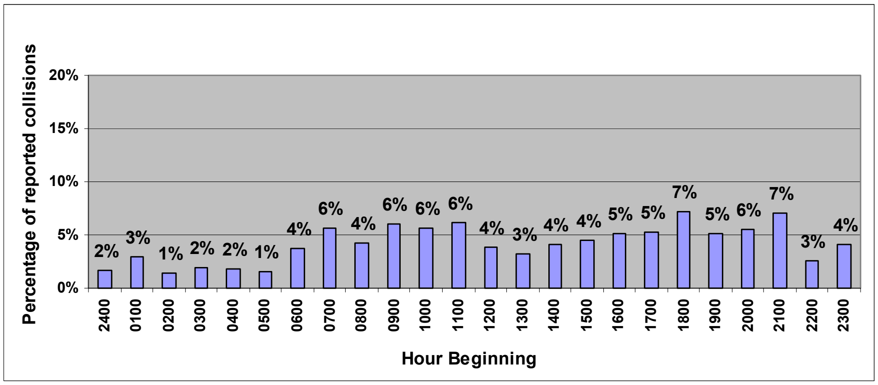
2.6.1 Corridor-Wide Trends.

Temporal Trends

The corridor-wide temporal trends are described in TABLE 2.7.

TABLE 2.7 CORRIDOR-WIDE TEMPORAL TRENDS

<table>
<tr><td>
</td><td>The annual distribution indicates an increasing trend, with an average of 100 or more collisions occurring in the last three years.</td></tr>
<tr><td>
</td><td>The monthly distribution indicates that collisions most frequently occur during the winter months (between November and January).</td></tr>
<tr><td>
</td><td>The weekly distribution indicates that collision frequencies are consistent throughout the week, with the peak day on Saturday.</td></tr>
</table>

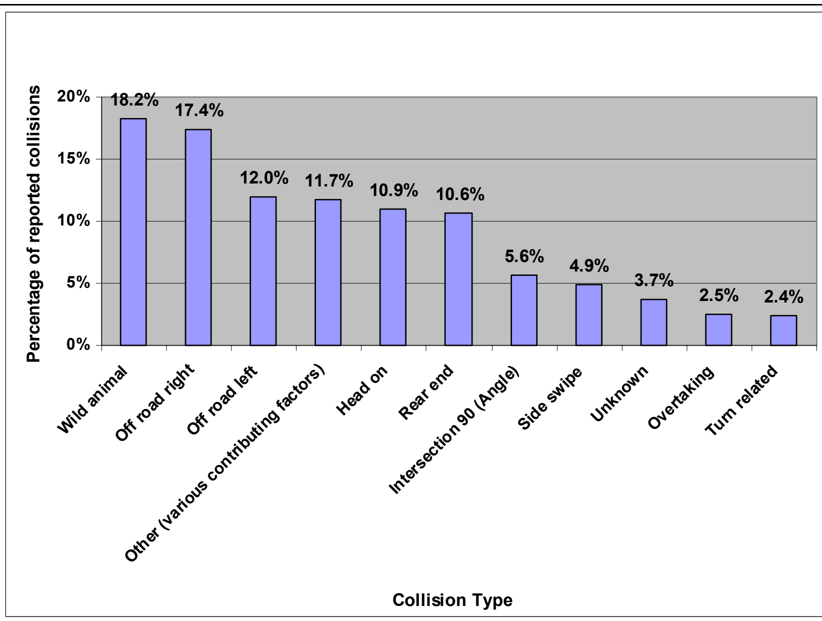


The hourly distribution indicates that collisions are occurring throughout the day, with relatively higher frequencies occurring during the mid-morning period (0900-1100 hours) and the late-afternoon period (1800-2100 hours). It is noted that corridor-wide collisions do not drop significantly in the evenings.

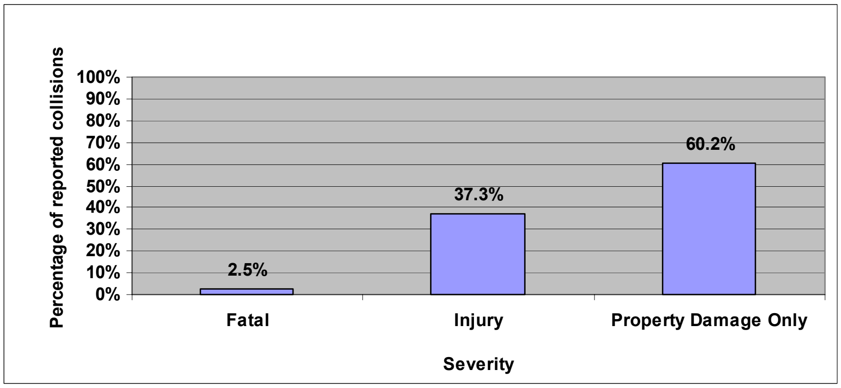
Collision Types and Severity Distribution

The collision types and severity distribution is summarized in TABLE 2.8.

TABLE 2.8 CORRIDOR-WIDE COLLISION TYPES AND SEVERITY DISTRIBUTION



Wild animal collision is the most commonly occurring collision type (at eighteen percent), followed by off-road collisions (total of off-road left and off-road right collisions is about 30 percent of total collisions).



Sixty percent of collisions resulted in property damages only, and thirty-seven percent resulted in an injury. Fatal collisions constituted approximately three percent of all collisions. This is similar to the provincial average.

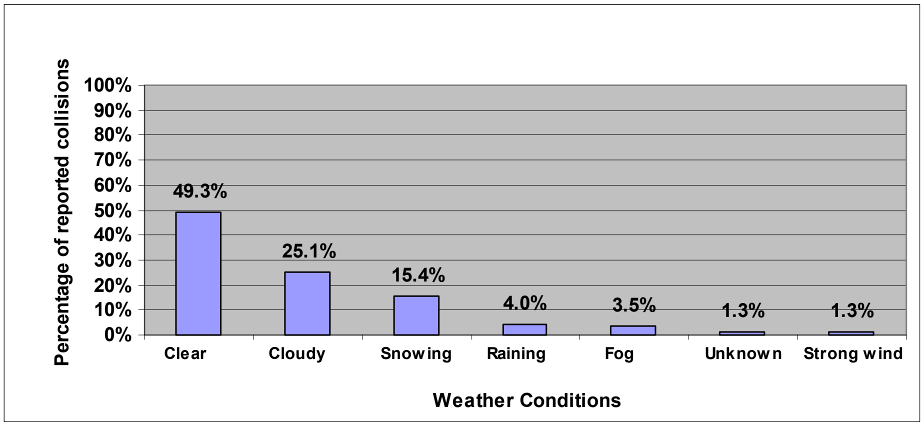
Noting that wild animal collision was the predominant collision type along the corridor, further analysis was conducted to determine where these collisions were occurring most frequently. The locations with relatively higher frequencies of animal collisions are as follows (frequency over 10 years is noted):

- LKI 21.3 to 24.1 between Mason Semple / Sweet Water and Old Alaska Highway (220) – 12 collisions
- LKI 42.5 to 45.0 between Nilray Farms and Gagne / Collins Road – 12 collisions
- LKI 14.5 to 18.0 between Mile 8 Road and 235 Road – 10 collisions
- LKI 29.8 to 30.4 between 245 Road and Pullout North of Kiskatnaw Bridge – 7 collisions
- LKI 34.4 to 35.2 between Old Alaska Highway (North) and Braden Road – 6 collisions
- LKI 59.83 at Todd Road intersection – 6 collisions
- LKI 59.83 at Todd Road intersection – 6 collisions

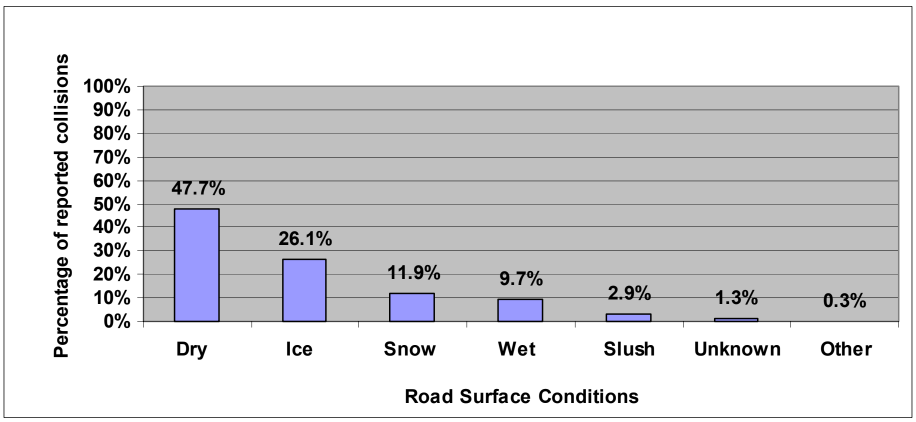
Environmental Trends

The corridor-wide environmental trends were also analyzed and are summarized in TABLE 2.9

TABLE 2.9 CORRIDOR-WIDE ENVIRONMENTAL TRENDS



Half of all corridor collisions occurred under clear or couldy conditions.



Approximately half of all corridor collisions occurred under dry pavement conditions, with the other half occurring under various wet road conditions, including ice, snow, slush and others.

2.6.2 Intersection Collision Trends

The temporal trends of the intersection collisions are summarized in FIGURE 2.6.

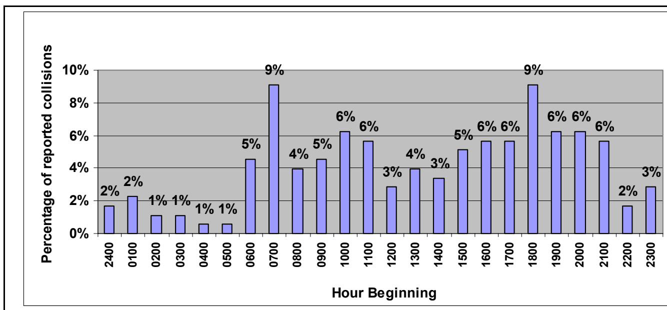


FIGURE 2.6 INTERSECTION HOURLY VOLUME DISTRIBUTION

- Annual average number of collisions is increasing and has remained high in the last two years, which is similar to the corridor-wide trend.
- Collisions occurred most frequently in the winter months, particularly in December, which is similar to the corridor-wide trend.
- Collisions occurred throughout the week, with a peak occurring on Thursday.
- The hourly distribution indicates distinct peaks at 0700 and 1800 hours, corresponding to typical morning and afternoon peak hours.

Collision Types and Severity Distribution

- Wild animal collision is the most commonly occurring collision type (at twenty percent, which is similar to the corridor percentage), followed by off-road (right) collisions.
- Sixty-six percent of collisions resulted in property damages only, and thirty-one percent resulted in an injury. Fatal collisions occurred at the following intersections:

    - Mason Semple / Sweet Water (one collision in 2004)
    - Braden Road (one collision in 2006)
    - Tower Lake Road (one collision in 2002)
    - Taylor / Birch (one collision in 2006)
    - Alcan Frontage Road (one collision in 2005 and one in 2006)
    - Barrette Road (one collision in 2001)

Environmental Trends

- Approximately half of all corridor collisions occurred under clear weather conditions.
- Approximately half of all corridor collisions occurred under dry pavement conditions, with the other half occurring under various wet road conditions, including ice, snow, slush and others.

Collision frequency ranking and collision rates

By examining the collision frequencies at each intersection between 2002 and 2006, a collision rate was calculated for each intersection. The collision frequencies and rates are summarized in TABLE 2.10.

TABLE 2.10 INTERSECTIONS COLLISION FREQUENCIES

LKI	Description	Collisions 2002 - 2006	Collision rate (2002 to 2006)
59.83	Rd #141N (Todd Road)	17	**0.75**
66.74	Barrett Rd (257A)	16	N/A
63.11 & 63.31	Alcan Frontage Rd	14	**0.56**
11.28	Mile 8 Rd #214 Crosses	10	**0.89**
34.92	Braden Rd #224 Crosses	10	**0.73**
58.07	Taylor - Birch Avenue	7	**0.32**
20.44	Rd #237 Crosses	6	**0.49**
22.48 & 22.52	Access to Farmington Store	5	**0.46**
25.90	Old Alaska Hwy / 220 Rd	5	**0.36**
2.36	Jctn Rte 94 (Dangerous Goods Rte)	4	0.22
34.43	Old Alaska Hwy (N)	4	**0.30**
39.36	Nilray Farms	4	N/A
18.51	Rd #235	3	**0.26**
29.34	Rd #245 Crosses	3	0.24
32.05	Pull out north of Kiskatnaw Bridge	3	N/A
44.86	Rd #230 Crosses (Gagne & Collins)	3	0.22
3.19	Frontage Rd Access (Loiselle)	2	N/A
4.01	Rd #223 Crosses (Haddow)	2	N/A
47.24	Rest Area (Brake Check)	2	N/A
53.09	Access Big Bam Ski Hill	2	0.14
60.62	West Wiles Rd #238	2	N/A
63.64	Rd 255 (Underpass North)	2	0.07
65.56	Rd 257 (Honey Place)	1	0.04
16.37	Farmington Fairways	0	0.00

Bold: Collision rate exceeds provincial average of 0.25 (Rural arterial undivided, up to three lanes)
N/A traffic volumes not available

With 17 collisions from 2002 to 2006, the Todd Road intersection had the highest number of collisions. Barrett Road and Alcan Frontage Road rank second and third in the number of collisions over the 5 year period. It is also noted that the collision rate at some intersections exceed the provincial rate (0.25 for undivided rural arterials up to three lanes). However, collision frequencies were relatively low, with only two locations exceeding two collisions per year.

From the collision analysis, it was observed that four intersections had noticeable collision trends. Due to low frequency of collisions, lack of directional information and prevalence of wildlife- related collisions, it was difficult to create spatial diagram for the rest of the study intersections. Spatial diagrams were created where possible and are provided in APPENDIX D. The four intersections with noticeable collision trends are:

- Alaska Hwy and Mason Semple/ Sweet Water Road- Off-Road Collisions and rear-end collisions.
- Alaska Hwy and Farmington Store Intersection- off-road collisions and wild-life related collisions.
- Alaska Hwy and Dangerous Goods Route – crossing collisions
- Alaska Hwy and Mile 8 Road- off-road collisions and left-turn opposing collisions.

The noted trends consist of off-road, rear-end and wildlife-related collisions. The main cause of the off-road and rear-end collisions appears to be weather and road surface related.

2.6.3 Midblock Segment Collision Trends

Temporal Trends

The temporal collision trends of the midblock segments are shown in FIGURE 2.7.

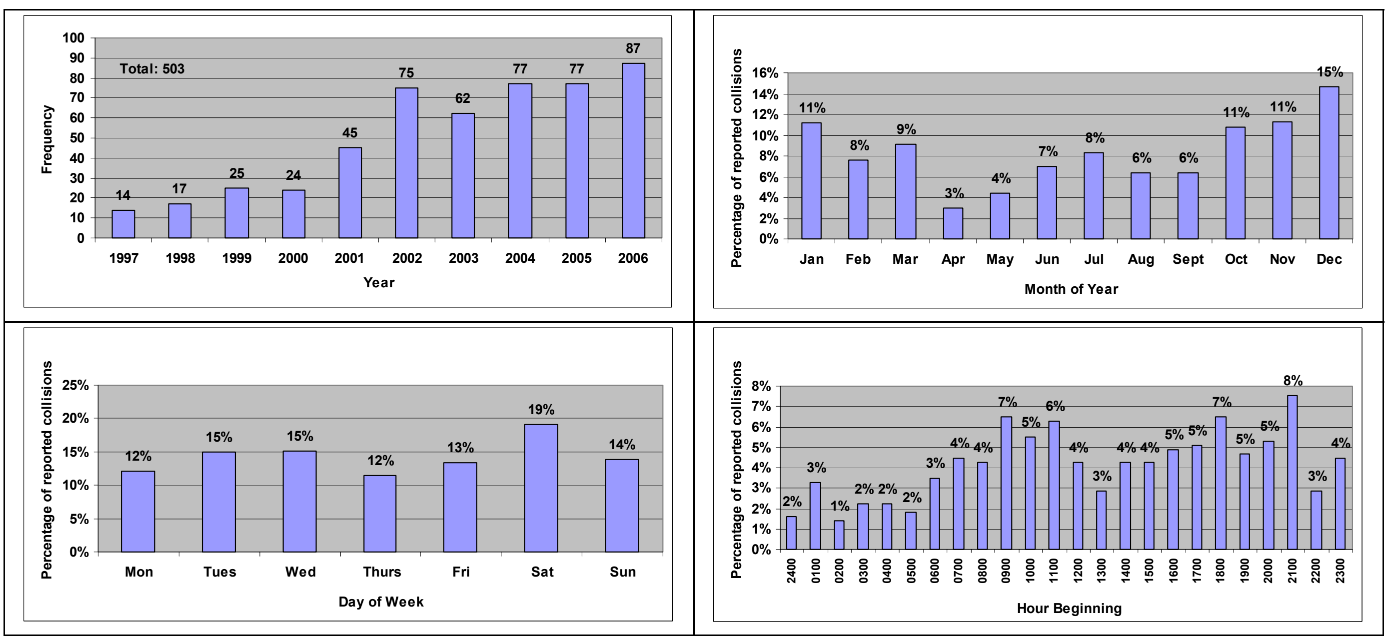


FIGURE 2.7 MIDBLOCK TEMPORAL COLLISION TRENDS

- The annual average number of collisions has remained high in the last five years.
- Similar to corridor wide trends, most collisions occurred during the winter months, particularly in December.

- Collisions occurred throughout the week, with a peak occurring on Saturday, which is similar to corridor-wide trend.
- Corresponding to typical morning and afternoon peak periods, the hourly distribution indicates distinct peaks between 0900 and 1100 hours and between 1800 and 2100 hours. However, it is noted that the number of collisions does not drop significantly during the evenings.

Collisions Types and Severity Distribution

- Wild animal collision is the most commonly occurring collision type (at eighteen percent, which is similar to the corridor percentage), followed by off-road collisions. Off-road right and off-road left collisions constitute about thirty percent of all midblock collisions.
- Fifty-eight percent of collisions resulted in property damages only, and forty percent resulted in an injury.
- Eleven fatal collisions have occurred over ten years, of which seven occurred in the last five years.

Environmental Trends

- Approximately half of all corridor collisions occurred under clear weather conditions.
- Approximately half of all corridor collisions occurred under dry pavement conditions, with the other half occurring under various wet road conditions, including ice, snow, slush and others.

3.0 FUTURE CONDITIONS

3.1 Projected Growth

An annual compound growth rate of four percent was used to prepare traffic volume forecast and for evaluating traffic operations in horizon years 2012 and 2022. This growth rate was derived from several information sources, including the following:

- Based on stakeholder consultation, the City of Fort St. John has indicated that the average growth rate up to year 2014 is expected to be four percent.

- A review of historical growth rates at three corridor traffic count stations indicated growth rates of 3.74 percent (43-023NS), 4.16 percent (43-020NS) and 3.90 percent (43-010NS) from year 2000 to 2005. The average growth rate was approximately four percent.

3.2 Intersection Capacity Analysis

3.2.1 Horizon Year 2012

Based on traffic operations analysis using Synchro software, the majority of study intersections are expected to operate at level of service A during the morning and afternoon peak hours in year 2012, with the exception of:

- Farmington store intersection: level of service C in the afternoon peak hour; and,
- Taylor / Birch intersection: level of service D in the afternoon peak hour.

3.2.2 Horizon Year 2022

In year 2022, several intersections are expected to operate at level of service D or worse on the sidestreet (the highway approaches remain at good level of service):

- Honey Place intersection: level of service D on both north and south legs in the morning peak hour and level of service E in the afternoon peak hour;
- Alcan Frontage Road: level of service D in the morning peak hour and level of service E in the afternoon peak hour;

- Taylor / Birch intersection: level of service D on the west leg in the morning peak hour;
- Dangerous Goods Route intersection: level of service D on the west leg in the afternoon peak hour;
- Underpass North intersection: level of service D in the morning peak hour and level of service F in the afternoon peak hour; and,
- Farmington store intersection: level of service D in the afternoon peak hour.

3.4 Mid-block Segment Capacity Analysis

The same methodology used to perform capacity analysis for existing conditions was applied to determine the capacity of the study corridor in years 2012 and 2022. Two scenarios, without passing lanes and with passing lanes, were evaluated to assess the need and benefits for providing additional passing lanes in the future horizon year. The results of the analysis are summarized in TABLE 3.1 and 3.2. The method used to determine the locations of potential climbing and passing lanes is provided in Section 3.3.

Year 2012
Corridor capacity analysis of the horizon year 2012 shows that without additional passing/climbing lanes, most segments of the highway operate at a level of service C, with some sections operating at a level of service D. With the proposed climbing lanes however, the levels of service for the respective segments improve by one level of service or more.

Year 2022
The analysis results indicate that without additional climbing lanes, all sections of Highway 97 operate at a level of service C or below, with one section operating at a level of service E. With the proposed climbing lanes however, the levels of service for the respective segments improve by one level of service or more.

To summarize the findings of the capacity analysis for existing conditions and for future both horizon years, the levels of services of the entire study corridor are shown in FIGURE 3.1. The base map was provided by the Ministry of Transportation. The x-axis shows the LKI landmarks, advancing from south to North. Several levels of information are stacked on the y-axis provides including horizontal and vertical alignment of the road, as well as laning information.

TABLE 3.1 CAPACITY ANALYSIS RESULTS FOR THE YEAR 2012

SEGMENT			LEVEL OF SERVICE		
FROM	TO	DIRECTION	WITHOUT CLIMBING LANES	WITH CLIMBING LANES	
			2012	POTENTIAL LANE LOCATION	2012
2.36	3.779	2 - WAY	C	-	C
3.779	7.500	NB SB	C C	5.30 – 6.80 -	B C
7.500	8.730	NB SB	C C	7.75 – 8.73 -	B C
8.730	10.039	NB SB	C C	8.73 – 9.70 -	A C
10.039	17.5	NB SB	C C	13.9 – 14.6 10.25 – 11.0	B B
17.500	21.000	NB SB	C C	- 17.5 – 20.3	C A
21.000	24.100	NB SB	C C	- 21.5 – 22.3	C A
24.100	27.600	NB SB	B B	24.1 – 25.6 -	A B
27.600	31.700	NB SB	C -	- EXISTING	C A
31.700	36.500	NB SB	- D	EXISTING -	A D
36.500	39.000	NB SB	B C	- 36.7 – 37.5	B A
39.000	44.229	NB SB	D B	- 39.5 – 41.6	D A
44.229	47.400	NB SB	C C	- 45.7 – 47.1	C B
52.630	57.000	2 - WAY	C	-	C
57.000	58.440	NB SB	- C	EXISTING -	B C
59.830	63.000	2 - WAY	C	-	C
63.000	64.300	2 - WAY	C	-	C
64.300	67.200	2 - WAY	C	-	C

TABLE 3.2 CAPACITY ANALYSIS RESULTS FOR THE YEAR 2012

SEGMENT			LEVEL OF SERVICE		
FROM	TO	DIRECTION	WITHOUT CLIMBING LANES	WITH CLIMBING LANES	
			2022	POTENTIAL LANE LOCATION	2022
2.36	3.779	2 - WAY	C	-	C
3.779	7.500	NB SB	D D	5.30 – 6.80 -	C D
7.500	8.730	NB SB	D D	7.75 – 8.73 -	C D
8.730	10.039	NB SB	C C	8.73 – 9.70 -	B C
10.039	17.5	NB SB	C C	13.9 – 14.6 10.25 – 11.0	B B
17.500	21.000	NB SB	C D	- 17.5 – 20.3	D B
21.000	24.100	NB SB	D D	- 21.5 – 22.3	D B
24.100	27.600	NB SB	C C	24.1 – 25.6 -	B C
27.600	31.700	NB SB	D -	- EXISTING	D B
31.700	36.500	NB SB	- D	EXISTING -	B D
36.500	39.000	NB SB	C C	- 36.7 – 37.5	C B
39.000	44.229	NB SB	E C	- 39.5 – 41.6	E B
44.229	47.400	NB SB	C C	- 45.7 – 47.1	D C
52.630	57.000	2 - WAY	C	-	C
57.000	58.440	NB SB	- D	EXISTING -	C D
59.830	63.000	2 - WAY	D	-	D
63.000	64.300	2 - WAY	D	-	D
64.300	67.200	2 - WAY	D	-	D

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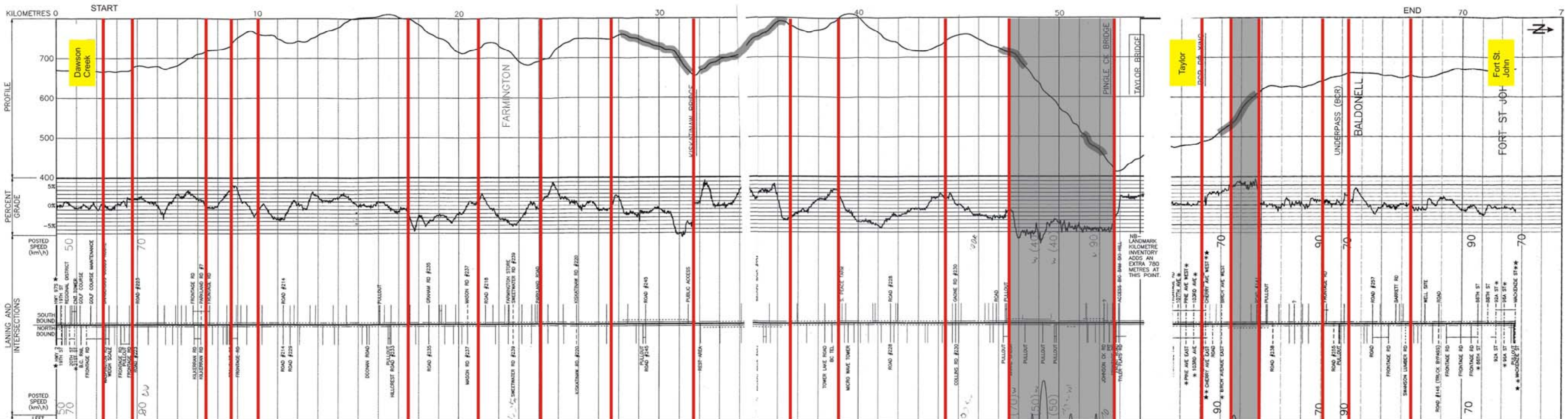

Existing		C	C / C	C / C	B / C	B / B	C / C	C / C	B / B	C / A	A / C	B / B	C / B	B / C		C	B / C		C	C	C
No Passing Lanes	5 year	C	C / C	C / C	C / C	C / C	C / C	C / C	B / B	C / A	A / D	B / C	D / B	C / C		C	B / C		C	C	C
	15 year	C	D / D	C / C	C / C	C / D	D / D	C / C	C / C	D / B	B / D	C / C	E / C	D / D		C	C / D		D	D	D
With Passing Lanes	5 year	C	B / C	B / C	A / C	B / B	C / A	C / A	A / B	C / A	A / D	B / A	D / A	C / B		C	B / C		D	D	D
	15 year	C	C / D	C / D	B / C	B / B	D / B	D / B	B / C	D / B	B / D	C / B	E / B	D / C		C	C / D		D	D	D

FIGURE 3.1 SUMMARY OF LEVELS OF SERVICE ALONG THE STUDY CORRIDOR

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3.4 Climbing Lane Analysis

To determine the locations where climbing lanes would be required, all segments with a 2% grade or more were considered as potential candidates for climbing lanes. These segments were then reviewed under guidelines specified by TAC Geometric Design Guideline. The TAC guideline states that a speed reduction of 15km/hr or more must be achieved to warrant a climbing lane, and also states that a climbing lane must have a minimum length that allows 30 seconds of passing opportunity. The minimum lengths required to attain a 15km/hr reduction at a specified grade is presented in TABLE 3.3; and the minimum lengths required to attain 30 seconds of passing opportunity at a specified speed limit is presented in TABLE 3.4.

TABLE 3.3 MINIMUM LENGTHS FOR A 15 KM/HR SPEED REDUCTION

PERCENTAGE GRADE	LENGTH (m)
2%	550
3%	340
4%	260
5%	210
6%	160
7%	120

TABLE 3.4 MINIMUM LENGTHS FOR 30 SECONDS OF PASSING OPPORTUNITY

DISTANCE	SPEED		TIME
(meters)	(km/hr)	(m/s)	(seconds)
583.33	70	19.44	30
625.00	75	20.83	30
666.67	80	22.22	30
708.33	85	23.61	30
750.00	90	25	30
791.67	95	26.39	30
833.33	100	27.78	30

The potential climbing lanes were then evaluated on-site, where physical characteristics and constructability were examined. All the potential northbound and southbound climbing lanes that were reviewed are presented in TABLE 3.5 and TABLE 3.6 respectively.

TABLE 3.5 POTENTIAL NORTHBOUND CLIMBING LANES

From (km)	To (km)	Horizontal (km)	Vertical (km)	Percent Grade	Speed Reduction		Passing Opportunity	
					Grade Length	Meets Criteria?	Speed Limit	Meets Criteria?
5.3	6.8	1.5	0.030	2.0	0.561	YES	70	YES
7.75	9.6	1.85	0.053	2.9	0.370	YES	70	YES
12.6	13.1	0.5	0.014	2.8	0.380	YES	90	NO
13.5	15	1.5	0.033	2.2	0.502	YES	90	YES
21	21.2	0.2	0.005	2.5	0.433	NO	90	NO
24.1	25.6	1.5	0.050	3.3	0.310	YES	90	YES
27.8	28	0.2	0.005	2.5	0.433	NO	90	NO
32	32.36	0.36	0.015	4.2	0.239	YES	90	NO
38.4	39.1	0.7	0.025	3.6	0.286	YES	100	NO
44	44.72	0.72	0.020	2.8	0.383	YES	100	NO
53	53.1	0.1	0.002	2.0	0.561	NO	70	NO

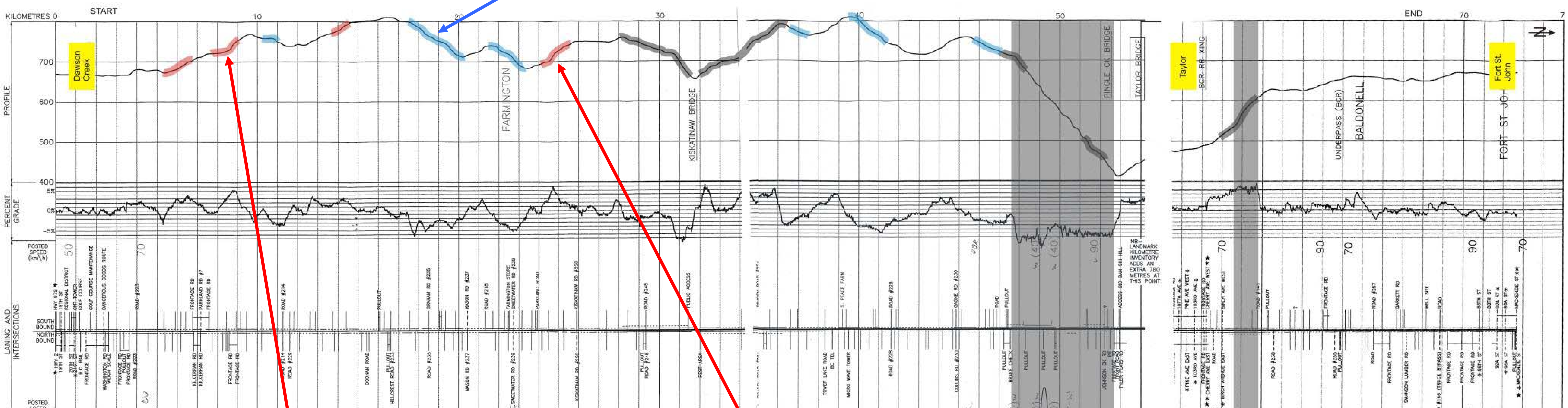
TABLE 3.6 POTENTIAL SOUTHBOUND CLIMBING LANES

From (km)	To (km)	Horizontal (km)	Vertical (km)	Percent Grade	Speed Reduction		Passing Opportunity	
					Grade Length	Meets Criteria?	Speed Limit	Meets Criteria?
47.08	45.7	1.38	0.032	2.3	0.473	YES	90	YES
41.61	39.5	2.11	0.067	3.2	0.328	YES	100	YES
38	36.5	1.5	0.015	1.0	1.255	YES	100	YES
23.3	21.5	1.8	0.057	3.2	0.329	YES	100	YES
20.3	17.5	2.8	0.088	3.1	0.332	YES	100	YES
11.8	10.25	1.55	0.027	1.7	0.659	YES	100	YES
9.95	9.7	0.25	0.008	3.2	0.325	NO	70	NO
5.35	5.15	0.2	0.005	2.5	0.433	NO	90	NO

After the on-site review, four northbound climbing lanes and 6 southbound climbing lanes are recommended. These potential climbing lanes are subjected to the economic evaluation, which is presented in Sections 5.0 of the report. It is recognized that the Ministry of Transportation has already begun work on evaluating climbing lanes. Several of the proposed climbing lanes correspond closely to the ministry's current locations. The locations of the recommended climbing lanes on Highway 97 are summarized in FIGURE 3.2.

The potential northbound climbing lanes are highlighted in orange and the potential southbound lanes are highlighted in blue. Locations of existing climbing lanes are highlighted in grey. Sections of FIGURE 3.2 are also shaded in grey to indicate areas that are excluded from the study.

	BC MOT	Opus Hamilton
Location	LKI 20.3 to LKI 17.5	LKI 19.5 to LKI 16.3
Start	Where the vertical curve begins to get steep (approx. 1% grade)	In the middle of the vertical upgrade (approximately 3% grade)
End	Where the vertical curve begins to flatten out	At the crest of the vertical curve



	BC MOT	Opus Hamilton
	LKI 8.2 to LKI 9.9	LKI 7.75 to LKI 9.6
Start	Where the vertical curve begins to get steep (approx. 2% grade)	At the foot of the vertical curve
End	The crest of the vertical curve	The crest of the curve

	BC MOT	Opus Hamilton
	LKI 24.6 to LKI 26.4	LKI 24.1 to LKI 25.6
Start	At the crest of the vertical curve	Before the uphill begins
End	After the vertical curve flattens	As soon as the vertical grade beings to flatten

FIGURE 3.2 POTENTIAL CLIMBING LANE LOCATIONS

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Corridor capacity analysis showed that the northbound segment of Highway 97 between LKI 39.000 and LKI 44.229 operates at a level of service E. The poor level of service is due to the steep downhill, which forces trucks to slow down significantly, in the northbound direction. Although a southbound climbing lane is proposed, it does not alleviate congestion in the northbound direction. Therefore, to improve the operating conditions of the northbound direction, a northbound passing lane is recommended on Highway 97 between LKI 39.5 and LKI 41.6. Capacity analysis conducted with the proposed passing lane improves the level of service from D to B for the year 2012, and improves the level of service from E to C for the year 2022. Since capacity analysis was conducted on this passing lane, the benefits provided by this passing lane are evaluated in the economic evaluation. It must be noted that with the addition of the suggested northbound passing lane and the proposed southbound climbing lane, this section of the highway becomes 4-lane wide.

As part of the climbing lane analysis, passing opportunity provided by passing lanes was also reviewed. According to TAC guidelines, it is recommended that passing opportunity be provided at every 8.0km for an AADT between 3001 – 5000. In the northbound direction, the proposed climbing lanes along with the existing climbing lane generally meet passing lane criteria and can also function as passing lanes. However, after the existing passing lane between LKI 32.36 and LKI 36.31, passing opportunity is not provided until after the district of Taylor. It is therefore suggested that passing lanes be provided in the area between LKI 42.0 and LKI 45.0, and between LKI 56.0 and 58.0 to enhance passing opportunity on the highway. As capacity analysis was not performed on the suggested passing lanes, these passing lanes are not included in the economic evaluation. In the southbound direction, the proposed climbing lanes along with the existing passing lane provide sufficient passing opportunity along the highway. It is therefore not necessary to provide additional passing lanes.

Since capacity analysis indicates that by 2022, many sections of the highway will be operating at a level of service C or below, further analysis was conducted to determine the volumes that would trigger the changes in level of service along the study corridor.

HSC analysis confirms that level of service of the corridor is calculated based on average travelling speeds and percent time spent following. For an average speed of between 90 km/hr and 100 km/hr, the LOS criteria are summarized in TABLE 3.7.

TABLE 3.7 LEVEL OF SERVICE CRITERIA

LOS	PERCENT TIME-SPENT FOLLOWING
A	Less than 35%
B	Between 35% and 50%
C	Between 50% and 65%
D	Between 65% and 80%
E	Greater than 80%

Based on the criteria, analysis was conducted to determine the volumes that would trigger the drop in operation from one level of service to the next. The analysis was conducted assuming the highway has 40 percent no passing and operates at an average speed 95 km/hr. Upgrade analysis was conducted assuming the upgrades are approximately 3% and are 1.2 km in length. The trigger volumes are summarized in FIGURE 3.1.

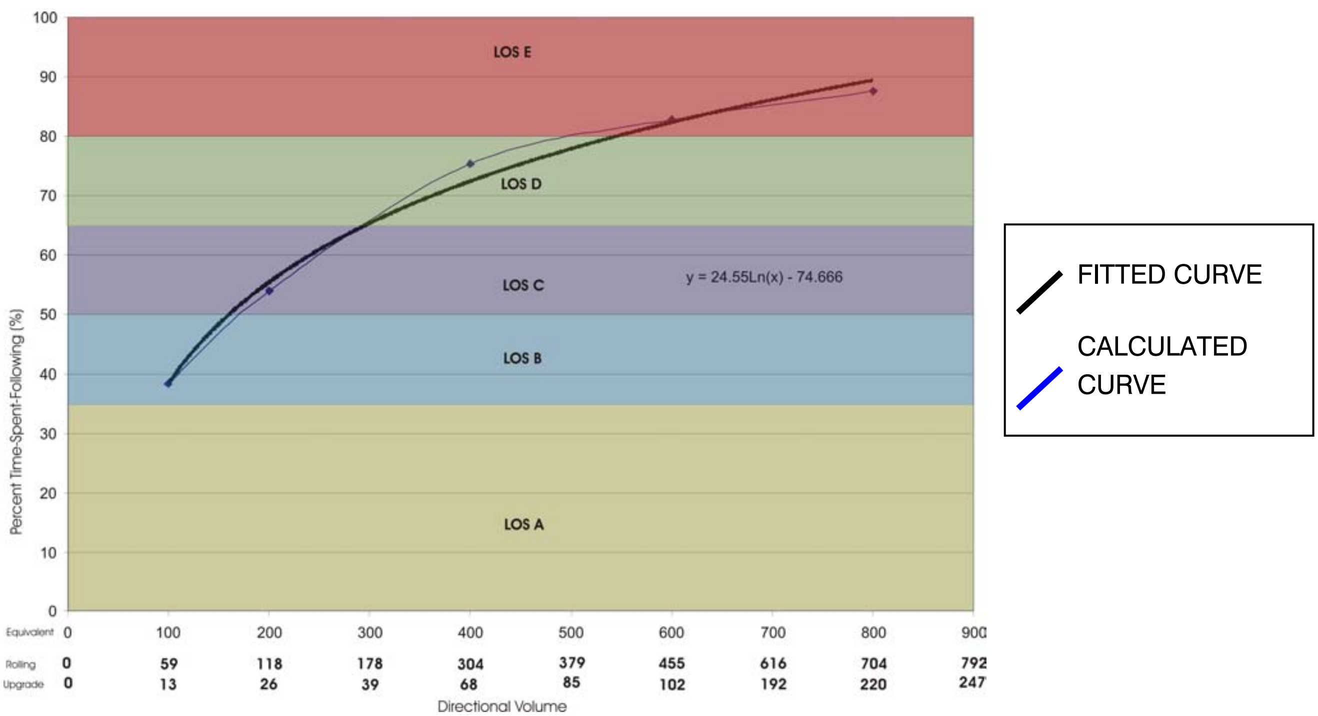

FIGURE 3.3 TRIGGER VOLUMES

It should be noted that the directional volumes are passenger car equivalent volumes. To convert this passenger car equivalent volume to the actual vehicle count volume, it is necessary to multiply the passenger car equivalent volume by the peak hour factor, the grade factor, and the heavy vehicle factor. These factors are different for different terrain types, and therefore result in different trigger volumes.

The findings from the analysis of the trigger volumes are:

- The level of service changes from C to D when a directional passenger car equivalent of 296 vehicles is achieved. Converting to actual vehicle volumes, 175 vehicles will trigger the change in level of service for rolling terrain. A vehicle count of only 38 vehicles will trigger the drop in level of service at an upgrade.

- The level of service changes from D to E when a directional passenger car equivalent of 545 vehicles is achieved. Converting to actual vehicle volumes, 414 vehicles will trigger the change in level of service for rolling terrain. However, at an upgrade, 93 vehicles will trigger the drop in level of service.

4.0 RECOMMENDED IMPROVEMENTS

4.1 Short Term Improvements

Short term improvements can be included as part of regular maintenance. The costs of such improvements have therefore not been included in the improvement evaluation.

4.1.1 Corridor-Wide Short Term Improvements

It is recommended that the following corridor-wide improvements be provided:

- Alcohol and speed enforcement should be conducted on a routine basis.
- Shoulder and median rumble strips should be implemented with any repaving.
- Improved signage on cross streets (bigger and more conspicuous Street Name Signs, designed to current Ministry standards, G-7x, Manual of Standard Traffic Signs and Pavement Markings, September 2000). Improved side slope with any reconstruction
- Wildlife countermeasures such as signage, reflectors or fencing should be considered for locations with higher frequencies of animal collisions identified in Section 2.6.

4.1.2 Intersection-Specific Short Term Improvements

Short-term improvements recommended for specific intersections mainly consist of improving signage, delineation, illumination, and access management as shown in FIGURES 4.1A and 4.1B. Sign improvements are summarized in TABLE 4.1, other improvements are summarized in TABLE 4.2.

Upon conducting field observations, signage improvements are recommended at many of the intersections, summarized in TABLE 4.1. Where major intersections are not as conspicuous as they could be, advance intersection signing is recommended.

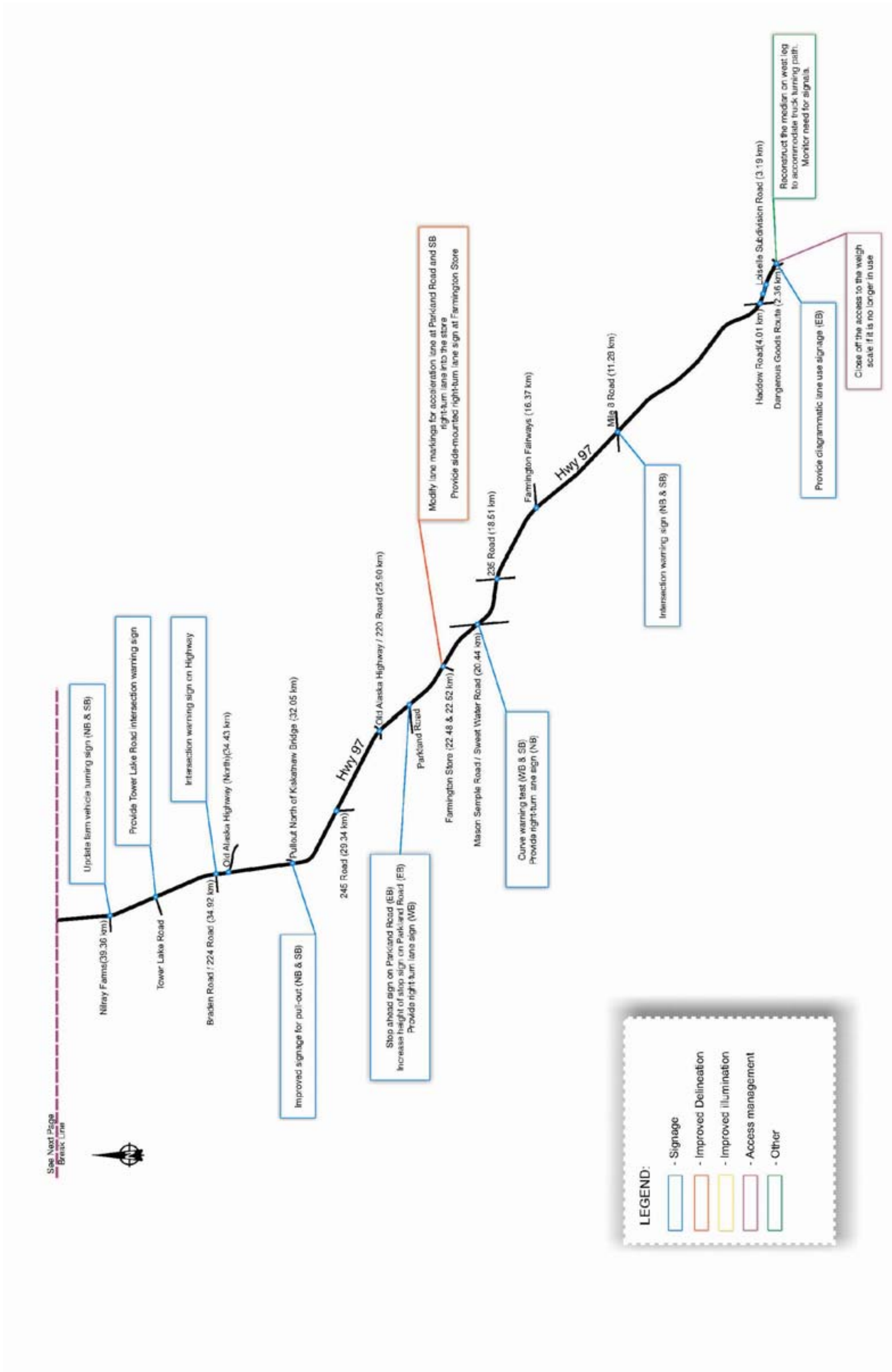

FIGURE 4.1A SHORT TERM IMPROVEMENTS – SOUTH SECTION

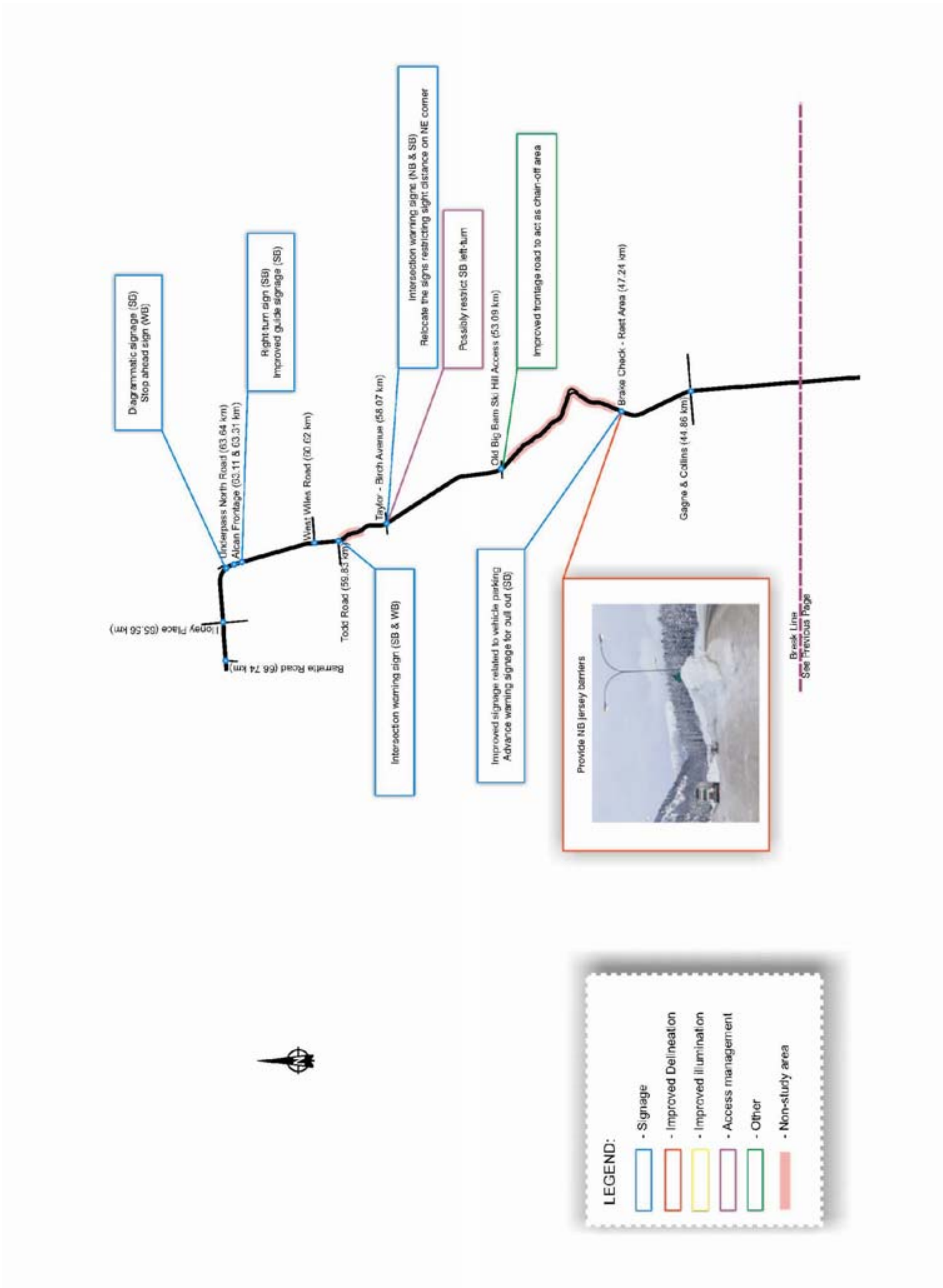

FIGURE 4.1B SHORT TERM IMPROVEMENTS – NORTH SECTION

An example of an advance street name sign is shown in FIGURE 4.2. Either Green guide signs or Intersection Warning Signs (WA11, WA-12 or WA13 in the Manual of Uniform Traffic Control Devices for Canada (MUTCDC)) with street name information tabs should be provided on the northbound and southbound approaches of Highway 97 at the following intersections:

- Mile 8 Road;
- Braden Road
- Tower Lake Road;
- Taylor-Birch
- Todd Road

FIGURE 4.2 ADVANCE STREET NAME SIGNAGE

TABLE 4.1 SIGN IMPROVEMENTS

INTERSECTION	PROPOSED SIGNAGE
Dangerous Goods Route	• Provide Diagrammatic lane use signage in advance of the curve on the eastbound approach.
Mason Semple Rd / Sweet Water Rd	• Possibly implement Curve Warning Signs for the westbound and southbound approaches. This should be confirmed using the ball-bank indicator test • Provide side-mounted right-turn Lane Use Sign for northbound direction (MUTCDC RB-41R)
Farmington Store	• Provide side-mounted right-turn lane sign southbound
Parkland Road	• Stop Ahead Sign on Parkland Road • Increase height of STOP sign on Parkland Road • Provide side-mounted right-turn Lane Use sign for southbound direction)
Pullout north of Kiskatnaw Bridge	• Improved signage for rest area(northbound and southbound)
Nilray Farms	• Provide new Farm Vehicle Turning Signs (northbound and southbound)
Brake Check Pull Out (LKI 47.24)	• Improved signage to indicate parking areas for trucks and for passenger vehicles • Signage for acceleration lane and pull-out (southbound)
Alcan Frontage	• Provide side-mounted right-turn Lane Use Sign for southbound direction (MUTCDC RB-41R) • Provide additional traveller service sign southbound
Underpass	• Diagrammatic signage for laning clarification southbound • Stop Ahead sign on sidestreet

4.2 Intersection-Specific Long Term Improvements

Based on the results of the site visits, capacity analysis, collision analysis and site visits, numerous issues were identified at intersections. The issues and potential solutions are summarized in FIGURES 4.3A and 4.3B, as well as TABLE 4.2.

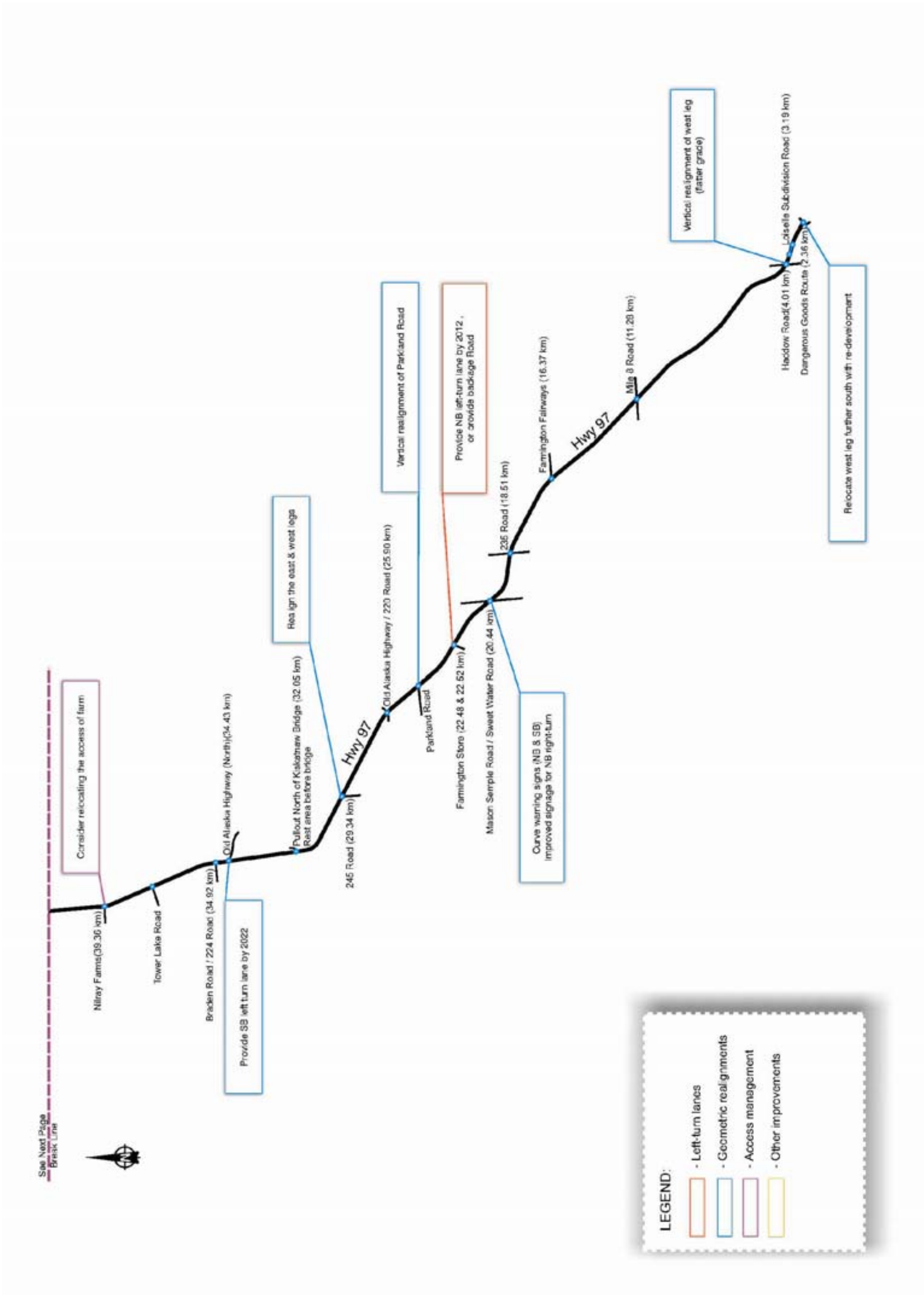

FIGURE 4.3A LONG TERM IMPROVEMENTS – SOUTH SECTION

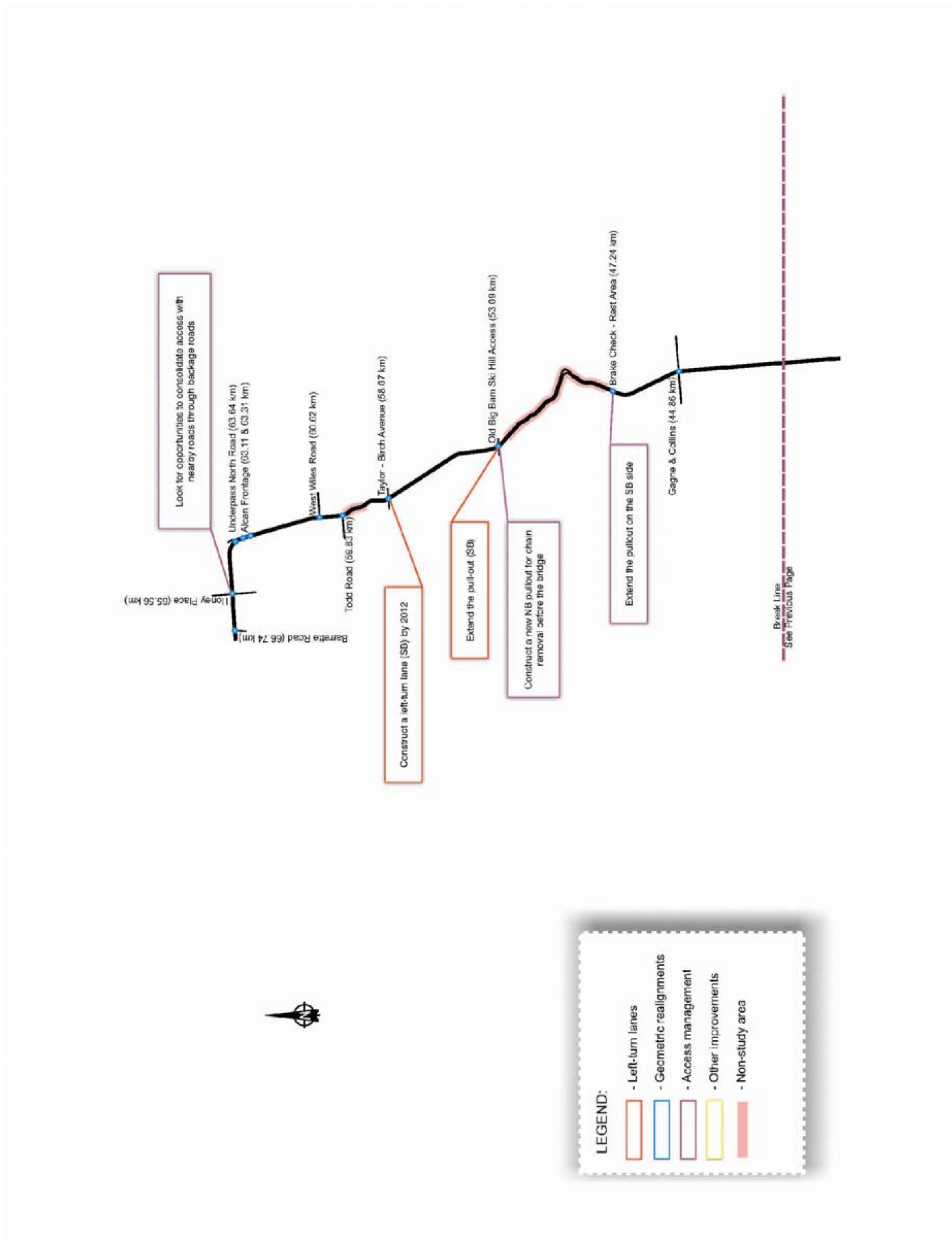

FIGURE 4.3B LONG TERM IMPROVEMENTS – NORTH SECTION

Other Improvements for Consideration

- At the intersection of Underpass North Road, it is recommended that the traffic volumes be monitored for the need of traffic signals.
- Todd Road had the highest collision frequency. However, all these collisions occurred prior to the recent relocation. Collision frequency at this location should be monitored to confirm the impact of the relocation on safety performance.

TABLE 4.2 SUMMARY OF SHORT-TERM AND LONG-TERM IMPROVEMENTS AT INTERSECTIONS

Intersection (LKI)	Issue	How the issue was identifies?	Improvements	Short term or long term?
Dangerous Goods Route (2.36)	Drivers' confusion	Stakeholder consultation and site visit	Closing off the access to the scale	Short term
Dangerous Goods Route (2.36)	Tight westbound left-turn movement for trucks	Stakeholder consultation	Set the median on west leg further back to accommodate truck path	Short term
Dangerous Goods Route (2.36)	Crossing collisions due to difficulty finding gaps in high speeds	Collision analysis and site visit	Monitor need for signals or roundabouts	Long term
Dangerous Goods Route (2.36)	S-curve may be difficult for trucks to negotiate	Site visit, Stakeholders	Relocate west leg further south (possibly with redevelopment)	Long term
Haddow Road (4.01)	West leg is misaligned	Site visit	Vertical realignment of west leg (flatter grade)	Long term
Farmington Store intersection (22.48 & 22.52)	High northbound left-turn movement	Capacity analysis and stakeholder consultation	Constructing a left-turn lane or a backage road	Long term
Farmington Store intersection (22.48 & 22.52)	Drivers' confusion	Site visit	Modify lane markings for acceleration lane at Parkland Road and Southbound lane into the store	Short term

TABLE 4.2 SUMMARY OF SHORT-TERM AND LONG-TERM IMPROVEMENTS (Continued)

Intersection (LKI)	Issue	How the issue was identifies?	Improvements	Short term or long term?
Parkland Road	Vertical crest in advance of intersection	Site visit	Vertical realignment	Long Term
Old Alaska Hwy, North Access (34.43)	High southbound left-turn movement	Capacity analysis	Construct a left-turn lane	Long term
Nilray Farms (39.36)	Restricted sight distance for turning trucks	Site visit	Consider relocating the access of farm	Long term
Brake Check- rest area (47.24)	Confusion about where trucks should park	Site visit and stakeholder consultation	Provide northbound jersey barriers and lighting (see inset photo in FIG. 4.1B	Short term
Brake Check- rest area, Southbound (47.24)	Only 100 meters	Site visit and stakeholder consultation	Extend the pullout	Long term, with reconstruction of Taylor left-turn lane
Old Big Bam Ski Hill Access (53.09)	Nowhere to remove chains prior to the Bridge	Site visit and stakeholder consultation	Signage and improvements to existing frontage road so it can be used as a chain-off area	Short term
			Construct a new chain-off area	Long term
Taylor-Birch (58.07)	High southbound left-turn movement	Capacity analysis	Constructing a left-turn lane	Long term
Honey Place Road	Difficulty finding gaps in high-speed multi-lane traffic	Site visit	Look for opportunities to consolidate access with nearby roads through backage roads	Long term

4.2.2 Midblock Improvements

Since capacity analysis indicates that climbing lanes are effective in alleviating congestion caused by slow moving trucks on steep upgrades, it is recommended that climbing lanes discussed in section 3.0 be provided to improve the operation of Highway 97 by 2022.

The design guidelines for the climbing lanes were obtained from the TAC Geometric Design Guide. According to the TAC design guide, the minimum climbing lane width is 3.6 metres with a diverge taper of 50 metres. The length of the merge taper is a function of the posted speed limit and is presented in TABLE 4.3.

TABLE 4.3 MERGE TAPER LENGTHS FOR VARIOUS DESIGN SPEEDS

POSTED SPEED LIMIT (KM/HR)	MERGE TAPER (m)
50	110
60	130
70	150
80	175
90	195
100	215
110	240

A summary of all the potential climbing lane locations and the merge taper lengths for each proposed climbing lane is shown in FIGURE 4.4.

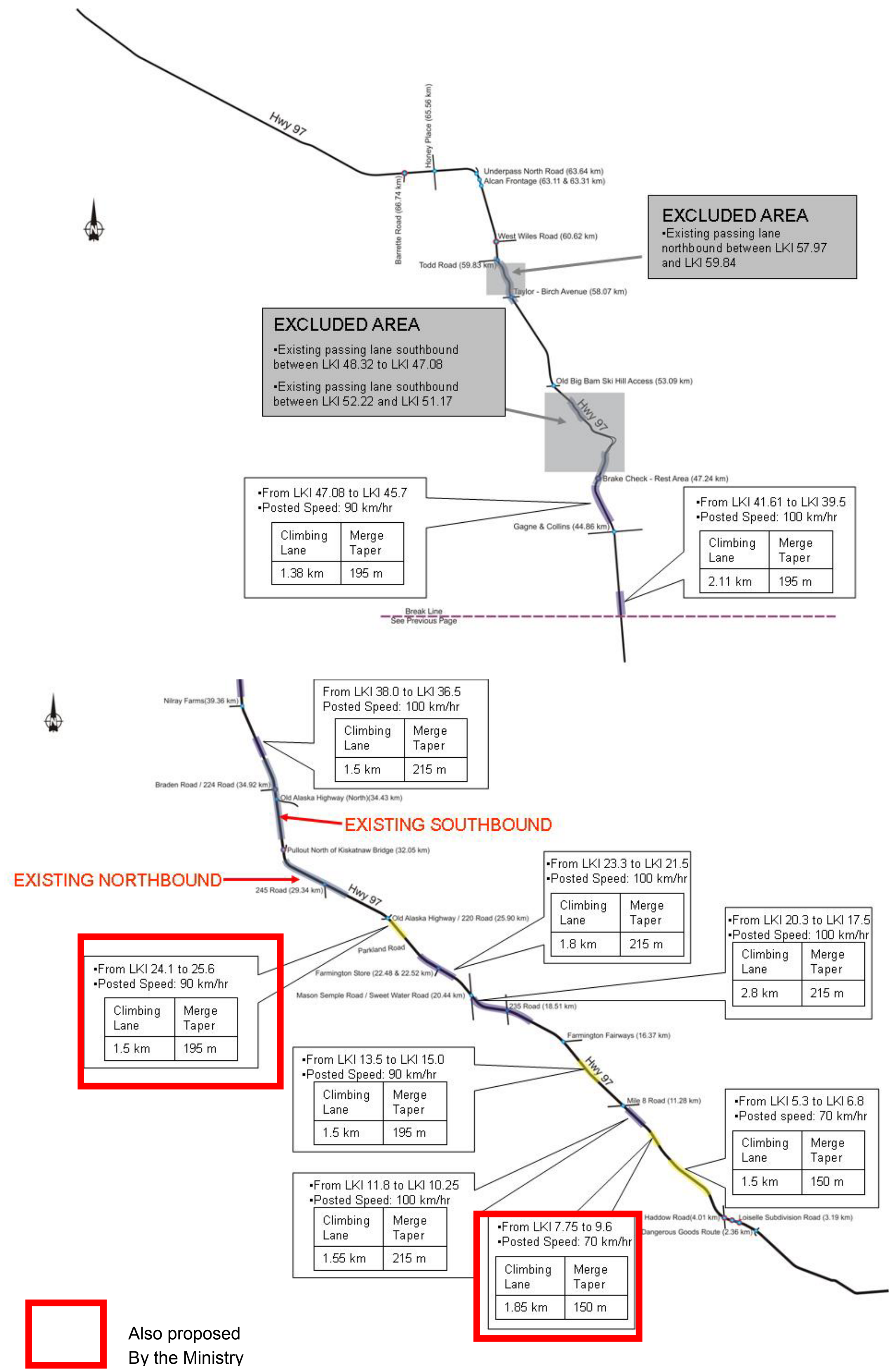

FIGURE 4.4 SUMMARY OF ALL POTENTIAL CLIMBING LANE LOCATIONS

5.0 Economic Analysis

The economic analysis of the proposed improvements was conducted using ShortBEN analysis. The analysis conducted on the proposed improvements was based on the following factors:

- Annual traffic growth rate of 4 percent(confirmed by the Ministry);
- Truck volume of 30 percent;
- Discount rate of 6 percent (suggested by the Ministry);
- Collision reduction factor of 30 percent for constructing left-turn lanes and climbing lanes;
- Analysis period of 25 years (as requested by the Ministry)
- Benefit in future years are related to the changes in traffic volumes in 2007;
- Construction cost of $275 per square meter. This rate was derived from rates used by similar projects provided in the *Construction and Rehabilitation Cost Guide* (Ministry of Transportation, June 2007); and,
- Road widening width of 3.5 meters for both left-turn lane and climbing lane construction.
- The value of time for vehicles and trucks is $14.52 per hour and $21.00 per hour respectively.

5.1 Cost Estimates

The construction cost estimates for providing left-turn lanes are summarized in TABLE 5.1.

TABLE 5.1 COST ESTIMATES FOR LEFT-TURN LANES

IMPROVEMENT	TOTAL LENGTH (km)	WIDENING AREA (m2)	RATE/m2	COST
Left Turn Lane at “T” intersection	0.34	1190	$275	$327,250
Left Turn Lane at cross intersection	0.68	2380	$275	$654,500
NB Left Turn lane at Farmington Store Intersection	0.34	1190	$275	$327,250
SB Left Turn Lane at Old Alaska Hwy, North access	0.34	1190	$275	$327,250
SB Left Turn Lane at Taylor-Birch	0.68	2380	$275	$654,500

For the construction of climbing lanes, ShortBEN analysis requires the discounted costs of the improvement. The discounted cost takes into account the engineering, maintenance, and resurfacing costs, as well as the salvage value of the improvement. The cost estimates for constructing climbing lanes along the study corridor are presented in TABLE 5.2.

TABLE 5.2 COST ESTIMATES FOR CLIMBING LANES

	Improvement			Costs
Direction	From	To	Length	
Northbound	5.3	6.8	1.5	$1,147,577.89
	7.75	9.6	1.85	$1,415,346.06
	13.5	15	1.5	$1,147,577.89
	24.1	25.6	1.5	$1,147,577.89
	39.5	41.6	2.1	$1,614,803.16
Southbound	11.8	10.25	1.55	$1,185,830.01
	20.3	17.5	2.8	$2,142,145.39
	23.3	21.5	1.8	$1,377,093.46
	38	36.5	1.5	$1,427,542.92
	41.61	39.5	2.11	$1,114,418.36
	47.08	45.5	1.58	$1,208,782.04

5.2 Collision Reduction Benefits

The provision of left-turn lanes and climbing lanes is expected to decrease the collision frequency along the study corridor. Both improvement options are anticipated to reduce the number of collisions by 30% (Desktop Reference for Crash Reduction Factors, FHWA, September 2007). The collision costs along the study corridor are assumed to be $243,000 per fatality, $26,000 per injury, and $3,000 per material damage only claims. The collision reduction benefits resulting from left-turn lanes are summarized in TABLE 5.3, and the benefits resulting from climbing lanes are summarized in TABLE 5.4.

TABLE 5.3 COLLISION REDUCTION SAVINGS DUE TO LEFT-TURN LANES

INTERSECTION	IMPROVEMENT	Total Cost of Collisions (25 years)	ANNUAL COLLISION COST SAVINGS (PRESENT VALUE)
Farmington Store intersection	Constructing northbound left-turn lane	$327,250	$115,000
Taylor-Birch	Constructing southbound left-turn lane	$654,500	$225,000
Old Alaska Hwy, North Access	Constructing southbound left-turn lane	$327,250	$145,000

TABLE 5.4 COLLISION REDUCTION SAVINGS DUE TO CLIMBING LANES

	IMPROVEMENT		REDUCTION FACTOR	COST		ANNUAL COLLISION REDUCTION SAVINGS (PRESENT VALUE)
DIRECTION	From	To		UNREDUCED	REDUCED	
NORTHBOUND	5.3	6.8	30%	$640,059.80	$448,129.30	$191,930.50
	7.75	9.6	30%	$603,917.99	$422,742.59	$181,175.40
	13.5	15	30%	$3,137,248.62	$2,142,175.93	$995,072.69
	24.1	25.6	30%	$390,752.68	$273,474.47	$117,278.20
	39.5	41.6	30%	$496,361.51	$358,048.42	$148,303.087
SOUTHBOUND	11.8	10.25	30%	$459,000.99	$321,662.11	$137,338.88
	20.3	17.5	30%	$954,843.30	$662,677.57	$292,165.73
	23.3	21.5	30%	$391,054.41	$273,376.00	$117,678.41
	38	36.5	30%	$468,903.21	$328,594.33	$140,308.88
	41.61	39.5	30%	$502,969.60	$352,290.94	$150,678.66
	47.08	45.5	30%	$141,768.82	$99,131.58	$42,637.24

5.3 Travel Time Savings

As the left-turn lane improvements would only result in very minimal travel time savings, travel time benefits were only evaluated for the proposed climbing lanes.

The travel time savings for each proposed climbing lane was determined using HCS2000. Using HCS2000, the study corridor was evaluated with improvements and without improvements. The annual travel times for both the unimproved and improved corridor is summarized in TABLE 5.5.

TABLE 5.5 ANNUAL TRAVEL TIME SAVINGS

DIRECTION	IMPROVEMENT			WITHOUT IMPROVEMENTS	WITH IMPROVEMENTS	ANNUAL TRAVEL TIME SAVINGS (VEH-HRS)
	FROM	TO	LENGTH	ANNUAL TRAVEL TIME (VEH-HRS)	ANNUAL TRAVEL TIME (VEH-HRS)	
NORTHBOUND	5.3	6.8	1.5	72,180	69,041	3,138
	7.75	9.6	1.85	58,096	51,781	6,315
	13.5	15	1.5	15,1412	134,944	16,467
	24.1	25.6	1.5	57,843	54,440	3,403
	39.5	41.6	2.1	105,478	98,673	6,805
SOUTHBOUND	11.8	10.25	1.55	148,467	142,012	6,455
	20.3	17.5	2.8	59,705	53,880	5,825
	23.3	21.5	1.8	50,968	48,055	2,912
	38	36.5	1.5	39,318	34,949	4,369
	41.61	39.5	2.11	76,619	71,298	5,321
	47.08	45.5	1.58	48,951	46,823	2,128

The annual travel time savings for each proposed climbing lane was then converted to a dollar amount by using values provided by the Ministry of Transportation. Based on an assumption of 30% trucks, the value of time savings was calculated for each proposed climbing lane and is summarized in TABLE 5.6

TABLE 5.6 PRESENT VALUE OF ANNUAL TRAVEL TIME SAVINGS

DIRECTION	IMPROVEMENT			ANNUAL TRAVEL TIME SAVINGS (VEH-HRS)	ANNUAL TRAVEL TIME SAVINGS ($/ANNUM)	PRESENT VALUE
	FROM	TO	LENGTH (KM)			
NORTHBOUND	5.3	6.8	1.5	3,138.2	$51,670.24	$977,287.06
	7.75	9.6	1.85	6,314.8	$103,970.60	$1,966,492.24
	13.5	15	1.5	16,467.1	$271,125.49	$5,128,047.39
	24.1	25.6	1.5	3402.5	$56,021.25	$1,059,581.81
	39.5	41.6	2.1	6,805	$112,042.28	$2,119,159.415
SOUTHBOUND	11.8	10.25	1.55	6,455.1	$106,281.06	$2,010,192.07
	20.3	17.5	2.8	58,24.9	$95,904.60	$1,813,932.40
	23.3	21.5	1.8	29,12.4	$47,952.30	$906,966.20
	38	36.5	1.5	4,368.6	$71,928.45	$1,360,449.30
	41.61	39.5	2.11	5,320.8	$87,604.62	$1,656,947.22
	47.08	45.5	1.58	2,128.3	$35,041.85	$662,778.89

5.4 Benefit-Cost Analysis

Based on the calculated savings and costs, the benefit/cost ratio was determined for each improvement measure. The benefit/cost analysis and the net present value of the proposed left-turn lanes and climbing lanes is summarized in TABLE 5.7 and 5.8 respectively.

TABLE 5.7 BENEFIT COST ANALYSIS FOR LEFT-TURN LANES

IMPROVEMENT	ANNUAL SAVINGS (BENEFITS)	COSTS	B/C	NET PRESENT VALUE
SB Left Turn Lane at Old Alaska Hwy, North access	$250,398.92	$247,536.96	1.0	$2,861.98
SB Left Turn Lane at Taylor-Birch	$412,449.38	$557,009.62	0.7	-$144,560.24
NB Left Turn Lane at Farmington Store Intersection	$384,278.48	$247,536.96	1.6	$136,741.52

TABLE 5.8 BENEFIT COST ANALYSIS FOR CLIMBING LANES

	IMPROVEMENT			ANNUAL SAVINGS (BENEFITS)	COSTS	B/C	NET PRESENT VALUE
DIRECTION	FROM	TO	LENGTHH				
Northbound	5.3	6.8	1.5	$1,169,217.55	$1,147,577.89	1.0	$21,639.67
	7.75	9.6	1.85	$2,147,667.64	$1,415,346.06	1.5	$732,321.58
	13.5	15	1.5	$6,123,120.08	$1,147,577.89	5.3	$4,975,542.19
	24.1	25.6	1.5	$1,176,860.02	$1,147,577.89	1.0	$29,282.13
	39.5	41.6	2.1	$2,267,462.50	$1,614,803.36	1.4	$652,659.34
Southbound	11.8	10.25	1.55	$2,147,530.95	$1,185,830.01	1.8	$961,700.94
	20.3	17.5	2.8	$2,106,098.13	$2,142,145.39	0.98	-$36,047.26
	23.3	21.5	1.8	$1,024,644.61	$1,377,093.46	0.74	-$352,448.85
	38	36.5	1.5	$1,500,758.18	$1,427,542.92	1.0	$73,215.26
	41.61	39.5	2.11	$1,807,625.87	$1,114,418.36	1.6	$693,207.52
	47.08	45.5	1.58	$705,416.12	$1,208,782.04	0.58	-$503,365.92

Based on the analysis, the left-turn lanes proposed at Old Alaska Highway (north access) and the Farmington Store intersections have benefit/cost ratios greater than 1.0. The benefit/cost ratios for the climbing lanes show that all the proposed northbound climbing lanes have benefit/cost ratios greater than 1.0, while in the southbound direction, only 3 of the proposed climbing lanes have benefit/cost ratios greater than 1.0. A summary of the improvements ranked according to the benefit/cost ratio is presented in TABLE 5.9.

TABLE 5.9 RANKINGS OF IMPROVEMENT MEASURES

IMPROVEMENT MEASURE	FROM	TO	B/C	RANK
Northbound Climbing Lane	13.5	15	5.3	1
Southbound Climbing Lane	11.8	10.25	1.8	2
NB Left Turn Lane at Farmington Store Intersection			1.6	3
Southbound Climbing Lane	41.61	39.5	1.6	3
Northbound Climbing Lane	7.75	9.6	1.5	4
Northbound Passing Lane	39.5	41.6	1.4	5
Northbound Climbing Lane	5.3	6.8	1.0	6
Northbound Climbing Lane	24.1	25.6	1.0	6
SB Left Turn Lane at Old Alaska Hwy, North access			1.0	6
Southbound Climbing Lane	38	36.5	1.0	6
Southbound Climbing Lane	20.3	17.5	0.98	7
Southbound Climbing Lane	23.3	21.5	0.74	
SB Left Turn Lane at Taylor-Birch			0.70	9
Southbound Climbing Lane	47.08	45.5	0.58	10

6.0 OVERVIEW

This report summarizes a review of existing and future conditions on the Alaska Highway between Fort St. John and Dawson Creek. Based on the results of the capacity analysis, traffic operations, collision history, site visits and stakeholder consultation, numerous issues were identified.

Intersections along Highway 97 are operating at acceptable levels of service, now and in the future. Collision rates are high, but collision frequency is low. The predominant collision type is wildlife collisions.

The issue of most concern to stakeholders was the lack of passing opportunities along the highway. Respondents all mentioned that motorists are making dangerous manoeuvres when it comes to passing in order to get past slower moving commercial vehicles. Other significant issues identified include:

- Speeding;
- Heavy commercial vehicle traffic;
- Drinking/drugs and driving;
- Narrow shoulder widths and grades;
- Wildlife collisions;
- Winter road conditions.

Minor issues were identified relating to:

- Low visibility signage;
- Poor transitions with added lanes.

Site specific issues were identified for numerous intersections. Some issues were identified for chain-up areas, particularly the lack of a signed area to remove chains prior to driving on the metal surface of the Taylor Bridge.

Analysis was conducted to confirm locations for future passing lanes, climbing lanes and turning lanes at intersections.

Based on this analysis, the following corridor-wide improvements were recommended:

- Alcohol and speed enforcement should be conducted on a routine basis.

- Shoulder and median rumble strips should be implemented with any repaving.
- Improved signage on cross streets
- Improved side slope with any reconstruction
- Wildlife countermeasures such as signage, reflectors or fencing for locations with higher frequencies of animal collisions.

Short-term improvements that were recommended for specific intersections mainly consist of improving signage, delineation, illumination, and access management. Long term improvements include ten climbing lanes, one passing lane, and three turn lanes at intersections

The economic analysis of the proposed improvements was conducted using ShortBEN analysis, and many showed a positive return. The improvements were then ranked using the results of the economic analysis. The identified improvements are expected to improve the safety and operations of the corridor. This document can be used to help prioritize improvements for the present and the future.

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APPENDIX A

SITE VISIT NOTES

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Intersection of Dangerous Goods Route and Alaska Highway #97N

80PHOTO	ISSUE
	**Southbound Approach** There is a horizontal curve in the southbound approach that makes it slightly difficult to see the intersection.
	**Westbound Approach** There are overhead lane marking signs on the westbound approach. From the westbound approach, sight distance to the south is good, but sight distance to the north is slightly limited by the sign and by the lighting pole on the channelization island.

Intersection of Haddow Road (223 Road) and Alaska Highway #97N

PHOTO	ISSUE
	**Westbound Approach** The westbound and eastbound approaches of the intersection are misaligned.

Intersection of Mile 8 Road (Road 214) and Alaska Highway #97N

PHOTO	ISSUE
	**Northbound Approach** Lighting is not provided at the intersection. The small road signs and the lack of lighting make it difficult to see the intersection from both the northbound and the southbound directions.

Intersection of Mason Semple Road (Road 237) and Alaska Highway #97N

PHOTO	ISSUE
 	**Westbound Approach** From the westbound approach, the eastbound approach looks aligned with the westbound approach, but there is actually a horizontal curve in the road. There is a warning sign to warn westbound drivers of the horizontal curve.

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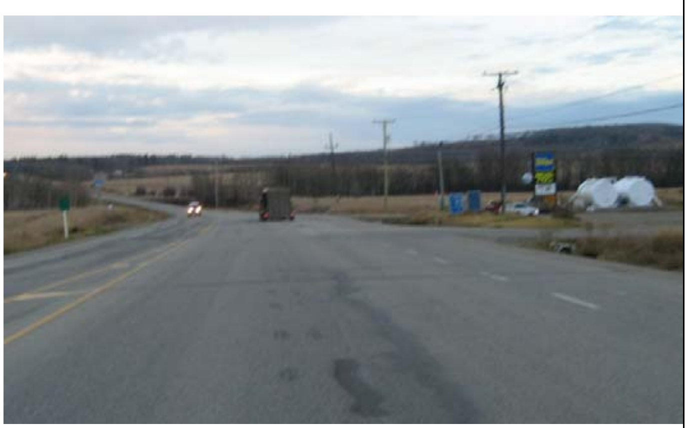
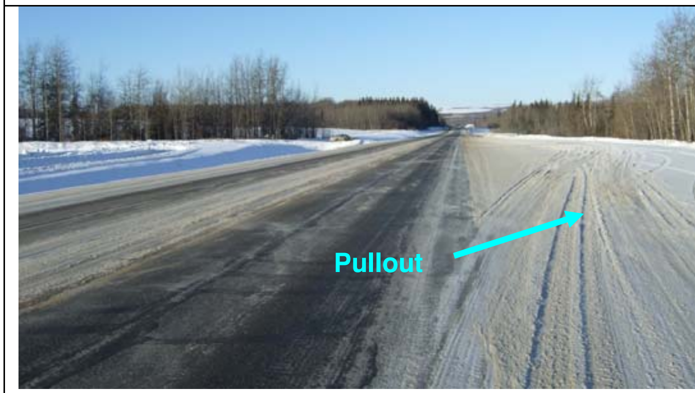
Intersection of Farmington Store Accesses and Alaska Highway #97N

PHOTO	ISSUE
  	**Northbound Approach** There is no northbound left-turn lane into the store, which may result in long queues. The accesses to the store are poorly lit. Except for the lights at the gas station, lighting is not provided at the accesses. The shoulder is wide in the northbound direction. However, the ditch makes it difficult for drivers to use the shoulder to pass vehicles turning left into the store. The driveway, also located in the northbound direction, may limit further widening of the shoulder.
	**Southbound Approach** There is an acceleration lane beginning at Parkland Road that continues to the South access of the store. Although this lane allows drivers to turn into the north store access, the lane configuration is confusing to drivers who do not intend to turn into the store.

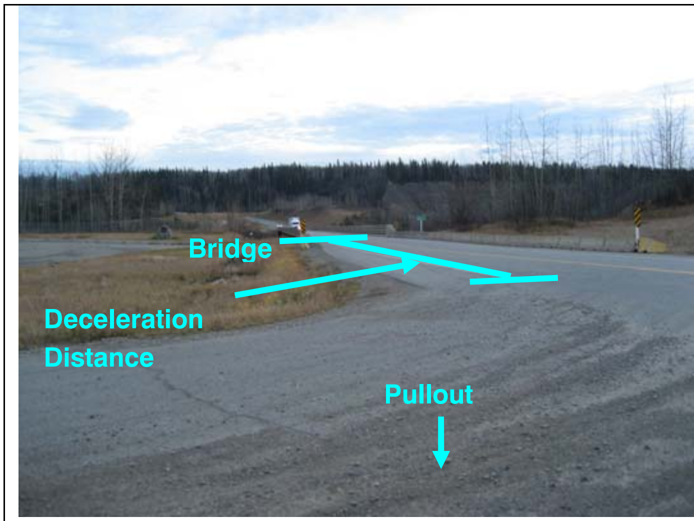
Intersection of Parkland Road and Alaska Highway #97N

PHOTO	ISSUE
 	**Southbound Approach** From Parkland Road, sight distance to the south is restricted by the horizontal curve. Street furniture on the west side of the highway also limits sight distance to the south. There is a southbound right-turn lane; however, it is difficult to see the lane markings for this lane.
	**Eastbound Approach** There is a vertical crest just west of the eastbound approach. This may make the stop sign, which is situated at the bottom of the vertical curve, difficult to see.

Intersection of 245 Road and Alaska Highway #97N

PHOTO	ISSUE
	**Northbound Approach** There is a pullout in the northbound direction, which may distract drivers from seeing the intersection. There is a passing lane in the Northbound direction. The passing lane makes it difficult for drivers to make left-turns from 245 Road onto the highway.
	**Westbound Approach** During the winter season, it appears that the westbound approach is not maintained and is closed.
	**Eastbound Approach** From the eastbound approach, sight distance to the north is restricted by the trees.
	General Observations Lighting is not provided at the intersection. The minor approaches of the intersection are not aligned.

Pullout North of Kiskatinaw Bridge

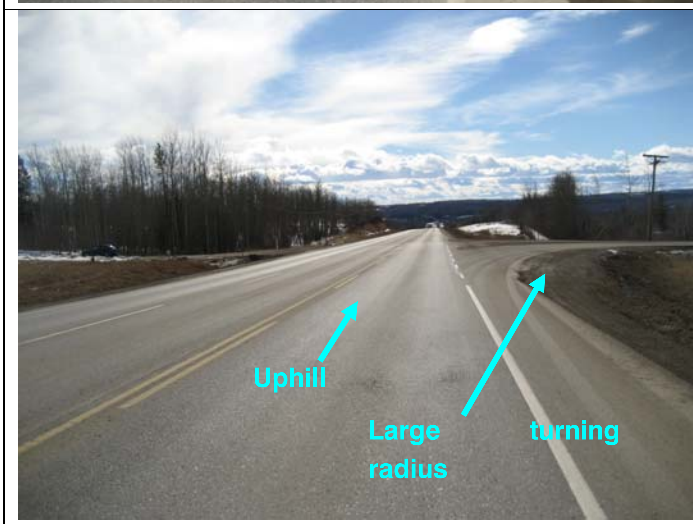
	**Northbound Approach** The pullout on the eastside of the highway is not noticeable. In addition, the deceleration distance from the Kiskatinaw Bridge to the pullout is very short.

Intersection of Old Alaska Highway (Road 64) and Alaska Highway #97N

PHOTO	ISSUE
	**Northbound Approach** There is a passing lane in the northbound direction that makes it difficult for drivers to make left-turn movements onto the highway from Old Alaska Highway
	**Westbound Approach** There is horizontal curve in the westbound approach. At the westbound approach, it may be difficult to make a left turn to travel southbound on the highway because of the existing northbound passing lane on the highway. Sight distance to the north is reduced by the hill; and sight distance to the south is reduced by the trees.

Intersection of Braden Road and Alaska Highway #97N

<table>
<tr><th>PHOTO</th><th>ISSUE</th></tr>
<tr><td>
</td><td>Northbound Approach

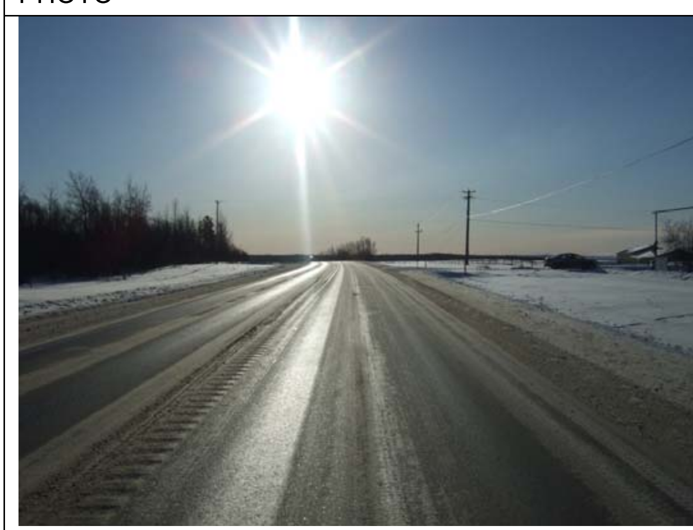
A northbound passing lane goes continues through the intersection. The passing lane makes it difficult for drivers to make left-turns from Braden Road onto the highway.</td></tr>
<tr><td>
</td><td>Southbound Approach

Sight distance to the south is restricted by the vertical curve

There is a channelized southbound right turn lane with a big turning radius.

Braden can be considered a major intersection as it provides access to the District of Chetwynd. However, there are no signs directing drivers to the intersection.</td></tr>
</table>

Intersection of South Peace Farm Access and Alaska Highway #97N

<table>
<tr><th>PHOTO</th><th>ISSUE</th></tr>
<tr><td></td><td>Southbound Approach

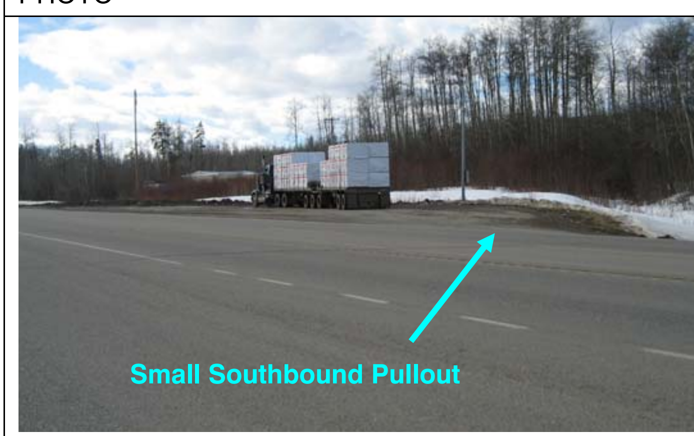
There is a vertical curve approximately 200 meters from the intersection. This may not allow enough sight distance for a slow moving farm vehicle.</td></tr>
</table>

Intersection of Gagne and Collins (Road 230) and Alaska Highway #97N

PHOTO	ISSUE
	**Southbound Approach** Lighting is not provided at the intersection. Sight distance to the south from both the westbound and eastbound approaches is limited by the horizontal and vertical curves.

Brake Check/Pullout at Approximately LKI 47.0

PHOTO	ISSUE
	**Southbound Approach** The pullout in the southbound direction is very small and insufficient for multiple trucks.

	**Northbound Approach** The brake check is very wide, but has no lane markings. No particular parking order was observed to be followed by truckers at the brake check. Some trucks were observed to be on the shoulder, while other trucks pulled all the way in. It is suggested to provide signage to indicate to drivers where to stop. Parking stalls for RVs and passenger cars can also be drawn in.

Brake Check South of Big Bam Skill Hill Access

PHOTO	ISSUE
	**Northbound Approach** There is a business on the east side of the highway, so northbound trucks pulling over to take off their chains would disrupt access to the business.
	**Southbound Approach** Although there is a sign indicating a "chain-up area", it is difficult to tell whether the designated area is an acceleration lane or an actual chain-up area. Aside from the sign at the chain-up area, there are no other warning signs of the pullout. During the winter season, the pullout is difficult to see and forces drivers to make quick manoeuvres into the chain-up area, which is only about 160m long.
	**Westbound Approach** From the intersection of Taylor Flats Subdivision, sight distance to the north is slightly limited by signs.

Intersection of Taylor Birch Avenue and Alaska Highway #97N

PHOTO	ISSUE
	**Southbound Approach** The southbound right-turn radius is tight. Although the school east of the intersection can generate a significant amount of traffic, there are no left-turn lanes at the intersection. The street name signs are small and the intersection is inconspicuous.
	**Westbound Approach** From the westbound approach, sight distance to the north is restricted by signs.
	General Observations The street name signs are small and the intersection is inconspicuous

Intersection Tod Road and Alaska Highway #97N

PHOTO	ISSUE
	**Northbound Approach** The intersection warning sign in the northbound approach does not indicate the name of the upcoming intersection. The intersection is located at a passing lane, which makes it difficult for drivers to turn left onto the highway from Tod Road.
 	**Southbound Approach** There is a southbound deceleration lane onto Tod Road. Sight distance to the southbound direction is insufficient because of the horizontal and vertical curves. When looking in the southbound direction, it is slightly confusing when determining where oncoming cars are coming from. In the southbound direction, there are no signs regarding the upcoming intersection.

Intersection Alcan Frontage Road and Alaska Highway #97N

PHOTO	ISSUE
	**Southbound Approach** There is a southbound deceleration lane to turn into the intersection; however, there are no signs to indicate the presence of this lane. In the winter season, the lane is very difficult to see.
	The ditch on the southbound side of the road is steep and makes it difficult for drivers to use the shoulder as a pull-over area.

Intersection of Underpass Road (Road 255) and Alaska Highway #97N

PHOTO	ISSUE
	**Southbound Approach** In the southbound direction, it is difficult to see the intersection. The underpass just before the intersection distracts drivers from seeing the intersection. There is a southbound left-turn lane at the intersection; however, it is difficult to see the lane marking. The southbound left-turn has a very tight turning radius even for a passenger car.

<table>
<tr>
<td>
</td>
<td>Westbound Approach

Due to the horizontal curve in the westbound approach, it is difficult to see the stop signs. Drivers can only see the stop sign from a short distance away.</td>
</tr>
</table>

Intersection of Barrett Road and Alaska Highway #97N

<table>
<tr>
<th>PHOTO</th>
<th>ISSUE</th>
</tr>
<tr>
<td>


</td>
<td>Northbound Approach

The lane configuration changes at the intersection from 1 lane in each direction to 2 lanes in each direction. There are no warning signs to indicate the change in the lane configuration. During the winter season, the lane marking is covered by snow and is not easily visible by drivers. This is of particular concern in the southbound direction because the narrowing of the highway will cause confusion over lane position. Combined with high travel speeds, the lane drop may make it difficult for turning vehicles to judge gaps in Highway traffic.

In the northbound direction, there are many commercial signs along the highway, which may distract drivers from seeing the intersection.</td>
</tr>
</table>

	**Southbound Approach** The intersection is inconspicuous from the southbound approach.

APPENDIX B

CAPACITY RESULTS FOR INTERSECTIONS - EXISTING, 2012 AND 2022

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APPENDIX C

CAPACITY RESULTS FOR SEGMENTS - EXISTING, 2012 AND 2022

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APPENDIX D

SPATIAL DIAGRAMS

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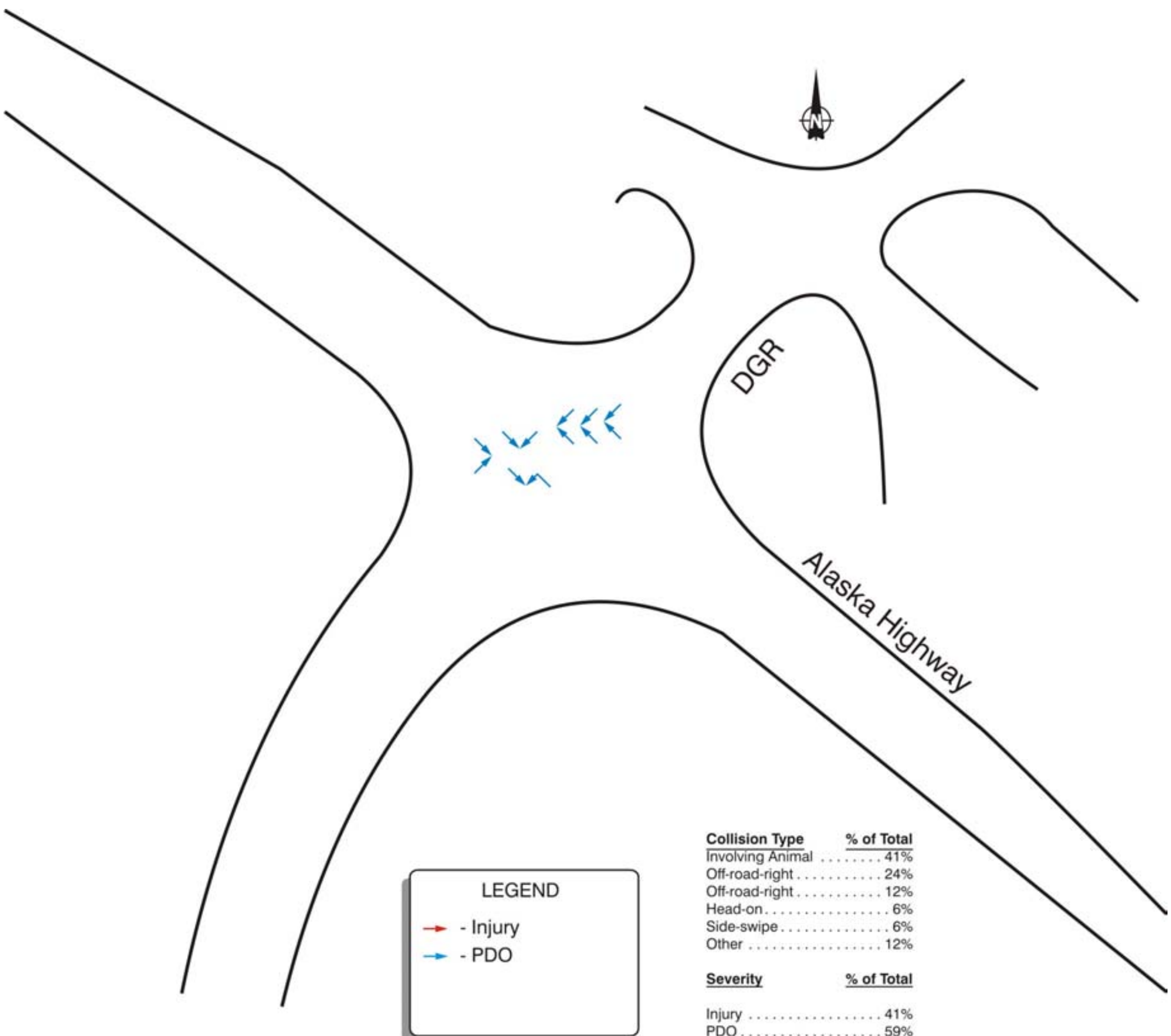
Intersection of Dangerous Goods Route and Alaska Highway #97N

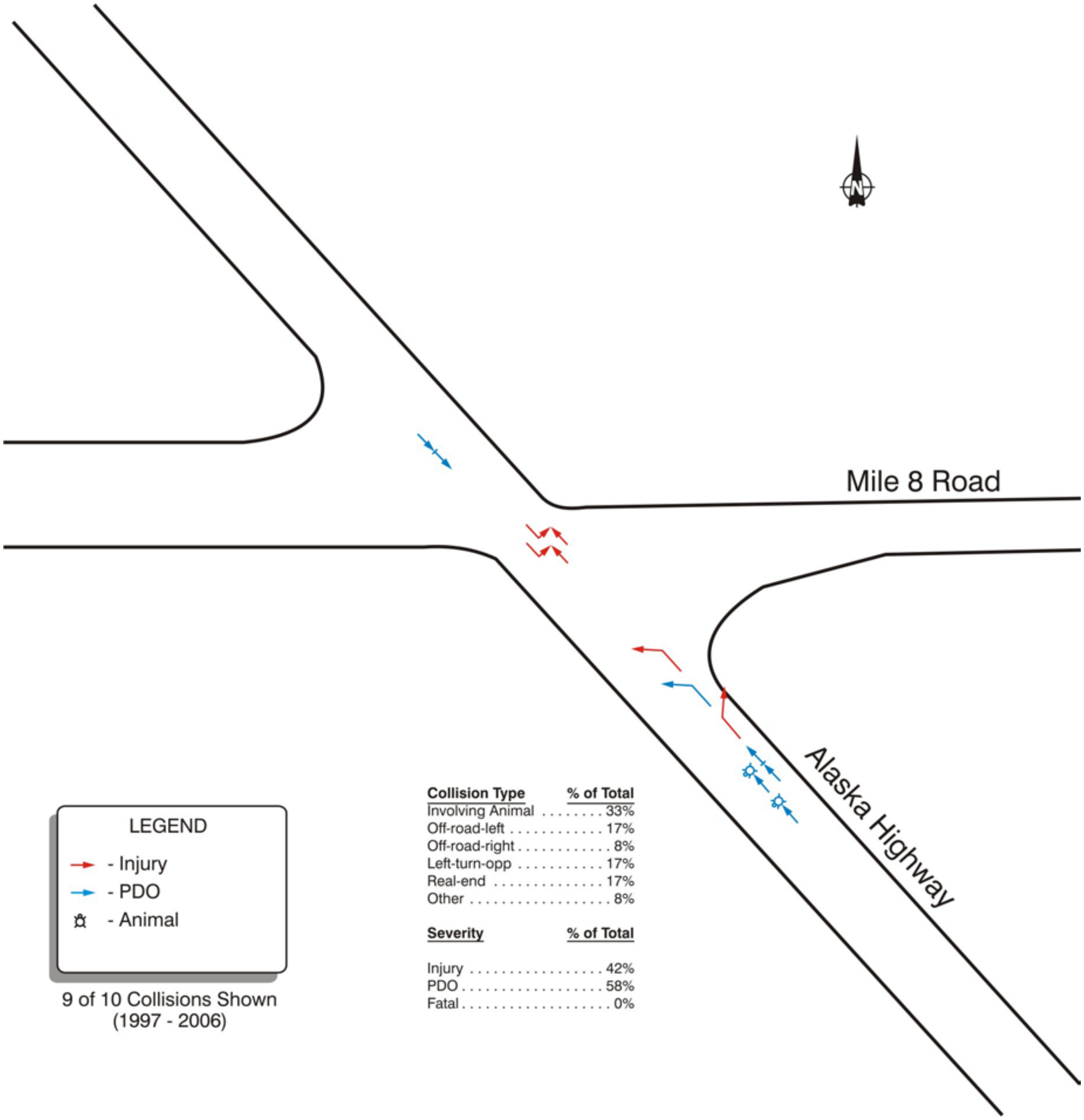


Collision Type	% of Total
Involving Animal	41%
Off-road-right	24%
Off-road-right	12%
Head-on	6%
Side-swipe	6%
Other	12%

Severity	% of Total
Injury	41%
PDO	59%
Fatal	0%

6 of 10 Collisions Shown
(1997 - 2006)

Intersection of Mile 8 Road (Road214) and Alaska Highway #97N

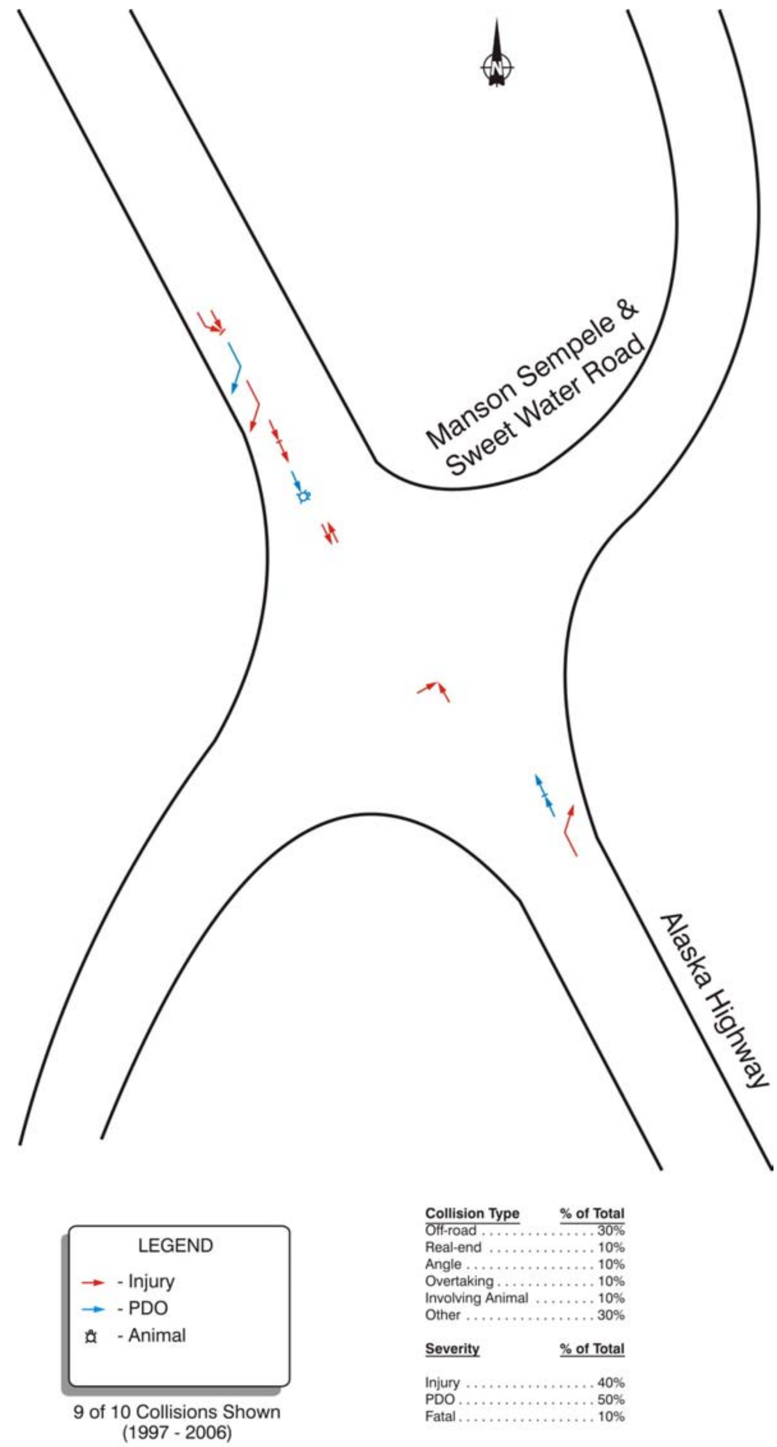


9 of 10 Collisions Shown
(1997 - 2006)

Collision Type	% of Total
Involving Animal	33%
Off-road-left	17%
Off-road-right	8%
Left-turn-opp	17%
Real-end	17%
Other	8%

Severity	% of Total
Injury	42%
PDO	58%
Fatal	0%

Intersection of Mason Semple Road (Road 237) and Alaska Highway #97N

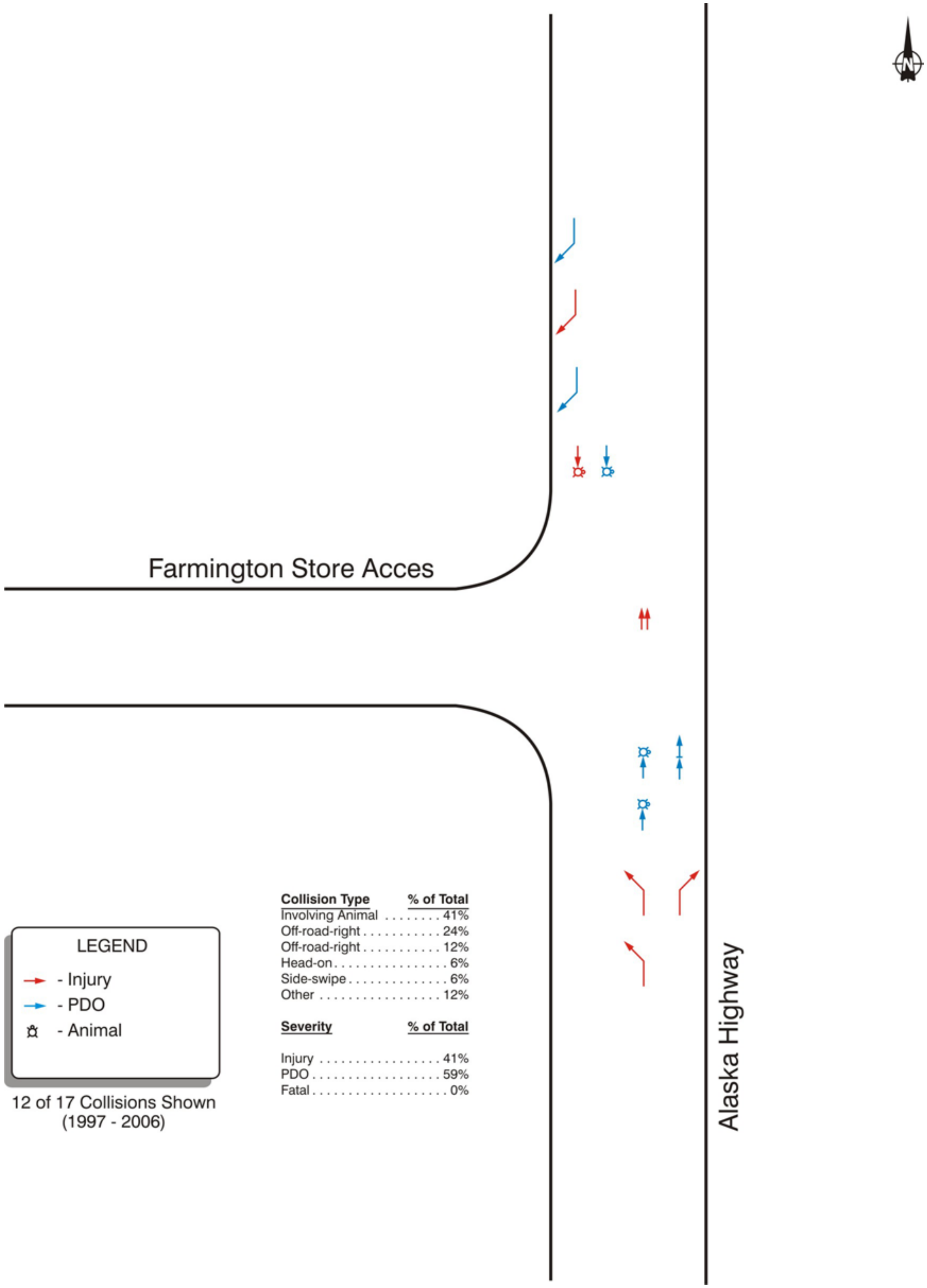


9 of 10 Collisions Shown
(1997 - 2006)

Collision Type	% of Total
Off-road	30%
Real-end	10%
Angle	10%
Overtaking	10%
Involving Animal	10%
Other	30%

Severity	% of Total
Injury	40%
PDO	50%
Fatal	10%

Intersection of Farmington Store Accesses and Alaska Highway #97N



Collision Type	% of Total
Involving Animal	41%
Off-road-right	24%
Off-road-right	12%
Head-on	6%
Side-swipe	6%
Other	12%

Severity	% of Total
Injury	41%
PDO	59%
Fatal	0%

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APPENDIX E

LEFT-TURN LANE WARRANTS ANALYSIS

Intersection	Posted Speed (Km/h)	Southbound on Alaska Highway										Left Turn Lane Wa	
		Left turn Volume			Advancing Volume (VPH)			Opposing Volume (VPH)			Percentage of Left Turn Traffic		
		Current	2012	2022	Current	2012	2022	Current	2012	2022		Current	2012
Dangerous Good Route	100	Left turn lane exists											
Mile 8 Road	100	1	1	2	188	229	339	157	191	283	1%	No	No
Farmington Fairways Intersection	100	4	5	7	220	268	396	193	235	348	2%	No	No
235 Road **	100	1	1	2	195	237	351	166	202	299	1%	No	No
Mason Semple and Sweet water Rd	100	3	4	5	159	193	286	171	208	308	2%	No	No
Farmington Store Intersection	100	T-Intersection, Warrant does not apply											
Old Alaska Hwy/ 220 Rd	100	2	2	4	188	229	339	237	288	427	1%	No	No
245 Road **	100	0	0	0	208	253	375	182	221	328	0%	No	No
Old Alaska Hwy (North)	100	10	12	18	184	224	331	215	262	387	5%	No	No
Braden Road /#224 Road	100	0	0	0	191	232	344	199	242	358	0%	No	No
Gagne and Collins	100	11	13	20	167	203	301	162	197	292	7%	No	No
Old Big Bam Ski Hill Area	70	4	5	7	213	259	384	221	269	398	2%	No	No
Taylor-Birch Ave	90	18	22	32	406	494	731	266	324	479	4%	No	Yes
Todd Road	70	T-Intersection, Warrant does not apply											
Alcan Frontage (South)	100	T-Intersection, Warrant does not apply											
Alcan Frontage (North)	100	T-Intersection, Warrant does not apply											
Underpass North Road	100	Left turn lane exists											
Honey Place North and South **	100	2	2	4	354	431	638	480	584	864	1%	No	No

Comments:

* Using the SITE IMPACT ANALYSSIS REQUIREMENTS MANUAL from British Columbia Ministry of Transportation and Highways, it was decided whether a left- turn lane could be warrented to study intersections or not. Based on the Left turn volume percentages and posted speed, an appropriate chart was selected. Then, based on the Advancing Volumes and Opposing Volumes on the selected chart, it was decided to warrant a left-turn lane to the intersectionor not.

** Highway runs East-West at this intersection

Intersection	Northbound on Alaska Highway											Left Turn Lane War	
	Posted	Left turn Volume			Advancing Volume (VPH)			Opposing Volume (VPH)			Percentage		
	Speed	Current	2012	2022	Current	2012	2022	Current	2012	2022	of Left Turn	Current	2012
Dangerous Good Route		Left turn lane exists											
Mile 8 Road	100	5	6	9	157	191	283	188	229	339	3%	No	No
Farmington Fairways Intersection	100	0	0	0	193	235	348	220	268	396	0%	No	No
235 Road **	100	1	1	2	166	202	299	195	237	351	1%	No	No
Mason Semple and Sweet water Rd	100	1	1	2	127	155	229	155	189	279	1%	No	No
Farmington Store Intersection	100	30	36	54	165	201	297	136	165	245	18%	No	Yes
Old Alaska Hwy/ 220 Rd	100	1	1	2	132	161	238	188	229	339	1%	No	No
245 Road **	100	0	0	0	182	221	328	208	253	375	0%	No	No
Old Alaska Hwy (North)	100	T-Intersection, Warrant does not apply											
Braden Road /#224 Road	100	4	5	7	199	242	358	191	232	344	2%	No	No
Gagne and Collins	100	2	2	4	143	174	258	198	241	357	1%	No	No
Old Big Bam Ski Hill Area	70	2	2	4	144	175	259	164	200	295	1%	No	No
Taylor-Birch Ave	90	2	2	4	328	399	591	269	327	484	1%	No	No
Todd Road	80	1	1	2	300	365	540	265	322	477	0%	No	No
Alcan Frontage (South)	100	6	7	11	425	517	765	345	420	621	1%	No	No
Alcan Frontage (North)	100	2	2	4	369	449	665	359	437	647	1%	No	No
Underpass North Road	100	T-Intersection, Warrant does not apply											
Honey Place North and South **	100	2	2	4	307	374	553	272	331	490	1%	No	No

Comments:

* Using the SITE IMPACT ANALYSIS REQUIREMENTS MANUAL from British Columbia Ministry of Transportation and Highways, it was decided whether a left-turn lane could be warranted to study intersections or not. Based on the Left turn volume percentages and posted speed, an appropriate chart was selected. Then, based on the Advancing Volumes and Opposing Volumes on the selected chart, it was decided to warrant a left-turn lane to the intersection or not.

** Highway runs East-West at this intersection

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- Traffic Operations
- Transportation Planning
- Road Safety Engineering
- Transit and Sustainability
- Asset Management
- Project Management