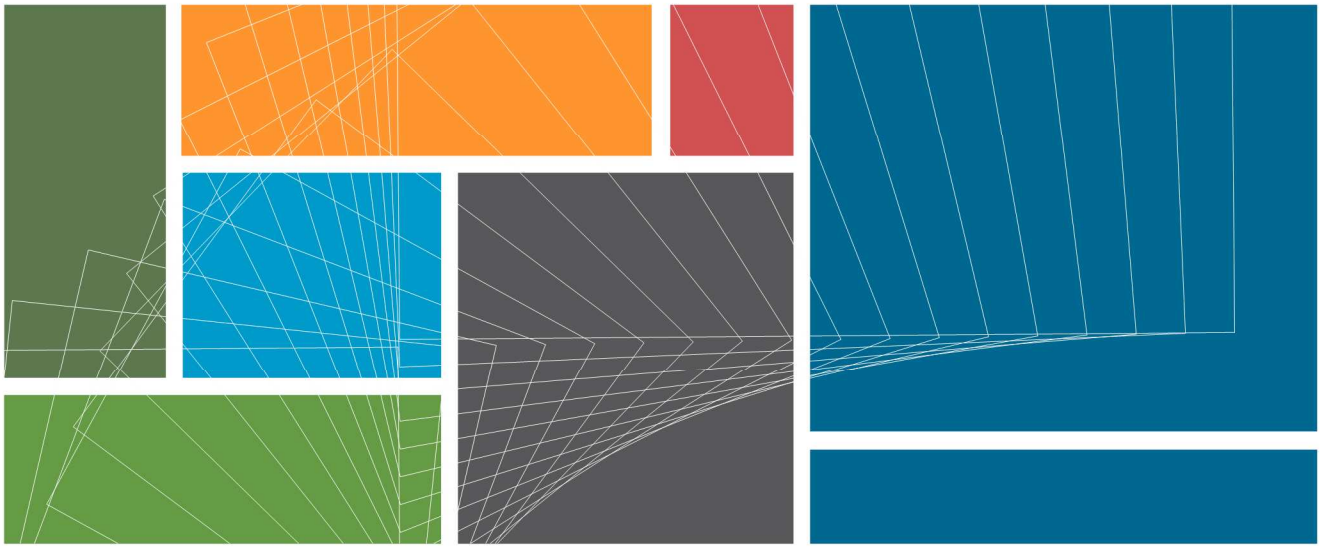


Alberta Transportation

Final Report

Okotoks Interchange
Operational and Safety Review

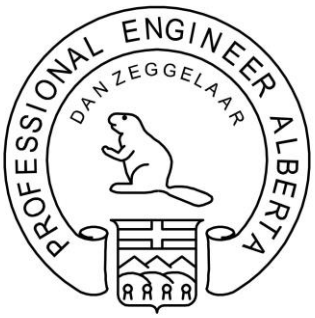
April 2022

ISL Engineering and Land Services Ltd. Is an award-winning full-service consulting firm dedicated to working with all levels of government and the private sector to deliver planning and design solutions for transportation, water, and land projects.

Proudly certified as a leader in quality management under Engineers and Geoscientists BC's OQM Program from 2014 to 2021.

Corporate Authorization

This document entitled “Okotoks Interchange Operational and Safety Review” has been prepared by ISL Engineering and Land Services Ltd. (ISL) for the use of Alberta Transportation. The information and data provided herein represent ISL’s professional judgment at the time of preparation. ISL denies any liability whatsoever to any other parties who may obtain this report and use it, or any of its contents, without prior written consent from ISL.



APEGA # 96374 2022-04-14

Daniel Zeggelaar, P.Eng., PTOE, PTP
Transportation Project Manager

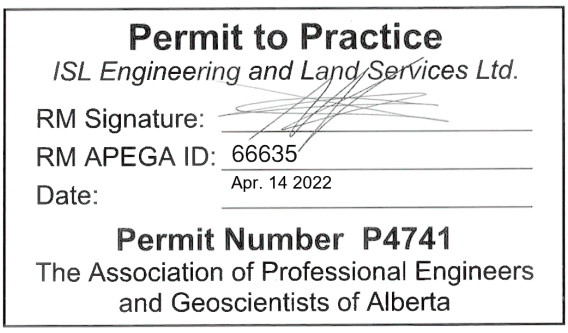


Table of Contents

APPENDICES

TABLES

FIGURES

EXHIBITS

Following Page

Executive Summary

1 Background

Alberta Transportation (AT) retained ISL Engineering and Land Services (ISL) to undertake a safety and operational review of the interchange between Highway 2:12, 2:15, 2A:06 and 552:02. The subject interchange is located between Calgary and Okotoks, just south of the Deerfoot Trail / Macleod Trail fork along Highway 2. It is the most-used highway access point to the Town of Okotoks and is referenced as intersection number 34 by AT.

The interchange is referred to as the “Okotoks interchange” or “study interchange” for the purposes of this report. And while the highways are oriented in diagonal directions at the interchange, for the purposes of the report Highway 2 is referred to as the north/south legs of the interchange, while Highway 2A and Highway 552 are the west and east legs of the interchange, respectively.

2 Scope of Work

The scope of work for the study was as follows:

- **Existing Conditions:** Obtain and review background information representing existing conditions including recording drawings, previous plans and studies, turning movement summaries, traffic control devices, signs, pavement markings, rumble strips, illumination and other relevant information.
- **Field Investigation:** Conduct a site investigation to observe site infrastructure and traffic conditions during the daylight and darkness periods.
- **Collision Review:** Review the most recently available 6-year collision data (2013-2018) and identify collision patterns and potential contributing factors.
- **Conditions Diagram:** Create a schematic diagram showing interchange layout, signs, pavement markings, barriers, accesses and other relevant site features.
- **Operational Analysis:** Review ramp intersections operations and warrants (left, right, traffic signal)) and interchanges operations (merge, diverge, weaving).
- **Geometric Analysis**: Complete a review of interchange geometric elements (horizontal, vertical, ramps, access management).
- **Traffic Control Signage, Pavement Markings and Rumble Strips:** Review appropriateness, condition, location and of existing traffic control devices and identify any recommendations for maintenance, replacement, or other modifications. Review pavement markings and rumble strips.
- **Cyclist Accommodation:** Review of the requirements for accommodating cyclists on the overpass.
- **Conclusions and Recommendations:** Based on analysis of the compiled information, provide a general summary of deficient items not meeting current standard requirements. Also identify potential collision-contributing factors and other apparent safety issues. Develop potential countermeasures for mitigating the identified safety issues, including any supporting information.

3 Study Synopsis

The safety and operational review of the study interchange was completed through the following steps:

- **Field Investigation:** A field investigation was completed on Wednesday, January 12, 2022, for observing the highway corridors, intersections and interchange ramp elements; observing traffic operations and driver behavior; collecting data on sightlines; and observing conditions and placement of other components (traffic controls, pavement markings, barriers, illumination, rumble strips etc.).

- **Collisions:** A review of historical collision data was completed for the most recent available six (6) year period from 2013 to 2018. Review of collision totals, rates, type, severity, temporal factors, locations and other items as needed.
- **Traffic operations:** Operations of existing traffic and an adjusted scenario that considers traffic diversion resulting from the planned closure of the medians on Highway 2 at 306 Avenue, 338 Avenue and 370 Avenue, south of the study interchange. The operational review included technical analysis of ramp intersections (delay, left turn warrants, signal warrants) and highway operations (ramp merging/diverging, and weaving).
- **Geometry:** Focus on reviewing the existing interchange geometry against the current relevant design standards from the Alberta Transportation Highway Geometric Design Guide (HGDG), including horizontal geometry, vertical profile, ramp geometry (exit, entrance, and design speed) and access management.
- **Traffic controls:** Review of adequacy, appropriateness and placement against Alberta Transportation Recommended Practice Guidelines and the Manual for Uniform Traffic Control Devices for Canada (MUTCDC).

4 Summary of Findings

The safety and operational review revealed 4 key safety findings, outlined below:

Key Finding #1 – (From Highway 2A:06 dual ramp diverges to split at Highway 2/2A): Several contributing factors appear to be influencing safety within this segment and are outlined as follows:

- Dual lane loop ramp diverge: The Highway 2A:06 approach design speed of 90 km/h (posted 80 km/h) is 50 km/h greater than the dual ramp design speed of 40 km/h. The large speed variance combined with the less than required decision sight distance (DSD) appear to be a contributing factor to the concentrated number of rear end and off-road collisions in this area. This condition was verified in our field investigation as several vehicles approaching the diverge display brake lights and appeared to be slowing abruptly. Another contributing factor may be that the right-hand lane is forced onto the ramp, and while overhead signage and ground mounted lane designation signs communicate this condition, it may still lead to drivers completing late lane changes.
- Dual lane loop ramp merge @ Highway 2:15: The merge point from the dual lane loop ramp onto northbound Highway 2:15 has a minimal approach gore and minimal separation with parallel traffic on the mainline. Drivers are entering from the dual lane loop ramp with a design speed of 40 km/h compared with Highway 2:15 with a design speed of 120 km/h, without the typical 60:1 entry taper, resulting in a significant speed differential between traffic lanes. The large speed differential and minimal separation between lanes are likely contributing factors to the high number of sideswipe / same direction collisions at this location.
- Weaving segment: Another contributing factor to the number of side-swipe collisions is the congested weaving conditions (LOS E) through the northbound segment of Highway 2:15. Concern about being unable to execute needed lane changes further north near the fork may be contributing to drivers changing lanes too early, while they are still driving relatively slowly compared to Highway 2:15. The presence of some slower vehicles including large trucks which need more distance to accelerate up the hill may also cause some drivers to behave over-aggressively and execute multiple lane changes to “get around” slower vehicles.

- **Key Finding #2 – Southbound ramp intersection (left turn sight distance):** A number of right angle and left turn across path collisions have occurred at this intersection. Limited sight distance to the left due to the crest curve of the overpass, combined with significant challenges to judge a gap in traffic due to high eastbound traffic volumes may be contributing factors to the type of collision occurring. These conditions were verified in our field investigation and through the traffic operations analysis, indicating this movement operates at LOS F. The traffic operations for this movement are expected to

be further degraded with closure of the medians at 306 Avenue, 338 Avenue and 370 Avenue due to the volume of traffic diverted to this intersection with a no alternative access to areas east of Highway 2 and north of the Sheep River. Longer delays can cause drivers to become impatient and accept smaller or riskier gaps to complete the delayed movement.

- **Key Finding #3 – Major collisions:** AT's collision database reports the threshold for the number of major collisions as four (4) for this interchange, compared with an actual count of seven (7) collisions occurring over a six (6) year period. In reviewing the detailed collision descriptions for the major collisions, three (3) of these are related to poor surface conditions, one (1) is due to a vehicle mechanical issue and one (1) is due to an animal. The remaining two (2) are due to driver error including travelling a high rate of speed and failing to stop at southbound ramp stop sign. Although the number of collisions (4) is higher than expected (7), two (2) are related to driver error (speed, failure to stop) and two (2) are related to random events (animals, mechanical issues) and no obvious deficiency appear to be contributing factors to these events.
- **Key Finding #4 – Northbound ramp intersection:** Drivers turning left at this intersection have obstructed sightlines due to the crest curve of the overpass. Drivers turning left may also have trouble judging the availability of a gap in approaching traffic as many of these vehicles enter the eastbound to northbound dual loop ramp instead of continuing eastbound on Highway 552:02. Traffic entering the loop ramp is steady and some of the vehicles entering the ramp do not signal as was noted in the field review. If a vehicle at the stop bar decides to go and then realizes that an approaching vehicle is continuing eastbound on Highway 552:02, they have limited time to clear the eastbound lane before the approaching eastbound vehicle arrives at the intersection.

4.1 Southbound Ramp Intersection Options (Roundabout or Traffic Signal)

To address several of the deficiencies noted for the southbound ramp intersection, two options were reviewed:

- **Option 1:** Resolve sight distance and level of service deficiencies by installing a traffic signal. Upgrade the intersection to provide a westbound left turn lane as warranted and install speed control measures to reduce vehicle speeds approaching the intersection to 70 km/h.
- **Option 2:** Construct a roundabout as an alternative to a traffic signal, which also resolves sight distance and level of service deficiencies. A westbound left turn lane is not needed in this case. Speed is naturally reduced through the roundabout and a reduced speed limit is realistic to apply up to the dual ramp diverge point.

Based on its ability to better accommodate traffic operations, **Option 2** is the preferred option, although it is recognized to be at a higher cost than the signal. Any additional analysis in the pursuit of a traffic signal is not recommended as it does not provide acceptable operational results. A roundabout also functions as an effective speed reduction measure as traffic entering the roundabout will be required to slow down and allows an effective reduced speed limit through the area to be implemented.

4.2 Cyclist Accommodation

A review of the overpass was completed to assess how best to accommodate cyclists, as more frequent use of the overpass by cyclists is expected with potential future closures of the medians at 308 Avenue, 338 Avenue and 370 Avenue. The review was based on relevant sections of the HGDG. The findings of the analysis revealed that accommodating cyclists at ramp diverge points is a challenge that exists all through the highway network and the responsibility to complete this movement is left to the cyclist. Completing the maneuver is further challenged where cyclists traveling in the eastbound direction and continuing eastbound on Highway 552:02 must cross the dual lanes loop ramp at its diverge point.

On the overpass it was found that sufficient shoulder width is provided in the westbound direction for cyclists based on the HGDG and roadway classification. In the eastbound direction the shoulder is narrow (effectively zero). There is minimal space for installing a shoulder on the bridge structure and widening the bridge to create a shoulder is not a realistic and/or practical option. In addition, providing a shoulder would not resolve the issue of having cyclists cross the dual lane ramp exit. The province could consider widening the overpass as part of future long-term improvements. It should be noted that the future 338 Avenue interchange, which is currently in the functional planning stage, is expected to accommodate better cyclists.

4.3 Recommended Minor Deficiency Safety Improvements

The report outlines safety improvements that can be addressed in the short-term with a relatively low cost (and are therefore categorized as minor deficiencies). Please refer to Appendix K of the report for a summary of the descriptions and locations of each of the improvements identified.

4.4 Recommended Major Safety Improvements

The following recommendations address major safety concerns identified by the review. They are categorized as major because they are higher cost, require dedicated budgeting and/or require more detailed planning.

4.4.1 Delineate Dual Lane Ramp Entrance

The design speed of the dual ramp merge is 40 km/h compared to the 120 km/h design speed on Highway 2:15. Physical separation or additional traffic control measures should be installed to delineate between the ramp lanes and the highway. Additional delineation measures to discourage drivers from changing lanes from the merge area onto Highway 2:15 could help reduce the number of side-swipe same direction collisions. Options for delineation are as follows:

1. **Physical delineation ($$$$):** Realign Highway 2:12 / 2:15 to the west to maintain a 2 m separation from the merge that is carried for approximately two thirds of the acceleration length. Realignment of Highway 2:12 / 2:15 may extend approximately 800 m, from the physical gore for the northbound right diverge to the physical gore for the westbound right merge. Realigning the ramps further east is not feasible due to already limited right shoulder offset from the overpass bridge abutment.
    a. **Delineator posts:** Through the 2 m separation, delineator posts should be installed to enforce that no early lane changes are allowed.

Figure E4.1: Ramp Merge Physical Separation Concept

2. **Traffic control and pavement markings ($):** Short-term measures that may help discourage early lane changes at the ramp entrance include replacing the existing solid white lane with a double solid white line and installing a 'do not cross double solid line' sign. Rumble strips installed between the double solid white line are also recommended as a deterrent for early lane changes.

4.4.2 Mitigate Differential Speeds (Dual Lane Diverge)

The design speed of the dual lane loop ramp lanes is 40 km/h compared to the 90 km/h design for the Highway 2A:06 approach. The speed differential appears to be a contributing factor to collisions occurring at the diverge point, such as off-road and rear end collisions. Options to mitigate the speed differential are as follows:

1. **Southbound ramp intersection roundabout ($$$$):** Construct a roundabout at the southbound ramp intersection to horizontally deflect and slow traffic on Highway 2A:06 as it enters the interchange area, which could help reduce the speed differential as drivers continue to the diverge point. Along with reducing travelling speeds, a roundabout may also provide benefit for a number of the other safety and operations concerns identified at the intersection, including:
   a. Westbound left warrant: Eliminate the need for a westbound left turn lane that was found to be warranted. The roundabout provides an efficient method for turning left and no left turn is needed.
   b. Southbound left delays: Reduce traffic delays for southbound left turning traffic, currently operating at a LOS F based on existing traffic volumes and further degrading due to increases in traffic volumes resulting from closure of the medians at 306 Avenue, 338 Avenue and 370 Avenue. Traffic analysis of the roundabout using Sidra Intersection 6.1 demonstrated an improved LOS from F to A based on adjusted traffic volumes.
   c. Eastbound through movement: Eastbound through movements are far less impacted with a roundabout compared to a traffic signal (see signal analysis in Section 10.5), with queuing reduced from 470 m to 110 m in the adjusted traffic scenario (See **Appendix J**).
   d. Southbound left turn sightlines: Mitigate the sub-standard sightlines for vehicles turning left.
   e. Collision reduction: Reduce opportunity for left turn across path and right-angle collisions.
   f. The conceptual roundabout configuration is shown in the following figure.

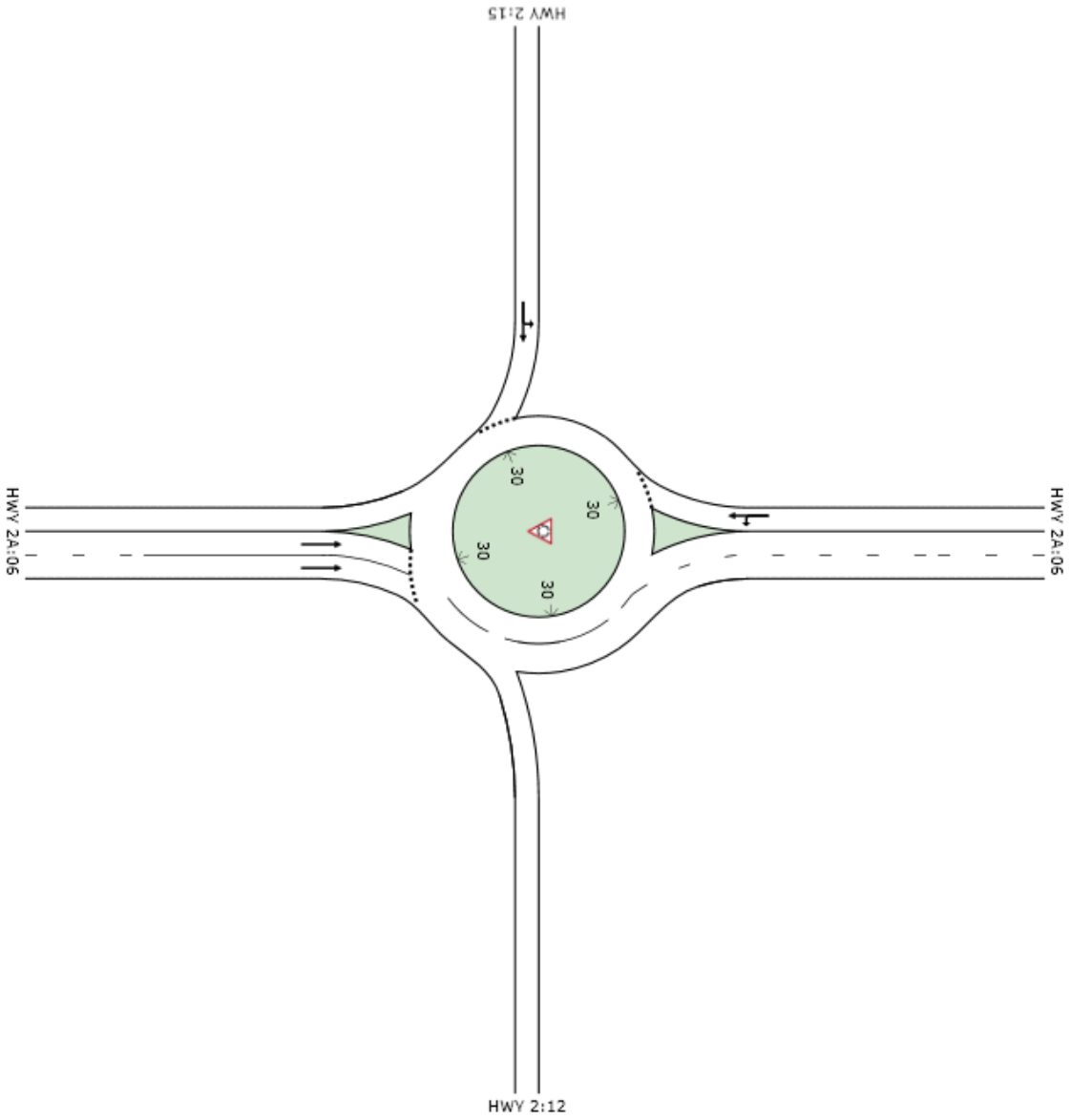


Figure E4.2: Southbound Ramp Roundabout Concept

2. **Reduced posted speed limit ($):** Implement a reduced speed limit on Highway 2A:06 / 552:02 from the west and east study limits. A posted speed limit of 60 km/h may be more appropriate, particularly if a roundabout is installed at the southbound ramp intersection (discussed above). Prior to that, posting a reduced speed limit alone is not usually effective and needs additional measures to help self-enforce the reduced speed limit. Speed control measures for highways are generally limited and some examples of measures based on the TAC Canadian Guide to Traffic Calming, which include:
   a. Pavement Markings such as converging chevrons and peripheral transverse bars.
   b. Increased enforcement.
   c. Speed display devices.
   d. Educational campaigns.

Examples of pavement markings are provided as follows:

Converging Chevrons
(Source: TAC Canadian Guide to Traffic Calming)

Peripheral Traverse Bars
(Source: TAC Canadian Guide to Traffic Calming)

4.4.3 Highway 2:15 Northbound Weaving

1. **Extend northbound right lane ($$$):** On Highway 2:15, in the northbound direction, approximately 1.2 km north of the overpass the right-hand lane from the dual lane loop ramp drops which may be causing drivers to feel anxious about needing to complete earlier lane changes. Extending the lane further north (approximately 800 m) and extending it into and beyond the fork to Deerfoot Trail would reduce some lane changing requirements in the weave section.
2. **Grade separation ($$$$$):**The Calgary Metropolitan Region Board's (CMRB) recent South & East Calgary Regional Transportation Study (S&ECRTS) identified the long-term need for grade-separated weaving ramps in this section. The S&ECRTS recommended completion of a functional planning study to confirm long-term requirements and costs for this section, which would allow for consideration of funding and implementation in the context of other regional highway priorities.

4.4.4 Northbound Ramp Intersection

1. **Relocate to the east ($$ - $$$):** Relocate the ramp intersection further east to increase sight distance to the west and provide a larger gap for vehicles to turn left.

4.4.5 Highway 552:02 Merge/274 Avenue Intersection

1. **Relocate 274 Avenue ($$):** Evaluate options to relocate 274 Avenue further east to meet the access management guideline of 1.6 km spacing. The roadway/intersection could be closed at HWY 552:02 and connected to 32 Street.

4.4.6 General

1. **Traffic signage ($):** Resolve general deficiencies in traffic controls, removing unnecessary signs, replacing signs where needed and improving sign placement to align with current standards. Sign deficiencies are outlined in Section 10.3.4 (technical reviews) and Section 3.2 (conditions review) of the report.

5 Conclusion

The Okotoks Interchange Operations and Safety Review combined a review of historical collisions reports and operational, geometric and traffic control elements to gain insight of potential contributing factors affecting safety and operational issues. The study identified contributing factors and provided remedial measures to improve safety and operations, which include a mix of low-cost, short-term modifications, higher cost interim modifications, and high-cost long-term solutions.

1.0 Introduction

Alberta Transportation (AT) retained ISL Engineering and Land Services (ISL) to undertake a safety and operational review of the interchange between Highway 2:12, 2:15, 2A:06 and 552:02. The subject interchange is located between Calgary and Okotoks, just south of the Deerfoot Trail / Macleod Trail fork along Highway 2. It is the most-use highway access point to the Town of Okotoks and is referenced as intersection number 34 by AT.

The interchange is referred to as the “Okotoks interchange” or “study interchange” for the purposes of this report. And while the highways are oriented in diagonal directions at the interchange, for the purposes of this report Highway 2 is referred to as the north/south legs of the interchange, while Highway 2A and Highway 552 are the west and east legs of the interchange, respectively.

1.1 Study Limits

The study limits are defined by the interchange footprint provided in AT Maps and is illustrated in the figure below.

Figure 1.1: Study Location (*Source: AT Webmaps*)

1.2 Scope of Work / Study Outline

AT requested a safety and operational review of the Okotoks interchange and the scope of work described within the study outline is as follows:

- **Section 2 – Existing Conditions:** Obtain and review background information representing existing conditions including recording drawings, previous plans and studies, turning movement summaries, traffic control devices, signs, pavement markings, rumble strips, illumination and other relevant information.
- **Section 3 – Field Investigation:** Conduct a site investigation to observe site infrastructure and traffic conditions during the daylight and darkness periods.
- **Section 4 – Collision Review:** Review the most recently available 6-year collision data (2013-2018) and identify collision patterns and potential contributing factors.
- **Section 5 – Conditions Diagram:** Create a schematic diagram showing interchange layout, signs, pavement markings, barriers, accesses and other relevant site features.
- **Section 6 – Operational Analysis:** Review ramp intersections operations and warrants (left, right, traffic signal)) and interchanges operations (merge, diverge, weaving).
- **Section 7 – Geometric Analysis**: Complete a review of interchange geometric elements (horizontal, vertical, ramps, access management).
- **Section 8 – Traffic Control Signage, Pavement Markings and Rumble Strips:** Review appropriateness, condition, location and of existing traffic control devices and identify any recommendations for maintenance, replacement, or other modifications. Review pavement markings and rumble strips.
- **Section 9 – Cyclist Accommodation:** Review of the requirements for accommodating cyclists on the overpass, based on the HGDG.
- **Section 10 – Conclusions and Recommendations:** Based on analysis of the compiled information, provide a general summary of deficient items not meeting current standard requirements. Also identify potential collision-contributing factors and other apparent safety issues. Develop potential countermeasures for mitigating the identified safety issues, including any supporting information.

1.3 Study Reference Material

ISL considered the following relevant guidelines as part of this study:

- “Highway Geometric Design Guide” (AT, 2021) – abbreviated as HGDG
- “Manual of Uniform Traffic Control Devices for Canada” (TAC, 2021) – abbreviated as MUTCDC
- “Geometric Design Guide for Canadian Roads” (TAC, 2017) – abbreviated as GDG
- “Illumination of Isolated Rural Intersections” (TAC, 2001)
- “Traffic Signal Warrant Handbook” (TAC, 2007)
- “Highway Capacity Manual” (TRB, 2020) – abbreviated as HCM
- “Highway Pavement Marking Guide” (AT, 2017) – abbreviated as HPMG

1.4 Study Reference Diagram

The study interchange is located at the terminus or beginning of several highway control sections. A reference diagram is provided for the reader in Exhibit 1.1 based on the highway control sections.

1.5 Other Background Materials

Existing plans and/or concurrent studies implicating the review include the following:

- **South & East Calgary Regional Transportation Study (2020, ISL):** Extensive network study of transportation networks and protect priorities in South and East areas of the Calgary region conducted for the Calgary Metropolitan Region Board (CMRB).
- **Previous Safety Reviews (2019, ISL):** Previous safety reviews completed at the intersections of Highway 2 / 306 Avenue, Highway 2 / 338 Avenue and Highway 2 / 370 Avenue.
- **Intermunicipal Transportation Analysis – Highway 2 Median Closures Memo (2021, Watt):** Memo conducted for the Town of Okotoks and Foothills County studying the changes in traffic patterns due to recommended median (intersection) closures between Highway 2 / 306 Avenue, Highway 2 / 338 Avenue and Highway 2 / 370 Avenue.
- **Highway 2 / 338 Avenue Interchange Functional Study (Ongoing, ISL):** Functional study to determine the appropriate requirements for a future interchange at the intersection of 338 Avenue and Highway 2 conducted for Alberta Transportation in collaboration with the Town of Okotoks and Foothills County. (Commenced December 2021 with expected completion Late 2022).

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 552:2 WBR RAMP
KM 0.0

SECTION 2:15 KM 0.00
SECTION 2:12 KM 28.669
SECTION 552:2 KM 0.00
SECTION 2A:06 KM 5.931

SECTION 552:2 EBR RAMP
KM 0.0

SECTION 2:12 NBL/R RAMP
KM 0.0

SECTION 2:15 SBL/R RAMP
KM 0.0

SECTION 2A06 EBR RAMP
KM 0.0

Detailed Descriptions

- **Highway 2:15:** Km 0 begins at the overpass, continuing north.
- **Highway 2:12:** From the south, ends at the overpass at km 28.58.
- **Highway 2A:06:** From the west, ends at the overpass at approximately km 5.931.
- **Highway 552:2:** Km 0 begins at the overpass, continuing to the east.

- **Highway 2:15 Southbound Ramp:** Km 0 begins at the physical gore and ends at the ramp terminal at Highway 2A:06.
- **Highway 2:12 Northbound Ramp:** Km 0 begins at the physical gore and ends at the ramp terminal at Highway 552:2.
- **Highway 2A:06 Eastbound Ramp:** Km 0 begins at the physical gore and ends at the physical gore at Highway 2:12.
- **Highway 552:2 Eastbound Ramp:** Km 0 begins at the physical gore and ends at the physical gore at Highway 2:15.
- **Highway 552:2 Westbound Ramp:** Km 0 begins at the physical gore and ends at the physical gore at Highway 2:15.

OKOTOKS INTERCHANGE SAFETY AND OPERATIONS REVIEW

OVERALL MAP

1:1500

EXHIBIT 1.1

2.0 Existing Conditions

2.1 Background Information

ISL obtained background information about the study interchange from the following sources:

- **AT website:** Information from the AT website, including but not limited to:
  - Turning movement summary diagrams provided in **Appendix A**.
  - Historical traffic volumes along the Highway, at automatic traffic recorder (ATR) 6002126, 60021540, 60200678, 60021260.
  - High load corridor network, existing and proposed.
  - Long combination vehicle network.
- **NESS:** Information from the Transportation Infrastructure Management System (TIMS), including:
  - Roadway classification, AT Videolog.
  - Reports generated from the Network Expansion Support System (NESS), in **Appendix B**.
    - Note, collision review is based on data from 2013 to 2018. During the preparation of this report, 2018 collision data became available and was added to the previous collision database, which was originally from 2013 to 2017.
- **Record Drawings:** Record drawings provided by AT. Record drawings do show the current widening of Highway 2A:06 to 16 Street (located approximately 800 m west of the study interchange) and the current widening southbound on Highway 2:15.

2.2 Roadway Classification

Table 2.1: Roadway Classifications

Design Criteria	Highway Control Sections				Source
	2:15	2:12	2A:06	552:2	
Designation	RFD-616-120	RAD-616-120	RAD-412.4-90	RAU-209-90	AT Functional Classification and NESS
Width (varies)	16 – 21.4 m	14.7 – 16.6 m	13.4 m	9.0 m	NESS
Service Classification	Level 1	Level 1	Level 4	Level 4	AT Provincial Highway Service Classification Map
Roadside Management	Freeway	Freeway	Multi-lane	Major	AT Roadside Classification
Functional Classification	Rural Freeway Divided	Rural Arterial Divided	Urban Arterial Divided	Rural Arterial Undivided	AT Functional Classification
Design Speed	120 km/h	120 km/h	90 km/h	90 km/h	Assumed, posted speed plus 10 km/h.
Posted Speed	110 km/h	110 km/h	80 km/h	80 km/h	AT Videolog
Oversize/Weight Corridor	No	No	Proposed	Proposed	AT Proposed High Load Corridors
Long Combination Route	Yes	Yes	No	No	AT Long Combination Routes

2.3 Traffic Volumes

Traffic volume reviews included existing volumes and expected changes to volumes with the proposed median closures between Highway 2 / 306 Avenue, Highway 2 / 338 Avenue and Highway 2 / 370 Avenue. Closure of the medians at these locations will result in traffic diverting to study intersections. The median closures are discussed in more detail below.

2.3.1 Existing Traffic Volumes

Existing traffic characteristics are presented in Figure 2.1. Additional data was sourced from ATR 60200668 located on Highway 2A:06 approximately 4.5 km south of the study interchange.

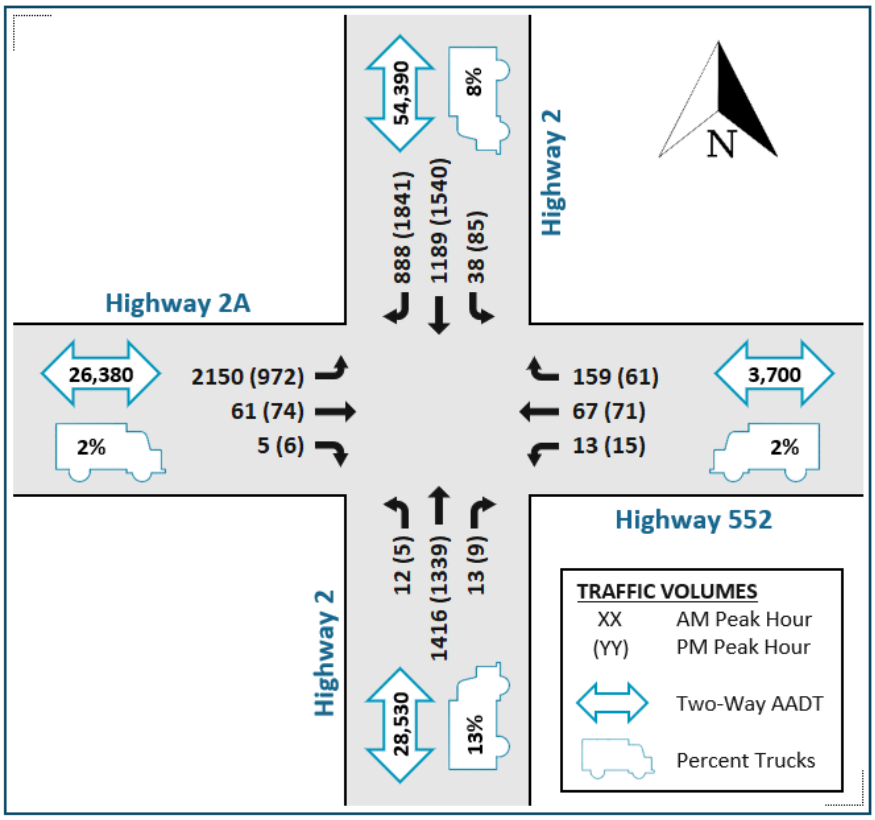


Figure 2.1: 2019 Traffic Characteristics (*Source: Alberta Transportation*)

Traffic characteristics and patterns based on the turning movement volumes illustrate the following:

- The dominant direction of travel is in the north/south direction (Hwy 2).
- Traffic volume from the west direction (Hwy 2A) is significantly higher than the east direction.
- The left turning movement from the west leg onto Highway 2 has the highest peak hour AM volume, with 2,150 vehicles making this left turn (Okotoks to Calgary commuting movement).
- Two-way AADT is highest on the north leg.
- Two-way AADT is lowest on the east leg.
- The highest percentages of heavy vehicles are in the north/south direction.

2.3.2 Change in Volumes (Due to Proposed Median Closures)

Traffic volume changes are anticipated when the median (intersection) closures between Highway 2 / 306 Avenue, Highway 2 / 338 Avenue and Highway 2 / 370 Avenue are implemented. The existing volumes at these intersections are illustrated in the following table.

Table 2.2: Traffic Volumes – Existing Conditions (All Intersections)

Intersection	Peak	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Study Interchange	AM	2150	61	5	13	67	159	12	1416	13	38	1189	888
	PM	972	74	6	15	71	61	5	1339	9	85	1540	1841
Highway 2/ 306 Ave	AM	111	7	92	21	7	2	65	1362	20	0	1208	55
	PM	65	9	91	9	10	1	73	1246	11	4	1334	151
Highway 2/ 338 Ave	AM	174	12	20	5	22	35	25	1398	6	9	1226	89
	PM	82	19	25	10	15	12	13	1286	7	22	1372	155
Highway 2/ 370 Ave	AM	109	0	4	10	4	29	3	1481	4	4	1154	46
	PM	39	7	8	2	7	7	8	1157	1	11	1529	81

With the planned median closures at 306 Avenue, 338 Avenue and 370 Avenue, traffic will likely reroute north to the study interchange or south to the Highway 2/7/547 interchange. Anticipated changes and their impact on volumes at the study interchange are summarized as follows:

- **Highway 2 / 306 Avenue:** Due to the proximity of this intersection to the study interchange (3.2 km south), it is assumed that all traffic rerouted from this intersection due to the median closure is redistributed to the study interchange.
- **Highway 2 / 338 Avenue:** Developed lands east of Highway 2:12 are bounded by the Sheep River and do not have access from the south using the Highway 2//7/547 interchange, therefore all traffic to/from the east will need to use the study interchange. Traffic accessing Highway 2 to/from the north are also assumed to use the study interchange. Traffic travelling on Highway 2 to/from the south may use both highway access point, so the volumes are divided evenly between the study interchange and the Highway 2/7/547 interchange.
- **Highway 2 / 370:** Developed lands east of Highway 2:12 are bounded by the Sheep River and do not have access from the south using the Highway 2//7/547 interchange, therefore all traffic to/from the east will need to use the study interchange. Travelers accessing Highway 2 from Okotoks are most likely to use the Highway 2/7/547 interchange, hence all west-side traffic is redirected there.
- **North/south through volumes:** North/south through volumes will be reduced at the study interchange in an amount equal to the turning volumes being rerouted as turning volumes at the study interchange due to the median closures further south.

Based on the above assumptions, the expected changes in traffic volumes are quantified in the following table.

Table 2.3: Estimated Traffic Pattern Changes – With Median Closures

Intersection	Peak	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Study Interchange	AM	+111 +174	+7 +12 +0		+21 +5 +10	+7 +22 +4		+65 +13	-111 -174		+0 +9 +4	-0 -9 -4	
	Total	**+285**	**+19**		**+36**	**+33**		**+78**	**-285**		**+13**	**-13**	
	PM	+65 +82	+ 9 + 19 +7		+9 +10 +2	+10 +15 +7		+73 +7	-65 -82		+4 +22 +11	-4 -22 -11	
	Total	**+147**	**+35**		**+21**	**+32**		**+80**	**-147**		**+37**	**-37**	
Highway 2 / 306 Avenue	AM	- 111	- 7		- 21	- 7		-65			- 0		
	PM	- 65	- 9		- 9	- 10		-73			- 4		
Highway 2 / 338 Avenue	AM	-174	- 12		- 5	- 22		-25			- 9		
	PM	-82	- 19		- 10	- 15		-13			- 22		
Highway 2 / 370 Avenue	AM	-109	- 0		-10	- 4		- 3			- 4		
	PM	-39	- 7		- 2	- 7		- 8			- 11		

The adjusted volumes are summarized in the following table.

Table 2.4: Traffic Volumes – With Median Closures (at Study Interchange)

Peak Hour	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
AM	2435	80	5	49	100	159	90	1131	13	51	1176	888
PM	1119	109	6	36	103	61	85	1192	9	122	1503	1841

2.4 Historical Traffic Volumes

Historical traffic growth was obtained from a TIMS NESS report generated for the interchange. The growth rates for the 5-, 10- and 20-year rates are described in the following table. It is noted that the negative growth in the 5-year period is due to a large reduction in volumes in 2020 resulting from the COVID-19 pandemic, which would also affect the overall 10- and 20-year rates proportionately.

Table 2.5: Historical Growth Rates

ATR	ATR Location	5-year	10-year	20-year
60021540	Highway 2:15, ~7.1 KM, North of Study Interchange	-2.16%	1.69%	3.07%~
60200678	Highway 2A:06, within Okotoks	n/a*	-1.98%	1.12%
60021260	Highway 2:12, ~3.9 KM South of Highway 547	-4.3%	0.49%	1.99%

*Not reported by NESS, ~Based on linear regression

2.5 Background Document Review

Three recent previous studies and one concurrent study is relevant to the subject corridor and study interchange, and these have been reviewed with pertinent information summarized below.

South & East Calgary Regional Transportation Study (S&ECRTS) (2020, ISL)

The S&ECRTS was completed for the Calgary Metropolitan Region Board (CMRB), with direct participation by the 8 (of 10 total) member municipalities covered by the study area, including the City of Calgary, City of Chestermere, Foothills County, Town of High River, Town of Okotoks, Rocky View County, Wheatland County and the Town of Strathmore. The study involved projecting expected transportation network demand and resulting infrastructure improvements at the 10-year (2028) and 20-year (2039) horizons based on land use plans approved before December 31, 2017 by each member municipality. Traffic growth associated with the land use growth was assessed at a regional level with improvements reflecting a mix of primary transit, corridor projects, interchange, and intersection projects for supporting growth to both horizons. Projects were ranked and prioritized on an objective basis, using evaluation criteria and performance measures pre-agreed by all study participants.

Of most relevance to this assessment, S&ECRTS identified that the weaving area on Highway 2 between the study interchange and the Deerfoot Trail / Macleod Trail interchange will be a critical future bottleneck point in the regional transportation network. This results from the “overlapping” corridor, with this highway segment essentially carrying the entirety of Highway 2 and Highway 2A travel demand on a single carriageway between the points where they split again at both interchanges. Analysis in S&ECRTS concluded the weaving section will operate with a level of service F and v/c of 1.27 during the AM peak (northbound) and level of service E and v/c of 0.96 during the PM peak (southbound) within the 10-year horizon. The report recommended separating the Highway 2 and Highway 2A corridor movements (e.g., with basket-weaves or other grade separation) by 2039 and completing a functional planning study in the near-term to define the optimum plan and costs for this improvement. This future functional planning study would likely identify the need for extensive revisions to the study interchange.

Previous Safety Reviews (2019, ISL)

Previous safety reviews were completed for AT by ISL at the intersections of Highway 2 / 306 Avenue, Highway 2 / 338 Avenue and Highway 2 / 370 Avenue. The reviews included studying the functional, traffic, collision, operational and geometric characteristics of these intersections. The studies recommended full closure of the medians based on providing the most significant safety benefit by eliminating all crossing conflicts and right-angle collisions, the most prevalent and severe collision type at the intersections. Closure of the medians will result in existing traffic demand diverting to the study interchange and/or the Highway 2/7/547 interchange to the south. Volumes diverting to the study intersection will increase left turns to/from Highway 2 and east/west through movements on Highway 552 and proportionally reduce the north/south traffic on Highway 2.

Intermunicipal Transportation Analysis – Highway 2 Median Closures Memo (2021, Watt)

This technical memo provided traffic forecasting and traffic analysis for a significant number of intersections located in the Town of Okotoks and Foothills County resulting from the potential closures of the intersections of Highway 2 / 306 Avenue, Highway 2 / 338 Avenue and Highway 2 / 370 Avenue. The memo discusses the changes in traffic patterns expected due to the closures and noted the following:

- The 306 Avenue and 370 Avenue closures are not expected to have a significant impact on the transportation network.
- The 338 Avenue closure will have a more significant impact on the transportation network with volumes diverting to Highway 2A:06 during the AM peak.

Based on the expected travel pattern changes, the memo recommended that traffic signalization is warranted at the Highway 2:15 southbound ramp intersection, but not at the Highway 2:12 northbound ramp intersection.

Highway 2 / 338 Avenue Interchange Functional Study (Ongoing, ISL)

This functional planning study will develop ultimate and staged plans for a future interchange at the intersection of Highway 2 and 338 Avenue, approximately 7.2 km south of the study interchange. The interchange will maintain freeway operations on Highway 2, with 338 Avenue expected to be a primary access point to Okotoks as future growth continues toward Highway 2. The Town of Okotoks, Foothills County and AT are participating in the study, which was started in December 2021. At the time of this report, the study is still in the early stages of completion. Future users of this report are advised to refer to the functional planning study report, when complete.

3.0 Field Investigation

ISL completed a field investigation on Wednesday, January 12, 2022, with a focus on observing the highway corridors, intersections, interchange ramp elements and collecting relevant data, including the following:

- **General observations:** Non-technical observations of the corridor components (sightlines, pavement markings, traffic controls, rumble strips, grades etc.) and a more detailed review of barrier systems, illumination, ramps and ramp intersections. These observations are provided for review and discussion in later sections of this report.
- **Traffic control signage review:** Detailed review of existing traffic control signage placement (lateral, vertical), condition, size and retro reflectivity based on relevant AT recommended practices.

Site photos are compiled in **Appendix C**.

3.1 General Observations

The following general observations are provided:

- **Sightlines:** Overall sightlines appeared to be mostly unobstructed, with a few exceptions where some visibility is obstructed due to the crest curve on the overpass, such as visibility for turning vehicles at the ramp intersection and visibility to the physical ramp gore for the exit to the dual lane loop ramp. Detailed technical sightline assessments are provided in Section 3.1.3 (ramps) and Section 3.1.4 (ramp intersections).
- **Pavement markings:** Pavement markings (shoulder line, centreline, lane markings, lane designation) appeared to be appropriate for the driver requirements. Gore markings for the merge from the dual lane ramp to Highway 2:15 appeared shorter than expected or typical at other similar interchanges.
- **Traffic control signage:** Overall traffic control signage appeared to communicate appropriately to the driver with a few observations for improvements as noted in Section 3.2. One example is the southbound Highway 2:15 to westbound Highway 2A:06 merge from the right sign, that should be replaced with an added lane sign.
- **Rumble strips:** Rumble strips are installed between lanes in the loop ramp and southbound on Highway 2, north of the overpass. No rumble strips are installed for the northbound direction.
- **Grades:** Ramp grades all relatively gentle with no steep sections.
- **Road conditions:** Pavement was all in generally good condition, with no major distresses, potholes, cracking or otherwise observed. It is noted that observations were made in the winter but generally the road surface was dry and visible.
- **Speeds:** Highway 2 traffic speeds were observed to be reasonably near to the posted speed limit based on comparing the ISL observers' speed (from the dashcam video) with the speeds of other vehicles on the highway. Speeds along Highway 2A:06 and Highway 552:02 also appeared to be reasonably close to the posted speeds. Vehicles approaching the Highway 2A:06 exit to the dual loop ramp were observed to slow down on the approach (compared to the mainline speed of 90 km/h) and the comfortable speed driven was about 50 km/h around the ramp curve.

3.1.1 Barrier Systems

A detailed field review of the barriers systems is summarized as follows:

- **Overpass:** Box beam barrier is installed within the centre of the overpass. One of the support posts within the overpass section of the barrier is broken away from the box beam and twisted. This post should be replaced.
- **Highway 2A:06 (Overpass to West Ramp Intersection):** Between the overpass and west ramp intersection, barriers include weak post W-beam guardrail on the north and south sides of Highway 2A.
  - Weak post W-beam guardrail is no longer used by AT for new construction.
  - The weak post guardrail at this site appears to use posts made of recycled plastic. A turn-down end treatment is used for the upstream end of the eastbound guardrail.
  - Turn down end treatments are no longer used by AT for new construction. The turn-down was observed to be corroded with holes in the steel face.
  - A wing end treatment is used on the downstream end of the westbound guardrail. Given that there is a possibility of opposing traffic crossing the centreline and hitting this end the wing treatment may not meet current standards.
  - On both sides of the overpass, the guardrail connects to the bridge rails.
- **Highway 552:02 (Overpass to East Ramp Intersection):** East of the overpass, the Highway 552 barrier is the same as west of the overpass.
- **Highway 2A:06 (Dual Loop Ramp):** Strong post W-beam guardrail is used for both sides of the eastbound to northbound loop ramp.
  - An impact absorbing end treatment is used for the upstream end of the guardrail on the left side of the loop ramp.
  - For the upstream end of the guardrail on the left side, the guardrail connects to the bridge rail. For the downstream end, the guardrail transitions to become Thriebeam barrier that connects to the concrete wing walls near the bridge abutment.
- **Sand/gravel:** On both sides of Highway 2A/552, there is a buildup of sand/gravel/grass under the guardrail. Although this is unlikely to impact the effectiveness of the guardrail, it may impede drainage.
- **Highway 552:02 (East of ramp intersection) and Highway 2A:06 (west of ramp intersection):** To the east of the east ramp intersection and west of the west ramp intersection, there is an approximately 250 mm high concrete curb which appears to function as a median barrier. Although the origin is not known, it is expected that it was installed in lieu of a taller F-shape barrier in order to avoid impeding sightlines between Highway 2A:06 and the ramp terminal. The curb does not meet AT standards for minimum median width.
- **Highway 552:02 (west of 274 Avenue):** Just west of the 274 Avenue intersection, weak post W-beam guardrail is used on both sides of Highway 552 for a culvert crossing.
  - Weak post W-beam guardrail is no longer used by AT for new construction.
  - Turn-down end treatments are used on the upstream ends of the guardrail on each side of the roadway. Turn down end treatments are no longer used by AT for new construction.

- **Highway 2:12 and 2:15 (North/south):** Strong post guardrail is used for the northbound and southbound roadways to protect the bridge piers and abutments.
  - Strong post guardrail is currently used by AT for new construction.
  - Impact absorbing end treatments are used for the upstream ends for each of these sections of guardrail.

3.1.2 Illumination

- **General:** Streetlights appear to be operational when it is dark. No deficiencies were observed with the streetlight operation.
- **Infrastructure Type:** There are a mix of streetlight infrastructure indicating that illumination upgrades were made at different times.
  - There are a variety of pole foundations including screw piles, square precast bases, and round cast-in-place bases.
  - Almost all of the streetlight poles were observed to have breakaway bases.
  - There are a variety of pole types. Some are galvanized steel poles. Others are painted steel poles. Most appeared to be 15 m in height (based on field judgement) while a few appeared to be either taller or shorter depending on their location.
  - Most of the luminaires were High Pressure Sodium (HPS), however, a few were observed to be LED luminaires.
- **Breakaway Shrouds:** The breakaway shrouds for many poles were damaged or missing, exposing the breakaway components to increased exposure to the elements.
- **Conditions:** Many of the painted steel poles were observed to be in poor condition with significant corrosion on the pole faces. Corrosion weakens the pole structure and increases the likelihood of the pole failing.
  - Some streetlight poles were observed to be out of plumb, including those on the right-hand side of the eastbound to southbound ramp located in advance of the merge onto Highway 2. Only spot checks were completed for plumbness.
  - The handhole covers for several poles were observed to be partially open or missing completely. In one case, the handhole cover was taped in place. When the handhole cover is missing, the wiring could be damaged due to exposure to the elements. Additionally, it allows public access to the wiring and potential for electric shock.

3.1.3 Ramp Drive Through Conditions

Highway 2:15 and Highway 2A Merge and Weave Area

- **Merge/Weave Area (Southbound):** Highway 2A (Macleod Trail) southbound and Highway 2 (Deerfoot Trail) southbound, merge approximately 2.4 km to the north of the study interchange.
  - Two lanes merge on the right from Highway 2A and the right-most lane from Highway 2A ends just south of the merge and the next lane becomes the right turn lane for the south ramp. This forces southbound traffic from Highway 2A wishing to continue south on Highway 2 to merge left.
  - Three lanes merge from Highway 2 on the left, and all three lanes continue south on Highway 2 before merging down to two lanes beyond the study interchange.
  - During the field investigation the weaving section appeared to operate with no issues.

- **Merge/Weave Area (Northbound):** Highway 2A:06 and Highway 2:15/2:12 merge at the study interchange and split into Highway 2A (Macleod Trail) and Highway 2 (Deerfoot) a similar distance to the north.
  - On Highway 2:15, in the northbound direction, approximately 1,200 m north of the study interchange the right-hand lane of the dual ramp lane drops which may be causing drivers to feel anxious about needing to complete abrupt lane changes. Extending the lane further north (approximately 800 m) to the split between Highway 2A and Highway 2 would reduce some lane changing requirements.
  - A steady stream of traffic was observed connecting from Highway 2A:06 onto Highway 2:15, using the dual ramps.
  - During the field observation the weaving section was noted to operate fairly well. Volumes travelling from the south and loop ramp, especially during the AM peak, were steady and the weaving maneuvers occurred over what appeared to be a reasonable length to allow appropriate distance for vehicles to change lanes.

Highway 2:15 Southbound Right Turn Ramp

- **Decision Sight Distance (DSD):** The recommended DSD for the Highway 2:15 southbound ramp is 265 m. The available DSD to the ramp gore is limited by the crest curve on Highway 2:15 and is less than 265 m. Although the recommended DSD is not met, there is an overhead sign that help drivers to be aware of the upcoming ramp exit.
- **Merge onto Highway 2A:06:** Both of the southbound to westbound ramp lanes (southbound right movement) enter westbound Highway 2A:06 with a lane away configuration and no merging is needed. The 3-lane cross-section for westbound Highway 2A:06 continues until the 290 Avenue intersection. Where the ramp lanes join with west Highway 2A:06, there is a merge sign (WA-16R), however, no merge is required due to the added lane configuration. A better sign for this location would be the added lane sign (WA-35R).

Highway 2:15 Southbound Left Turn Ramp

- **General:** Observations related to Highway 2 approaching the southbound left turn ramp are the same as for the southbound right Movement.
- **Ramp Intersection:** The southbound left turn ramp intersects with Highway 2A:06 at a skew. To see traffic coming from the right, a driver at the ramp stop bar must turn their neck beyond the normal range provided for in modern design.
  - From the ramp stop bar, sight lines to the right (west) are good with no notable obstructions.
  - From the ramp stop bar, sight lines to the left (east) are partially obstructed by the vertical profile of the Highway 2A overpass (crest curve) and by objects including signs, streetlight poles, and the bridge rail. The sight line obstructions from the objects can be resolved if a driver pulls ahead beyond the stop bar.
- **Operational Observation:** In peak traffic times, gaps in the oncoming eastbound Highway 2A:06 traffic, especially in the AM peak period, are very limited.

Highway 2:12 Northbound Right Turn Ramp

- **Northbound Diverge:** Northbound Highway 2:12 has three (3) lanes until just south of the northbound ramp for the Highway 2A/552 interchange, where the right lane is dropped.
- **DSD:** The DSD for the Highway 2:12 northbound ramp is 265 m. The available DSD to the northbound ramp gore is met as the gore is visible in advance of 265 m.
- **Access:** There is a driveway on the northbound ramp that provides access to what appears to be an abandoned site, where there appears to be some type of loading ramp as well as monitoring wells. Sight lines to enter the ramp from the driveway appear to be acceptable.
- **274 Avenue Intersection:** This intersection is immediately following the merge onto Highway 552:02. The south leg of the intersection is a field access. The north leg is 274 Avenue which is a local road that provides access to a number of country residential properties. The location of the intersection does not meet AT's current access management requirements (see access management review in Section 7.6).

Highway 2:12 Northbound Left Turn Ramp

- **General:** Observations related to Highway 2 approaching the NBL ramp are the same as for the NBR Movement.
- **Ramp Curve:** Where the northbound ramp splits, the tight curvature of the northbound to westbound ramp results in an abrupt sensation when departing the main ramp alignment.
- **Ramp Intersection (East):** The northbound to westbound ramp intersects with Highway 552:02 at a skew. To see traffic coming from the right, a driver at the ramp stop bar must turn their neck beyond the normal expected design range.
  - From the ramp stop bar, sight lines to the right (east) are good with no notable obstructions.
  - From the ramp stop bar, sight lines to the left (west) are partially obstructed by the vertical profile of Highway 552 (crest curve). There are no notable objects that obstruct sight lines.
- **Operational Observations:** Traffic volumes on Highway 552:02 are relatively low and gaps are frequent, however, a driver's ability to perceive the available gaps is challenged due to the proximity of this intersection to the dual loop ramp. It is difficult for a driver to judge whether an eastbound vehicle on Highway 552:02 will exit onto the loop ramp or continue travelling eastbound on Highway 552:02. This can reduce the effective gap that a driver has to make a left turn from the ramp onto Highway 552:02, and when combined with the limited sightlines create a short time window within which drivers may be comfortable to react to a gap and proceed.

Highway 2A:06 Eastbound Right Turn Ramp (to SB HWY 2:12)

- **DSD:** The recommended DSD for Highway 2A:06 is 230 m. The available DSD to the ramp gore is met as the gore is visible at a longer distance than 230 m.
- No observed issues for this ramp.

Highway 552:02 Westbound Left Turn Ramp (to SB HWY 2:12)

- **Left Turn:** There is no dedicated left turn lane from westbound Highway 552:2. Considering the 80 km/h speed limit, a westbound driver may not feel comfortable stopping in the shared lane to make a left turn across two lanes of near constant oncoming eastbound traffic, especially in the morning peak period. The lack of the dedicated left turn lane may increase the probability of there being rear end collisions. The potential need for a dedicated left turn lane should also consider the westbound volumes, which are relatively low.
  - During the site visit, turning left at approximately 8:15 required about a 20 second wait time to obtain a gap to turn.
- **Stopping Sight Distance (SSD):** 164 m stopping sight distance (assuming a 3% downgrade) for westbound drivers approaching a stopped vehicle waiting to turn left onto the Highway 2 onramp is met.

Highway 2A:06 Eastbound Left Turn Ramp (Dual Lane Loop)

- **Eastbound Diverge/Exit:** From Highway 2A:06, in the eastbound direction, the right lane is forced into the loop ramp and although there are several warning signs indicating the condition unfamiliar drivers may still not realize this and need to make an abrupt lane change. The left eastbound lane of Highway 2A:06 is a shared through left lane. Vehicles entering the ramp slow down before traversing the loop. Through vehicles continuing onto Highway 552:02 that don't expect the vehicle in front of them to slow down may not have opportunity to slow down quickly enough and result in a rear-end collision.
- **Missing Exit Sign:** There is no Exit sign at the ramp gore. The overhead sign may have been considered sufficient for the exit, but an Exit sign could reinforce that there is a gore at this location.
- **DSD:** The recommended DSD for Highway 552:02 is 230 m. The available DSD to the ramp gore is limited by the crest curve on Highway 2A for the overpass and is less than 230 m. Although the recommended DSD is not met, there are multiple overhead signs that help drivers to be aware of the upcoming ramp exit. An Exit sign would also help improve visibility to gore location.
- **Rumble Strips:** There are rumble strips in the shoulder space between the two lanes on the loop ramp.
- **Ramp Merge:** As the ramp lanes become parallel with Highway 2:15, there is only a short gore and then a single solid white line separating the entering and through traffic. There is no lateral separation or physical obstruction between entering loop traffic and through traffic. Typically, the gore for the entering traffic would be much longer, with a 600 m long, 60:1 taper that extends well beyond the overpass. A single white line may not be as effective at deterring entering drivers from merging into the through Highway 2 lanes early. With the dual ramp lanes, there is very limited space, if any, for widening/extending the gore area unless the Highway 2:15 lanes were shifted to the left, or the bridge abutment wall was located further to the right.

Highway 552:02 Westbound Right Turn Ramp

- **DSD:** The recommended DSD for Highway 552:02 is 230 m. The available DSD to the ramp gore is met as the gore is visible in advance of 230 m.
- No observed issues for this ramp.

3.1.4 Intersection Observations

Southbound Ramp Intersection (Highway 2:15 Southbound Ramp @ Highway 2A:06)

- **Intersection Sight Distance (ISD):** The ISD was checked for a vehicle at the stop bar.
  - **Right:** There is significant ISD to the right (west) as drivers can see all the way around the curve.
  - **Left:** The ISD to the left (east) is limited by the vertical crest curve on the bridge. The time from vehicles becoming visible to arriving at the intersection is about 6 to 7 s, depending on the speed and size of the vehicle. This improves to 8 to 13 s if the vehicle pulls forward to get a better view of oncoming traffic. This indicates the ISD is in the 175 m range from the stop bar, or the 200 to 300 m range if the driver pulls ahead to get a better view (90 km/h running speed assumed). These sight distances may be insufficient for tractor trailer vehicles. A detailed summary is provided in the following table.

Table 3.1: Intersection Sight Distance (Left Sightline at Southbound Ramp Intersection)

Major Road (Design Speed)	Design Vehicle	Eye Height (m)	Required ISD (m)	Required ISD (s)	Available ISD (s)	Sufficient
HWY 2A:06 (90 km/h)	P	1.05	175	7.0	ISD to East: 6 to 7 s at stop bar. 8 to 13 s if vehicle pulls ahead.	Yes (P and SU) if vehicle pulls ahead.
	SU	1.80	265	10.5		
	WB-21	2.10	460	18.4	ISD to West: >500m	No (WB-21)

- **Stop Bar:** The stop bar appears to be in a poor location as sight lines to the left (east) are limited. Signs, streetlight poles, and the bridge rail obstruct the view of oncoming traffic. This can be resolved if the vehicle pulls forward to get a better view of oncoming traffic. Most of the vehicles on the ramp approach were observed pulling forward to get a better view. It would be beneficial if the stop bar was moved closer to the intersection.
- **Operations:** Judging the availability of a gap in traffic may be challenging during the peak hour when there is a near constant flow of eastbound traffic on Highway 2A:06. The eastbound traffic is distributed across two lanes, however, a vehicle at the ramp stop bar may not know if an approaching eastbound vehicle is in the inner or outer eastbound lane.
- **Delineator Post:** There was a broken delineator guidepost on the right-hand side of the SB to WB ramp near the stop bar.
- **Turn restrictions:** The ramp features a shared left-through arrow pavement marking, which may not be a suitable marking for the location as there is essentially zero through demand and the through movement is not well aligned on the ramp terminals on either side of Highway 2A:06. It would be better to replace it with a definitive left turn arrow.
- **Do Not Enter Sign (RB-23):** A do not enter sign (RB-23) is on the back of the stop sign, somewhat blurring the shape of the stop sign. This should be placed on a separate post.

Northbound Ramp Intersection (Highway 2:12 Northbound Ramp @ Highway 552:02)

- **Intersection Sight Distance (ISD):** The ISD was checked for a vehicle at the stop bar.
  - ISD to the right (east) is sufficient, with a clear sight-line all the way around the curve of the highway.
  - ISD to the left (west) is limited by the vertical crest curve on the bridge. The time from vehicles becoming visible to arriving at the intersection is about 8 to 13 s, depending on the speed and size of the vehicle. This indicates the ISD is in the 200 to 300 m range assuming a 90 km/h running speed. This may be insufficient for tractor trailer vehicles. A detailed summary is provided in the following table.

Table 3.2: Intersection Sight Distance (Left, Southbound Ramp)

Major Road (Design Speed)	Design Vehicle	Eye Height (m)	Required ISD (m)	Required ISD (s)	Available ISD (s)	Sufficient
HWY 552:02 (90 km/h)	P	1.05	175	7.0	ISD to Right / East: >500m ISD to Left / West: 8 to 13 s (200m to 325m)	Yes (P and SU)
	SU	1.80	265	10.5		
	WB-21	2.10	460	18.4		No (WB-21)

- **Stop Bar:** The positions of the stop bar and stop sign appear to be appropriate.
- **Operations:** Judging the availability of a gap in traffic can be challenging as many of the vehicles approaching from the left enter the EB to NB loop ramp instead of continuing EB on Highway 552:02. Traffic entering the loop ramp is nearly constant and many of the vehicles entering the ramp do not signal. If a vehicle at the stop bar decides to go and then realizes that an approaching vehicle is continuing EB on Highway 552, they may only have ~6 s to clear the EB lane before the approaching EB vehicle arrives at the intersection.
- **Do Not Enter Sign (RB-23):** A do not enter sign (RB-23) is on the back of the stop sign, somewhat blurring the shape of the stop sign. This should be placed on a separate post.

3.2 Traffic Control Signage Conditions

Traffic control signs were reviewed for correct lateral and vertical placement, condition and retro-reflectivity. A detailed review of signage is provided in **Appendix D**. The following bullets highlights signs which may require follow-up action:

Damaged Guide Sign
(Highway 2A:06, Westbound Km 5.841)

- **Highway 2A:06 (Km 5.823, Westbound):** A large exit directional sign on the north side of Highway 2A has sections of the sign that are deteriorating and that impact the readability of some of the sign lettering. (Refer to photo).
- **Highway 2A:06 (Westbound to south ramp):** The merge sign to the right of the ramp is installed on a twisted wooden post. Due to the twist in the post, the sign faces inward towards the ramp.
- **Highway 2A:06 (Km. 5.734, Eastbound):** 300 m distance tab installed on the lane control sign is bent and signpost is installed on a slight tilt.
- **Highway 2A:06 (Km. 5.766, Eastbound):** Hazard marker installed on the shoulder guard rail showed signs of damage and possibly needs to be replaced.
- **Highway 2A:06 (Km. 6.032, Eastbound):** Diagrammatic overhead sign could be improved by using a thicker loop to reinforce that there are two exit lanes with a single shared through lane. The right lane could also show a truck symbol as trucks are required to use the right lane.
- **Highway 552:02 (Km. 0.221, Eastbound):** Hazard marker installed on the median is bent.
- **Highway 2A:06 (Eastbound Dual Loop Ramp):** Two notable items:
  - Exit signs: Missing exit sign at the physical gore. Also, one of the anchor bolts for the north pole for the overhead bridge sign structure is missing. The hole for the anchor bolt in the base flange appears to be filled with tar to prevent ingress of water.
  - Chevron alignment signs: Chevron alignment signage was not obvious during our field investigation, possibly covered by dirt and/or snow. Dashcam video review did confirm signs were not reflective.

4.0 Collision Review

4.1 6-Year Collision History

Historical collision data was obtained from the TIMS NESS for the six (6) year period from 2013 to 2018. During the preparation of this report, 2018 collision data became available and was added to an earlier version of this report which used 5-year collision data from 2013 to 2017. The analysis includes collisions on Highways 2:12, 2:15, 2A:06 and 522:02 and the interchange ramps, within the study area limits. During the six (6) year period, 135 collisions were recorded. One (1) collision has been entirely omitted from analysis due to the description indicating that it did not take place in the study area. Therefore, 134 collisions will be analyzed in this section. Detailed collision reports are provided in **Appendix E**, which are intended to be viewed in the electron version of this report as the information requires the reader to zoom.

4.2 Total Collisions and Collision Rate

134 collisions occurred within the interchange area and 108 collisions are reported as non-animal. While the total non-animal collisions is lower than the average number of collisions at interchanges (112 collisions/interchange) based on information provided by AT. NESS reports the five-year non-animal collision rate as 144.3 collisions per million vehicles entering (MVE) for the period of 2014 to 2018 and 150.5 for the period of 2013 to 2017, compared to the typical rate of 106.6 collisions per MVE. In addition, the nine (9) major injury collisions reported are higher than the expected amount of four (4), based on information provided by AT.

4.3 Collision Type and Severity

Using available collision data, figures were compiled to identify collision patterns by type and severity. Figure 4.1 provides a summary of collisions by type.

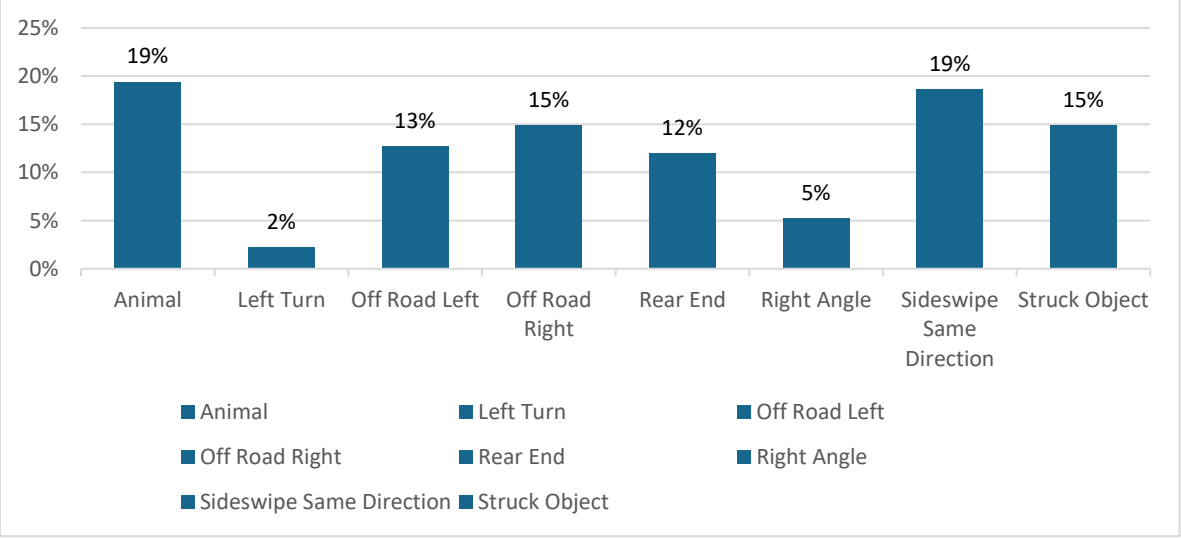


Figure 4.1: Distribution of Collisions by Type

The spread of the four (4) most dominant collision types is close (<4% difference between each type) and are the animal, sideswipe same direction, off road right, and struck object types. Left turn and right angle were the least frequent collision types, making up 2% and 5% of collisions, respectively.

Figure 4.2 shows the collision severities by percentage of total collisions. Most collisions resulted in property damage (100). There was a total of 25 minor injury collisions and nine (9) major injury collisions. Over the six (6) year assessment period there were no fatal collisions.

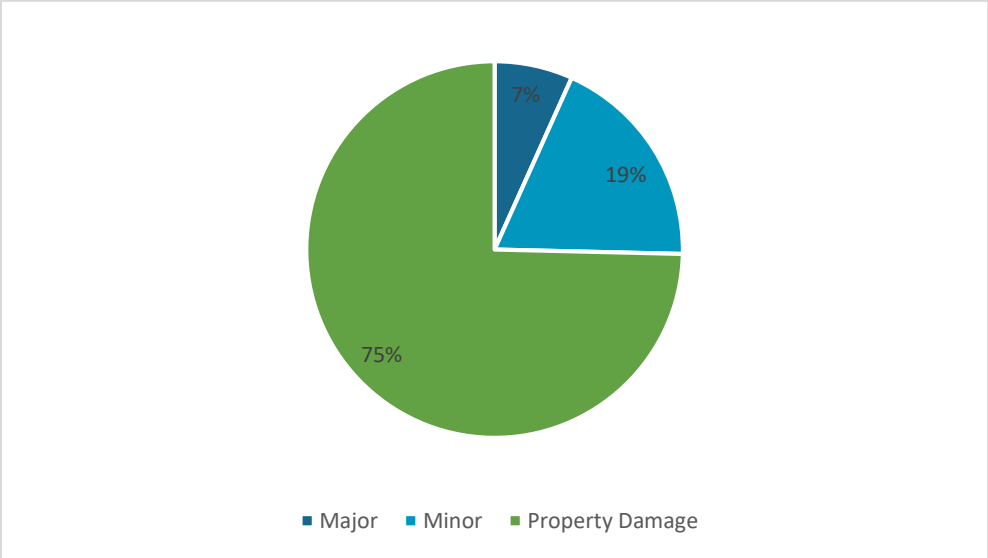


Figure 4.2: Distribution of Collisions by Severity

Figure 4.3 provides a summary of the collisions by type and severity. Only off road left, off road right, rear end, and right angle collision types resulted in major collisions over the six (6) year period.

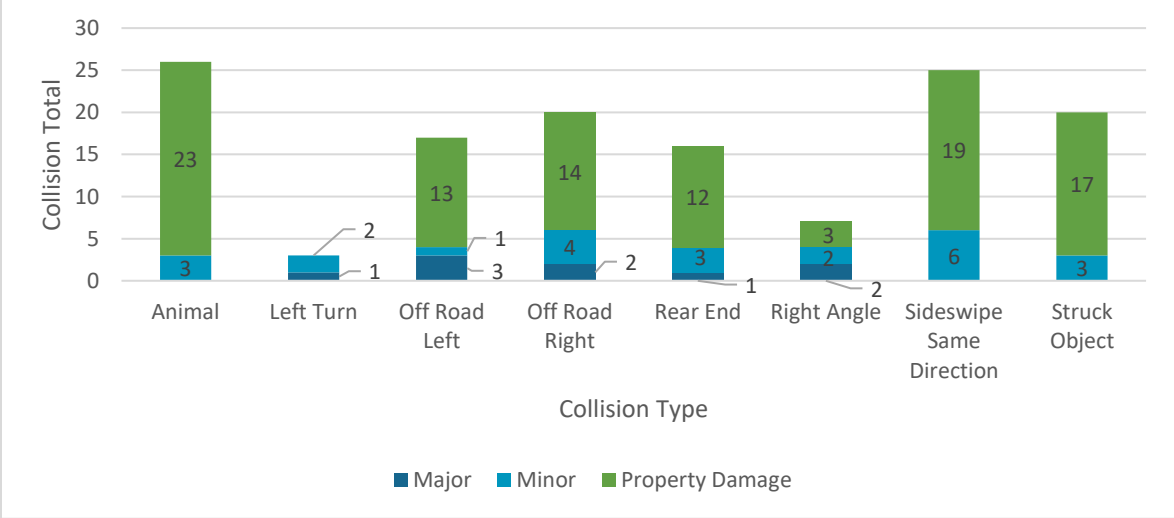


Figure 4.3: Distribution of Collisions by Type and Severity

Observations made based on Figure 4.3 are as follows:

- **Off-road Collisions:** Off-road left collisions have the largest number of major injuries with three (3) out of 17 collisions involving major injury. The total of the off-road collisions (both left (3) and right (2)) comprised the largest quantity of major injury collisions, followed by rear end (1) and right angle (2).
- **Sideswipe:** Sideswipe, same direction collisions have the largest number of collisions (25) and one of the largest proportion (19%) compared to other collision types.
- **Left turn:** Although fewer in number, all left turn collisions (2) resulted in minor injury.
- **Right angle:** Right angle collisions have the second largest percentage of major (2, 29%) and minor (2, 29%) injury collisions compared to the total collisions (7).

To better understand the circumstances leading to major collisions a detailed review of the descriptions provided for each major collision is provided in the following table.

Table 4.1: Major Injury Collision Descriptions

Collision ID	Detailed Description	Likely Contributing Factor (as reported)
291810	Vehicle travelling at a high rate of speed in snow/wet and darkness conditions, northbound on Highway 2A:06. Hit boulevard and rolled a number of times.	High rate of speed.
294615	Vehicle was stopped on the overpass due to an earlier collision and was read-ended. Conditions were snow/slush/ice and darkness conditions. Note: Direction of travel was not reported.	Previous collision and poor surface conditions.
311761	Vehicle travelling westbound from Highway 552:02 to Highway 2:15 on the ramp and experienced a tire blow out, causing the vehicle to strike the ditch. Conditions were clear, dry and daylight.	Mechanical issue.
322379	Vehicle travelling northbound on Highway 2:15 north of the overpass during darkness conditions and swerved to miss a deer and rolled.	Animal.
332599	Vehicle travelling westbound on Highway 552:02, just before the overpass and hit ice and went off the road right. Conditions were snow/ice/slush and darkness.	Poor surface conditions.
336121	Vehicle travelling southbound on Highway 2:15 north of the overpass during snow/west and darkness conditions and went off the road to the left and hit a pole.	Poor surface conditions.
345814	Southbound vehicle at turning left from Highway 2:15 ramp to Highway 552:02, failed to stop and was struck at a right angle by an approaching vehicle from the west. Conditions were dry, clear and daylight.	Stop sign violation.
364483	Vehicle 1 was travelling west on Highway 552:02. Vehicle 2 stopped at a stop sign and proceeded to enter the intersection into the path of Vehicle 1 and collided. Conditions were dry, clear, and daylight.	Poor distance judgement.
368627	Driver 1 was travelling west on Highway 552:02 and attempted to turn south on Highway 2:15 when they collided with an eastbound vehicle. Conditions were clear and slush/snow/ice.	Poor surface conditions.

As highlighted in the detailed descriptions, of the nine (9) major injury collisions there does not appear to be any obvious geometric contributing factors for five (5) of the nine (9) records as three (3) collisions occurred due to driver error (travelling at a high rate of speed, violating a stop sign), one (1) due to a vehicle mechanical issue and one (1) due to an animal. The remaining four (4) of the nine (9) collisions appear to be related to surface conditions (snow, slush and/or ice).

4.4 Temporal Collision Factors

Figure 4.4 illustrates the number of collisions per year from 2013-2018.

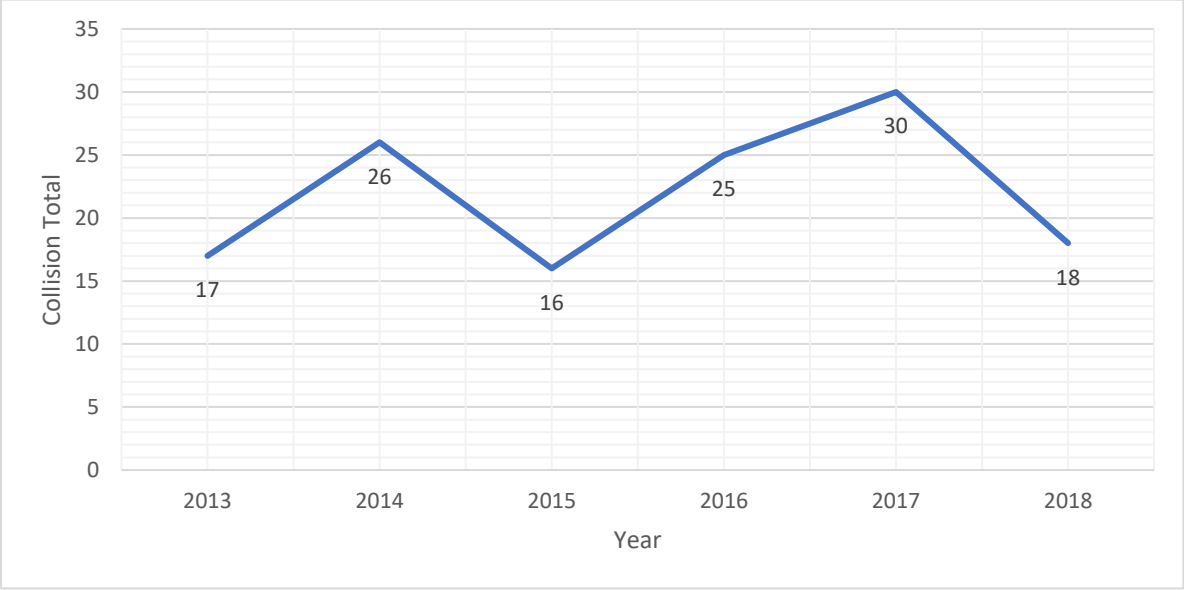


Figure 4.4: Distribution of Collisions by Year

Figure 4.5 indicates the number of collisions per month. Collision totals trend upward during winter months, indicating that environmental and surface conditions may be a contributing factor. The data illustrates a total of 90 collisions from October and March compared with 43 from April to September.

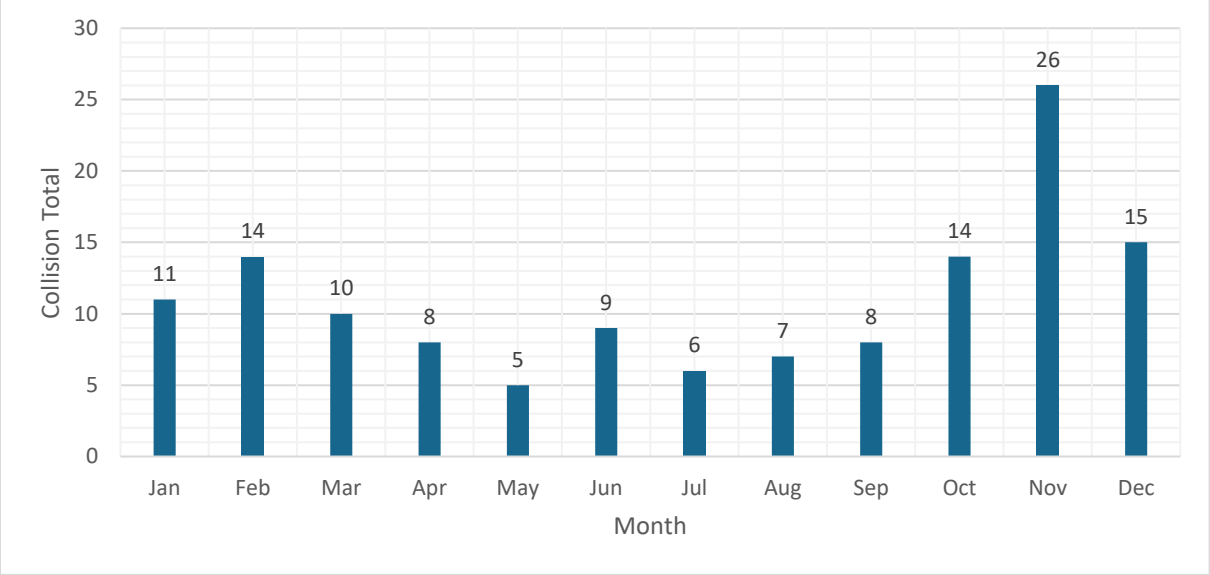


Figure 4.5: Distribution of Collisions by Month

Figure 4.6 shows the distribution of collisions throughout the day in one-hour groupings. The collision distribution has one (1) large peak and two (2) smaller peaks. The large peak is in the period from 7:00 to 8:00 a.m. The smaller peaks are in the 2:00 to 3:00 p.m. hour and the 5:00 to 6:00 p.m. hour. Collisions peaks correlate well with peak traffic periods.

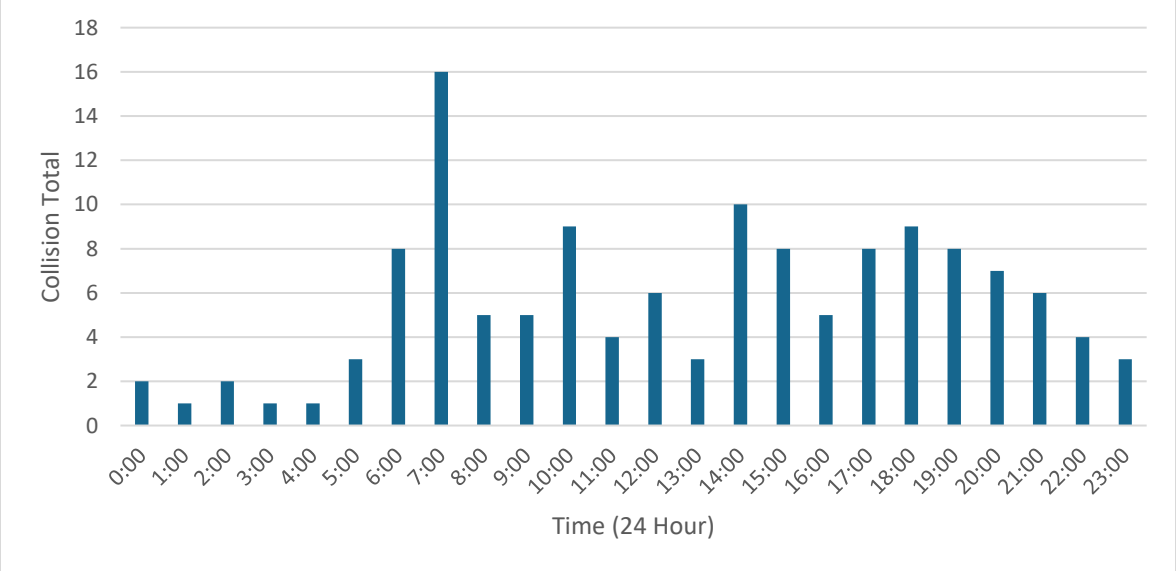


Figure 4.6: Distribution of Collisions by Time of Day

Figure 4.7 shows the distribution of collisions by season and environmental condition. Seasons are defined as a three-month period from the first day to the last day of each month for Spring (March, April, May), Summer (June, July, August), Fall (September, October, November) and Winter (December, January, February). Most collisions occurred in Fall (48) and Winter (40), and the fewest in Summer (22) and Spring (23).

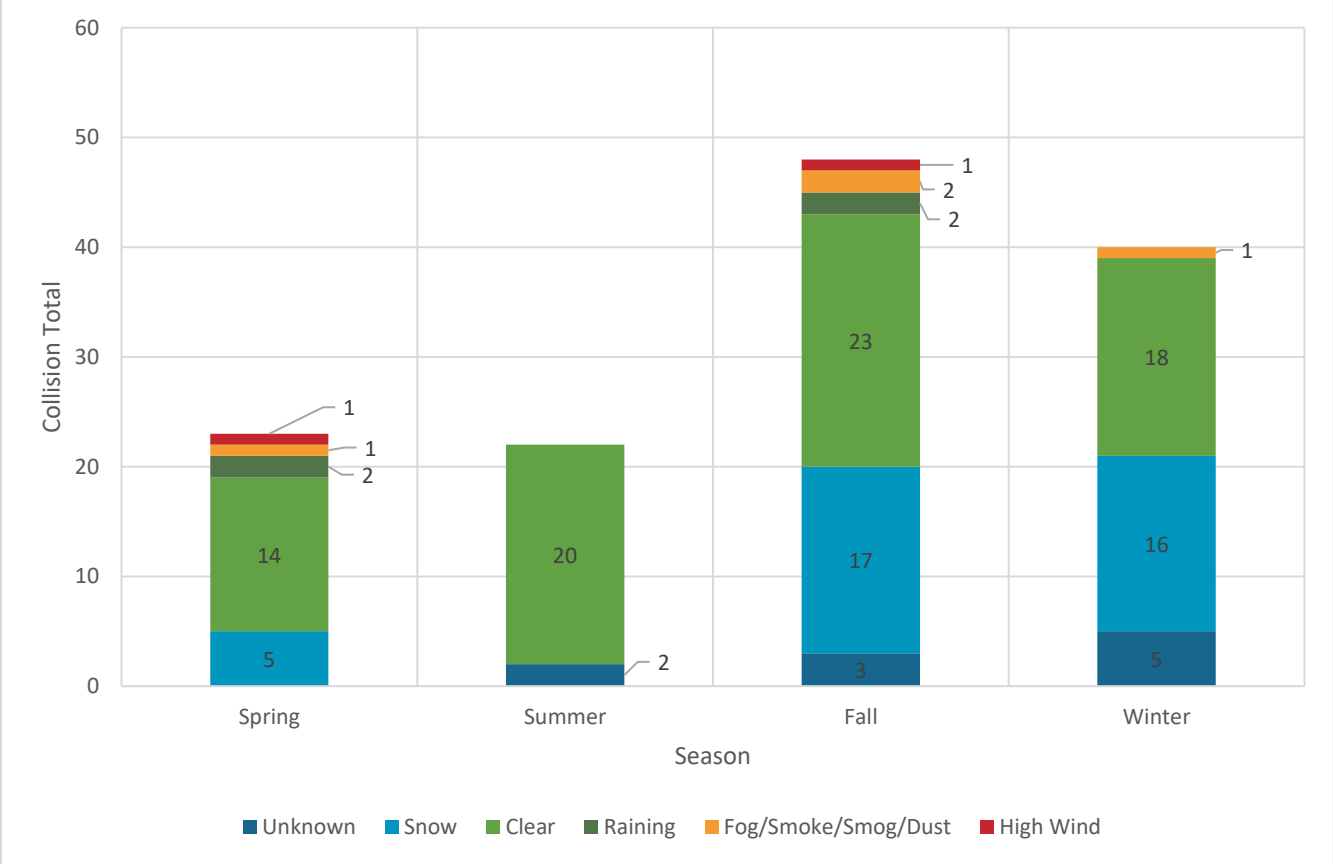


Figure 4.7: Distribution of Collisions by Season and Environmental Condition

- **Interchange Orientation and Sun Glare:** Orientation of the interchange is such that sun glare was reviewed as a potential contributing factor. This is discussed as follows:
  - Eastbound: Sun glare due to sunrise occurring around the end of summer (June 21) may be an issue for eastbound drivers travelling in the very early morning. The collision database does not include any collisions occurring around sunrise time of 5:23 AM near or around June 21. It is noted that sunrise occurs well before the peak hour.
  - Westbound: Sun glare due to sunset occurring around the beginning of winter (December 21) may be an issue for drivers travelling in the westbound direction. The collision database does not include any collisions occurring around sunset time of 4:32 PM near or around December 21.
  - Sun glare is not likely a contributing factor based on the above assessment.

4.5 Other Collision Factors

The following section discusses other collision factors to be considered, including environmental conditions, surface conditions and lighting conditions. The percentage of total collisions by environmental condition is shown in Figure 4.8. From Figure 4.8, over half (57%) of total collisions occurred in clear weather conditions and 28% occurred in snowy weather conditions.

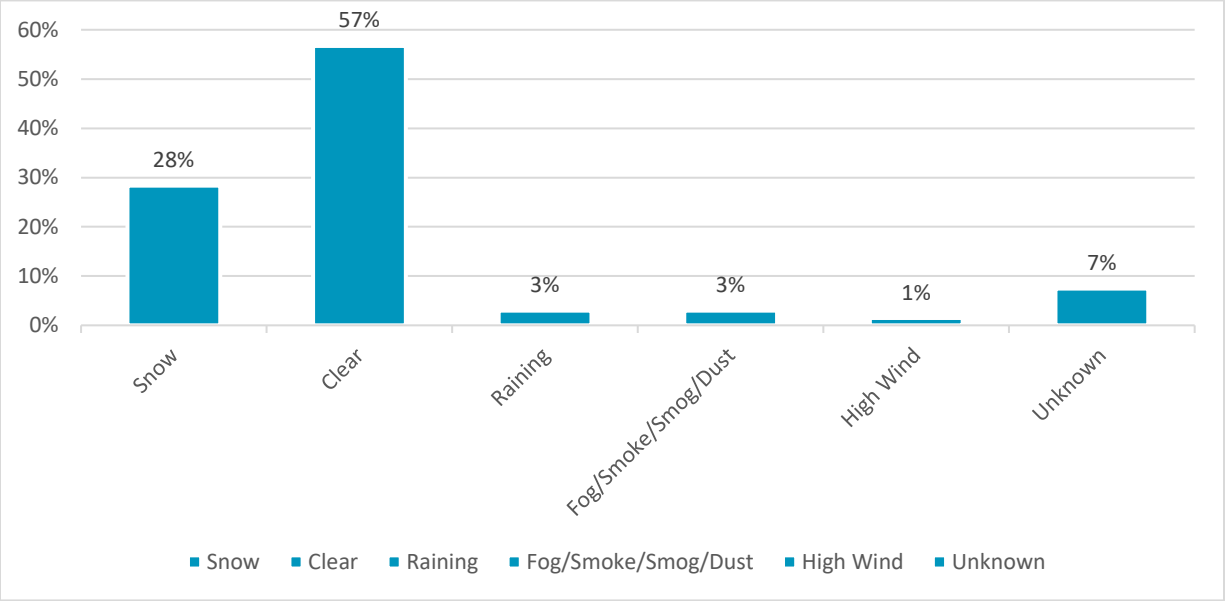


Figure 4.8: Distribution of Collisions by Environmental Condition

Figure 4.9 shows the distribution of collisions by season and surface condition.

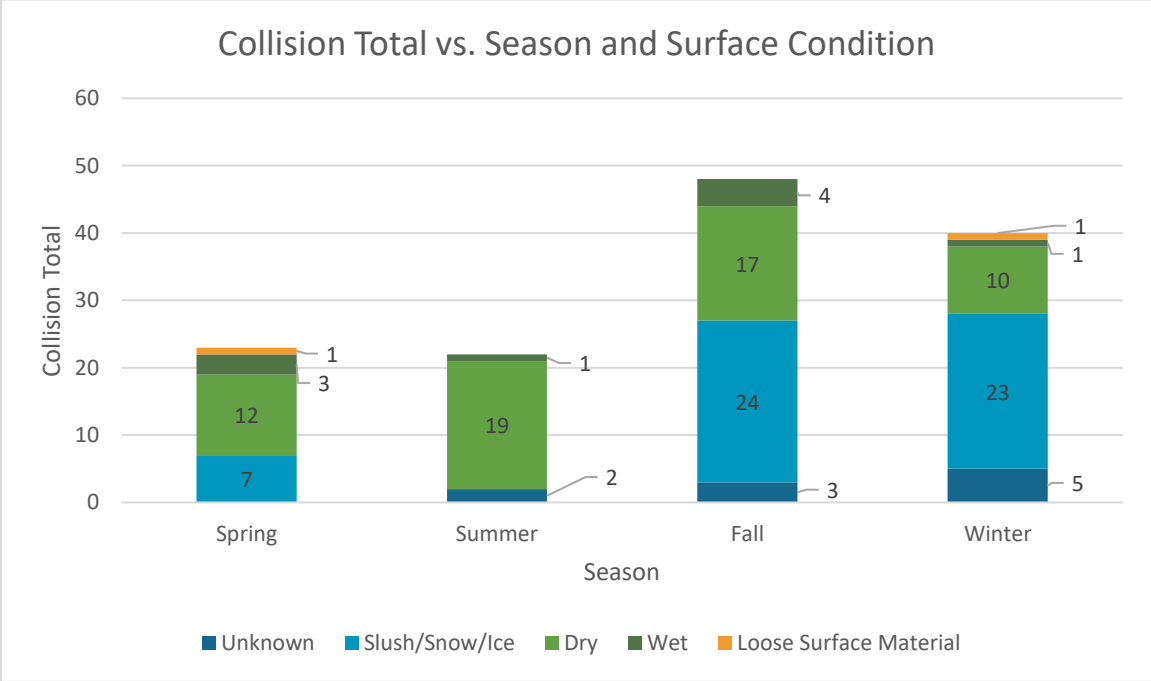


Figure 4.9: Spatial Distribution of Collisions by Season and Surface Condition

Observations from Figure 4.9 include:

- Most collisions in the Fall and Winter occurred with slush/snow/ice on the road surface and most collisions in the Spring and Summer occurred with dry surface conditions.
- The number of collisions with dry conditions is relatively similar for all seasons, ranging from a low of ten (10) in the winter, to a high of nineteen (19) in the summer.
- The number of collisions with slush/snow/ice conditions is significant in the fall and winter, totaling 47, compared to seven (7) in the spring and summer months.

As shown in Figure 4.10, the total number of collisions that occurred in slush/snow/ice and dry conditions is comparable. This indicates that while slush/snow/ice would be a contributing factor to collisions, other surface conditions do not appear to play a significant role in causing collisions.

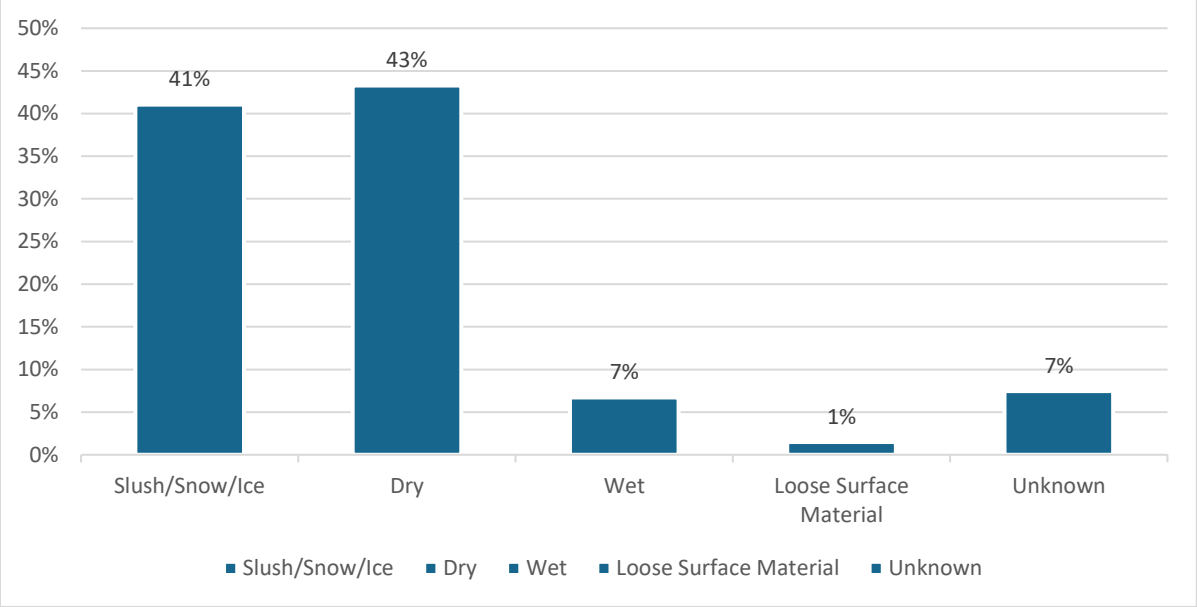


Figure 4.10: Distribution of Collisions Surface Condition

Figure 4.11 shows the distribution of total collisions by light condition. The majority of collisions occurred in daylight. However, a large proportion (40%) of collisions occurred in the darkness, indicating that visibility due to light conditions may be a contributing to a pattern of collisions in the study area. Peak traffic periods would notably occur in darkness during periods of shortest daylight in the winter months.

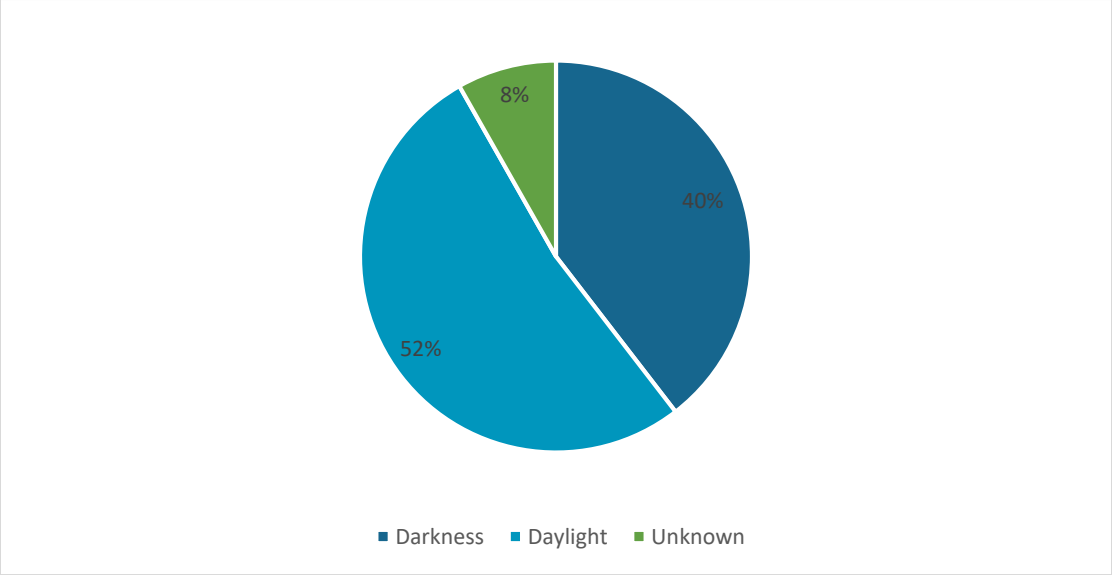


Figure 4.11: Distribution of Collisions by Light Condition

Figure 4.12 compares collision totals based on light condition and severity. Comparable collision totals can be observed in daylight, darkness, and unknown light conditions for minor collisions. However, almost twice as many major collisions occurred in darkness compared to daylight. Overall, the majority of collisions resulted in property damage only.

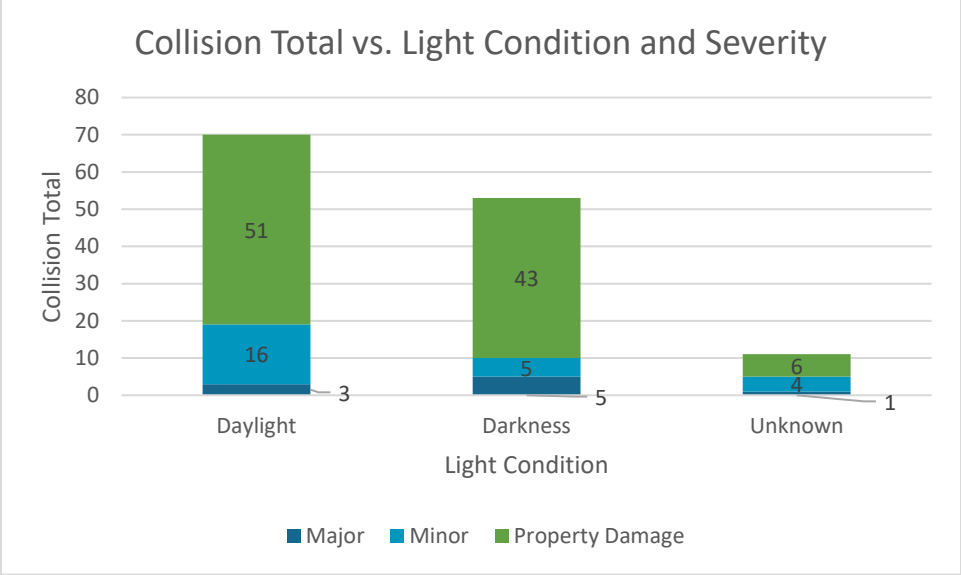


Figure 4.12: Spatial Distribution of Collisions by Severity and Light Condition

Figure 4.13 compares collision totals based on surface condition and severity. The majority of collisions of all severities occurred in either slush/snow/ice or dry surface conditions, with comparable numbers across severities.

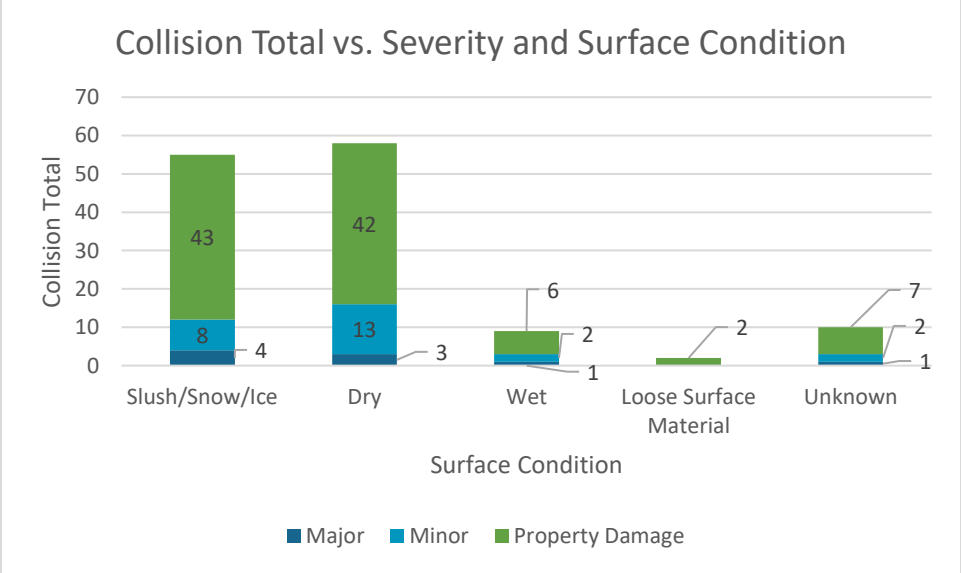


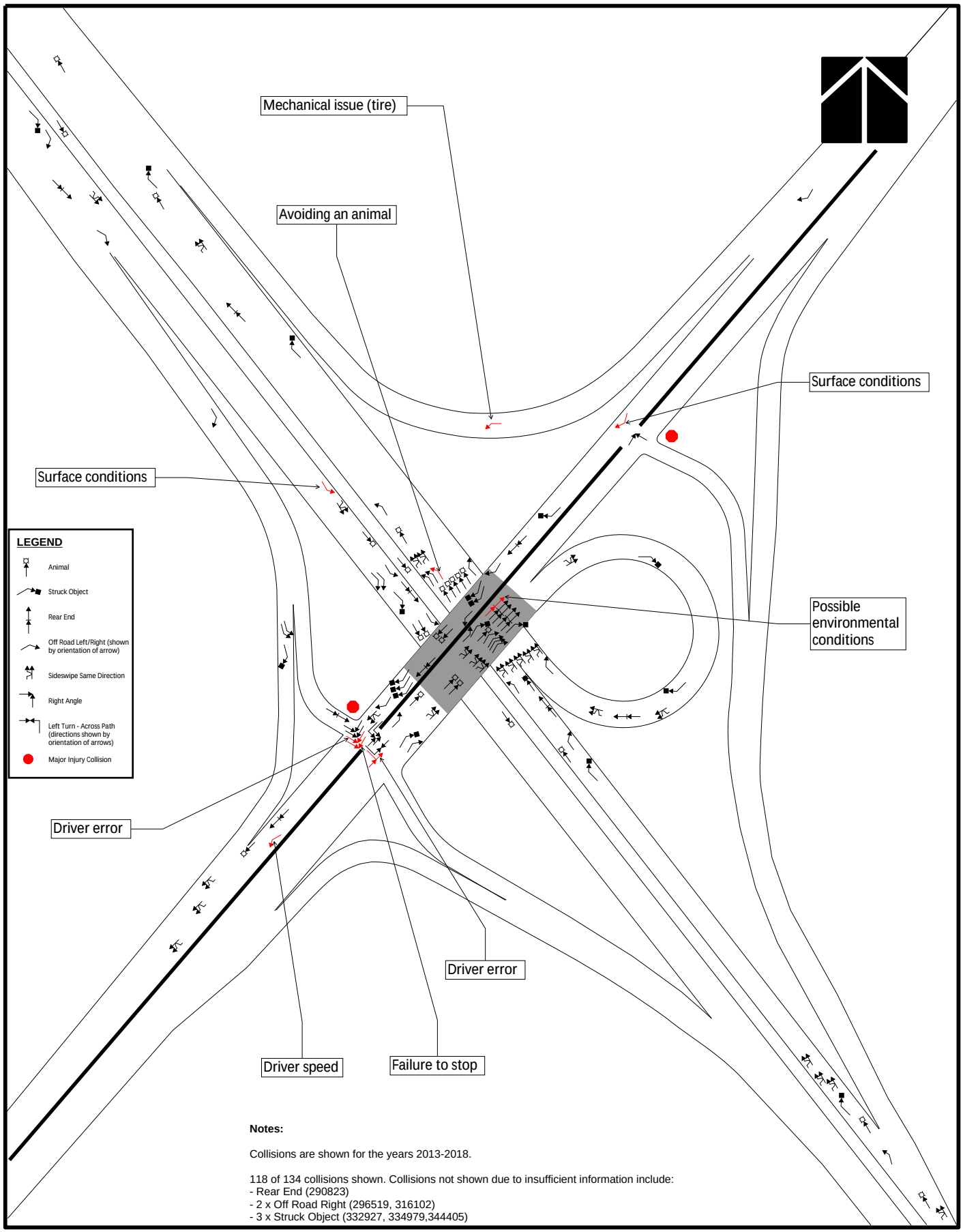
Figure 4.13: Spatial Distribution of Collisions by Severity and Surface Condition

Comparing and analyzing Figures 4.10 and 4.13, the following was observed:

- **Total Collisions (Poor vs. dry conditions):** The proportion of total collisions in dry conditions and poor conditions (slush/snow/ice) is fairly comparable. This could indicate that a geometric condition exists causing the number of collisions in dry conditions to be similar to the number of collisions in poor conditions. The proportions are reiterated as follows:
  - 41% of collisions occurred in poor conditions (slush/snow/ice).
  - 43% of collisions occurred in dry conditions.
- **Injury Collisions (Poor vs. dry conditions):** The total number of injury collisions in dry conditions and poor conditions (slush/snow/ice) is fairly comparable, as follows:
  - Four (4) major injury collisions and eight (8) minor injury collisions occurred in poor conditions (slush/snow/ice).
  - Three (3) major injury collisions and thirteen (13) minor injury collisions occurred in dry conditions.

4.6 Collisions by Geographic Location

Generally, a significant number of collisions are centralized around the overpass, west ramp intersection and Highway 552:02 eastbound to northbound dual ramp merge area. The following discusses collision based on these locations within the study interchange area. Location and collision types are illustrated in Exhibit 4.1.



Notes:

Collisions are shown for the years 2013-2018.

118 of 134 collisions shown. Collisions not shown due to insufficient information include:
- Rear End (290823)
- 2 x Off Road Right (296519, 316102)
- 3 x Struck Object (332927, 334979,344405)

*Interchange geometry is exaggerated for illustration purposes.

HIGHWAY 2/2A/552 INTERCHANGE SAFETY AND OPERATIONAL REVIEW

EXHIBIT 4.1 : COLLISION DIAGRAM

March, 2022

4.6.1 Collisions on Highway 522:02 Overpass

Approximately 25% (34 of 134) of collisions occurred on the overpass and to better understand potential contributing factors, detailed collision event factors are provided as follows:

- Seven (7) Animal
- Seven (7) Off Road Right
  - One (1) collision had no apparent contributing factor.
  - Five (5) collisions were related to poor roadway conditions.
  - One (1) related to an animal and should have been categorized as an animal collision.
- Three (3) Off Road Left
  - One (1) collision due to vehicle being covered by slush/ice by larger truck.
  - One (1) collision due to avoiding an earlier collision in poor roadway surface conditions.
  - One (1) collision due to poor surface conditions (slush, snow).
- Seven (7) Struck Object
  - One (1) collision due to vehicle avoiding colliding with vehicle in front after coming over the bridge (eastbound).
  - One (1) collision due to hitting a stray debris (hay) from other vehicle.
  - Two (2) collisions due to poor surface condition.
  - One (1) collision due to vehicle avoiding another vehicle.
  - One (1) collision due to hitting the median in clear conditions (no reason provided).
  - One (1) collision due to driver error.
- Four (4) Sideswipe Same Direction
  - Three (3) collisions due to improper lane change.
  - One (1) collision due to needing to avoid any earlier collision.
- Six (6) Rear End
  - One (1) collision occurring in dry conditions and did not appear to have a contributing factor.
  - One (1) collision due to a vehicle avoiding another vehicle.
  - Two (two) collisions related to poor roadway conditions (black ice, slush and snow).
  - Two (two) collisions related to vehicles needing to brake hard due to other vehicles abruptly changing lanes at the exit ramp to Highway 2:15.

Based on the above information, the following is observed:

- **Surface Conditions:** Slush/snow/ice on the road surface was a factor for eleven (11) collisions.
- **Lane changes:** Lanes changes were a factor in four (4) collisions. The lane changes occurred in the eastbound direction and possibly due to vehicles making a late lane change due to the forced exit to the loop ramp for vehicles in the right lane.
- **Avoiding an event or vehicle:** Avoiding another vehicle or earlier collision was the contributing factor in six (6) collisions in off road or struck object collisions.
- **Other:** Seven (7) collisions related to animals and four (4) did not appear to have any contributing factors.

Contributing factors based on the review may be as follows:

- **Speed changes:** Travel speeds may be abruptly changing in the eastbound direction with vehicles completing late/abrupt lane changes (to avoid being forced onto Highway 2). The design speed for the ramp was found to be 40 km/h (see section 7.2), which verifies a potential abrupt speed change between Highway 2A:06/552:02 which has a much higher design speed of 90 km/h.
- **Forced right turn:** The eastbound right lane is forced right and this may be increasing the number of vehicles completing late/abrupt lane changes. Although there are several visible signs warning of the lane condition, it was found that the sight distance from the highway to the physical gore is less than the required decision site distance (see section 3.1.3), which verifies a potential for drivers to make an abrupt lane change, especially if they are unfamiliar with the area.
- **Trucks (use right lane):** A sign indicating trucks must use the right-hand lane is located at the beginning of the ramp connecting to Highway 2:15 northbound and may result in trucks completing a sudden/late lane change as this is the only sign indicating the rule.
- **Limited maneuvering space:** Limited maneuvering space available within the overpass for vehicles to avoid earlier collisions or objects which could also increase the number of collisions with poor surface conditions.

4.6.2 Southbound Ramp Intersection

This intersection is stop-controlled in the southbound direction and is reported to have a high number of collisions (9) involving two (2) vehicles (examples being left turn, right angle and rear end). Most collisions at this intersection occurred in clear environmental conditions and dry road conditions. The majority of collision reports indicate collisions occurred at this intersection due to unsafe gap selection and/or user judgement error. Unsafe gap selection is the inability of a driver on the stop-controlled approach to recognize oncoming highway traffic, judge their speed and distance (i.e., arrival time) and select safe gaps in the highway traffic stream so that they can safety cross and enter highway traffic.

Contributing factors based on the review may be as follows:

- **Visibility to the left / high eastbound volumes:** The field review found the sight distance is limited due to the crest curve of the overpass and various intruding obstacles. While site lines were found to be sufficient for passenger cars and single unit trucks, drivers may focus their attention on judging gaps in traffic travelling from the west, especially in the morning when volumes are highest and steady, with reduced attention paid to traffic travelling from the east.
- **Stop bar location:** The stop bar is painted well back of the intersection and drivers need to pull closer to have improved visibility to the left.

4.6.3 Highway 2A:06 Eastbound to Northbound Merge

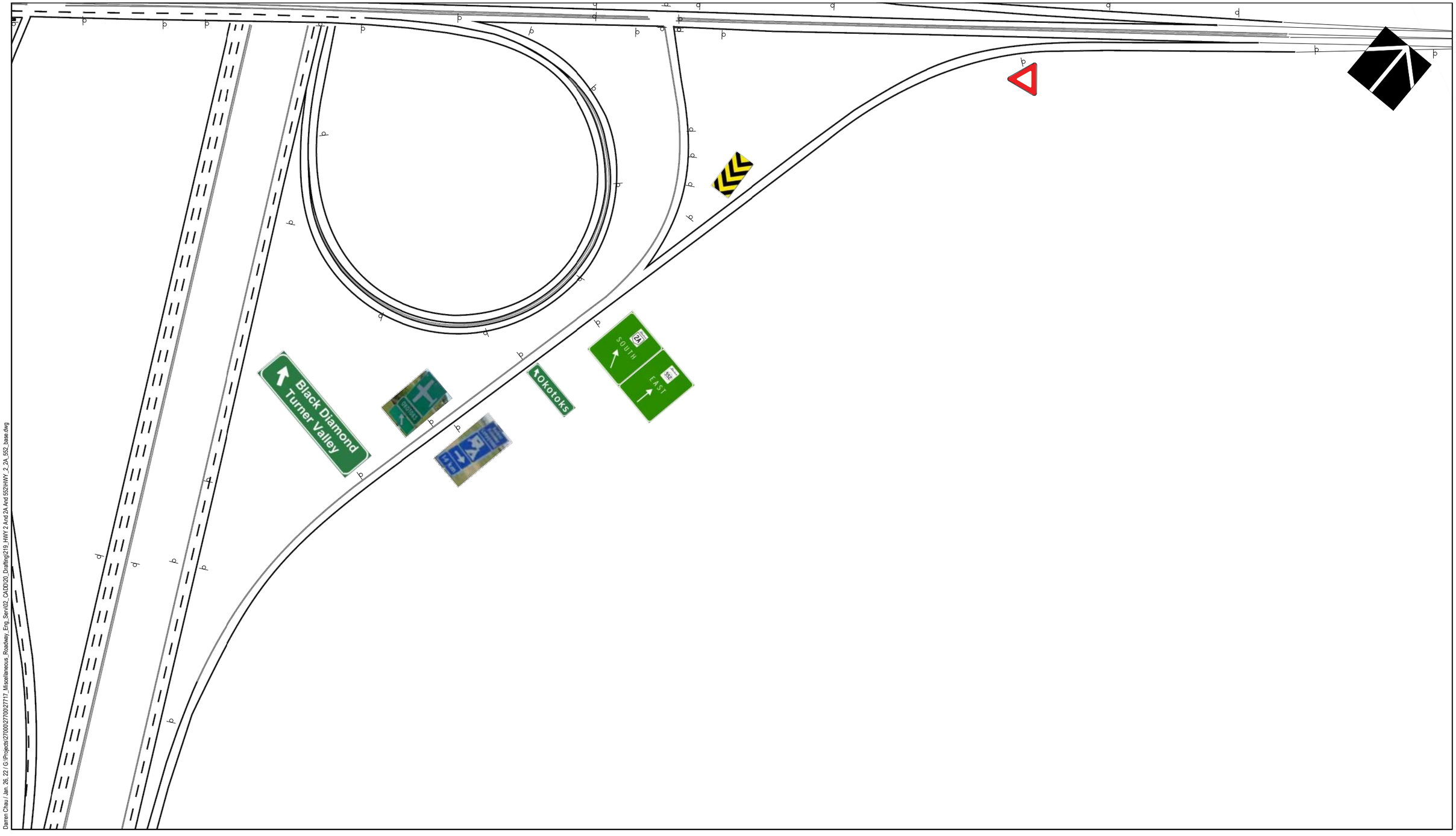
The eastbound to northbound merge from Highway 2A:06 to Highway 2:15 is the location of several same direction sideswipe collisions near the area where vehicles are expected to merge. Most collision reports indicate that collisions occurred either due to speed, unsafe gap selection, user judgement, and/or surface conditions. Environmental conditions (slush/snow/ice or wet surface conditions) may have been a factor in seven (7) of nine (9) collisions. Each collision reported only involved two vehicles. The collisions at this location were all a severity of minor or property damage only with no major collisions.

A contributing factor based on the review may be as follows:

- **Minimal separation at merge:** It was noted in the field review that, where the ramp lanes become parallel with Highway 2:15, there is only a short gore and then a single solid white line separating the entering and through traffic. Typically, the gore for the entering traffic would be much longer, 600 m with a gradual 60:1 taper, extending well beyond the underpass. Increased separation (extending the gore, double white solid lines, physical separation) may mitigate the number of sideswipe/same direction collisions.

5.0 Conditions Diagram

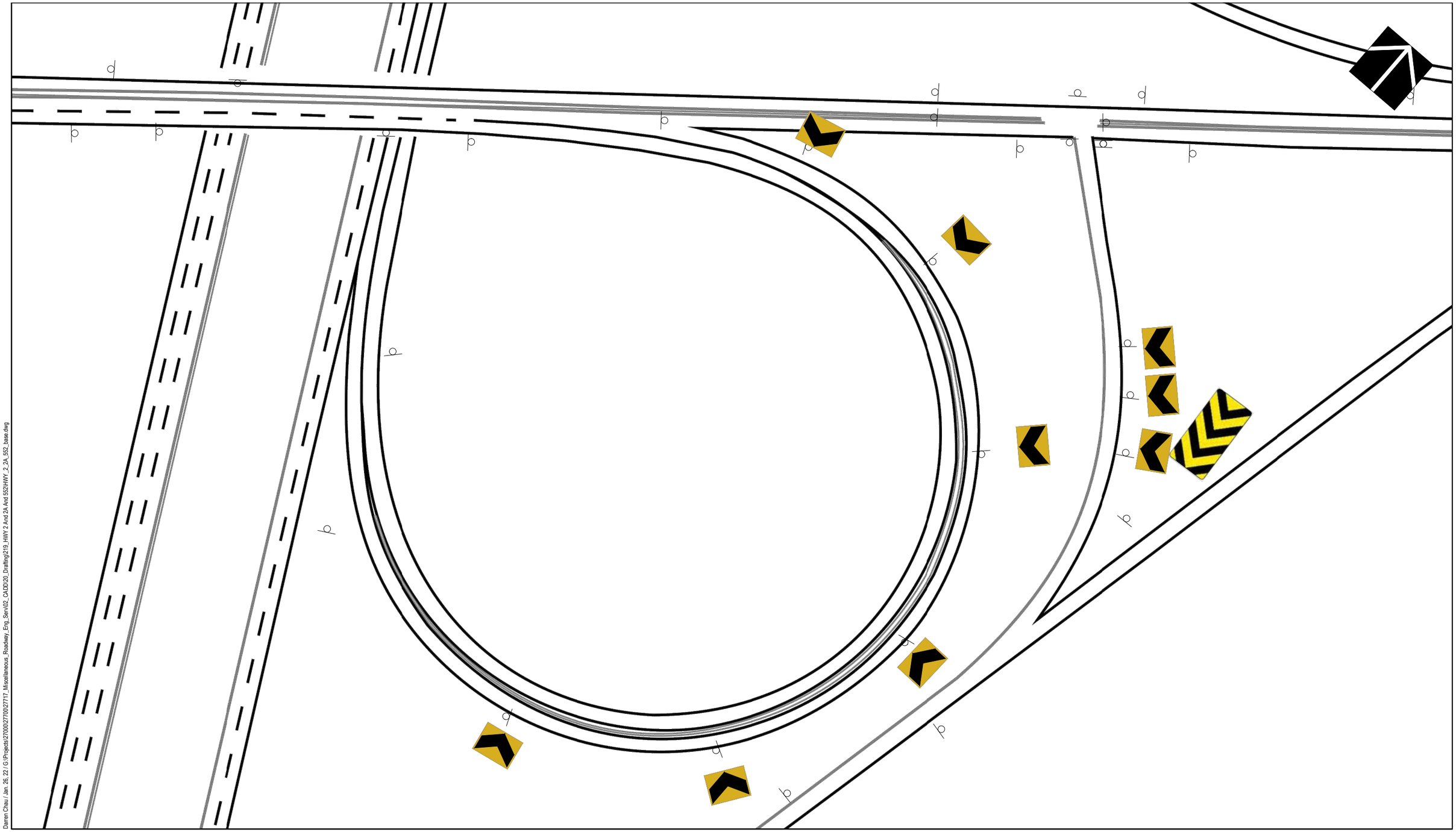
Exhibits 5.1 to 5.10 provide a summary conditions diagram showing traffic control devices, lane markings and rumble strips within each of the interchange segments.



OKOTOKS INTERCHANGE SAFETY AND OPERATIONAL REVIEW

EXISTING SIGNAGE AND PAVEMENT MARKINGS
SECTION 2:12 RAMP NBL / NBR
EXHIBIT 5.1

1:1500

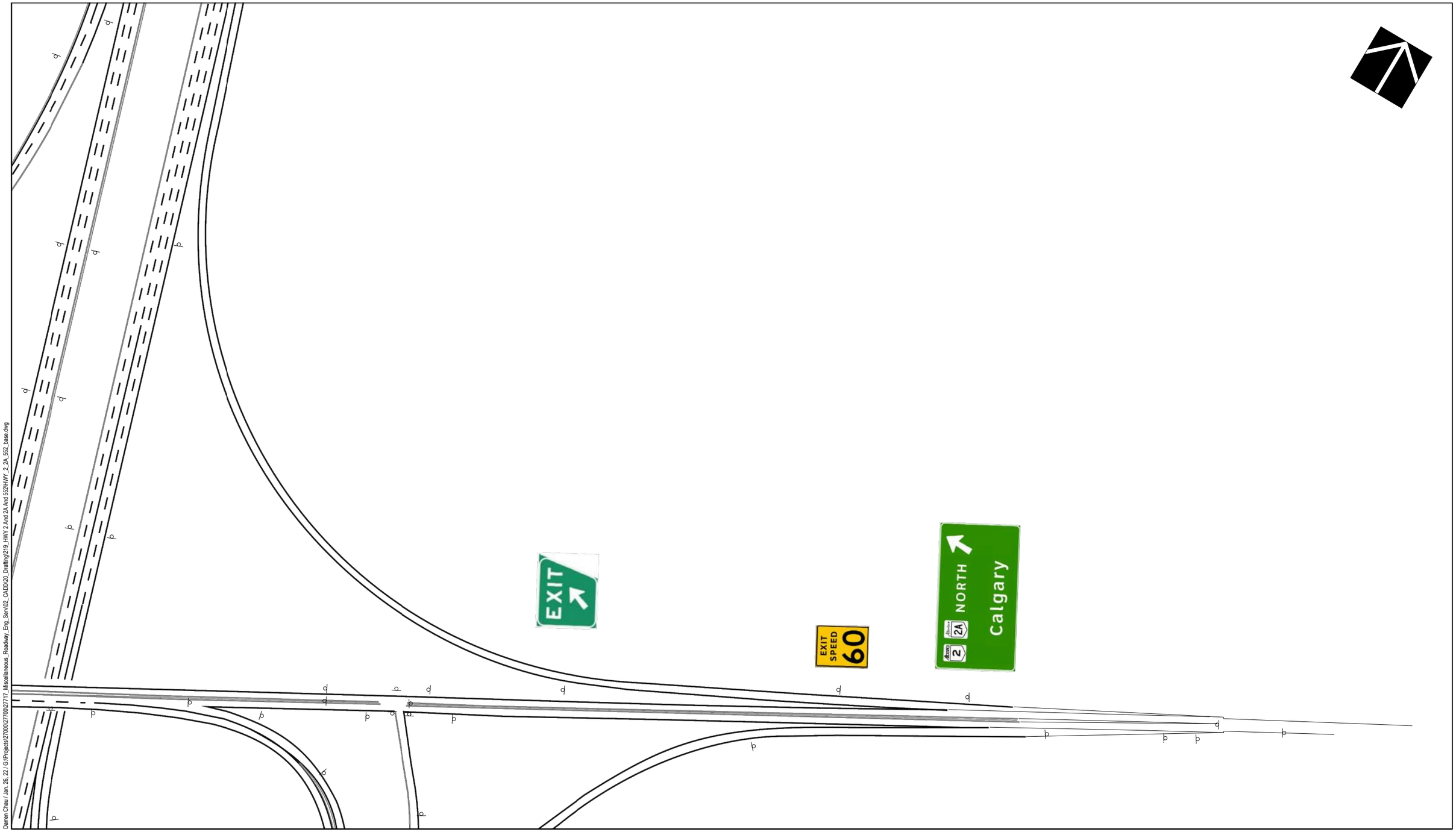


Darren Chau / Jan. 26, 22 / G:\Projects\27000\27700\27700\27717_Miscellaneous_Roadway_Eng_Serv\02_CADD\20_Drafting\219_HWY 2 And 2A And 552\HWY_2_2A_552_base.dwg

OKOTOKS INTERCHANGE SAFETY AND OPERATIONAL REVIEW

1:1000

EXISTING SIGNAGE AND PAVEMENT MARKINGS
SECTION 552:2 RAMP EBR
EXHIBIT 5.2

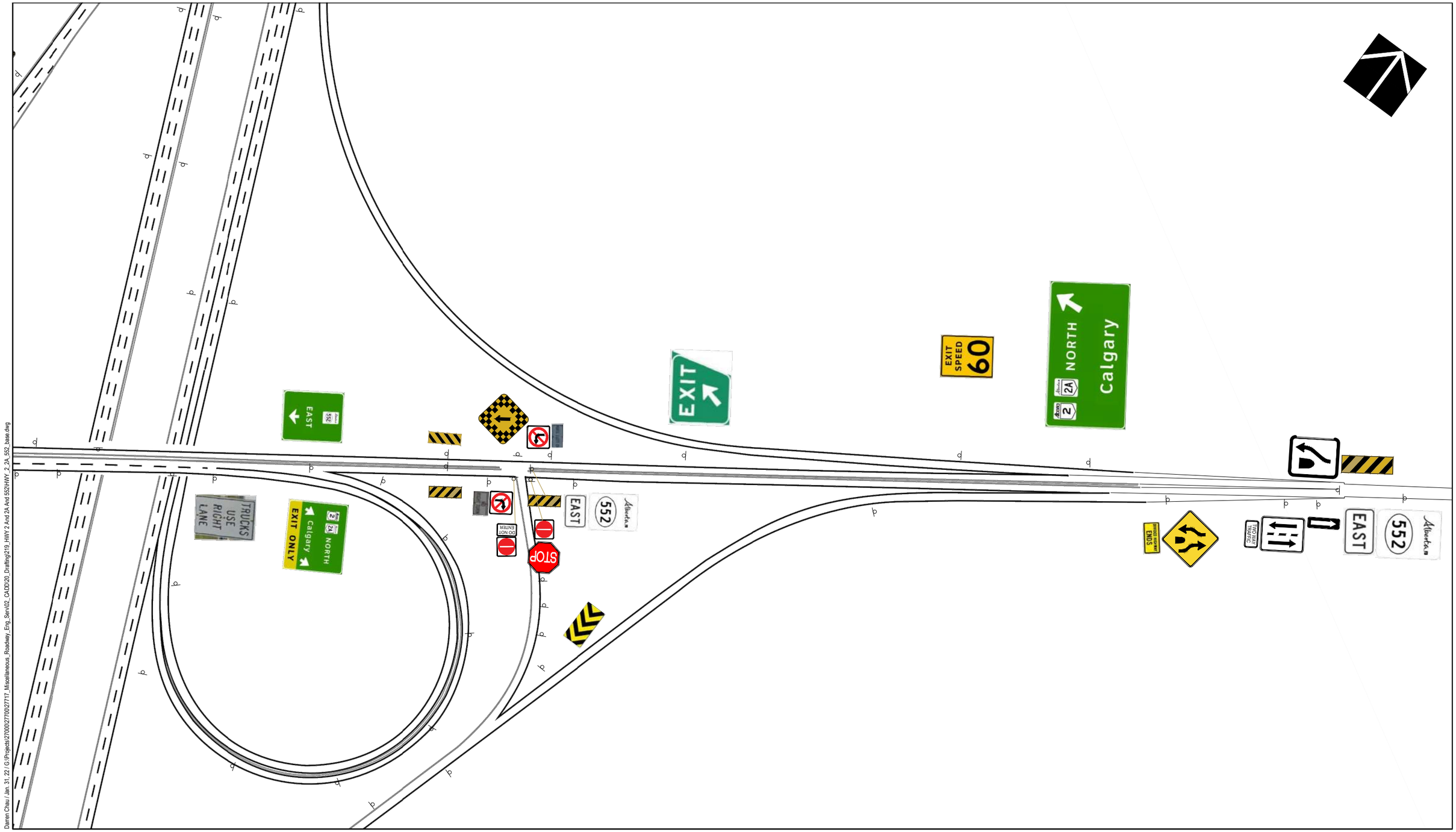


Darren Chiau / Jan. 26, 22 / G:\Projects\27\00\02\77\00\27717_Miscellaneous_Roadway_Eng_Serv\02_CADD\20_Drafting\219_HWY 2 And 2A And 552\HWY_2_2A_552_base.dwg

OKOTOKS INTERCHANGE SAFETY AND OPERATIONAL REVIEW

EXISTING SIGNAGE AND PAVEMENT MARKINGS
SECTION 552:2 RAMP WBR
EXHIBIT 5.3

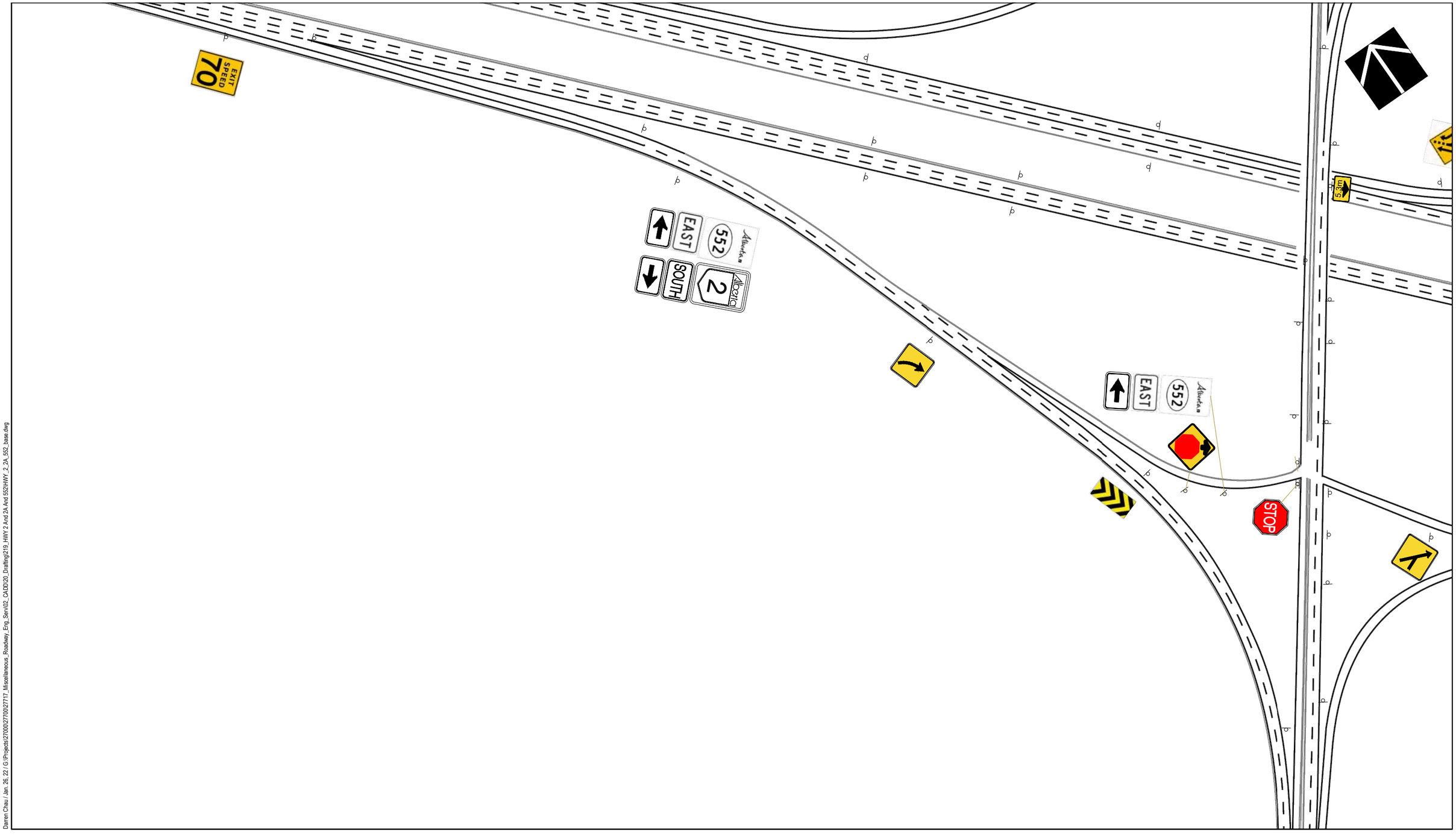
1:1500



OKOTOKS INTERCHANGE SAFETY AND OPERATIONAL REVIEW

EXISTING SIGNAGE AND PAVEMENT MARKINGS
SECTION 552:2
EXHIBIT 5.4

1:1500

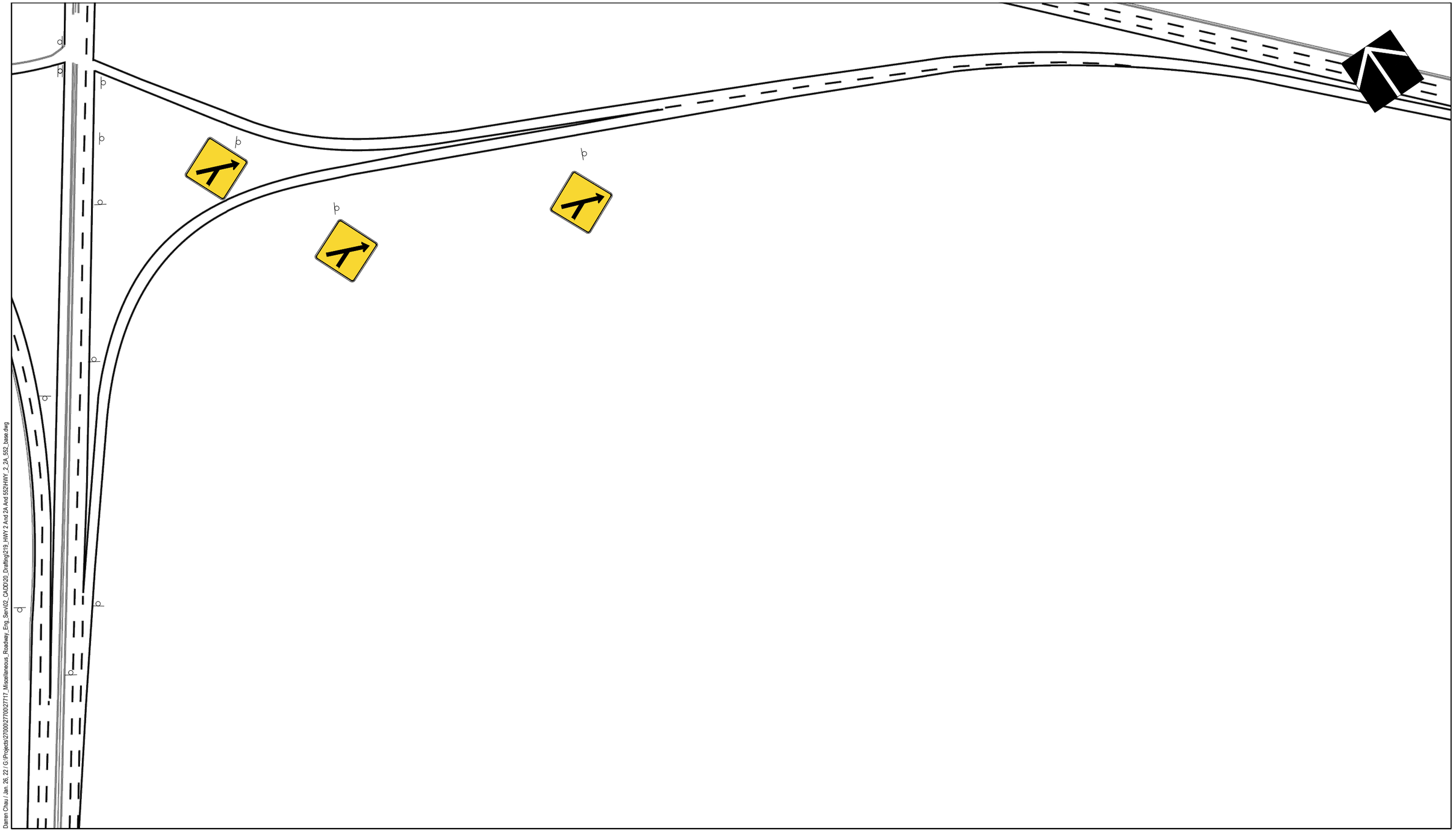


Darren Chau / Jan. 26, 22 / G:\Projects\27000\27700\27717_Miscellaneous_Roadwey_Eng_Serv\02_CADD\20_Drafting\219_HWY 2 And 2A And 552\HWY_2_2A_552_base.dwg

OKOTOKS INTERCHANGE SAFETY AND OPERATIONAL REVIEW

1:1500

EXISTING SIGNAGE AND PAVEMENT MARKINGS
SECTION 2:15 RAMP SBL/SBR
EXHIBIT 5.5

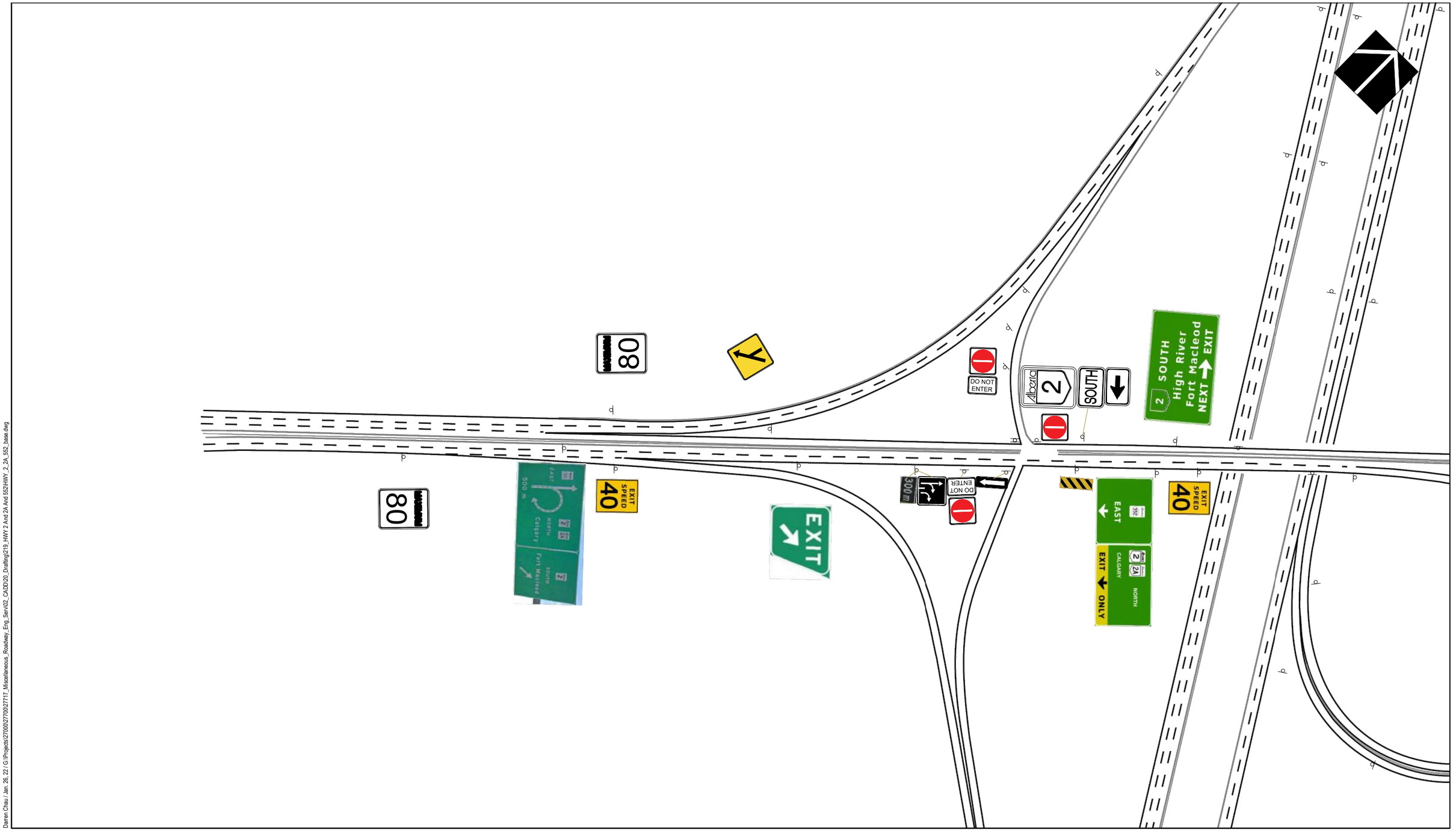


Darren Chau / Jan. 26, 22 / (G:\Projects\27000\27000\27717_Miscellaneous_Roadway_Eng_Servi\02_CADD\20_Drafting\219_HWY 2 And 2A And 552\HWY_2_2A_552_base.dwg

OKOTOKS INTERCHANGE SAFETY AND OPERATIONAL REVIEW

1:1500

EXISTING SIGNAGE AND PAVEMENT MARKINGS
SECTION 2A:6 RAMP EBR
EXHIBIT 5.6

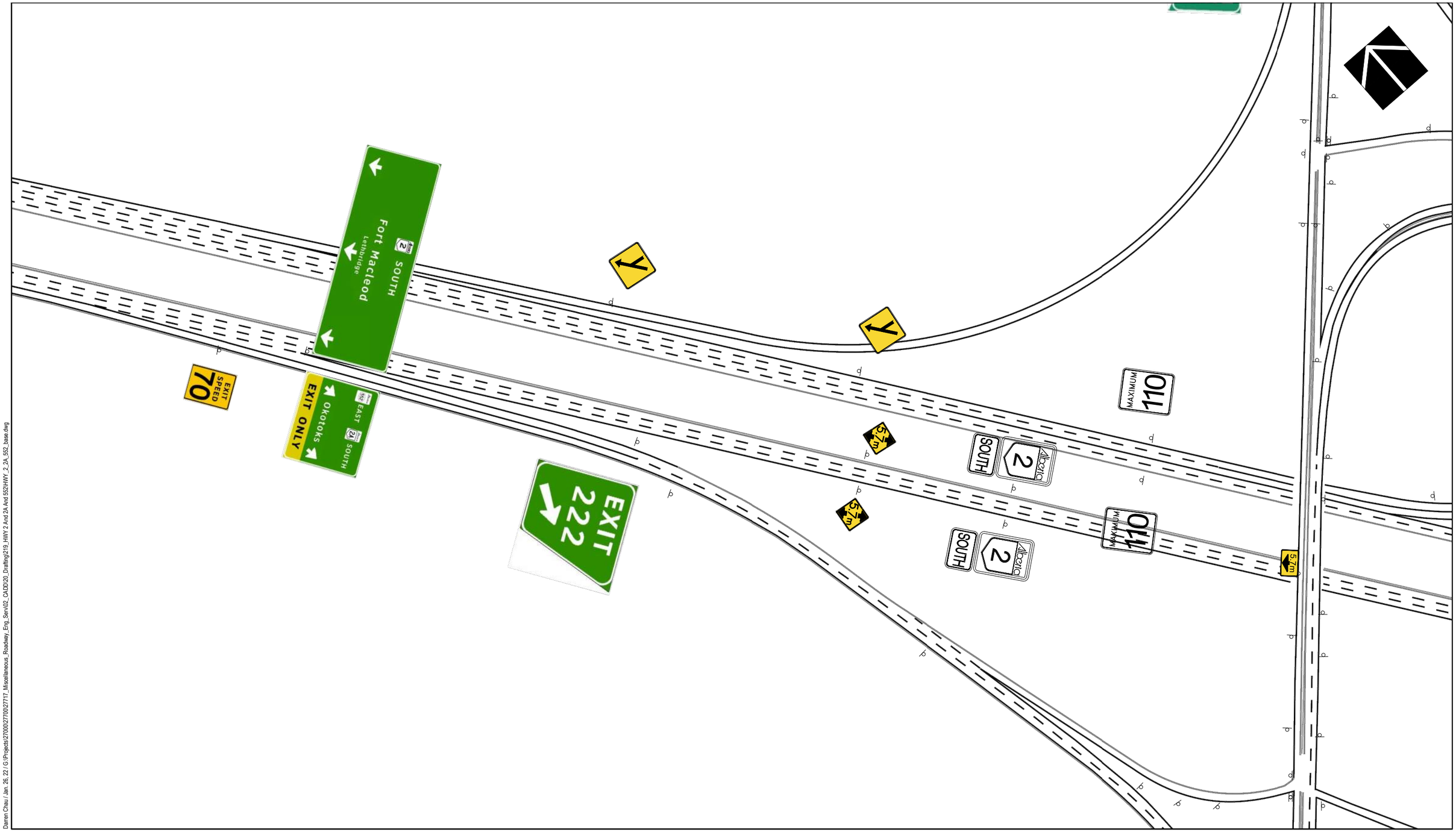


Darren Chau / Jan. 26, 22 / G:\Projects\27000\27700\27717_Miscellaneous_Roadway_Eng_Serv\02_CADD\20_Drafting\219_HWY 2 And 2A And 552\HWY_2_2A_552_base.dwg

OKOTOKS INTERCHANGE SAFETY AND OPERATIONAL REVIEW

EXISTING SIGNAGE AND PAVEMENT MARKINGS
SECTION 2A:06
EXHIBIT 5.7

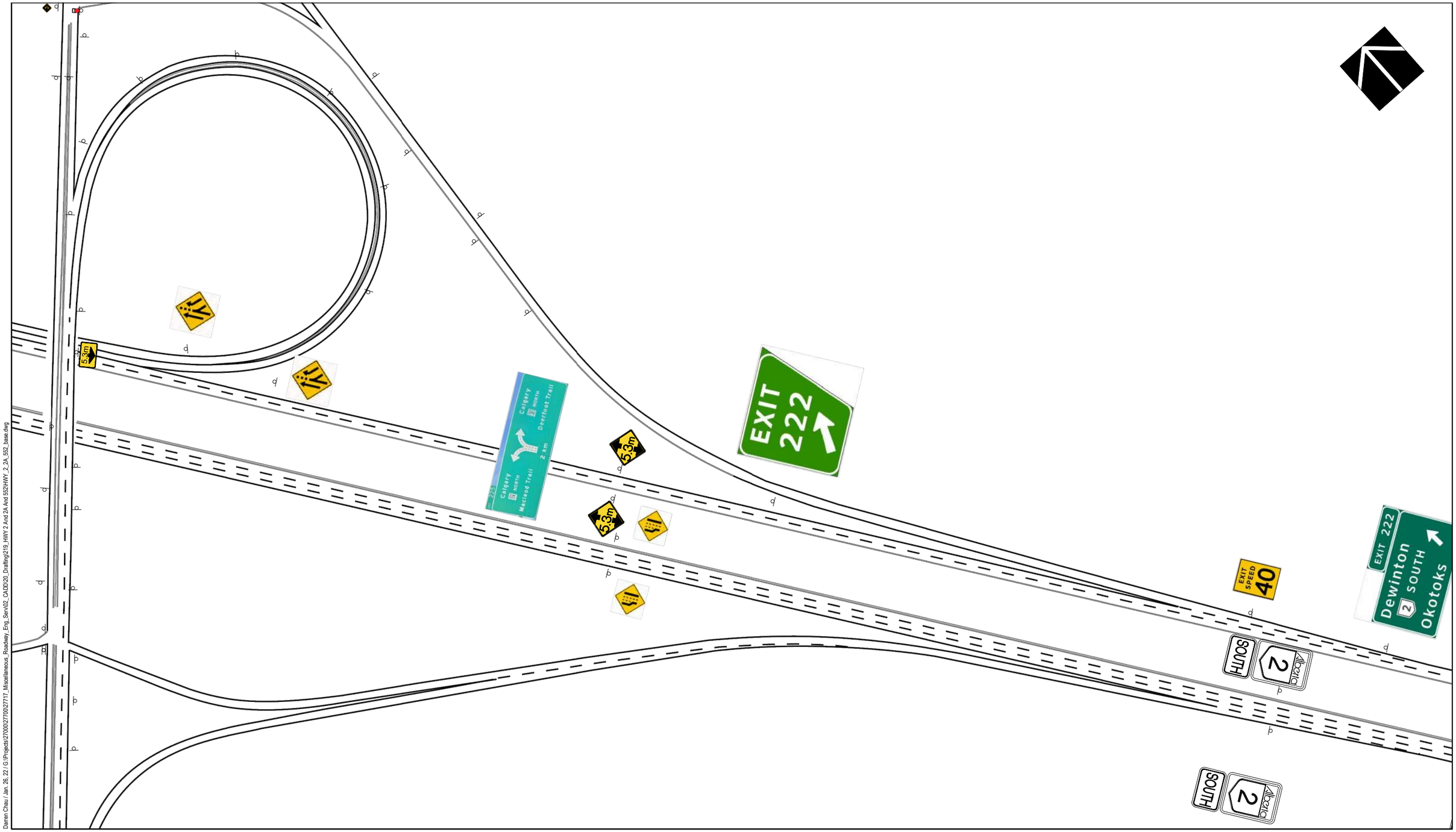
1:1500



OKOTOKS INTERCHANGE SAFETY AND OPERATIONAL REVIEW

EXISTING SIGNAGE AND PAVEMENT MARKINGS
SECTION 2:15
EXHIBIT 5.8

1:1500



Darren Chau / Jan. 26, 22 / G:\Projects\27000\27700\27717_Miscellaneous_Roadway_Eng_Serv\02_CADD\20_Drafting\219_HWY 2 And 2A And 552\HWY_2_2A_552_base.dwg

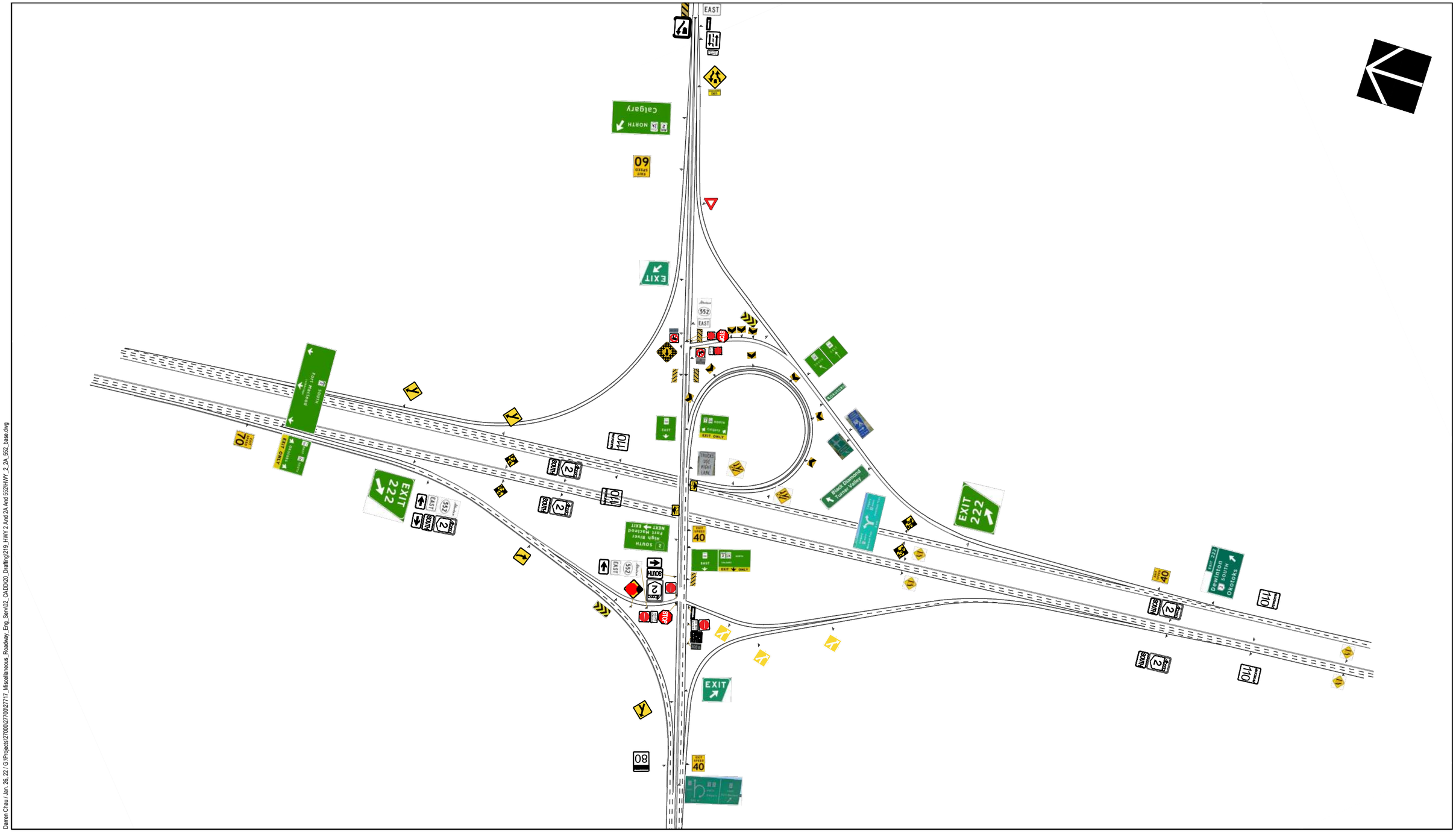
OKOTOKS INTERCHANGE SAFETY AND OPERATIONAL REVIEW

EXISTING SIGNAGE AND PAVEMENT MARKINGS

1:1500

SECTION 2:12

EXHIBIT 5.9



OKOTOKS INTERCHANGE SAFETY AND OPERATIONAL REVIEW

OVERALL MAP

1:1500

EXHIBIT 5.10

6.0 Operational Analysis

Traffic volumes for the operational analysis were based on the 2019, 100th highest hour AM and PM turning movement counts from AT. Volumes include the existing and adjusted volume scenario, with closure of the medians at 306 Avenue, 338 Avenue and 370 Avenue as described in Section 2.3. 2020 volumes were excluded from the analysis due to the significant changes in traffic patterns caused by the COVID-19 pandemic.

6.1 Analysis Methodology

6.1.1 Operational Analysis Methodology

Intersections were assessed using the Trafficware Synchro/SimTraffic 10 software package, which employs methods set forth in the Highway Capacity Manual (HCM). The quality of intersection traffic operations is commonly reported in terms of level of service (LOS) and intersection capacity.

The LOS is based on average total delay per vehicle, and ranges from LOS of 'A' (free flow) to LOS of 'F' (very congested). For rural areas, a LOS of 'C' is generally considered as the acceptable standard for operations, and a LOS of 'D' may be accepted where limited to certain low-volume movements. When intersection operations are below the accepted standard, intersection improvements may be required. LOS criteria for unsignalized intersections are shown in the following table.

Table 6.1: LOS Criteria for Unsignalized Intersections

Level of Service (LOS)	Control Delay per Vehicle (sec)
A	≤ 10.0
B	> 10.0 and ≤ 15.0
C	> 15.0 and ≤ 25.0
D	> 25.0 and ≤ 35.0
E	> 35.0 and ≤ 50.0
F	> 50.0

The capacity of a controlled intersection approach is based on the distribution of gaps in the major road traffic flow, driver judgement in selecting a gap through which to execute the desired maneuver, and the follow-up time required by each driver in a queue. The volume-to-capacity (v/c) ratio is a ratio of the traffic flow for a given lane group to the capacity. A v/c ratio of 1.0 indicates that the flow rate equals the capacity. A v/c ratio of 0.85 or less for all intersection movements is the generally accepted standard for peak hour operations. The HCM 2010 indicates that any traffic movement with a v/c ratio of 1.0 or greater is considered to be LOS F regardless of delay.

Detailed Synchro reports are provided in **Appendix H.**

6.1.2 Warrant Analysis Methodology

Along with intersection delay, v/c ratio and vehicle queuing the following warrants were completed to determine any warranted intersection improvements:

- **Traffic Signals:** TAC's Signal Warrant Matrix.
- **Left Turn Warrant:** AT's Geometric Design Guide, plotted using the appropriate tables given in AT's Geometric Design Guide.

6.1.3 Merge, Diverge and Weaving Analysis

Merge and diverge analysis was completed using MacTrans HCS Analysis 7 software, which applies analysis techniques from the Highway Capacity Manual. Analysis results are stated in level of service (LOS) based on density of passenger cars per mile per lane (pc/mi/ln). LOS for diverge movements is based on the freeway demand and capacity, while LOS for merge segments is based on ramp demand and capacity. Free-flow speed (ffs) for the main line is assumed as the main line posted speed limit and the ffs for the ramp is estimated based on the design speed of the curves for the ramp. For weaving, the split between flows from ramp to ramp (F_{rr}), ramp to freeway (F_{rf}), freeway to freeway (F_{ff}) and freeway to ramp (F_{rr}) is assumed to be 50/50 split in each direction, based on the weaving analysis from the S&ECRTS which indicated a relatively equal split among all origins and destinations on the Highway 2 and Highway 2A corridors, based on the data from the Calgary Regional Transportation Model (RTM).

Detailed HCS reports are provided in **Appendix I.**

6.2 Existing Traffic Volumes Analysis

6.2.1 Operational Analysis

Southbound Ramp Intersection

Table 6.2: Operational Analysis, Southbound Ramp (AM Peak, 2019 Traffic)

Performance Measure	Southbound	Eastbound	Westbound
	T/L	T	T/L
LOS	F	A	A
Delay(s)	56.5	0.0	5.1
V/C	0.38	0.71	0.07
95% Queue (veh)	12.2	0.0	1.8
Intersection LOS	A		

Table 6.3: Operational Analysis, Southbound Ramp (PM Peak, 2019 Traffic)

Performance Measure	Southbound	Eastbound	Westbound
	T/L	T	T/L
LOS	C	A	A
Delay(s)	20.5	0.0	2.0
V/C	0.29	0.33	0.03
95% Queue (veh)	9.2	0.0	0.6
Intersection LOS	A		

In the morning peak period, the southbound left turn experiences a delay of just under a minute and operates at LOS F. Other movements and other times of day fall within expected guidelines.

Northbound Ramp Intersection

Table 6.4: Operational Analysis, Northbound Ramp (AM Peak, 2019 Traffic)

Performance Measure	Eastbound	Westbound	Northbound
	T	T	L
LOS	A	A	A
Delay(s)	0.0	0.0	9.7
V/C	0.06	0.05	0.02
95% Queue (veh)	0.0	0.0	0.4
Intersection LOS	A		

Table 6.5: Operational Analysis, Northbound Ramp (PM Peak, 2019 Traffic)

Performance Measure	Eastbound	Westbound	Northbound
	T	T	L
LOS	A	A	B
Delay(s)	0.0	0.0	10.1
V/C	0.10	0.05	0.01
95% Queue (veh)	0.0	0.0	0.2
Intersection LOS	A		

As shown in the above tables, the northbound ramp intersection operates well within the acceptable guidelines.

6.2.2 Warrant Analysis

Left Turn Warrant

Inputs for the left turn warrant include:

- **Vℓ** - the number of left turning vehicles, which is used to calculate L, the percent left turning vehicles in the advancing traffic stream.
- **Va** - The advancing volume (eastbound).
- **Vo** – the opposing volume (westbound).

Outputs from the left turn warrant include:

- the warranted left turn treatment
- **S** - additional required storage length based on traffic volumes
- **St** - additional required storage length for trucks (HGDG Table D.7.6a)

Additional storage lengths S and St are only considered where a Type IV left turn treatment is warranted. Results of the left turn lane warrant are provided in the following table. The analysis is based on the lowest design speed in the HGDG of 90 km/h and the results are illustrated in **Appendix D**.

Table 6.6: Left Turn Warrant Analysis (Southbound Ramp, 2019 Traffic)

Period	Volumes					HGDG Chart
	Vℓ	Va	L	Vo	Trucks	
AM	13	92	14%	2211	4%	Figure D-7.6-4b
PM	15	91	16%	1046	2%	Figure D-7.6-4b
Recommendation – Type IIIb or IVb						

The opposing volumes (Vo) far exceed the limit of the left turn warrant chart, which has a maximum value of 900 vehicles per hour, compared to the 2,200 vph in this case. Warrant results are provided in **Appendix F**.

Traffic Signal Warrant

- **Southbound Ramp:** The TAC traffic signal warrant procedure was completed using the adjusted AM peak and PM peak traffic volumes, with noon volumes conservatively assumed to be the average of the AM and PM peak volumes. The result of the traffic signal warrant is a value of 94, where a minimum value of 100 is typically required to warrant signals.
- **Northbound Ramp:** The TAC traffic signal warrant procedure was completed using the adjusted AM peak and PM peak traffic volumes, with noon volumes conservatively assumed to be the average of AM and PM peak volumes. The result of the traffic signal warrant is a value of 2, where a minimum value of 100 is required to warrant signals.
- Warrant results are provided in **Appendix F**.

6.2.3 Merge and Diverge Analysis

The results of the merge and diverge analysis at the main entry / exit points are provided in the following table. Merging and diverging movements are stated relative to the mainline (Highway 2).

Table 6.7: Merge and Diverge Analysis (2019 Traffic)

Direction	Type	AM	PM
HWY 552:2 WB HWY 2:15 NB	Merge	B	B
HWY 2A:06 EB to HWY 2:12 SB	Merge	B	A
HWY 2:15 SB to HWY 2A:06 WB	Diverge	B	B
HWY 2:12 NB to HWY 552:2 EB	Diverge	A	A

As shown in the table, the merge and diverge analysis indicates no operational issues.

6.2.4 Weaving Analysis

AM Peak Northbound (HWY 2:15 Northbound)

During the AM peak period significant volumes are travelling from Highway 2A:06 and Highway 2:12 from the south and merge on a common corridor towards the Macleod Trail / Deerfoot Trail fork farther north, creating a major weaving section. The short length (Ls) for the weaving section is approximately 1.8 km, resulting in a density of 24.4 pc/km/ln and falls into the LOS E range, which ranges from 21.9 to 26.9 pc/km/ln. Due to limitations of the HCS, the analysis assumes a two lane on and off ramp with a continuous two-lane freeway, however, the fourth lane is dropped approximately 500 m section before the fork. Therefore, the resulting weaving section is actually less than the Ls value of 1.8 km and therefore the density is likely higher. An obvious measure to improve operations is to extend the fourth lane to the fork. During the field investigation the weaving section did not appear to be operating significantly poorly, although it was noted that observed volumes are still reduced compared to the 2019 baseline volumes used for analysis, due to the COVID-19 pandemic.

PM Peak Southbound (HWY 2:15 Southbound)

Similar to the northbound case, significant PM peak volumes combine from the Macleod Trail / Deerfoot Trail fork onto a common corridor before splitting again between Highway 2A:06 and Highway 2:15 southbound. The short length (Ls) for the weaving section is approximately 1.1, which is shorter than the northbound weaving Ls as the fork extends further south and the diverge point is much further north. The resulting density is 14.9 pc/km/ln and falls into LOS C range, which ranges from 12.5 to 17.5 pc/km/ln. The southbound operations are better than in the AM peak as there is an additional lane (five merging into four) in the weaving section, compared to the northbound segment (four merging into three).

6.3 Adjusted Traffic Volume Analysis

6.3.1 Operational Analysis

Southbound Ramp Intersection

Table 6.8: Operational Analysis, Southbound Intersection (AM Peak, Adjusted Traffic)

Performance Measure	Southbound	Eastbound	Westbound
	T/L	T	T/L
LOS	F	A	C
Delay(s)	362.7	0.0	23.4
V/C	1.25	0.71	0.37
95% Queue (veh)	42.2	0.0	12.2
Intersection LOS	A		

Table 6.9: Operational Analysis, Southbound Intersection (PM Peak, Adjusted Traffic)

Performance Measure	Southbound	Eastbound	Westbound
	T/L	T	T/L
LOS	F	A	A
Delay(s)	53.9	0.0	2.9
V/C	0.67	0.39	0.08
95% Queue (veh)	32.6	0.0	2.9
Intersection LOS	A		

Under the adjusted traffic scenario, the southbound left would operate at LOS F during both the AM and PM peak periods. Other movements at the southbound ramp intersection operate within guidelines.

Northbound Ramp Intersection

Table 6.10: Operational Analysis, Northbound Intersection (AM Peak, Adjusted Traffic)

Performance Measure	Eastbound	Westbound	Northbound
	T	T	L
LOS	A	A	B
Delay(s)	0.0	0.0	10.8
V/C	0.08	0.06	0.14
95% Queue (veh)	0.0	0.0	3.8
Intersection LOS	A		

Table 6.11: Operational Analysis, Northbound Intersection (PM Peak, Adjusted Traffic)

Performance Measure	Eastbound	Westbound	Northbound
	T	T	L
LOS	A	A	B
Delay(s)	0.0	0.0	12.2
V/C	0.15	0.09	0.16
95% Queue (veh)	0.0	0.0	4.4
Intersection LOS	A		

Under the adjusted traffic scenario, the northbound ramp intersection continues to operate well within the accepted guidelines.

6.3.2 Warrant Analysis

Left Turn Warrant

Inputs and outputs for the left turn warrant are similar to what was used for the 2019 scenario. Results of the left turn lane warrant are provided in the following table. The analysis is based on 90 km/h and the results are illustrated in **Appendix D**.

Table 6.12: Left Turn Warrant Analysis (Southbound Ramp, Adjusted Traffic)

Period	Volumes					HGDG Chart
	Vℓ	Va	L	Vo	Trucks	
AM	49	239	21%	2515	4%	Figure D-7.6-4b
PM	36	224	16%	1228	2%	Figure D-7.6-4b
Recommendation – Type IVb with additional storage (~15 m)						

The opposing volumes (Vo) far exceed the limit of the left turn warrant chart, which has a maximum value of 900 vehicles per hour, compared to the 2,515 vph. Warrants results are clearly for a Type IV intersection and additional storage is estimated based on visually extrapolating the chart.

Traffic Signal Warrant

- **Southbound Ramp:** The TAC traffic signal warrant procedure was completed using the adjusted AM peak and PM peak traffic volumes, with noon volumes conservatively assumed to be the average of AM and PM peak volumes. The result of the traffic signal warrant is a value of 190, where a minimum value of 100 is required to warrant signals.
- **Northbound Ramp:** The TAC traffic signal warrant procedure was completed using the adjusted AM peak and PM peak traffic volumes, with noon volumes conservatively assumed to be the average of AM and PM peak volumes. The result of the traffic signal warrant is a value of 24, where a minimum value of 100 is required to warrant signals.

6.3.3 Merge and Diverge Analysis

The results of the merge and diverge analysis are provided in the following table.

Table 6.13: Merge and Diverge Analysis (Adjusted Traffic)

Direction	Type	AM	PM
HWY 552:2 WB HWY 2:15 NB	Merge	B	B
HWY 2A:06 EB to HWY 2:12 SB	Merge	B	A
HWY 2:15 SB to HWY 2A:06 WB	Diverge	B	B
HWY 2:12 NB to HWY 552:2 EB	Diverge	A	A

As shown in the table, the merge and diverge analysis indicates no operational issues under the adjusted traffic scenario.

6.3.4 Weaving Analysis

AM Peak Northbound (HWY 2:15 Northbound)

The change in volume patterns due to the closure of the medians have negligible impact on the weaving section, which operates at LOS E before and after the change.

PM Peak Southbound (HWY 2:15 Southbound)

Similar to the northbound weaving section, changes to volume patterns have negligible impact on the weaving section, which operates at LOS C before and after the change.

7.0 Geometric Analysis

The geometric review was focused on reviewing the existing interchange geometry against the current relevant design standards from the Highway Geometric Design Guide (HGDG).

7.1 Highway Design Requirements

The following table summarizes the geometric elements of each highway as published in the HGDG.

Table 7.1: Geometric Elements of the Highways

	Highway 2:12, 2:15	Highway 2A:06	Highway 552:02
Designation	RFD-616-120	RAD-412.4-90	RAU-209-90
Design Speed	120 km/h	90 km/h	90 km/h
Horizontal Radii (min)	750 m	340 m	340 m
Vertical K Values* (Crest/sag)	95 / 37	39 / 21	39 / 21
Decision Sight Distance	265 – 470 m	230 – 430 m	230 – 430 m

*Crest K are based on Minimum Stopping Sight Distance and Sag K are based on Comfort Minimum Sight Distance for Illuminated Areas

7.1.2 Horizontal Geometry

A review of the horizontal curves was completed using the record drawings provided by AT. It is noted that curves transitioning the highway between undivided and divided, once located to the south, are no longer in place. This are highlighted in the record drawings shown in Appendix G, but not included in the review. The results are summarized in the following table.

Table 7.2: Horizontal Curvature

Reference Curve Location	Horizontal Radius (m)	Meets Standards (Yes/No)
HWY 2:15 @ km 0.970	6,985	Yes
HWY 2A:06 @ km 5.100	388	Yes
HWY 552:02 @ km 0.900	349	Yes

*Curves noted in degree of curvature on the as-builts were converted to radii for readability in the report.

Horizontal geometry on the highways exceed minimum standards.

7.1.3 Vertical Profiles

At the time of this report, no profile as-builts or survey data was available to verify the vertical geometry. Basic on-site observations were used to evaluate these elements.

Stopping Sight Distance

Stopping sight distance is the minimum sight distance available on a highway at any spot having sufficient length to enable the driver to stop a vehicle traveling at design speed, safely without collision with any other obstruction.

Overall sightlines appeared to be mostly unobstructed, with the primary exception being the stricter visibility in both directions of Highway 2A:06 and Highway 552:02 due to the crest curve on the overpass. This affects visibility for turning vehicles at the southbound and northbound ramp intersections and visibility to the physical ramp gore for the exit to the dual lane loop ramp. Detailed technical sightline assessments are provided in Section 3.1.3 (ramps) and Section 3.1.4 (ramp intersections).

Decision Sight Distances

Decision sight distance (DSD) is the distance required for a driver to:

- detect an information source or hazard which is difficult to perceive in a roadway environment that might be visually cluttered;
- recognize the information or the threat potential of a hazard;
- select appropriate action; and
- complete the maneuver safely and efficiently.

Site observation was used in the absence of profile information to confirm if adequate decision site distance is available. The results are summarized in the following table.

Table 7.3: Decision Points at Interchange

Decision Point	Required Distance	Actual Distance (m) (estimated from field)	Meets Standards (Yes/No)
HWY 2:15 SB to exit ramp	265m – 470m	<265 m	No (overhead signs in place)
SB exit ramp diverge point*	230m – 430m	>230 m	Yes
HWY 2:12 NB to exit ramp	265m – 470m	>265 m	Yes
NB exit ramp diverge point*	230m – 430m`	>230 m	Yes
HWY 2A:06 EB to HWY 2:12 SB entrance ramp	230m – 430m	>230 m	Yes
HWY 2A:06 EB to HWY 2:15 NB entrance ramp (dual lane loop)	230m – 430m	<230 m	No (overhead signs in place)
HWY 552:02 WB to HWY 2:15 NB entrance ramp	230m – 430m	>230 m	Yes

*Design speed taken at physical gore with the highway

DSD is not met for the southbound exit ramp from Highway 2:15 to westbound Highway 2A:06, however there is an overhead sign installed at the beginning of the painted gore for the exit, which mitigates this condition.

DSD is also not met for the eastbound exit from Highway 2A:06 to northbound Highway 2:15 via the dual-lane loop, however there is an overhead sign installed at the beginning of the physical gore for the exit, which mitigates this condition.

7.2 Interchange Ramp Elements

As-built drawings provided by AT were used to evaluate the interchange ramp elements. The detailed record drawings are provided in **Appendix G**. The following table summarizes the exit and entrance terminals for the interchange.

Table 7.4: Exit and Entrance Terminals

Location	Existing Exit Taper	Existing Entrance Taper	Standard (HGDG Figure E-2-3-1a)	Meets Standards (Yes/No)
HWY 2:15 SB Exit	96.9 m at 30:1, 150 m parallel lane, 132.5 m at 25:1	-	275m at 25:1	Yes
HWY 2:12 SB Entrance	-	300.5 m at 50:1 taper plus 90m spiral	500 m at 50:1	No (Only meets 100 km/h design speed)
HWY 2:12 NB Exit	288.5 m at 25:1	-	275 m at 25:1	Yes
HWY 2:15 NB Loop Entrance	-	2 lanes added	n/a	n/a
HWY 2:15 NB Entrance	-	500m at 50:1	500 m at 50:1	Yes
HWY 2A:06 EB Exit	243.8 m at 25:1 taper plus 45 m spiral	-	220 m at 20:1	Yes
HWY 552:02 EB Entrance	-	289.6 m at 50:1 taper plus 46 m of spiral	200m at 20:1 (DS=80 km/h) 350m at 35:1 (DS=100km/h)	No (Only meets 60 km/h design speed)
HWY 552:02 WB Exit	243.8 m at 25:1	-	220m at 20:1	Yes

There are two locations where the entrance ramp terminals do not meet the standards for the highways they are entering. A review should be completed to determine if these can be modified, or if a change in posted speed is needed.

It should be noted that several of the ramp terminal lengths include spirals, a practice that is no longer recommended. A review should be completed to determine if the spirals can be moved downstream of the tapers; however, this report acknowledges that this is a complex issue to correct and is only likely to occur if other major modifications are being undertaken at the interchange.

An additional issue is that the ramps on Highway 552:02 overlap with the 274 Avenue intersection. This does not meet current standards and should be reviewed to determine if this can be corrected.

The following table summarizes the ramp geometry and the related design speeds.

Table 7.5: Ramp Curve Geometry

Location	Radius	Design Speed	Presence of Regulatory or Advisory Sign
HWY 2:15 SB Exit Ramp			
On HWY 2:15	-	120 km/h	
At the Physical Gore	-	90 km/h	Ramp Advisory Speed Sign (70 km/h)
First Curve	250 m	80 km/h	
Curve to the Left to Stop Condition	70 m	40 km/h	
Curve to the Right to Free Flow Condition	146 m	60 km/h	
At Physical Gore	-	~79 km/h	
On HWY 2A:06	-	90 km/h	
HWY 2:12 NB Exit Ramp			
On HWY 2:12	-	120 km/h	Ramp Advisory Speed Sign (40 km/h)
At the Physical Gore	-	90 km/h	
First Curve	269 m	80 km/h	
Curve to the Left before Stop Condition	104 m	60 km/h	
Curve to the Right before Merge Condition	175 m	60 km/h	
At Physical Gore	-	~79 km/h	
On HWY 552:02	-	90 km/h	
HWY 2:12 SB Entrance Ramp			
On HWY 2A:06	-	90km/h	Ramp Advisory Speed Sign (40 km/h)
At the Physical Gore	-	~71km/h	
Curve from the West	70 m	40km/h	
Curve from the East	146 m	60km/h	
Final Curve	437 m	90km/h	
At Physical Gore	-	101km/h	
On HWY 2:12	-	120km/h	
HWY 2:15 WB-NB Entrance Ramp			
On HWY 552:02	-	90 km/h	Ramp Advisory Speed Sign (60 km/h)
At the Physical Gore	-	~71 km/h	
First Curve	250 m	80 km/h	
At Physical Gore	-	101 km/h	
On HWY 2:15	-	120 km/h	
HWY 2:15 EB-NB Loop Ramp			
On HWY 2A:06	-	90 km/h	Ramp Advisory Speed Sign (40 km/h)
At the Physical Gore	-	~71 km/h	
First Curve	80 m	40 km/h	
At Physical Gore	-	101 km/h	
On HWY 2:15	-	120 km/h	

*Curves noted in degree of curvature on the as-builts was converted to radii for readability in the report.

7.3 Access Management

Highway 2 has a Freeway roadside management classification. Table I.5 of the HGDG states that public road intersections are not permitted on a Freeway or must have a spacing of 1.6 km for a Future Freeway. There is an at-grade intersection at 306 Avenue, about 3.2 km from the interchange, and meets the standards for a Future Freeway, but not a Freeway.

Highway 2A:06 has a Multi-Lane roadside management classification. Table I.5 states that a public road intersection requires a spacing of 1.6 km. There is an existing at-grade intersection at 16 Street, located 600 m from the ramp tapers which does not meet the standards for this roadway classification.

Highway 552:02 has a Major roadside management classification. Table I.5 states that a public road intersection requires a spacing of 1.6 km. There are three existing accesses:

- at-grade intersection at 274 Avenue, located within the ramp tapers for the interchange, does not meet standards and should be moved east and/or possibly connected to 32 Street, and
- two private accesses located 400 m beyond the ramp tapers, which also do not meet standards for this road classification.

It is recommended that accesses that do not meet the standards for their roadside management classifications be reviewed to determine if they can be relocated. It is understood that this may be a complex issue and may not be able to be undertaken unless there are other major modifications to the interchange.

8.0 Traffic Control Signage and Pavement Markings

The following section provides an overview of existing traffic control signage, pavement markings and rumble strips and is followed by a review of their adequacy, appropriateness, location and size against Alberta Transportation Recommended Practice Guidelines and the TAC Manual of Uniform Traffic Control Devices for Canada (MUTCDC).

The section reviews the following signage:

- **Regulatory signs:** Stop, yield, maximum speed limit, lane designation, one-way, two-way, do not enter, keep right and no right/left turn signage.
- **Warning signs:** Single curve**,** ramp advisory speed, low clearance/low clearance ahead, added lane, lane ends, merge from the right, object marker, divided highway ends, checkerboard, chevron alignment and stop ahead signage.
- **Pavement markings:** Centreline, shoulder line, stop bars, lane divider and gore markings.
- **Rumble strips**

8.1 Summary of Existing Conditions

An inventory of traffic control signage and centreline pavement markings is provided in Exhibit 5.1 to 5.10 for reference and discussed in the following sub-sections. Control km locations and types of signage are summarized in **Appendix D**.

8.2 Regulatory Signage Review

The following sub-sections provide a review of regulatory signage based on the traffic control recommended practices published by AT. Applicable guidance from the recommended practices is summarized at the beginning of each sub-section.

8.2.1 Stop Signs

Need/Guidelines for Use: A stop sign should be installed at the intersection between the highway ramps and the intersecting highway. Stop sign placement requirements are provided in the following table.

Placement: On the right-hand side facing approaching traffic, at or as near as possible to the point where a vehicle is to stop (not closer than 2.0 m to the edge of the road). It shall be placed not farther than 5 m from the roadway edge but not farther than 15 m from the near edge of the intersecting road.

Table 8.1: Stop Sign, Stop Line, and Stop Line Sign Guidelines

Item	Alberta Transportation Guideline
Stop Sign Placement (from edge of intersecting road)	• 2.0 m Min. (Design Bulletin #82/2014) • 15.0 m Max. (Design Bulletin #82/2014) • ≤ 5.0 m Preferred. (2012 Recommended Practice)
Stop Line Placement	• 4.7 m or 4.9 m from nearest lane line (Design Bulletin #56/2007) or, • 1.2 m to 10 m from edge of intersecting roadway. (2013 Recommended Practice)
Stop Line Sign	• Consider when stop sign is ≥ 15 m from stop line

The review of Stops signs is summarized in the following table.

Table 8.2: Stop Signage (RA-1) Review

Location	Intersecting Roadway	Needed	Installed	Notes
Southbound Ramp	Highway 2A:06	Yes	Yes	Painted stop bar could be closer to Highway 2A:06 as noted from the field review.
Northbound Ramp	Highway 552:2	Yes	Yes	

The painted stop bar at the southbound ramp intersection should be moved closed to Highway 2A:06 to improve visibility to the left. As noted in the field investigation, the current stop bar appears to be in a poor location as sight lines to the left (east) are obstructed by a number of objects (signs, streetlight poles, and bridge rail), which is resolved if the vehicle moved closed to the highway.

8.2.2 Yield Signs

Need/Guidelines for Use: To regulate right-of-way control at locations where the normal roadway right-of-way rule does not sufficiently regulate traffic movements and a stop regulation at one or more of the approaches is too restrictive. Where the length of an acceleration lane is less than the specified standard length a yield sign may be justified. Yield signs at the entrance to a freeway may be used (optionally, but not required) where an acceleration lane is less than 50 percent of the standard length.

Placement: For intersections, a yield sign must be installed on the right-hand side of the roadway, facing traffic, no closer than 1.5 m and no further than 15 m from the edge of the intersecting roadway. The preferred sign location is 5 m from the roadway edge. For ramps, yield signs are placed at

The review of Yield signs is summarized in the following table.

Table 8.3: Yield Signage (RA-2) Review

Control Section	Direction of Travel	Needed (as per geometric review)	Installed	Notes
HWY 2:15	Westbound to northbound entrance	No	No	
HWY 2:12	Eastbound to southbound entrance	No	No	Taper design is for 100 km/h design speed (posted 110 km/h).
HWY 552:02	Northbound to eastbound entrance	No	Yes	Taper design is for 60 km/h design speed (posted 80 km/h).

Yield signs are not required at the two ramp entrance points noted as the entrance taper design speed is not less than 50% of the required design speed. Of concern is the yield sign installed at the Highway 552:02 northbound to eastbound entrance as practical implications of vehicles stopping at the entrance needs to be carefully considered against the benefits of a yield sign. In this case, the taper design is only 20 km/h less than the design speed and vehicles not reaching the targeted entrance speed are expected to negotiate their maneuver with adjacent vehicles on the highway but are highly unlikely to come to a complete stop.

8.2.3 Maximum Speed Limit Signs

Need/Guidelines for Use: Indicate the maximum legally permitted speed of a road under ideal driving conditions.

Placement: On the right-hand side in line of sight of approaching vehicles. On divided highways a second sign on left hand side is typically provided. Signs should be a minimum of 6 m from painted shoulder line to nearest sign edge, outside of the sight triangle. Mounting height should be between 1.5 m and 2.5 m from the road surface to the bottom of the sign. The review of Maximum Speed Limit signs is summarized in the following table.

Table 8.4: Maximum Speed Limit Signage (RB-1) Review

Control Section	km #	Direction of Travel/Speed	Needed	Installed	Notes
HWY 2:15	0.117	NB (110 km/h)	Yes	Yes	First sign indicating increase speed to 110 km/h for traffic coming from Highway 552 heading northbound.
HWY 2:12	27.849	SB (110 km/h)	Yes	Yes	First sign indicating increased speed to 110 km/h for traffic coming from HWY 2:06 EB to SB ramp.
HWY 2A:06	5.47	EB (80 km/h)	Yes	Yes	Speed limit repeater sign.
HWY 2A:06	5.555	WB (80 km/h)	Yes	Yes	First sign indicating reduced speed limit for traffic coming from Highway 2:15 SB to WB ramp.

There is no maximum speed limit sign provided for vehicles travelling through the following speed limit changes:

- From Highway 552:02 westbound to Highway 2:15 northbound.
- There are no maximum speed signs for vehicles turning left from the interchange ramps as the first maximum speed limit sign (80 km/h) beyond the interchange are located to the east at 274 Avenue (for eastbound traffic) and west near the southbound ramp merge (for westbound traffic).

8.2.4 Lane Designation Signs

Need/Guidelines for Use: Lane designation signs are used on intersection approaches to indicate permitted and prohibited movements where the permitted movement for one or more of the approach lanes is contrary to the default rules of the road. This may include permission for a movement normally prohibited, prohibition of a movement normally permitted, or both.

Placement: Lane designation signs should be located no more than 50 m in advance of an intersection. When lane designation signs are installed, they should be accompanied by the appropriate lane designation pavement marking arrows. To designate two right-turn lanes, the sign must be placed on the right side of the turn lanes. If there is no median, overhead signs should be used.

The study interchange has one lane designation sign indicating the right lane is forced right and the left lane is shared through and right, ahead of the dual lane loop ramp.

Table 8.5: Lane Designation Signage (RB-47R) Review

Control Section	km #	Direction of Travel	Needed	Installed	Notes
HWY 2A:06	5.734	EB	Yes	Yes	Located 300 m ahead of the exit point

In addition to the ground mounted sign, two sets of overhead signs indicate the lane designation rules, although it is noted that the messaging on each sign differs slightly from the other. Pavement markings are provided to help enforce the lane designation rules. The sign should be relocated east within 50 m of the approach to the dual lane loop ramp.

8.2.5 One-Way Signs

Need/Guidelines for Use: The One-Way sign (RB-21) indicates to drivers that traffic is allowed to travel only in the direction of the arrow on the road or section of road. The sign is typically used to indicate the restriction to intersecting traffic.

Placement: At intersections where the one-way direction is from right to left, One-Way signs must be placed on the near-side right-hand side and far-side right-hand side corners of the intersection to face traffic entering or crossing the one-way road. At intersections where the one-way direction is from left to right, One-Way signs must be placed on the near-side right-hand side and far-side left-hand side corners of the intersection. An oversize One-Way sign must be used where the posted speed is 70 km/h or greater.

The review of One-Way signs is summarized in the following table.

Table 8.6: One-Way Signage (RB-21) Review

Control Section	km #	Direction of Travel	Needed	Installed	Notes
HWY 552:02	0.659	EB	Unlikely	Yes	Designates one-way for two-way road and could cause driver confusion.
HWY 2A:06	5.776	EB	Unlikely	Yes	Designates one-way for two-way road and could cause driver confusion.

The two one-way signs appear to be unnecessary and may potentially be causing driver confusion. They also do not meet the placement requirements as they are placed on the far side of the intersection.

8.2.6 Two-Way Signs

Need/Guidelines for Use: Used to indicate a change from one-way traffic operation to two-way operation, advising motorists that their ability to pass freely is now restricted by opposing traffic. The two-way traffic ahead sign (WB-3) must be used in conjunction with the two-way traffic sign (RB-24) to provide advance warning of two-way traffic operation ahead.

Placement: This sign should be placed on both sides of the road, at each location required. An oversize sign should be used where the posted speed is 70 km/h or greater.

The review of Two-Way signs is summarized in the following table.

Table 8.7: Two-Way Signage (RB-24) Review

Control Section	km #	Direction of Travel	Needed	Installed	Notes
HWY 552:02	0.641	EB	Yes	Yes	Oversized sign is provided.

8.2.7 Do Not Enter Signs

Need/Guidelines for Use: The do not enter sign (RB-23) indicates to drivers that vehicular traffic is not permitted to enter the road beyond the location of the sign.

Placement: Must be conspicuously placed near the end or at the end of a one-way road or ramp to indicate that traffic entry is prohibited. The driver must be given every opportunity to notice a do not Enter sign, because the consequences of missing it could be serious, (e.g., high speed head-on collisions); therefore, redundancy in its use is encouraged. At unsignalized intersections, the do not enter sign must be placed across the intersection on both the left and right sides, facing traffic that could otherwise illegally enter the one-way road. The do not enter sign should be used for absolute conditions with no time restrictions. Where required at intersections, the do not enter sign should be placed at the far corners facing traffic that would otherwise illegally enter the one-way road or ramp.

The review of Do Not Enter signs is summarized in the following table.

Table 8.8: Do Not Enter Signage (RB-23) Review

Control Section	km #	Direction of Travel	Needed	Installed	Notes
HWY 2A:06	5.811	WB	Unlikely	Yes	Appears to be installed to enforce the divided highway flow but not a typical location for this type of sign.
HWY 2A:06		NB (Ramp)	Yes	Yes	
HWY 552:02		SB (Ramp)	Yes	Yes	

Notably, a one-way sign and a do not enter sign are used to enforce the two-way traffic flow condition at the southbound ramp intersection. These signs are not installed at the northbound ramp intersection, which could imply a historical issue of drivers travelling in the wrong direction of travel.

8.2.8 Keep Right

Need/Guidelines for Use: The keep right sign (RB-25R) indicates that traffic is required to pass to the right of obstructions such as medians, islands, or underpass piers.

Placement: The mounting location of the sign depends on the type of obstruction, as follows:

- On a median, the Keep Right/Keep Left sign should be mounted not more than 15 m beyond the approach end,
- On a pedestrian island or intersection channelization island the sign should be mounted at or as close as practicable to the approach end, and
- The sign should be mounted on the face of, or just in front of, a pier or other obstruction in the centre of the road.

When used on a median island, the island should be at least 1.2 m in width. The oversize Keep Right sign should be used where posted speed is 70 km/h or greater.

The review of Keep Right signs is summarized in the following table.

Table 8.9: Keep Right Signage (RB-25) Review

Control Section	km #	Direction of Travel	Needed	Installed	Notes
HWY 552:02	0.675	WB	Yes	Yes	Installed on the start of the median for drivers travelling westbound.
HWY 2A:06	5.347	EB	Yes	Yes	Installed on the start of the median (outside of the study area) for drivers travelling eastbound.

The keep right sign on HWY 552:02 has a flashing light installed for increasing awareness of the median for westbound drivers, who are approaching from a more rural area.

8.2.9 Right/Left Turn Prohibited Signs

Need/Guidelines for Use: The Right Turn Prohibited sign (RB-11R) indicates to drivers that they are not permitted to turn right. The Left Turn Prohibited sign (RB-11L) indicates to drivers that they are not permitted to turn left.

Placement: The Left Turn Prohibited sign (RB-11L) should not be used at approaches to roundabouts to prohibit drivers from turning left onto the circulatory roadway of a roundabout. One-Way signs (RB-21) should be used instead.

The review of Right/Left Turn Prohibited Signs is summarized in the following table.

Table 8.10: Right/Left Turn Prohibited Signage (RB-11) Review

Control Section	km #	Direction of Travel	Needed	Installed
HWY 552:02	0.197	EB	Yes	Yes
HWY 552:02	0.231	WB	Yes	Yes

It is worth noting the right/left turn prohibited signage are not provided at the southbound ramp intersection.

8.3 Warning Signage Review

8.3.1 Ramp Advisory Speed Signs

Need/Guidelines for Use: Motorists are advised of the appropriate ramp speed at the highway exit point with the use of a Ramp Advisory Speed sign. Before a Ramp Advisory Speed warning sign can be introduced, the configuration of the ramp (i.e., curvature, deceleration taper) should be studied to determine the safe travelling speed along the curved portion of the ramp. Where an exit ramp is comprised of two or more successive curves which have a speed differential exceeding 10 km/h, a Curve sign with the speed advisory tab may be introduced to inform motorists about the advised speed reduction.

Placement: Ramp advisory speed signs are typically preceded by a ramp ahead advisory speed sign (WA-10B) placed at the beginning of the ramp deceleration taper, usually at the point where the exit taper is at a 2 m offset. The Ramp Advisory Speed sign is typically placed at the beginning of a curve.

Table 8.11: Ramp Advisory Speed Signs (WA-10A) Review

Control Section	km #	Direction of Travel	Exit Design Speed*	Needed	Installed	Notes
HWY 2:15	0.616	SB	60 – 90 km/h	Yes	Yes	70 km/h
HWY 2:12	28.006	NB	60 – 90 km/h	Yes	Yes	40 km/h (lower than design speed)
HWY 2A:06	5.554	EB (to south)	40 – 90+ km/h	Yes	Yes	40 km/h
HWY 2A:06	5.877	EB (to north)	40 – 90 km/h	Yes	Yes	40 km/h
HWY 552:02	0.459	WB (to north)	~71 – 80+ km/h	Yes	Yes	60 km/h

*Refer to section 7.2

As noted in the table, the ramp advisory speed is too low for the Highway 2:12 northbound exit, which is posted at 40 km/h exit speed compared to a ramp design speed of 60 to 90 km/h. In addition, the Highway 2:15 southbound exit which is posted at a 70 km/h exit speed compared to a 60 to 90 km/h.

Existing Ramp Advisory Speed Signs

The ramp advisory speed signage used at the intersection is an older sign type, which includes the words 'Exit Speed' and is different than the existing standard. This may not be a significant issue, but noted for information. Both are shown in the following figure.

Figure 8.1: Existing sign (Left) vs. Current Standard (Right) for Ramp Advisory Speed Sign

Ramp Advisory Sign Placement

The existing ramp advisory speed signs are placed at or just ahead of the physical gore and do not match current placement standards as follows:

- Ramp ahead advisory speed sign (WA-10B) placed at the beginning of the ramp deceleration taper (where the taper is at a 2 m offset).
- Ramp advisory speed signs installed at the beginning of the first curve.

8.3.2 Turn and Curve Signage

Need/Guidelines for Use: Where an exit ramp is comprised of two or more successive curves which have a speed differential exceeding 10 km/h, a Curve sign with the speed advisory tab may be introduced to inform motorists about the advised speed reduction. Used where the advisory speed on a curve is less than the curve approach (posted) speed based on Table 1 of the turn and curve sign recommended practice. Warn drivers of the presence, severity, and direction of a single curve in the road ahead.
Placement: Placement is based on Table 2 of the turn and curve sign recommended practice.

The following table illustrates the design speed for ramps with more than one curve.

- The differential speed for the first curve is the difference between the mainline approach speed and the design speed of the first curve. Signage may not be needed if the ramp advisory speed sign is installed.
- The differential speed between successive curves on the ramp is the difference between the design speed for the upstream curve and the subject curve.

Table 8.12: Turn and Curve Signage Review

Location	Approach Radius	Design Speed	Needed	Curve Sign Installed	Notes
HWY 2:15 SB Off-ramp					
First Curve	250 m	80 km/h	No	No	Ramp advisory speed (70 km/h)
Curve to the Left to Stop Condition	70 m	40 km/h	Yes	No	Consider WA-2*
Curve to the Right to Free Flow Condition	146 m	60 km/h	Yes	Yes (WA-3)	
HWY 2:12 NB Off-ramp					
First Curve	269 m	80 km/h	Yes	No	Ramp advisory speed (40 km/h)
Curve to the Left before Stop Condition	104 m	60 km/h	Yes	Yes (WA-9)	Consider WA-3*.
Curve to the Right before Merge Condition	175 m	60 km/h	Yes	No	Consider WA-3*
HWY 2:12 SB On-ramp					
First curve	70 m	40 km/h	No	No	Ramp advisory speed (40 km/h).
Curve from the East	146 m	60 km/h	No	No	
Final Curve	437 m	90 km/h	No	No	

*Warrants an advisory speed sign

The following is observed in reviewing the above table:

- **HWY 2:15 SBL Ramp:** Although a WA-2 (sharp curve) sign is needed WA-9 (chevron alignment) signage should be considered at this location, similar to the NBL ramp. Placement requirements for a WA-2 sign mean installation ahead of the curve but this will be on the main ramp and confusing.
- **HWY 2:12 NBL Ramp:** The design speed for the NBL ramp is 60 km/h. WA-9 (chevron alignment signage) is installed at this location and based on field review this seems reasonable.
- **HWY 2:12 NBR Ramp:** WA-3 (curve sign) could be considered for this turn.
- **HWY 2A:06 EBR Ramp:** The approach design speed for 2A:06 is 90 km/h compared with a design speed of 40 km/h for the curve in the ramp. The difference between the approach speed and first curve is 50 km/h and although there is a ramp advisory speed of 40 km/h posted at the ramp, WA-9 (chevron alignment) signs could be considered, similar to those installed on the dual ramp.

8.3.3 Chevron Alignment Signs

Need/Guidelines for Use: Used to provide additional guidance to drivers where there is a change in the horizontal alignment of the road. Should be used where the difference between the posted speed on the approach and the safe speed in the turn or curve (as shown on the advisory speed tab sign) is 35 km/h or greater.

Placement: A minimum of three signs should be provided per curve, and a minimum of two signs should be within the driver's field of view for as much of the curve as possible. The signs should be installed at a height of 1.2 m above the near edge of the nearest traffic lane to the bottom of the sign.

The review of Chevron Alignment signs is summarized in the following table.

Table 8.13: Chevron Alignment Signage (WA-9) Review

Control Section	km #	Direction of Travel	Needed	Installed
HWY 2:12	0.409	NBL Ramp	Yes	Yes
	0.420			
	0.431			
HWY 2A:06	n/a	EBR Ramp	Yes	No
HWY 552:02	0.008	EBL (Dual) Ramp	Yes	Yes
	0.051			
	0.102			
	0.155			
	0.211			
	0.265			

As shown in the above table, WA-9 (chevron alignment) signs could be considered for the eastbound ramp, from Highway 2A:06 to Highway 2:12.

Spacing of Chevron Alignment Signs

Spacing of chevron alignment signs depend on the curve radius and land use context (rural/high speed urban or low speed). Required spacing for signs are summarized in the following table.

Table 8.14: Chevron Alignment Sign Spacing

Control Section	Direction	Existing Spacing	Radius	Recommended Spacing
HWY 2:12	NBL Ramp	~10 m	104 m	30 m
HWY 552:02	EBL Ramp	~55 m	79 m	27 m

For the NBL ramp signs should be further spaced apart and for the EBL ramp additional signs should be installed, at approximately the mid-point between signs.

8.3.4 Low Clearance and Low Clearance Ahead Signs

Need/Guidelines for Use: Low Clearance Ahead and Low Clearance signs must be used at all points where the clearance does not exceed the maximum height of a vehicle plus its load, as permitted under provincial law, by at least 150 mm. In any case, it must be used where the clearance is less than 4.3 m. Vehicle heights are restricted to 4.15.

Placement: The WA-26 (low clearance ahead) sign must be installed in advance of the structure, to indicate a low clearance ahead. The WA-27 sign must be installed on the overhead structure above the lanes where the clearance is insufficient and must be clearly visible from each travel lane passing under the structure.

The review of Low Clearance/Low Clearance Ahead signs is summarized in the following table.

Table 8.15: Low Clearance (WA-27) and Low Clearance Ahead (WA-26) Review

Control Section	km #	Direction of Travel	Needed	Installed	Notes
HWY 2:15	0.021	SB	Technically not required.	Yes	5.7 m clearance.
HWY 2:15	0.252	SB	Technically not required.	Yes	5.7 m clearance.
HWY 2:15	0.252	SB	Technically not required.	Yes	5.7 m clearance.
HWY 2:12	28.368	NB	Technically not required.	Yes	5.3 m clearance.
HWY 2:12	28.663	NB/SB	Technically not required.	Yes	On bridge structure

Although technically not required, vehicle clearance signs are common on AT roadways and should be retained.

8.3.5 Added Lane Signs

Need/Guidelines for Use: The Added Lane sign indicates that two roads converge, and merging movements are not required.

Placement: When used, the sign must be installed in advance of the point of convergence where it is visible from both roads. Where the Added Lane sign is not visible from both roads, such signs must be installed on each road.

The review of Added Lane signs is summarized in the following table.

Table 8.16: Added Lane Signage (WA-35) Review

Control Section	Needed	Installed	Notes
HWY 2:12 NBR Merge at HWY 552:2	Yes	Yes	
HWY 552:2 Merge with HWY 2:15 (dual ramps)	Yes	Yes	
HWY 2:15 SBR Merge at HWY 2A:06	Yes	No	Merge from the right sign installed.

The westbound merge point from Highway 2:15 to Highway 2A:06 is currently signed as merge from the right (WA-16-R), however there is no need to merge as the two lanes continue westbound. An added lane sign is more suitable and was noted to have been present in a 2009 Google Street View photo. It is not clear why the added lane sign was removed and replaced with a Merge sign.

8.3.6 Lane Ends Signs

Need/Guidelines for Use: The Lane Ends sign must be used to advise drivers that the number of travel lanes will be reduced, and a merging maneuver will be required.

Placement: Where the left lane ends, the Lane Ends sign should be installed on the left side of the roadway, where sufficient space is available. On divided roads and one-way roads, Lane Ends signs should be installed on both sides of the roadway to enhance sign visibility in all affected lanes.

- A sign shall be located on each side of the highway located 250 to 500 m in advance of the start of the taper.
- A second set of signs shall be located at the start of the taper indicating the end of the lanes.

The review of Lane Ends signs is summarized in the following table.

Table 8.17: Lane Ends (WA-33) Review

Control Section	km #	Direction of Travel	Needed	Installed	Notes
HWY 2:12	27.725	SB	Yes	Yes	Installed approximately at the start of the taper.
HWY 2:12	28.321	SB	Yes	Yes	Installed ~600 m in advance of the start of the taper.

The locations of the signs generally match AT's recommended practices. A WA-501-T distance tab could be added indicating lane ends in 600 m.

8.3.7 Merge from Right

Need/Guidelines for Use: The Merge sign (WA-16R) indicates that merging movements may be encountered. Two streams of traffic will be required to converge into a single lane ahead.

Placement: The Merge sign must be placed in advance of the point where two roadways converge, and a merging traffic condition is present but not obvious to the driver. The Merge sign must be installed on the side of the road on which merging traffic will be encountered so that it is visible to drivers on both roads, and in such a position as not to obstruct the driver's view of those vehicles about to merge. Where the Merge sign cannot be installed to be visible from both roads, a Merge sign must be installed on each roadway.

Table 8.18: Merge from Right (WA-16-R)

Control Section	km #	Direction of Travel	Needed	Installed	Notes
HWY 2A:06	5.668	WB	No	Yes	Two added lanes, no need to merge.
HWY 2:15	0.26	NB	Yes	Yes	
HWY 2:15	0.405	NB	Yes	Yes	
HWY 2A:06 EBR Ramp	0.123	SB	Yes	Yes	Twisted pole – requires replacement
HWY 2A:06 EBR Ramp	0.12	SB	Yes	Yes	

The existing merge from the right sign for Highway 2A:06 westbound travel should be replaced with an added lane sign.

8.3.8 Object Marker Signs

Need/Guidelines for Use: Used to mark obstructions immediately adjacent to the travel lane or within the road itself, such as bridge piers, introduced medians, curb extensions, wing walls, bridge rail ends, and traffic islands. The WA-36R must be used to mark obstructions on the right side of the road, the WA-36L must be used to mark obstructions on the left side of the road, and the WA-36 marker must be used to mark an obstruction in the road, which may be passed on either side.

Placement: Object Marker signs should be placed as closely as possible to the obstruction itself. When object markers or markings are applied to an obstruction that by its nature requires a lower mounting, the vertical mounting height should vary according to need.

The review of Object Marker signs is summarized in the following table.

Table 8.19: Object Marker Signage (WA-36) Review

Control Section	km #	Direction of Travel	Needed	Installed	Notes
HWY 2:15	0.06	SB	Yes	Yes	At beginning of guard rail under bridge.
HWY 2:15 Ramp	0.329	SBL/R	Yes	Yes	At the split between left and right ramp.
HWY 2:12	28.60	NB	Yes	Yes	At beginning of guard rail under bridge.
HWY 2A:06	5.823	EB	Yes	Yes	On overpass guardrail.
	5.795	EB	Yes	No	On median between east/west lanes. (west ramp intersection)
	5.745	WB	Yes	No	
HWY 552:02	0.153	WB	Yes	Yes	On median between east/west lanes. (east ramp intersection)
	0.221	EB	Yes	Yes	

As noted, hazard markers are missing on Highway 2A:06 westbound marking the median, at southbound ramp intersection.

8.3.9 Divided Highway Ends Signs

Need/Guidelines for Use: The Divided Highway Ends sign (WA-32) indicates the transition from a divided to an undivided road cross-section ahead.

Placement: The Divided Highway Ends sign should be used before the end of a section of divided road as a warning of two-way traffic ahead. The Divided Highway Ends sign should be installed on both sides of the roadway. The Divided Highway Ends sign should be followed by the Two-Way Traffic Ahead sign (WB-3) and the Two-way Traffic sign (RB-24), closer to the transition point.

The review of Divided Highway Ends signs is summarized in the following table.

Table 8.20: Divided Highway Ends Signage (WA-32) Review

Control Section	km #	Direction of Travel	Needed	Installed
HWY 552:02	0.575	EB	Yes	Yes

The divided highway ends signage is appropriate but should be installed on both sides of the highway.

8.3.10 Checkerboard Signs

Need/Guidelines for Use: The Checkerboard signs with directional arrows (WA-8L) indicate an abrupt change of alignment that is more extreme than that associated with turn or curve signing. The black arrow indicates the direction taken by the curve or turn.

Placement: The single direction Checkerboard sign should be installed on the far side of the abrupt turn or curve and should always be located directly in line with the path of the approaching vehicle. When used, the Checkerboard signs should be visible for a sufficient distance to provide the driver with sufficient time to stop or adjust speed to match the alignment.

The review of Checkerboard signs is summarized in the following table.

Table 8.21: Checkerboard Signage (WA-8L) Review

Control Section	km #	Direction of Travel	Needed	Installed
East ramp intersection	0.213	NB	Yes	Yes

The checkerboard signage is appropriate.

8.3.11 Stop Ahead Signs

Need/Guidelines for Use: The Stop Ahead sign must be installed on any approach to an intersection controlled by a Stop sign (RA-1) where the visibility of the stop sign does not exceed the required stopping sight distance.

Placement: Limited visibility due to conditions such as horizontal and vertical curves, parked vehicles, foliage, high vehicle approach speeds, and/or high driver workload approaching the intersection should be considered in determining the need for these signs.

The stopping sight distance requirements are outlined in the following table.

Table 8.22: Sight Distance Assessment (Stopping Sight Distance)

Location	Design Speed	Sight Distance Requirement	Sight Distance Available*	Notes
Southbound ramp intersection	90 km/h	164 m	>300 m	Ramp grades are low and sightlines are good.
Northbound ramp intersection	90 km/h	164 m	>200 m	Sightlines obstructed due to the northbound ramp grades.

*Estimated from field observations

The review of Stop Ahead signs is summarized in the following table.

Table 8.23: Stop Ahead Signage (WB-1) Review

Control Section	km #	Direction of Travel	Needed	Installed
Southbound ramp	0.021	SBL	No	Yes
Northbound ramp		NBL	No	No

The stop ahead sign installed exceeds the requirements.

8.4 Pavement Markings

Centreline, Shoulder Line, Lane Delineation

Exhibits 5.1 to 5.10 identify the centreline, shoulder line and lane delineation. Stop line placement review can be found in Section 3.1.4.

Gore Markings

Need/Guidelines for Use: Where there are pavement transitions from two-lane undivided to four-lane divided highways (and vice versa), chevron markings shall be used. Typically, on divided highways with an AADT exceeding 12,000, chevrons are provided at all gore areas adjacent to the through lanes (i.e., the merge and diverge areas on the main alignment).

Placement: Placement of gore marking should follow the Alberta Highway Pavement Marking Guide, with 200 m gore markings at 3 m spacing.

Merge and diverge points on Highway 2 meet the minimum threshold (12,000 AADT) to require gore marking and these are provided as needed. Gore markings are also provided on Highway 552:02 and Highway 2A:06 at the merge and diverge points, which help to delineate the movement, although may not be technically required. Placement of gore markings appear to meet the standard spacing requirements.

8.5 Rumble Strips

Need/Guidelines for Use: Shoulder rumble strips can be placed on multi-lane highways to reduce off-road collisions. They are not typically located on overpass structures but can be considered in critical locations such as approaches to narrow bridges, gore areas or impact attenuators. Centreline rumble strips are appropriate on horizontal with a collision history or where a double solid painted line exits, demarcating a no passing zone.

Placement: For multi-lane highways, rumble strips are placed on the right shoulder where there is a minimum of 1.4 m and on the left shoulder where there is a minimum of 0.6 m.

A review of rumble strips are as follows:

- Left shoulder rumble strips are installed on Highway 2:15, in the southbound direction and on the right shoulder of the southbound Highway 2:15 southbound right turn ramp.
- Centreline rumble strips are installed on the dual lane ramp, between the double solid white line implying this is a no passing zone.

The existing locations of the rumble strips appear to be appropriate.

Additional consideration for rumble strips could be made within the left shoulder below the overpass as there appears to be more off-road left collisions relative to other section of the highway. In addition, rumble strips could be considered between the northbound Highway 2:15 through lanes and the entry lanes from the dual lane ramp as a measure to discourage early lane changes.

9.0 Cyclist Accommodation

The following section provides a review of the overpass in terms of accommodation of cyclists, as more frequent use of the overpass by cyclists is expected with the planned future closures of the medians at 308 Avenue, 338 Avenue and 370 Avenue. The review is based on relevant sections of the HGDG.

9.1 Accommodating Cyclists (Overpass)

Need/Guidelines for Use: Requirements for accommodating cyclists are provided as follows:

- **Shoulder Width:** The roadway shoulder is the portion of the roadway running adjacent to the travel lanes, performing a variety of functions. This space can be used by cyclists, although is not primarily designed for cyclists. When a shoulder is provided the width requirements are found in Table C-3a of the HGDG based on the roadway classification.
- **Accommodation on Bridges:** The HGDG identifies that a dedicated cycling facility within a bridge structure is needed if it already exists (in the case of a bridge replacement), where a network plan is in place that identifies the bridge connection is within the dedicated cyclist network, or where safety concerns exist.
- **Drive Lanes:** In most urban conditions (UAD classification) AT may consider the installation of a 4.3 to 4.5 m wide drive lane compared to a typical 3.5 to 3.7 m wide drive lane, allowing for concurrent side-by-side use of cyclists and vehicles.

Applicability: The following table summarizes the requirements for accommodating cyclists based on comparing the requirements outlined in the HGDG and the existing conditions.

Table 9.1: Cyclists Accommodation Requirements (Overpass)

Need/Guidelines	Existing Conditions	Requirement (where a shoulder is provided)
Shoulder Width	Eastbound – Narrow Westbound – ~1.8 m	RAU (HWY 552:02) Classification = 1.0 m RAD (HWY 2A:06) Classification = 2.0 m*
Accommodation on Bridge	No facilities exist other than the westbound shoulder.	There is no existing network plan identifying the overpass as part of a larger cycling network.
Wide Drive Lanes	Eastbound/Westbound lanes = ~3.7 m	Not located in an urban setting, therefore the conditions for a wide drive lane do not apply.

*2.0 m based on a design speed of 120 km/h (no value provided for 90 km/h design speed)

Discussion: The following discusses the need to accommodate cyclists:

- **Shoulder Width:** Sufficient shoulder width is provided in the westbound direction, but there is effective no shoulder in the eastbound direction. If a shoulder is provided in the eastbound direction it should be at least 2.0 m. A wide shoulder is provided on Highway 2A:06 leading up to the overpass but does not continue on the overpass.
- **Accommodation on Bridges:** A separated cycling facility is not required on the bridge.
- **Drive Lanes:** A wider drive lane is not warranted.

9.2 Accommodating Cyclists (Ramp Diverge Points)

Accommodating cyclists at ramp diverge points is a challenge that exists all through the highway network and the responsibility to complete this movement is left to the cyclist. Completing the maneuver is further challenged where cyclists traveling in the eastbound direction and continuing eastbound on Highway 552:02 must cross the dual lanes ramps at the diverge point.

9.3 Cyclist Accommodation Summary

As per the analysis, on the overpass it was found that sufficient shoulder width is provided in the westbound direction for cyclists based on the HGDG and roadway classification. In the eastbound direction the shoulder is narrow (effectively zero). There is minimal space for installing a shoulder on the bridge structure and widening the bridge to create a shoulder is not a realistic and/or practical option. In addition, providing a shoulder would not resolve the issue of having cyclists cross the dual lane ramp exit. The province could consider widening the overpass as part of future long-term improvements. It should be noted that the future 338 Avenue interchange, which is currently in the functional planning stage, is expected to accommodate better cyclists.

10.0 Conclusions and Recommendations

10.1 Study Synopsis

Alberta Transportation initiated a safety and operational review for the interchange of Highways 2:15 / 2:12 / 2A:06 / 552:02, which is located between Calgary and Okotoks and is referred to in this report as the Okotoks interchange or study interchange. A summary of content included in this review follows:

- **Field Investigation:** A field investigation was completed on Wednesday, January 12, 2022, for observing highway corridors, intersections and interchange ramp elements; observing traffic operations and driver behavior; collecting data on sightlines; and observing conditions and placement of other components (traffic controls, pavement markings, barriers, illumination, rumble strips etc.).
- **Collisions:** A review of historical collision data was completed for the most recent available six (6) year period from 2013 to 2018. Review of collision totals, rates, type, severity, temporal factors, locations and other items as needed.
- **Traffic operations:** Operations of existing traffic and an adjusted scenario that considers traffic diversion resulting from the potential closure of the medians on Highway 2 at 306 Avenue, 338 Avenue and 370 Avenue, south of the study interchange. The operational review included technical analysis of ramp intersections (delay, left turn warrants, signal warrants) and highway operations (ramp merging/diverging, and weaving).
- **Geometry:** Focus on reviewing the existing interchange geometry against the current relevant design standards from the Highway Geometric Design Guide (HGDG), including horizontal geometry, vertical profile, ramp geometry (exit, entrance, and design speed) and access management.
- **Traffic controls:** Review of adequacy, appropriateness and placement against Alberta Transportation Recommended Practice Guidelines and the Manual for Uniform Traffic Control Devices for Canada (MUTCDC).
- **Cyclist Accommodation:** Review of the requirements for accommodating cyclists on the overpass, based on the HGDG.
- **Deficiency Summary:** A summary of deficiencies based on the study results are provided in Appendix K.

10.2 Collision Review Key Findings

The following provides a summary of key findings from the detailed collision history and is intended to provide context to the technical review of the traffic operations, geometric review and traffic control reviews:

- **Collision totals / rates:** 134 collisions occurred within the interchange area and 108 collisions are reported as non-animal. AT reports that the 108 non-animal collisions are lower than the average of 112 collisions for interchanges in the province. Although the total is lower, the 144.3 collisions per million vehicles entering (MVE) is much higher than the 106.6 MVE expected value. In addition, the nine (9) major injury collisions are higher than the expected amount of four (4), based on information provided by AT.

- **Major collisions:** Of the nine (9) major injury collisions there does not appear to be any obvious geometric contributing factors for five (5) of the nine (9) records as three (3) collisions occurred due to driver error (travelling at a high rate of speed, violating a stop sign), one (1) due to a vehicle mechanical issue and one (1) due to an animal. The remaining four (4) of the nine (9) collisions appear to be related to surface conditions (snow, slush and/or ice).
- **Temporal factors:** Collision totals are highest through the Fall and Winter seasons, especially in the months of October, November, and December. The number of collision occurrences is highest from 7:00 to 8:00 AM, 2:00 to 3:00 PM, and 5:00 to 7:00 PM, when traffic volumes are highest.
- **Total Collisions (Poor vs. dry surface conditions):** The number of collisions in dry conditions and poor conditions (slush/snow/ice) are fairly comparable. This could indicate that a geometric condition exists causing the number of collisions in dry conditions to be similar to the number of collisions in poor conditions. The proportions are reiterated as follows:
  - 41% of collisions occurred in poor conditions (slush/snow/ice).
  - 43% of collisions occurred in dry conditions.
- **Injury Collisions (Poor vs. dry surface conditions):** The total number of injury collisions in dry conditions and poor conditions (slush/snow/ice) is fairly comparable.
  - Four (4) major injury collisions and eight (8) minor injury collisions occurred in poor conditions (slush/snow/ice).
  - Three (3) major injury collisions and thirteen (13) minor injury collisions occurred in dry conditions.
- **Interchange Orientation and Sun Glare:** The orientation of the interchange provides only a narrow time window near the beginning of summer and winter each year when sun glare could be a factor. However, no collisions occurred during times and day when this could have been the case, and thus is not likely a contributing factor or issue at this location.
- **Collisions on the overpass:** Approximately 31% (34 of 108) of non-animal collisions occurred on the overpass. Collision events were reviewed in detail, resulting in better understanding potential contributing factors, such as:
  - **Speed changes:** Travel speeds may be abruptly changing as vehicles are slowing to enter the dual lane loop ramp. The design speed for the dual lane loop ramp is 40 km/h (see section 7.2), which can create a potential abrupt speed change from Highway 2A:06, which has a much higher design speed of 90 km/h.
  - **Forced right turn:** The eastbound right lane is forced to turn right onto the loop ramp, and this may be increasing the number of vehicles completing late / abrupt lane changes. Although there are several visible signs warning of the lane condition, it was found that the decision sight distance from the highway to the physical gore is less than the required decision site distance (see section 3.1.3), which verifies a potential for drivers to make an abrupt lane change.
  - **Trucks (use right lane):** A sign indicating trucks use right lane is located at the end of the loop ramp where it connects to Highway 2 northbound, and may result in trucks completing a sudden / late lane change as this is the only sign indicating the rule.
  - **Limited maneuvering space:** Limited maneuvering or shoulder space is available within the overpass for vehicles to avoid other collisions or objects which could also increase the number of collisions with poor surface conditions.
- **Southbound ramp intersection collisions:** Several right angle and left turn across path collisions occur at this intersection. These collision events were reviewed in detail to understand potential contributing factors, such as:

- **Visibility to the left / high eastbound volumes:** The field review found the sight distance to the left (east) is limited due to the crest curve of the overpass. While site lines were found to be sufficient for passenger cars and single unit trucks, drivers may focus their attention on judging gaps in traffic arriving from the right (west), especially in the morning when volumes are highest and there is a steady flow of vehicles.
- **Stop bar location:** The stop bar is painted well back of the intersection and drivers need to pull closer to have improved visibility to the left as there are signs, poles and other items obstructing visibility.

- **Eastbound to northbound dual lane loop ramp merge collisions:** Several side-swipe same-direction collisions occur at the merge between the dual lane loop ramp and Highway 2:15. Collision events were reviewed in detailed, resulting in better understanding potential contributing factors, including:
  - **Minimal separation at merge:** It was noted in the field review that as the ramp lanes become parallel with Highway 2:15, there is only a short gore and then a single solid white line separating the entering and through traffic. Typically, the gore for the entering traffic would be much longer, 600 m with a 60:1 taper, extending well past the underpass. Increased separation (extending the gore, double white solid lines, physical separation, rumble strips) may mitigate the number of sideswipe / same direction collisions.
  - **Right lane drop:** Approximately 1,200 m north of the ramp entry, the right-hand lane of the dual ramp lane drops which may be causing drivers to feel anxious about needing to complete early lane changes while at lower speeds than the main highway lanes. With no separation and only a single painted white line at the merge point, there is little discouragement from doing so. Extending the lane further north (approximately 800 m) to the Macleod Trail / Deerfoot Trail fork could reduce some lane changing requirements.
  - **Weaving:** Traffic entering Highway 2:15 from the dual lane loop is negotiating with traffic already on Highway 2:15 to diverge at the Macleod Trail / Deerfoot Trail fork located about 1.5 km north of the study interchange. The weaving segment operates at LOS E during the AM peak. This may be causing drivers to feel pressure and merge from the dual lane ramp onto Highway 2:15 while not fully at speed.

10.3 Summary of Other Findings

Notable findings from a review of interchange elements (geometry, ramp elements, merge, diverge), traffic analysis (operations, warrants), traffic controls (signage, pavement markings, rumble strips), barriers and illumination against relevant best practices and standards are summarized in the follow sections.

10.3.1 Highway and Ramps

Highway Geometry

- **Horizontal Geometry:** Horizontal geometry on the highways exceeds minimum standards.
- **Vertical Profile:** At the time of this report, no profile as-builts or survey data was available to verify the vertical geometry. Sight observations were used to evaluate these elements. Overall sightlines appeared to be mostly unobstructed, with the exception of sightlines at the two interchange ramp intersections in the direction of the crest curve on the overpass, and visibility to the physical ramp

gore for the exit to the dual lane loop ramp. Detailed technical sightline assessments from the field review are provided in Section 3.1.3 (ramps) and Section 3.1.4 (ramp intersections).

Highway 2:15 Southbound Right Turn Ramp to Highway 2A:06 Westbound

- **Southbound Diverge/Exit:** The available DSD to the ramp gore is limited by the crest curve on Highway 2:15 and is less than 265 m. Although the recommended DSD is not met, there is an overhead sign placed above the painted gore for the second exit lane that help drivers to be aware of the upcoming ramp exit.

Highway 2:12 Northbound Right Turn Ramp to Highway 552:02 Eastbound Intersection

- **274 Avenue:** This intersection is immediately following the merge from Highway 2:12 onto Highway 552:02. The south leg of the intersection is a field access. The north leg is 274 Avenue which is a local road that provides access to a handful of country residential properties. The location of the access does not meet AT's access management requirements (see access management review in Section 7.6), which requires a spacing of 1.6 km. The existing spacing from the ramp intersection is approximately 470 m and this intersection should be moved further east to meet the access management spacing or if possible connected to 32 Street.

Highway 2A:06 Eastbound Left Turn Ramp (Dual lane loop)

- **Eastbound Diverge / Exit:** On Highway 2A:06, in the eastbound direction, the right lane is forced into the loop ramp and, although there are several warning signs indicating the condition, unfamiliar drivers may still not realize this and need to make an abrupt lane change.
  - The left-hand eastbound lane of Highway 2A:06 prior to entering the loop ramp is a shared through / left lane. Vehicles entering the ramp slow down before entering the ramp. Through vehicles that don't expect the vehicle in front of them to slow down may not slow down quickly enough and cause a rear-end collision.
  - The ramp design speed is 40 km/h compared to an approach design speed of 90 km/h which may be causing vehicles to slow down significantly on the approach.
  - The recommended DSD for Highway 552:02 is 230 m. The available DSD to the ramp gore is limited by the crest curve on Highway 2A for the overpass and is less than 230 m. Although the recommended DSD is not met, there are multiple overhead signs, including an overhead sign placed above the physical gore that help drivers to be aware of the upcoming ramp exit.
- **Northbound Entry:** As the ramp lanes enter and become parallel with Highway 2:15, there is only a short gore and then a single solid white line separating the entering and through traffic. There is no lateral separation or physical obstruction between entering loop traffic and through traffic. Typically, the gore for the entering traffic would be much longer, 600 m with a 60:1 taper, extending well past the underpass. The single white line may not be effective at deterring entering slower drivers from merging into the through Highway 2 lanes early.

10.3.2 Intersections

Southbound Ramp Intersection (Highway 2:15 Southbound Ramp @ Highway 2A:06)

- **Westbound left turn (observations):** There is no dedicated left turn lane for westbound Highway 552:02. Considering the 80 km/h speed limit, a westbound driver may not feel comfortable stopping in the shared lane to make a left turn across two lanes with nearly constant oncoming eastbound

traffic, especially in the morning peak period. The lack of the dedicated left turn lane may increase the probability of there being rear end collisions.

  - **Westbound left turn warrant:** Due to high volumes in the eastbound direction, a left turn is warranted with a IVb geometry. The exact type of geometry is not shown on Figure D-7.6-db of the HGDG as the opposing volume (Vo) value far exceeds the limit of the warrant chart.
- **Left turning sightlines:** ISD to the left (east) from the ramp approach is limited by the vertical crest curve on the bridge. Sightlines for passenger vehicles are insufficient if stopped at the existing stop bar location which is too far back from the intersection, but is improved if the driver pulls further ahead. The sightlines for a WB-21 are insufficient in either case.
- **Operations (observations):** Judging the availability of a gap in traffic may be challenging during the peak hours when there is a near constant flow of eastbound traffic on Highway 2A:06. The eastbound traffic is distributed across two lanes, however a vehicle at the ramp stop bar may not know if an approaching eastbound vehicle is in the inner or outer eastbound lane.
  - **Operations (analysis):** Traffic operations for the southbound left turn operate at LOS F during the AM peak period. This is due to the significant volumes of traffic travelling on Highway 2A:06 from the west and limited gap acceptance opportunity for vehicles turning left. Traffic operations degrade further with closure of the medians at 306 Avenue, 338 Avenue, 370 Avenue due to additional volumes rerouted to the study interchange, decreasing gap availability further for southbound left turning vehicles.
- **Signal warrant analysis:** Traffic signals are not warranted in the existing scenario but are warranted in the adjusted volume conditions, with closure of the medians. Traffic signals would likely resolve the delay issues for southbound left turning vehicles, but would then significantly impede and generate large queues for eastbound traffic on Highway 2A:06 and described as follows:
  - Improvements gained for southbound left turning traffic from operating a traffic signal were tested and verify that delays will improve from LOS F with the existing stop control to LOS D with signals in both the existing and adjusted traffic volumes scenarios. Although improved for southbound left turning traffic, significant congestion is generated for traffic on Highway 2A:06, with 95th percentile queue lengths estimated at 153 m with existing volumes and growing to over 400 m with adjusted volumes.
  - From testing a traffic signal, it is apparent that the operational/safety benefits gained for southbound left turning vehicles will likely generate new operational/safety concerns for eastbound traffic on Highway 2A:06. While it is recognized that current southbound left turning delay is a concern and a traffic signal may resolve this, safety and congestion implications for eastbound through vehicles outweigh the value of installing a signal.
  - Detailed Synchro reports are provided in Appendix H.
- **One-way sign:** A one-way sign is located on the southside of Highway 552:02 near 274 Avenue and on the southside at the southbound ramp intersection. The one-way signs appear to be unnecessary and could potentially be causing driver confusion.
- **Stop Bar:** The stop bar appears to be in a poor location as sight lines to the left (east) are limited. Signs, streetlight poles, and bridge rail obstruct the view of oncoming traffic. This can be largely resolved if the vehicle pulls forward to get a better view of oncoming traffic, however, it was found that sight lines are still inadequate for WB-21 vehicles. Regardless, it would be beneficial if the stop bar were moved closer to the intersection.
- **Traverse rumble strips (intersection approaches):** To enforce the stop condition at the ramp intersection and reduce speeds approaching the intersection traverse rumble could be installed.

- **Do Not Enter Sign (RB-23):** A do not enter sign (RB-23) is on the back of the stop sign, somewhat blurring the shape of the stop sign. The RB-23 should be put on a separate post is possible

Northbound Ramp Intersection (Highway 2:12 Northbound Ramp @ Highway 552:02)

- **Operational observations:** Traffic volumes on Highway 552:02 are relatively low and gaps are readily available, however, a driver's perception of the gaps is challenged due to the proximity of this intersection to the dual loop ramp exit. It is difficult for a driver to judge whether an eastbound vehicle on the overpass will exit onto the loop ramp or continue travelling eastbound on Highway 552:02. This can reduce the effective gap that a driver has to make a left turn from the ramp onto Highway 552:02.
- **Left turning sightlines:** Similar to the southbound ramp intersection**,** ISD to the left (west) is limited by the vertical crest curve on the overpass and appears to be insufficient for WB-21 vehicles.
- **Do Not Enter Sign (RB-23):** Similar to the southbound ramp intersection, a do not enter sign (RB-23) is on the back of the stop sign, somewhat blurring the shape of the stop sign. The RB-23 should be put on a separate post if possible.

10.3.3 Highway 2 and 2A Weaving

- **Northbound:** Highway 2:12 (two lanes) connect with Highway 2A:06 (dual lane ramp) in the northbound direction and split at a major fork into Macleod Trail (Highway 2A, two lanes) and Deerfoot Trail (Highway 2, two lanes) approximately 1.5 km north of the study interchange. Based on forecast data from the S&ECRTS, traffic flows from both southern corridors mix relatively equally through the weaving section and split approximately 50% in each direction to the northern corridors, causing weaving and turbulence of traffic flow in this segment. HCS weaving analysis of this segment found it operates with LOS E during the critical AM peak period, although operations may be worse due to the lane drop which occurs 500 m before the fork. This segment is expected to further degrade, operating at LOS F within the 10-year horizon based on the S&ECRTS (refer to Section 2.5). During the field investigation the weaving section did not appear to be operating significantly poorly, although this may be related to reduced traffic volumes resulting from the COVID-19 pandemic.
- **Southbound:** North of the study interchange, southbound Macleod Trail (Highway 2A, two lanes) merges with southbound Deerfoot Trail (Highway 2, three lanes), with a significant volume of traffic connecting from both corridors before mixing and splitting again between Highway 2A:06 or Highway 2:12 at the study interchange. Weaving analysis found that this segment operates at LOS C during the critical PM peak. The segment is expected to degrade to LOS E within the 10-year horizon based on the S&ECRTS (refer to Section 2.5). It was observed to operate with no issues during the field investigation. The southbound weaving LOS C is better than the northbound weaving LOS E primarily because there is one more lane available through the southbound weaving segment compared to northbound.

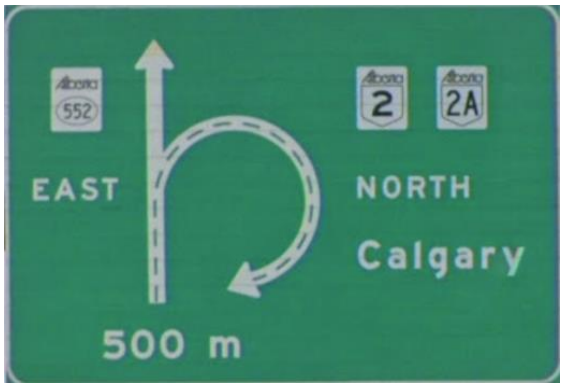
10.3.4 Traffic Control Signage Review

The general condition review of traffic control signage is detailed in Section 3.2. Detailed traffic control signage information is available in **Appendix D**.

Key findings from the detailed technical review of traffic control signage are as follows:

- **Maximum Speed:** There is no maximum speed limit sign provided for vehicles travelling through the following speed limit changes:
  - After merging from Highway 552:02 westbound to Highway 2:15 northbound, although the first speed limit sign is close to the overhead sign for the MacLeod Trail/Deerfoot Trail fork.
  - For vehicles turning left off either interchange ramp, as the first maximum speed limit signs (80 km/h) in both directions are located beyond the next following ramp entrances.
- **Lane Designation Sign:** The eastbound lane designation for the dual ramp loop ramp is approximately 300 m west of the ramp diverge point and should be relocated east within 50 m of the dual lane loop ramp.
- **Yield Sign:** The design taper for the northbound right to entrance at Highway 552:02 eastbound is not less than 50% of the entrance design speed of 90 km/h, therefore the yield sign that exists is not required.
- **Ramp advisory speed signs:** The ramp advisory speed is too low for the Highway 2:12 northbound exit, which is posted at 40 km/h exit speed compared to a ramp curve design speed of 60 to 90 km/h. In addition, the Highway 2:15 southbound exit advisory speed of 70 km/h is too high compared to a 60 to 90 km/h design for the ramp curves.
  - Placement: The existing ramp advisory speed signs are placed at or just ahead of the physical gore and do not match current placement standards which is that a ramp ahead advisory speed sign (WA-10B) is placed at the beginning of the ramp deceleration taper (where the taper is at a 2 m offset) and the ramp advisory speed sign is installed at the beginning of the first curve.
- **Turn and curve signs:** Turn and curve signs for interchange ramps can be considered where there is a differential speed between consecutive curves. A review of curves within the ramps is as follows:
  - Highway 2:15 SBL Ramp: WA-9 (chevron alignment) signage should be considered at this location, similar to the NBL ramp. A WA-2 is necessary based on the curve, but placement requirements would place it main ramp which curves to the right and would be confusing for drivers.
  - Highway 2:12 NBL Ramp: The design speed for the NBL ramp is 60 km/h. WA-9 (chevron alignment signage) is installed at this location and based on field review this seems reasonable.
  - Highway 2:12 NBR Ramp: WA-3 (curve sign) could be considered for this turn.
- **Chevron alignment signs:** For the Highway 2A:06 eastbound dual lane loop ramp the approach design speed is 90 km/h compared with a design speed of 40 km/h for the curve in the ramp. The difference between the approach speed and first curve is 50 km/h and although there is a ramp advisory speed of 40 km/h posted at the ramp, WA-9 (chevron alignment) signs are appropriate.
  - Placement: Additional signs should be installed to provide a spacing of 27 m compared to 55 m existing.
- **Merge from the right (Highway 2:15 to Highway 2A:06):** The Highway 2:15 southbound to westbound ramp lanes (southbound right movement) enter westbound Highway 2A:06 with a lane away configuration and no merging is needed. The 3-lane cross-section for westbound Highway 2A:06 continues until the 290 Avenue intersection. Where the ramp lanes join with westbound Highway 2A:06, there is a merge sign (WA-16R), however, no merge is required. A better sign for this location would be the added lane sign (WA-35R), which appears to have been previously installed but was changed sometime after 2009.

- **Object marker signs:** Hazard markers are missing on HWY 2A:06 marking the median and in the westbound direction, at west ramp intersection.
- **Highway 2A:06 (Eastbound):** The overhead diagrammatic sign could be replaced with an updated diagrammatic sign showing only one lane continuous to the east. The thickness of the arrow implies that both lanes continue east. The existing sign is shown below.



Highway 2A:06 (overhead sign)

10.3.5 Pavement Markings and Rumble Strips

Centreline, Shoulder line, Lane Delineation

Exhibits 5.1 to 5.10 identify the centreline, shoulder line and lane delineation.

Rumble Strips: Rumble strips could be considered for the northbound left shoulder below the overpass as there appears to be more off-road left collisions relative to other section of the highway. In addition, centreline rumble strips could be considered between double solid white lines if these were added from the dual lane loop ramp and extended further north on Highway 2:15 as a measure to mitigate early / lower-speed lane changes.

10.3.6 Barriers

- **Overpass:** Box beam barrier is installed within the centre of the overpass. One of the support posts within the overpass section of the barrier is broken away from the box beam and twisted. This post should be replaced.
- **Overpass to Ramp Intersections:** Between the overpass and ramp intersections, weak post W-beam guardrail is installed on the north and south sides, however, this type of barrier is no longer used by AT for new construction. Turn down end treatments are installed but no longer used by AT for new construction.
- **Sand/gravel:** On both sides of Highway 2A/552, there is a buildup of sand/gravel/grass under the guardrail. Although this is unlikely to impact the effectiveness of the guardrail, it may impede drainage.

10.3.7 Illumination

Streetlights appear to be operational when it is dark. No deficiencies were observed with the streetlight operation. Many of the painted steel poles had significant corrosion. Some streetlights were out of plumb, especially those on the right-hand side of the eastbound to southbound ramp (only spot check completed). The handhole covers for several poles were observed to be partially open or missing completely. In one case, the handhole cover was taped in place.

10.3.8 Cyclist Accommodation

At the overpass it was found that sufficient shoulder width is provided in the westbound direction for cyclists based on the HGDG and roadway classification. In the eastbound direction the shoulder is narrow. There is minimal space for installing a shoulder on the bridge structure and widening the bridge to create a shoulder is not a realistic and/or practical option. In addition, providing a shoulder would not resolve the issue of having cyclists cross the dual lane merge ramp. The province could consider widening the overpass as part of future long-term improvements. It should be noted that the future 338 Avenue interchange, which is currently in the planning stages, is expected to accommodate cyclists.

10.4 Key Safety Related Findings

- **Key Finding #1 – (From Highway 2A:06 dual ramp diverge to split at Highway 2/2A):** Several contributing factors appear to be influencing safety within this segment and are outlined as follows:
  - Dual lane loop ramp diverge: The Highway 2A:06 approach design speed of 90 km/h (posted 80 km/h) is 50 km/h greater than the dual ramp design speed of 40 km/h. The large speed variance combined with the less than required decision sight distance (DSD) appear to be a contributing factor to the concentrated number of rear end and off-road collisions in this area. This condition was verified in our field investigation as several vehicles approaching the diverge display brake lights and appeared to be slowing abruptly. Another contributing factor may be that the right-hand lane is forced onto the ramp, and while overhead signage and ground mounted lane designation signs communicate this condition, it may still lead to drivers completing late lane changes.
  - Dual lane loop ramp merge @ Highway 2:15: The merge point from the dual lane loop ramp onto northbound Highway 2:15 has a minimal approach gore and minimal separation with parallel traffic on the mainline. Drivers are entering from the dual lane loop ramp with a design speed of 40 km/h compared with Highway 2:15 with a design speed of 120 km/h, without the typical 60:1 entry taper, resulting in a significant speed differential between traffic lanes. The large speed differential and minimal separation between lanes are likely contributing factors to the high number of side-swipe / same direction collisions at this location.
  - Weaving segment: Another contributing factor to the number of side-swipe collisions is the congested weaving conditions (LOS E) through the northbound segment of Highway 2:15. Concern about being unable to execute needed lane changes further north near the fork may be contributing to drivers changing lanes too early, while they are still driving relatively slowly compared to Highway 2:15. The presence of some slower vehicles including large trucks which need more distance to accelerate up the hill may also cause some drivers to behave over-aggressively and execute multiple lane changes to “get around” slower vehicles.

- **Key Finding #2 – Southbound ramp intersection (left turn sight distance):** A number of right angle and left turn across path collisions have occurred at this intersection. Limited sight distance to the left due to the crest curve of the overpass, combined with significant challenges to judge a gap in traffic due to high eastbound traffic volumes may be a contributing factor to the type of collision occurring. These conditions were verified in our field investigation and through the traffic operations analysis indicating this movement operates at LOS F. The traffic operations for this movement are expected to be further degraded with closure of the medians at 306 Avenue, 338 Avenue and 370 Avenue due to the volume of traffic diverted to this intersection with a no alternative access to areas east of Highway 2 and north of the Sheep River. Longer delays can cause drivers to become impatient and accept smaller or riskier gaps in order to complete the delayed movement.
- **Key Finding #3 – Major collisions:** AT's collision database reports the threshold for the number of major collisions as four (4) for this interchange, compared with an actual count of seven (7) collisions occurring over a six (6) year period. In reviewing the detailed collision descriptions for the major collisions, three (3) of these are related to poor surface conditions, one (1) is due to a vehicle mechanical issue and one (1) is due to an animal. The remaining two (2) are due to driver error including travelling a high rate of speed and failing to stop at southbound ramp stop sign. Although the number of collisions (4) is higher than expected (7), two (2) are related to driver error (speed, failure to stop) and two (2) are related to random events (animals, mechanical issues) and no obvious deficiency appear to be contributing factors to these events.
- **Key Finding #4 – Northbound ramp intersection:** Drivers turning left at this intersection have obstructed sightlines due to the crest curve of the overpass. Drivers turning left may also have trouble judging the availability of a gap in approaching traffic as many of these vehicles enter the eastbound to northbound dual loop ramp instead of continuing eastbound on Highway 552:02. Traffic entering the loop ramp is steady and some of the vehicles entering the ramp do not signal as was noted in the field review. If a vehicle at the stop bar decides to go and then realizes that an approaching vehicle is continuing eastbound on Highway 552:02, they have limited time to clear the eastbound lane before the approaching eastbound vehicle arrives at the intersection.

10.5 Southbound Ramp Intersection Options (Roundabout or Traffic Signal)

The southbound ramp intersection is noted to have the following deficiencies:

- Sight distance for southbound left turning vehicles to observe vehicles approaching from the left.
- Level of service F for southbound left turning vehicles.
- Need for a westbound left turn lane based on the left turn warrants, (refer to Section 6.2.2).
- Potential need for traffic signals. Existing volumes do not quite warrant signals (94 points of 100 required), but signals are needed in the adjusted volume scenario.
- Speed is also noted as a probable collision factor contributing to collisions at the dual ramp diverge point.

To resolve the deficiencies the following options were reviewed:

- **Option 1:** Resolve sight distance and level of service deficiencies by installing a traffic signal. Upgrade the intersection to provide a westbound left turn lane as warranted and install speed control measures to reduce vehicle speeds approaching the intersection to 70 km/h.
- **Option 2:** Construct a roundabout as an alternative to a traffic signal, which also resolves sight distance and level of service deficiencies. A westbound left turn lane is not needed in this case.

Speed is naturally reduced through the roundabout and a reduce speed limit is realistic to apply up to the dual ramp diverge point.

Improvements options are first reviewed in their ability to accommodate traffic operations. Traffic signals may not be worth any additional consideration or analysis since queueing was flagged as an issue in initial testing. Operational analysis is provided in the following subsection.

Operational Analysis Comparison

Operational comparison of the roundabout and traffic signal is focused on the AM peak hour when the approaching volumes from the west are highest for the existing and adjusted traffic volume scenario. Existing volumes are found in Appendix A and adjusted volumes, representing closure of the 308 Avenue, 338 Avenue and 370 Avenue medians are found in Table 2.4. For the adjusted traffic volume scenario with traffic signals, the westbound left turn is required to operate as a protected/permissive phase due to the higher left turning vehicles resulting from closure of the medians to the south. Operational Comparison is provided in the following table:

Table 10.1: Roundabout and Traffic Signal Operational Comparison (AM Peak)

Criteria		Roundabout		Traffic Signal	
Traffic Volume Scenario		Existing	Adjusted	Existing	Adjusted
EBT	V/C Ratio	0.71	0.85	0.78	1.06
	95th Percentile Queueing (m)	62.7	111	153	471*
	Delay (s)	6.5	7.5	9.8	55.5
WBL	V/C Ratio	0.054	0.141	0.15	0.43
	95th Percentile Queueing	0.0	0.0	2.2	11.9
	Delay	9.2	9.2	5.9	19.4
WBT	V/C Ratio	0.05	0.14	0.06	0.14
	95th Percentile Queueing	0.0	0.0	5.2	17.1
	Delay	3.5	9.2	1.9	3.5
SBL	V/C Ratio	0.03	0.04	0.24	0.22
	95th Percentile Queueing	1.0	1.5	20.4	26.6
	Delay	9.6	10.2	44.3	51.7

*Estimated at 500 m in the DA Watt Report

Comparing the operational analysis, the following is observed:

- The adjusted volume scenario produces worse operational results due to higher volumes of traffic using the intersection.
- The maximum eastbound queueing with a roundabout is 111 m compared to 471 m with a traffic signal.
  - The 111 m queue is acceptable for the roundabout. The queue is 63 m in the existing volume scenario.
  - The queues caused by the traffic signal are not acceptable. The 471 m queue extends past and blocks access to the southbound on-ramp

- The existing southbound left turn delay is 56.5 seconds (Section 6.2.1) and this is reduced to 44.3 seconds with a traffic signal and 9.6 seconds with a roundabout. The traffic signal, therefore, only provides a marginal improvement for the southbound left turn movement and this is due to the high volumes of eastbound traffic which absorb most of the signalized intersection capacity.

Preferred Option: Based on the above analysis, the roundabout is the preferred option, compared to a traffic signal. Any additional analysis in the pursuit of a traffic signal is not recommended as it does not provide acceptable operational results. A roundabout also functions as an effective speed reduction measure as traffic entering the roundabout will be required to slow down and allows an effective reduced speed limit through the area to be implemented.

10.6 Recommended Safety Improvement Measures

The following section outlines recommendation safety improvement measures focused on improving safety. Planning level order of magnitude costs are provided in 5 different ranges:

	Short Term				Long Term
	$	**$$**	**$$$**	**$$$$**	**$$$$$**
Delineate Dual Lane Ramp Entrance	Traffic control and pavement markings			Physical delineation	
Mitigate Differential Speeds (Dual Lane Diverge)	Reduce posted speed limit			Southbound ramp intersection roundabout	
Highway 2:15 Northbound Weaving			Extend northbound right lane		Grade separation
Northbound Ramp Intersection		Relocate	to the east		
Highway 552:02 Merge/274 Intersection		Relocate intersection			
General	Traffic signage				

Legend

$	<$100,000
$$	$100,000 - <$250,000
$$$	$250,000 to <$1,000,000
$$$$	$1,000,000 to $10,000,000
$$$$$	>$10,000,000

10.6.1 Delineate Dual Lane Ramp Entrance

The design speed of the dual ramp merge is 40 km/h compared to the 120 km/h design speed on Highway 2:15. Physical separation or additional traffic control measures should be installed to delineate between the ramp lanes and the highway. Additional delineation measures to discourage drivers from changing lanes from the merge area onto Highway 2:15 could help reduce the number of side-swipe same direction collisions. Options for delineation are as follows:

1. **Physical delineation ($$$$):** Realign Highway 2:12 / 2:15 to the west to maintain a 2 m separation from the merge that is carried for approximately two thirds of the acceleration length. Realignment of Highway 2:15 / 2:12 may extend approximately 800 m, from the physical gore for the northbound right diverge to the physical gore for the westbound right merge. Realigning the ramps further east is not feasible due to already limited right shoulder offset from the overpass bridge abutment.
    a. **Delineator posts:** Through the 2 m separation, delineator posts should be installed to enforce that no lane early changes are allowed.

Figure 10.1: Ramp Merge Physical Separation Concept

2. **Traffic control and pavement markings ($):** Short-term measures that may help discourage early lane changes at the ramp entrance include replacing the existing solid white lane with a double solid white line and installing a ‘do not cross double solid line’ sign. Rumble strips installed between the double solid white line are also recommended as a deterrent for early lane changes.

10.6.2 Mitigate Differential Speeds (Dual Lane Diverge)

The design speed of the dual lane loop ramp lanes is 40 km/h compared to the 90 km/h design for the Highway 2A:06 approach. The speed differential appears to be a contributing factor to collisions occurring at the diverge point, such as off-road and rear end collisions. Options to mitigate the speed differential are as follows:

1. **Southbound ramp intersection roundabout ($$$$):** Install a roundabout at the southbound ramp intersection to horizontally deflect and slow traffic on Highway 2A:06 as it enters the interchange area, which could help reduce the speed differential as drivers continue to the diverge

point. Along with reducing travelling speeds, a roundabout may also provide benefit for a number of the other safety and operations concerns identified at the intersection, including:

a. Westbound left warrant: Eliminate the need for a westbound left turn lane that was found to be warranted. The roundabout provides an efficient method for turning left and no left turn is needed.
b. Southbound left delays: Reduce traffic delays for southbound left turning traffic, currently operating at a LOS F based on existing traffic volumes and further degrading due to increases in traffic volumes resulting from closure of the medians at 306 Avenue, 338 Avenue and 370 Avenue. Traffic analysis of the roundabout using Sidra Intersection 6.1 demonstrated an improved LOS from F to A based on adjusted traffic volumes.
c. Eastbound through movement: Eastbound through movements are far less impacted with a roundabout compared to a traffic signal (see signal analysis in Section 10.5), with queuing reduced from 470 m to 110 m in the adjusted traffic scenario - (See **Appendix J**).
d. Southbound left turn sightlines: Mitigate the sub-standard sightlines for vehicles turning left.
e. Collision reduction: Reduce opportunity for left turn across path and right-angle collisions.
f. The conceptual roundabout configuration is shown in the following figure.

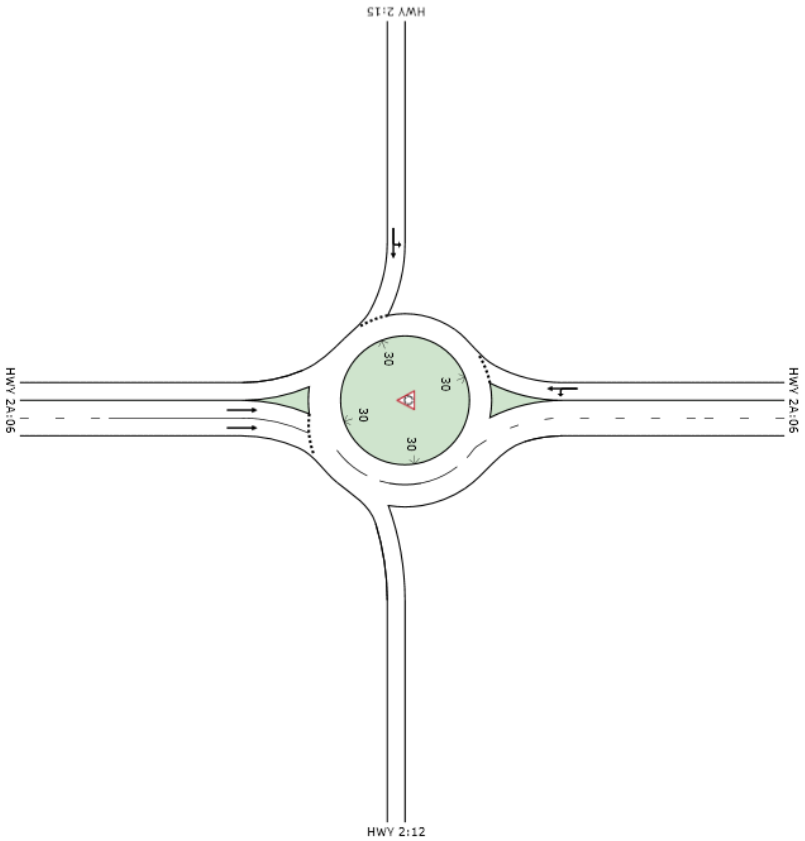


Figure 10.2: Southbound Ramp Roundabout Concept

A scale concept of the roundabout at the intersection is illustrated in Appendix L. This figure shows that a roundabout should fit within the available right-of-way, but should be confirmed through a formal planning / design process.

2. **Reduced posted speed limit ($):** Implement a reduced speed limit on Highway 2A:06 / 552:02 from the west and east study limits. A posted speed limit of 60 km/h may be more appropriate, particularly if a roundabout is installed at the southbound ramp intersection (discussed above). Prior to that, posting a reduced speed limit alone is not usually effective and needs additional measures to help self-enforce the reduced speed limit. Speed control measures for highways are generally limited and some examples of measures based on the TAC Canadian Guide to Traffic Calming, which include:
   a. Pavement Markings such as converging chevrons and peripheral transverse bars.
   b. Increased enforcement.
   c. Speed display devices.
   d. Educational campaigns.

Examples of pavement markings are provided as follows:

Converging Chevrons
(Source: TAC Canadian Guide to Traffic Calming)

Peripheral Traverse Bars
(Source: TAC Canadian Guide to Traffic Calming)

10.6.3 Highway 2:15 Northbound Weaving

1. **Extend northbound right lane ($$$):** On Highway 2:15, in the northbound direction, approximately 1.2 km north of the overpass the right-hand lane from the dual lane loop ramp drops which may be causing drivers to feel anxious about needing to complete earlier lane changes. Extending the lane further north (approximately 800 m) and extending it into and beyond the fork to Deerfoot Trail would reduce some lane changing requirements.
2. **Grade separation ($$$$$):** The Calgary Metropolitan Region Board's (CMRB) recent South & East Calgary Regional Transportation Study (S&ECRTS) identified the long-term need for grade-separated weaving ramps in this section. The S&ECRTS recommended completion of a functional planning study to confirm long-term requirements and costs for this section, which would allow for consideration of funding and implementation in the context of other regional highway priorities.

10.6.4 Northbound Ramp Intersection

1. **Relocate to the east ($$ - $$$):** Relocate the ramp intersection further east to increase sight distance to the west and provide a larger gap for vehicles to turn left.

10.6.5 Southbound Ramp Intersection

1. **Traverse Rumble Strips ($):** Install traverse rumble strips to slow vehicle approaching the intersection and help enforce the stop condition.

10.6.6 Highway 552:02 Merge/274 Avenue Intersection

1. **Relocate 274 Avenue ($$):** Evaluate options to relocate 274 Avenue further east to meet the access management guideline of 1.6 km spacing. The roadway/intersection could be closed at HWY 552:02 and connected to 32 Street.

10.6.7 General

1. **Traffic signage ($):** Resolve general deficiencies in traffic controls, removing unnecessary signs, replacing signs where needed and improving sign placement to align with current standards. Sign deficiencies are outlined in Section 10.3.4 (technical reviews) and Section 3.2 (conditions review).

10.7 Closure

The Okotoks Interchange Operations and Safety Review combines a review of historical collisions reports and operational, geometric and traffic control elements to gain insight of potential contributing factors affecting safety and operational issues. The study identifies contributing factors and provides remedial measures to improve safety and operations, which include a mix of low-cost, short-term modifications, higher cost interim modifications, and high-cost long-term solutions.

APPENDIX A
Traffic Volumes

Turning Movement Summary Diagram

Reference No.: 81170

Intersection of:
2 & 2A & 552 N OF OKOTOKS

2019 AADT / ASDT ESTIMATES

North On 2		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	49876	91.7
B: Recreational Vehicle	349	0.6
C: Bus	80	0.1
D: Single Unit Truck	1367	2.5
E: Tractor Trailer Unit	2718	5.0
ASDT 61500	**AADT** 54390	

West On 2A		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	25690	97.4
B: Recreational Vehicle	78	0.3
C: Bus	97	0.4
D: Single Unit Truck	382	1.4
E: Tractor Trailer Unit	133	0.5
ASDT 27360	**AADT** 26380	

East On 552		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	3528	95.4
B: Recreational Vehicle	19	0.5
C: Bus	66	1.8
D: Single Unit Truck	55	1.5
E: Tractor Trailer Unit	32	0.9
ASDT 4180	**AADT** 3700	

South On 2		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	24612	86.3
B: Recreational Vehicle	286	1.0
C: Bus	49	0.2
D: Single Unit Truck	992	3.5
E: Tractor Trailer Unit	2591	9.1
ASDT 32260	**AADT** 28530	

27200 — A 24947, B 209, C 41, D 680, E 1323 — NR NT NL

27190 — 12280 — A 11985, B 27, C 21, D 183, E 64 — WL

27190 — 14050 — A 12115, B 110, C 18, D 486, E 1321 — ST

27190 — 860 — A 829, B 3, C 0, D 18, E 10 — ER

NR: 12280 — A 11991, B 37, C 22, D 176, E 54

ET: 13190 — 840 — A 797, B 4, C 28, D 8, E 3

SL: 13190 — 70 — A 59, B 3, C 0, D 3, E 5

WR: 13190 — A 12843, B 34, C 47, D 195, E 71

ER: A 1753, B 8, C 35, D 30, E 14 — 1840

EL: A 843, B 3, C 0, D 12, E 12 — 870

WT: A 796, B 6, C 26, D 9, E 3 — 840 — 1860

SR: A 136, B 2, C 5, D 4, E 3 — 150

WR: A 62, B 1, C 0, D 3, E 4 — 70

NT: A 12113, B 169, C 19, D 492, E 1257 — 14050 — 14260

EL: A 127, B 1, C 7, D 4, E 1 — 140

SL ST SR: A 12310, B 115, C 23, D 493, E 1329 — 14270

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Annual Average Daily Traffic
Average daily traffic expressed as vehicles per day fo
period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehicles per day fo
period of May 1 to September 30 (153 days)

Turning Movement Summary Diagram

Reference No.: 81170

Intersection of:
2 & 2A & 552 N OF OKOTOKS

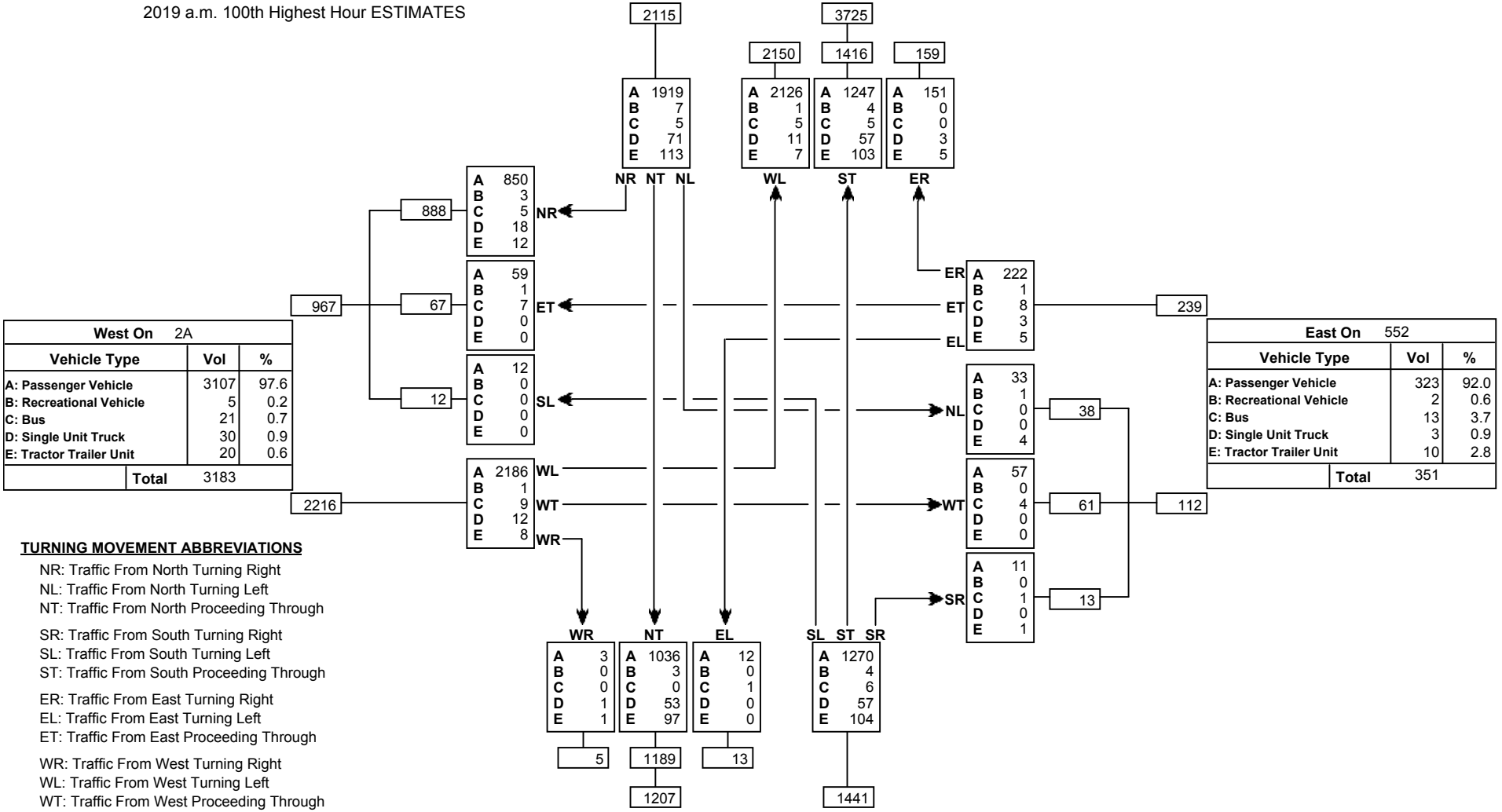
2019 a.m. 100th Highest Hour ESTIMATES

North On 2		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	5443	93.2
B: Recreational Vehicle	12	0.2
C: Bus	15	0.3
D: Single Unit Truck	142	2.4
E: Tractor Trailer Unit	228	3.9
Total	5840	

West On 2A		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	3107	97.6
B: Recreational Vehicle	5	0.2
C: Bus	21	0.7
D: Single Unit Truck	30	0.9
E: Tractor Trailer Unit	20	0.6
Total	3183	

East On 552		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	323	92.0
B: Recreational Vehicle	2	0.6
C: Bus	13	3.7
D: Single Unit Truck	3	0.9
E: Tractor Trailer Unit	10	2.8
Total	351	

South On 2		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	2321	87.7
B: Recreational Vehicle	7	0.3
C: Bus	7	0.3
D: Single Unit Truck	111	4.2
E: Tractor Trailer Unit	202	7.6
Total	2648	



TURNING MOVEMENT ABBREVIATIONS

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

Turning Movement Summary Diagram

Reference No.: 81170

Intersection of:
2 & 2A & 552 N OF OKOTOKS

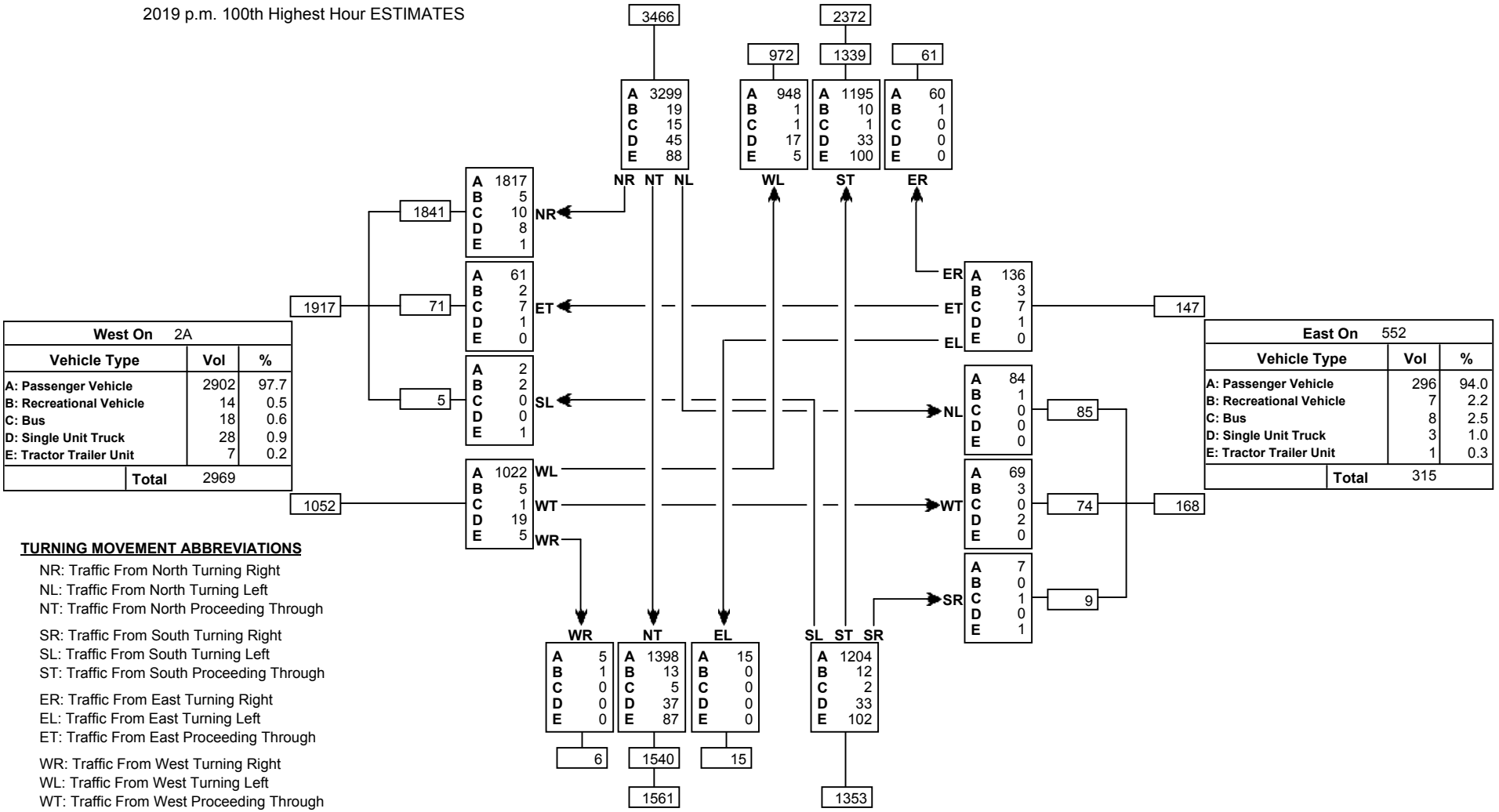
2019 p.m. 100th Highest Hour ESTIMATES

North On 2		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	5502	94.2
B: Recreational Vehicle	31	0.5
C: Bus	17	0.3
D: Single Unit Truck	95	1.6
E: Tractor Trailer Unit	193	3.3
Total	5838	

West On 2A		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	2902	97.7
B: Recreational Vehicle	14	0.5
C: Bus	18	0.6
D: Single Unit Truck	28	0.9
E: Tractor Trailer Unit	7	0.2
Total	2969	

East On 552		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	296	94.0
B: Recreational Vehicle	7	2.2
C: Bus	8	2.5
D: Single Unit Truck	3	1.0
E: Tractor Trailer Unit	1	0.3
Total	315	

South On 2		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	2622	90.0
B: Recreational Vehicle	26	0.9
C: Bus	7	0.2
D: Single Unit Truck	70	2.4
E: Tractor Trailer Unit	189	6.5
Total	2914	



TURNING MOVEMENT ABBREVIATIONS

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

APPENDIX B
NESS Reports

Report Notes

Report Name	HWY 2,2A,552
Segments	ALL
Collision Year Range	2013-2017
LRS Provided to Create the Report	Not provided
Intersections Provided to Create the Report	34-HIGHWAY 2:12 AND 2:15 AND 2A:06 AND 552:02

Report Contents

Intersection Summary Report

LRS	Intersection Site #	Description	Type
2:15 L1 0.000	34	HIGHWAY 2:12 AND 2:15 AND 2A:06 AND 552:02	DD
552:02 L1 0.671	16171	HIGHWAY 552:02 AND TOWNSHIP ROAD 214	TYPE 1A

NESS Work Activity Summary

Refresh was last successfully run at 2021 Sep 16 18:58

NESS Scheduled Year	WA Scheduled Year	LRS	Length	Int #	Location	Direction	Work
2045		2:12 L1 15.383 - 28.669	13.286		Hwy 547 - Hwy 2A		6 - LANE
2070		2:12 L1 15.383 - 28.669	13.286		Hwy 547 - Hwy 2A		8 - LANE
2070		2A:06 L1 0.000 - 5.946	5.946		-5 Km N of Hwy 7 - Hwy 2		8 - LANE
2021		2:15 L1 0.683 - 6.160	5.477		1 Km N of Hwy 2A - CITY of Calgary		CLIMBING LANE
2071		2:12 L1 27.778 - 28.669	0.891		1 Km S of TOWN of Okotoks - Hwy 2A		OVERLAY
2071		2:15 L1 0.000 - 1.960	1.96		Hwy 2A - Hwy 2A		OVERLAY
2071		2A:06 L1 5.316 - 5.946	0.63		Hwy 7 - Hwy 2 selective		OVERLAY
2071		2A:06 R1 5.310 - 5.936	0.626		Hwy 7 - Hwy 2 selective		OVERLAY
2071		552:02 L1 0.000 - 0.671	0.671		Hwy 2A to East of Hwy 2A		OVERLAY
2071		552:02 R1 0.000 - 0.672	0.672		Hwy 2A to East of Hwy 2A		OVERLAY
2021		2:12 L1 27.778 - 28.669	0.891		1 Km S of Hwy 2A - Hwy 2A		SAFETY ASSESSMENT
2021		2A:06 L1 5.316 - 5.946	0.63		Hwy 7 - Hwy 2		SAFETY ASSESSMENT
2021		2A:06 R1 5.310 - 5.936	0.626		Hwy 7 - Hwy 2		SAFETY ASSESSMENT
2021		552:02 L1 0.000 - 0.671	0.671		Hwy 2 - 1 Km E of Hwy 2		SAFETY ASSESSMENT
2021		552:02 R1 0.000 - 0.672	0.672		Hwy 2 - 1 Km E of Hwy 2		SAFETY ASSESSMENT

PMA D. Planning Assessment Report(PAR) Summary

Refresh was last successfully run at 2021 Nov 18 06:00

LRS	Length	Int #	Location	Report Type	Report Name	Completed Year	In NESS Snapshot
No data found							

PMA D. Planning Assessment Report(PAR) Work Activity Summary

Refresh was last successfully run at 2021 Nov 18 06:00

LRS	Length	Int #	Location	Work Activity Type	WA In NESS	NESS Need Year	WA Need Year	WA Scheduled Year	Origin	WA Status	WA ID
No data found											

New PMA D. Work Activity Summary

Refresh was last successfully run at 2021 Nov 18 06:00

WA Scheduled Year	LRS	Length	Int #	Location	Recommended Work Activity Type
	2:02 L1 0.000		34	Interchange lighting upgrades - INT 34	SIGNALIZATION/LIGHTING
	2:06 L1 5.936		34	Interchange lighting upgrades - INT 34	SIGNALIZATION/LIGHTING
	2:12 L1 0.000		34	Interchange lighting upgrades - INT 34	SIGNALIZATION/LIGHTING

Width Sufficiency Report

Report Notes

Number of results found	9
WSI	WIDTH COLLISION COST PER KILOMETER
WSNA	WIDTH NON-ANIMAL COLLISION RATE
WNT	WIDTH TOTAL COLLISION RATE

Width collision data is obtained from the overlapping safety segment

Collision Cost in $/km (M) over 5 years

Collision Rate in C/100MVKM

Collision rate is calculated as (sum total collisions over 5 years * 100 Mil) / (sum of AADT history for the same 5 years * 365.25 * length (km))

Collision cost is calculated as (sum of collisions involving a fatality * $9,120,367) + (sum of collisions involving a serious injury * $66,744) + (sum of collisions involving a minor injury * $66,744) + (sum of the property damage only collisions * $5,851)/km)

Growth Rate in %

					Grade Widening Deltas								HPMA First Rehab					Worst Safety Delta		Year 0				Region
LRS	Len	Exist Width	Serv Class	# Lanes	Need Year	Sch Year	Pred Width	3R 4R BM	Δ	NC BM	Pred WAADT	Notes	Need Year	Pred Width	3R 4R	WAADT	PL/CL	Type	Δ	Pred Width	3R 4R	WAADT	Growth Rate	
2:12 L1 27.778 - 28.669	0.891	14.70	LV 1	3						17			2023	14.10	13.2	12,491		WNT	***-65.5***	14.70	13.2	23,820	1.81	1
2:12 R1 27.788 - 28.676	0.888	16.60	LV 1	2						12			2032	15.80	9.5	14,524		WNT	5.5	16.60	9.5	23,820	1.81	1
2:15 L1 0.000 - 0.500	0.5	16.00	LV 1	3						17			2023	15.39	13.2	25,846		WNT	5.5	15.99	13.2	47,360	3.68	1
2:15 L1 0.500 - 1.430	0.93	21.40	LV 1	3						17			2023	20.79	13.2	25,846	CL	WNT	5.5	21.39	13.2	47,360	3.68	1
2:15 R1 0.000 - 1.315	1.315	21.00	LV 1	3						17			2032	20.20	13.2	34,352		WNT	0.8	21.00	13.2	47,360	3.68	1
2A:06 L1 5.316 - 5.946	0.63	13.40	LV 4	2						12			2022	12.80	9.5	11,637		WNT	***-24.0***	13.40	9.5	22,360	2.34	1
2A:06 R1 5.310 - 5.936	0.626	13.40	LV 4	2						12			2022	12.80	9.5	11,637		WNT	***-37.7***	13.40	9.5	22,360	2.34	1
552:02 L1 0.000 - 0.671	0.671	4.50	LV 4	1									2022	3.90		1,838		WSNA	***-102.0***	4.50		3,560	1.81	1
552:02 R1 0.000 - 0.672	0.672	4.50	LV 4	1									2022	3.90		1,838		WSNA	***-327.9***	4.50		3,560	1.81	1

Width Safety Report

Report Notes

Number of results found 8

Collision Cost in $/km (M) over 5 years

Collision Rate in C/100MVKM

Collision rate is calculated as (sum total collisions over 5 years * 100 Mil) / (sum of AADT history for the same 5 years * 365.25 * length (km))

Collision cost is calculated as (sum of collisions involving a fatality * $9,120,367) + (sum of collisions involving a serious injury * $66,744) + (sum of collisions involving a minor injury * $66,744) + (sum of the property damage only collisions * $5,851)/km)

		Existing			Collision Frequency				Total Rate			Non Animal Rate			Collision Cost (M)			Safety	Region
LRS	Len	WAADT	Width	Paved Y/N	Total	Fatal	Injury	Non Animal	Actual	BM	Δ	Actual	BM	Δ	Actual	BM	Δ	Issues	
2:12 L1 27.778 - 28.669	0.891	23,820	14.70	Y	25	0	6	19	113.7	48.3	***-65.5***	86.4	36.7	***-49.7***	0.574	1.010	0.436	Yes	1
2:12 R1 19.480 - 28.676	9.196	23,804	16.50	Y	97	0	24	67	42.8	48.3	5.5	29.6	36.7	7.2	0.221	1.010	0.789	~~No~~	1
2:15 L1 0.000 - 6.567	6.567	40,214	17.70	Y	96	0	29	68	37.8	43.3	5.5	26.7	43.1	16.3	0.354	1.010	0.655	Yes	1
2:15 R1 0.000 - 6.560	6.56	40,212	15.70	Y	108	0	19	76	42.5	43.3	0.8	29.9	43.1	13.2	0.273	1.010	0.737	~~No~~	1
2A:06 L1 5.316 - 5.946	0.63	22,360	13.40	Y	11	0	2	6	72.3	48.3	***-24.0***	39.4	36.7	***-2.7***	0.295	1.003	0.708	Yes	1
2A:06 R1 5.310 - 5.936	0.626	22,360	13.40	Y	13	0	2	7	86.0	48.3	***-37.7***	46.3	36.7	***-9.6***	0.316	1.003	0.687	Yes	1
552:02 L1 0.000 - 0.671	0.671	3,560	4.50	Y	5	0	2	3	226.4	69.7	***-156.8***	135.9	33.9	***-102.0***	0.225	0.378	0.153	Yes	1
552:02 R1 0.000 - 0.672	0.672	3,560	4.50	Y	13	0	3	8	587.8	69.7	***-518.2***	361.7	33.9	***-327.9***	0.385	0.378	***-0.007***	Yes	1

Multilane Report

Report Notes

Number of results found	4
4 Lane - Lv 1	7500
4 Lane - Lv 2	9300
4 Lane - Lv 3	11200
4 Lane - Lv 4	11200
6 Lane	31000
8 Lane	50000
Growth Rate in %	
Collision Cost in $/km (M) over 5 years	
Collision Rate in C/100MVKM	

Collision rate is calculated as (sum total collisions over 5 years * 100 Mil) / (sum of AADT history for the same 5 years * 365.25 * length (km))

Collision cost is calculated as (sum of collisions involving a fatality * $9,120,367) + (sum of collisions involving a serious injury * $66,744) + (sum of collisions involving a minor injury * $66,744) + (sum of the property damage only collisions * $5,851)/km)

				WAADT		LOS			NESS Sched		4 lane		6 lane		8 lane			
LRS	Len	Serv Class	# Lanes	Year 0	Year 20	Year 0	Year 20	Growth Rate	1st Work Year	WAADT	Need Year	WAADT	Need Year	WAADT	Need Year	WAADT	Notes	Region
2:12 L1 19.690 - 28.669	8.979	LV 1	5	23,820	32,450	A	B	1.81	2045				2045		2070			1
2:15 L1 0.000 - 1.602	1.602	LV 1	8	47,360	82,250	B	C	3.68										1
2A:06 L1 0.000 - 5.946	5.946	LV 4	4	22,360	32,810	A	B	2.34	2070				2037		2070			1
552:02 L1 0.000 - 0.671	0.671	LV 4	2	3,560	4,848	C	C	1.81										1

Pave Gravel Roads Report

Report Notes

Number of results found	0
ASSIGN PAVE GRAVEL MIN AADT	400

Growth Rate in %

Gravel Road collision data is obtained from the overlapping safety segment

Collision Cost in $/km (M) over 5 years

Collision Rate in C/100MVKM

Collision rate is calculated as (sum total collisions over 5 years * 100 Mil) / (sum of AADT history for the same 5 years * 365.25 * length (km))

Collision cost is calculated as (sum of collisions involving a fatality * $9,120,367) + (sum of collisions involving a serious injury * $66,744) + (sum of collisions involving a minor injury * $66,744) + (sum of the property damage only collisions * $5,851)/km)

			WAADT		Growth					
LRS	Length	Service Classification	Year 0	Year 20	Rate	Width	Sched Year	% CM	Notes	Region
No data found										

Intersection Report

Report Notes

Number of results found 1

The number of collisions in this report are collisions at and near the intersection and are collisions within the intersection polygon in TIMS

For details on individual collisions, see the "Collision Details" section within Excel report

The Signalization Work Activity Trigger is Traffic Score (TS) > 79 or TS >= 60 with 5 or more angle collisions

Interchange Trigger - Signalization trigger met on Level 1 divided highway with 100+ km/h, or left turn volume >= 700 vehicles per hour

Collision Cost in $ (M) over 5 years

Collision Rate in C/100MEV

Intersection collision rate is calculated as (sum of intersection collisions over 5 years * 100 Mil) / (sum of AADT entering over 5 years * 365.25)

Collision cost is calculated as (sum of collisions involving a fatality * $9,120,367) + (sum of collisions involving a serious injury * $66,744) + (sum of collisions involving a minor injury * $66,744) + (sum of the property damage only collisions * $5,851)

Va, Vo and Vl in VPH

LT & RT Length in m

Pk = Peak Hour

Year LT = Scheduled Year of Left Turn Lane Construction

Year LTR = Scheduled Year of Left Turn Lane Reconstruction

Year RT = Scheduled Year of Right Turn Lane Construction

Year RTR = Scheduled Year of Right Turn Lane Reconstruction

INT #:34 LRS: 2:15 L1 0.000

Location: HIGHWAY 2:12 AND 2:15 AND 2A:06 AND 552:02

Lv 2 Work Activity Summary | Lv 3 Work Activity Summary

Major Road Details — TMD Ref: 81170

			Veh/day	Growth
Int. Type: DD	Posted Speed: 110	Maj Rd: 2-NB/SB	47,360	3.7%
Service Class: LV 1	Lit: Y Sig: N Div: Y Radius:	Min Rd: 2A-WB/EB	22,480	2.3%

Collision Frequency				Collision Rate				Collision Cost	
Total	Fatal	Inj	Non-An	Total	BM	Non-An	BM	Cost (in $M)	BM
116	0	31	97	*180.0*	120.0	*150.5*	106.6	2.566	7.635

Approach	LT Lane	LT Len	LT BM	RT Lane	RT Len	RT BM	Chan	Yr LT	Vo	Vl	BM	Va	Undiv BM	Pk	Yr RT	RT AADT	Yr Chan
2-NB				Y	736		Y										
2-SB				Y	609		Y										

Yr Signal	TS	Ang. Coll	Yr IC	TS	LT vph	Yr Light.	Day	Night	N/D Col%	Near VC
							62	45		Y

Intersection Access

LRS	Access Type	Access Count	Road Side	Int #	Int Type	Speed	Roadside Class	MD Name	Distance Last Access	Distance Last Public
2A:06 R1 5.796	HWY			34	DD		UED	FOOTHILLS COUNTY	0.892	0.892
2A:06 L1 5.806	HWY			34	DD		UED	FOOTHILLS COUNTY		
2:15 L1 0.001	HWY			34	DD	110	UFD	FOOTHILLS COUNTY	2.054	2.054
2:15 R1 0.001	HWY			34	DD	110	UFD	FOOTHILLS COUNTY	3.217	3.217
552:02 L1 0.152	HWY			34	DD	80	RAU	FOOTHILLS COUNTY	0.532	0.532
552:02 R1 0.153	HWY			34	DD	80	RAU	FOOTHILLS COUNTY		

Horizontal Curve Report

Report Notes

Number of results found 0

Collision Cost in $/km (M) over 5 years

Collision Rate in C/100MVKM

Collision rate is calculated as (sum total collisions over 5 years * 100 Mil) / (sum of AADT history for the same 5 years * 365.25 * length (km))

Collision cost is calculated as (sum of collisions involving a fatality * $9,120,367) + (sum of collisions involving a serious injury * $66,744) + (sum of collisions involving a minor injury * $66,744) + (sum of the property damage only collisions * $5,851)/km)

e in %

Deflection Angle in degrees

			Geometric Analysis						Collision Frequency				Safety Analysis				Work Activity Year		Region
LRS	Len	Exist WAADT	Type	Actual	BM	Δ	Defl Angle	Int On Curve	Total	Fatal	Injury	Non Animal	Type	Actual	BM	Δ	Safety Assess	Recon	
No data found																			

Vertical Curve Report

Report Notes

Number of results found 0

Gradient in %

Collision Rate in C/100MVKM

Collision rate is calculated as (sum segment collisions over 5 years * 100 Mil) / (sum of AADT 5 years * 365.25 * length (km))

Collision cost is calculated as (sum of collisions involving a fatality * $9,120,367) + (sum of collisions involving a serious injury * $66,744) + (sum of collisions involving a minor injury * $66,744) + (sum of the property damage only collisions * $5,851)/km)

					K-Value						Running Speed		Total Collision Rate				
LRS	Len	Existing WAADT	Type	Grad	k	3R4R BM	Δ	NC BM	Δ	Estimated	Design	Δ	H Curve	INT	WA Year	Heavy Truck %	Region
2:12 L1 27.510 - 28.353	0.843		TAN	-0.20													1
2:12 L1 28.353 - 28.629	0.276		SAG		148												1
2:12 L1 28.629 - 28.654	0.025		TAN	1.70													1
2:12 R1 27.410 - 28.283	0.873		TAN	-0.20													1
2:12 R1 28.283 - 28.671	0.388		SAG		191												1
2:12 R1 28.671 - 28.675	0.004		TAN	1.80													1
2:15 L1 0.016 - 0.078	0.062		TAN	1.80													1
2:15 L1 0.078 - 0.278	0.20		SAG		88												1
2:15 L1 0.278 - 0.536	0.258		TAN	4.00													1
2:15 L1 0.536 - 1.077	0.541	47,360	CREST		134	50	84	130	4	130	120	10	136.9			8.3	1
2:15 L1 0.683 - 6.160	5.477															10.8	1
2:15 R1 0.004 - 0.126	0.122		TAN	2.30													1
2:15 R1 0.126 - 0.291	0.165		SAG		82												1
2:15 R1 0.291 - 0.482	0.191		TAN	4.30													1
2:15 R1 0.482 - 1.273	0.791	47,360	CREST		138	50	88	130	8	130	120	10	117.0			8.3	1
2A:06 L1 5.473 - 5.772	0.299		SAG		136												1
2A:06 L1 5.772 - 5.931	0.159		TAN	0.90													1
2A:06 R1 5.485 - 5.760	0.275		SAG		126												1
2A:06 R1 5.760 - 5.917	0.157		TAN	1.00													1
552:02 L1 0.016 - 0.069	0.053		TAN	-2.10													1
552:02 L1 0.069 - 0.190	0.121	3,560	CREST		59	25	34	55	4	90	90	0				4.2	1
552:02 L1 0.190 - 0.192	0.002		TAN	-4.30													1
552:02 L1 0.192 - 0.348	0.156		SAG		74												1
552:02 L1 0.348 - 0.671	0.323		TAN	-2.10													1
552:02 R1 0.013 - 0.071	0.058		TAN	-2.10													1
552:02 R1 0.071 - 0.192	0.121	3,560	CREST		58	25	33	55	3	90	90	0				4.2	1
552:02 R1 0.192 - 0.194	0.002		TAN	-4.30													1
552:02 R1 0.194 - 0.331	0.137	3,560	SAG		68	20	48	40	28	130	90	40				4.2	1
552:02 R1 0.331 - 0.672	0.341		TAN	-2.20													1

Posted Speed Summary

LRS	Length	Speed Km/Hr
2:12 R1 27.876 - 28.186	0.31	110
2:12 R1 27.876 - 28.186	0.31	110
2:12 L1 27.876 - 28.186	0.31	110
2:12 L1 27.876 - 28.186	0.31	110
2:12 R1 27.882 - 28.181	0.299	110
2:12 L1 27.882 - 28.181	0.299	110
2:12 L1 27.882 - 28.181	0.299	110
2:12 R1 27.882 - 28.181	0.299	110
2:12 R1 28.181 - 28.597	0.416	110
2:12 L1 28.181 - 28.597	0.416	110
2:12 L1 28.181 - 28.597	0.416	110
2:12 R1 28.181 - 28.597	0.416	110
2:12 R1 28.186 - 28.669	0.483	110
2:12 R1 28.186 - 28.669	0.483	110
2:12 L1 28.186 - 28.669	0.483	110
2:12 L1 28.186 - 28.669	0.483	110
2:12 R1 28.597 - 28.676	0.079	110
2:12 L1 28.597 - 28.669	0.072	110
2:12 L1 28.597 - 28.669	0.072	110
2:12 R1 28.597 - 28.676	0.079	110
2:15 R1 0.000 - 0.408	0.408	110
2:15 R1 0.000 - 0.440	0.44	110
2:15 R1 0.000 - 0.408	0.408	110
2:15 R1 0.000 - 0.440	0.44	110
2:15 L1 0.000 - 0.440	0.44	110
2:15 L1 0.000 - 0.408	0.408	110
2:15 L1 0.000 - 0.440	0.44	110
2:15 L1 0.000 - 0.408	0.408	110
2:15 R1 0.408 - 0.834	0.426	110
2:15 L1 0.408 - 0.834	0.426	110
2:15 R1 0.408 - 0.834	0.426	110
2:15 L1 0.408 - 0.834	0.426	110
2:15 L1 0.440 - 0.849	0.409	110
2:15 R1 0.440 - 0.849	0.409	110
2:15 L1 0.440 - 0.849	0.409	110
2:15 R1 0.440 - 0.849	0.409	110
2A:06 R1 5.516 - 5.639	0.123	80
2A:06 L1 5.516 - 5.639	0.123	80
2A:06 L1 5.525 - 5.585	0.06	80
2A:06 R1 5.525 - 5.585	0.06	80
2A:06 L1 5.585 - 5.805	0.22	80
2A:06 R1 5.585 - 5.805	0.22	80
2A:06 L1 5.639 - 5.797	0.158	80

LRS	Length	Speed Km/Hr
2A:06 R1 5.639 - 5.797	0.158	80
2A:06 R1 5.797 - 5.936	0.139	80
2A:06 L1 5.797 - 5.936	0.139	80
2A:06 R1 5.805 - 5.936	0.131	80
2A:06 L1 5.805 - 5.946	0.141	80
552:02 L1 0.000 - 0.200	0.2	80
552:02 L1 0.000 - 0.106	0.106	80
552:02 R1 0.000 - 0.200	0.2	80
552:02 R1 0.000 - 0.106	0.106	80
552:02 L1 0.106 - 0.429	0.323	80
552:02 R1 0.106 - 0.429	0.323	80
552:02 L1 0.200 - 0.410	0.21	80
552:02 R1 0.200 - 0.410	0.21	80
552:02 L1 0.410 - 0.540	0.13	80
552:02 R1 0.410 - 0.540	0.13	80
552:02 R1 0.429 - 0.541	0.112	80
552:02 L1 0.429 - 0.541	0.112	80

Collision Summary

Report Notes

For details on individual collisions, see 'Collision Details' section within the Collision Summary worksheet in the Excel version of this report

	Total				Roadway				Intersection			
Event	Fatal	Injury	Property Damage Only	Total	Fatal	Injury	Property Damage Only	Total	Fatal	Injury	Property Damage Only	Total
BACKING	0	0	0	0	0	0	0	0	0	0	0	0
HEAD ON	0	0	0	0	0	0	0	0	0	0	0	0
LEFT TURN - ACROSS PATH	0	0	1	1	0	0	0	0	0	0	1	1
OFF ROAD LEFT	0	4	11	15	0	0	0	0	0	4	11	15
OFF ROAD RIGHT	0	6	13	19	0	0	0	0	0	6	13	19
OTHER	0	0	3	3	0	0	0	0	0	0	3	3
PASSING - LEFT TURN	0	0	0	0	0	0	0	0	0	0	0	0
PASSING - RIGHT TURN	0	0	0	0	0	0	0	0	0	0	0	0
REAR END	0	4	8	12	0	0	0	0	0	4	8	12
RIGHT ANGLE	0	5	3	8	0	0	0	0	0	5	3	8
SIDESWIPE - OPPOSITE DIRECTION	0	0	0	0	0	0	0	0	0	0	0	0
SIDESWIPE SAME DIRECTION	0	7	13	20	0	0	0	0	0	7	13	20
STRUCK OBJECT	0	2	17	19	0	0	0	0	0	2	17	19
ANIMAL	0	3	17	20	0	0	1	1	0	3	16	19
TOTAL	**0**	**31**	**86**	**117**	**0**	**0**	**1**	**1**	**0**	**31**	**85**	**116**

Bridge & Small Culvert Summary

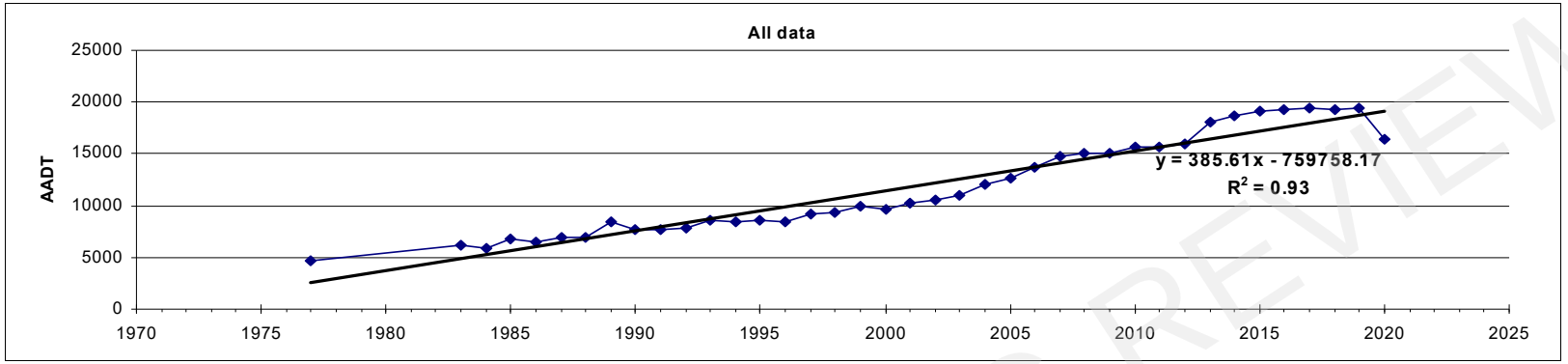
			Bridge Data						AIA Data		
LRS	Description	Structure Type	BF #	Suff. Rating	Cond. Rating	BEADS Est Replace Year	BEADS Replace Cost	Inspection Date	Location Type	Cond. Rating	Inspection Date
2:12 R1 27.877									CENTERLINE R1	GOOD	2009 Nov 03
2:12 R1 28.258									CENTERLINE R1	GOOD	2009 Nov 03
2:12 R1 28.441									CENTERLINE R1	GOOD	2009 Nov 03
2:15 L1 0.170									CENTERLINE L1	FAIR	2009 Nov 04
2:15 L1 0.510									CENTERLINE L1	GOOD	2009 Nov 04
2:15 L1 0.802									CENTERLINE L1	FAIR	2009 Nov 04
2:15 R1 0.164									CENTERLINE R1	GOOD	2009 Nov 04
2:15 R1 0.476									MEDIAN CROSSOVER	FAIR	2009 Nov 04
2A:06 L1 5.929	HIGHWAY 2A OVER HIGHWAY 2 INTERCHANGE, AT DEWINTON	MAJOR BRIDGE	76392 -1	37.1	38.9	2027	5,220,000	2020 Apr 28			
2A:06 R1 5.553									CENTERLINE	FAIR	2009 Nov 05
2A:06 R1 5.886									CENTERLINE	GOOD	2009 Nov 04

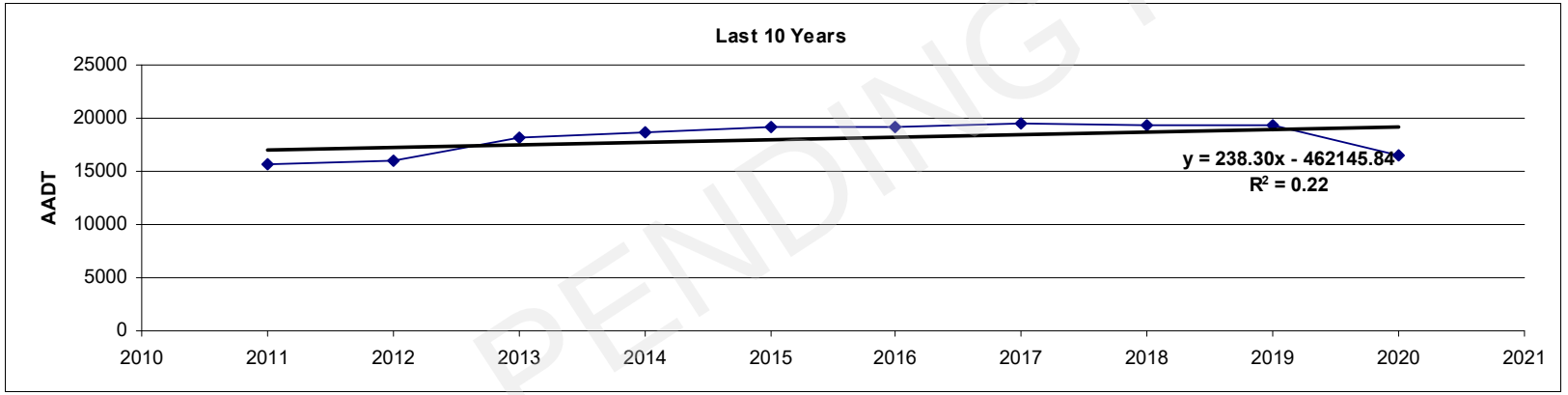
Traffic Growth

Table of ATR's included within the report by location

Hwy	CS	Label	From	To	ATR #
2	12	L1	19.600	28.669	60021260
2	15	L1	0.000	2.010	60021540
2A	6	L1	0.000	5.946	60200678
552	2	L1	0.000	0.671	60021260

ATR NUMBER: 60021260 2:12:L1 km 11.185 4.3 KM S OF 2 & 7 & 547 ALDERSYDE



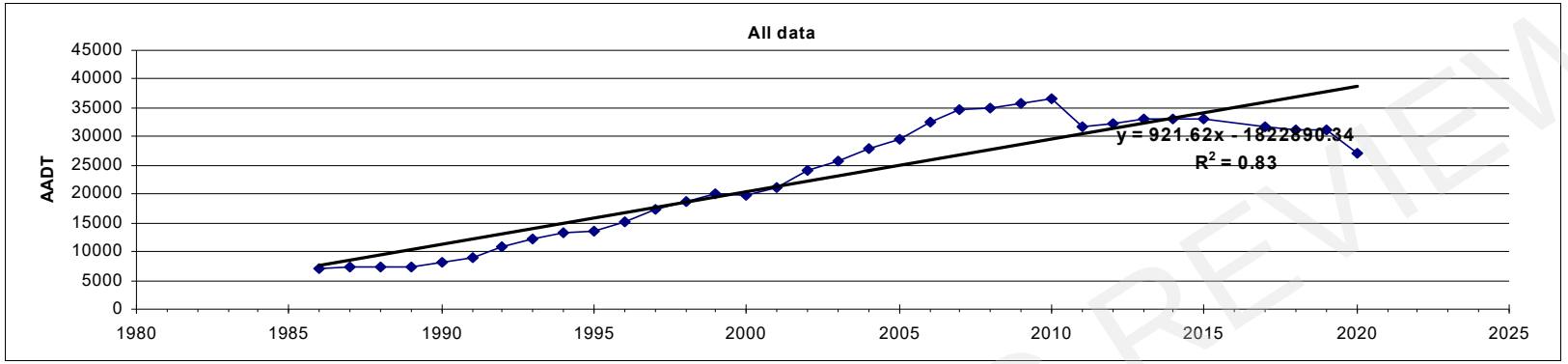


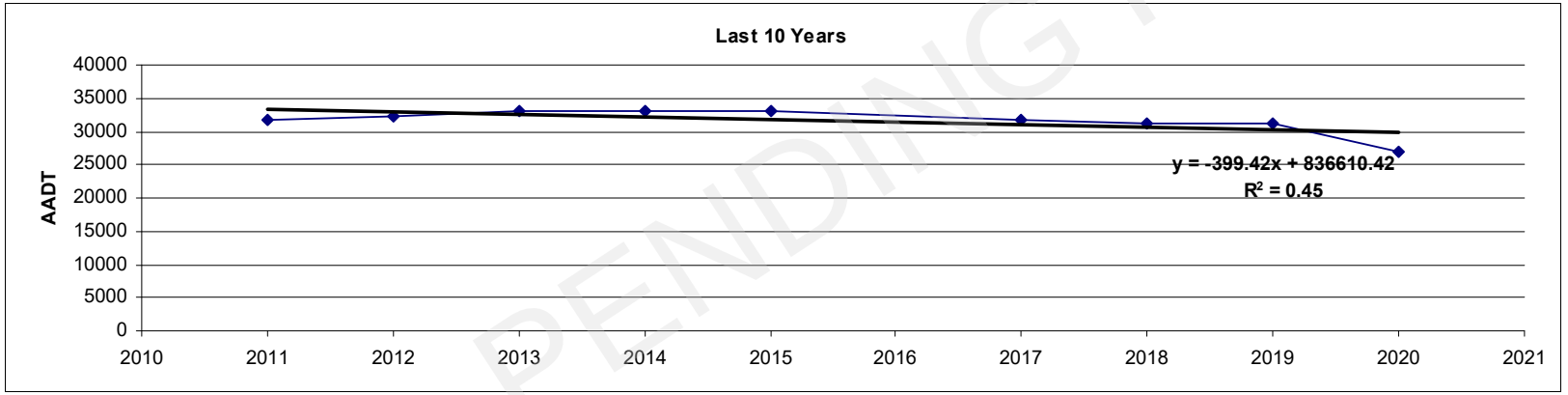
Growth rate	Since	Two points	Diff to historical	linear regression	Diff to historical	r square
Historical:	1977	1.67		2.01		0.934
20 yrs:	2001	1.99	0.32	2.43	0.42	0.865
10 yrs:	2011	0.49	-1.18	1.24	-0.77	0.224
5 yrs:	2016	-4.3	-5.97	-3.28	-5.29	0.478

Other Calculation	Two points	Diff to historical	linear regression	Diff to historical	r square
Start yr:					
End yr:					
# yr:					

Year	AADT	ASDT	% diff
2020	16,420	19,006	15.7
2019	19,373	21,865	12.9
2018	19,349	22,062	14
2017	19,497	22,162	13.7
2016	19,247	21,424	11.3
2015	19,150	21,207	10.7
2014	18,607	20,422	9.8
2013	18,114	20,731	14.4
2012	15,963	17,775	11.4
2011	15,697	17,531	11.7

ATR NUMBER: 60200678 2A:05:L1 km 2.498 2.5 KM N OF 2A & 7 & 783 IN OKOTOKS



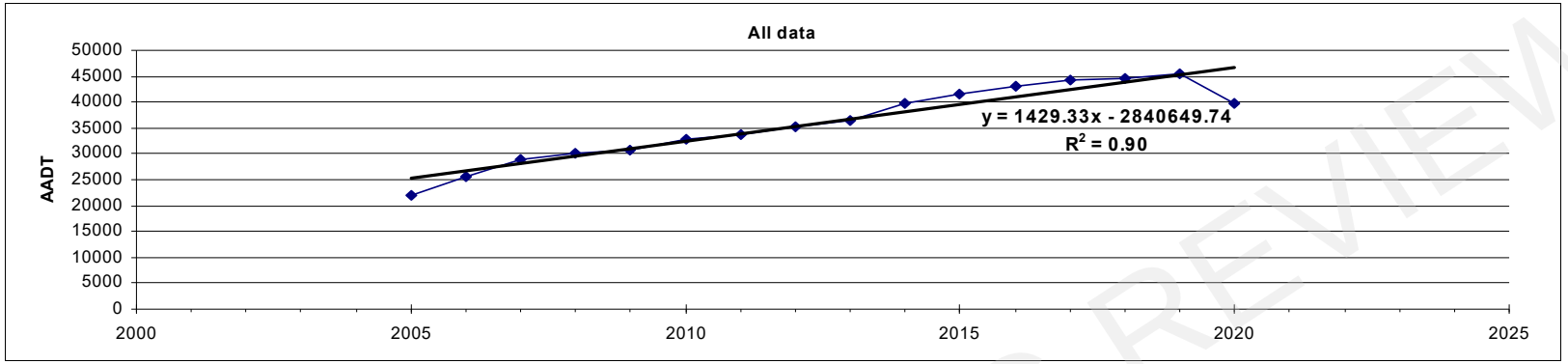


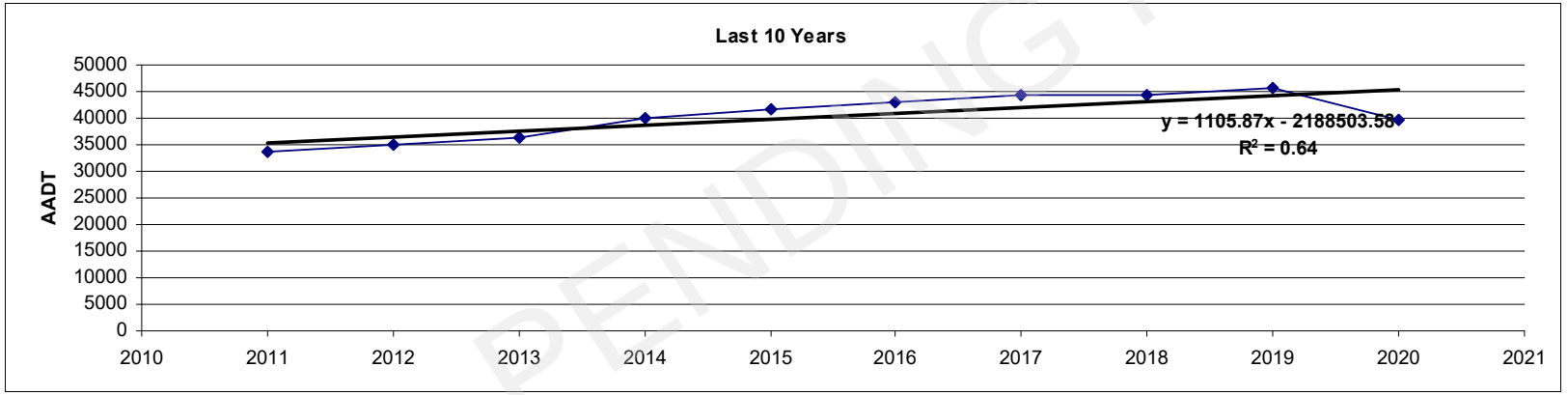
Growth rate	Since	Two points	Diff to historical	linear regression	Diff to historical	r square
Historical:	1986	2.16		2.38		0.829
20 yrs:	2001	1.12	-1.04	0.81	-1.57	0.157
10 yrs:	2011	-1.98	-4.14	-1.34	-3.72	0.453
5 yrs:	2016			-5.01	-7.39	0.676

Other Calculation	Two points	Diff to historical	linear regression	Diff to historical	r square
Start yr:					
End yr:					
# yr:					

Year	AADT	ASDT	% diff
2020	26,976	28,706	6.4
2019	31,286	32,399	3.6
2018	31,099	32,229	3.6
2017	31,742	33,198	4.6
2015	33,124	34,074	2.9
2014	32,995	34,212	3.7
2013	33,190	35,162	5.9
2012	32,232	33,798	4.9
2011	31,790	33,178	4.4

ATR NUMBER: 60021540 2:15:L1 km 7.112 0.2 KM N OF BOW RIVER BRIDGE, CALGARY





Growth rate	Since	Two points	Diff to historical	linear regression	Diff to historical	r square
Historical:	2005	2.96		3.07		0.899
20 yrs:	2001			3.07	0	0.899
10 yrs:	2011	1.69	-1.27	2.44	-0.63	0.639
5 yrs:	2016	-2.16	-5.12	-1.34	-4.41	0.155

Other Calculation	Two points	Diff to historical	linear regression	Diff to historical	r square
Start yr:					
End yr:					
# yr:					

Year	AADT	ASDT	% diff
2020	39,663	44,602	12.5
2019	45,558	50,065	9.9
2018	44,466	49,245	10.7
2017	44,403	49,447	11.4
2016	43,084	46,435	7.8
2015	41,596	44,900	7.9
2014	39,849	43,834	10
2013	36,428	40,394	10.9
2012	35,147	38,878	10.6
2011	33,635	36,895	9.7

Intersection Left Turn Graph

No data found.

INT Collision History

Report Notes

Number of results found	1

This Section includes details on the collision history for selected intersections.

INT # **34-1** INT type DIAMOND INTERCHANGE

Region: SOUTHERN REGION

Classification: LV 1 Signalized: N Last paved yr: 2012

Posted speed: 110 Lit: Y Last paved road name: 2

INT Effective Date: 01-Oct-00

Divided: Y

TM number: 81170

Location: **HIGHWAY 2:12 AND 2:15 AND 2A:06 AND 552:02**

NESS Safety Calculations (2013 - 2017)

	Actual	BM	Deltas
Total rate:	115.065	133.3	18.2
Non animal rate:	96.218	127.6	31.4
Collision cost ($ x M):	2.566	3.387	0.821

Total (ani + non ani)		Non-animal	2013	2014	2015	2016	2017
# Daytime:	62	Daytime	10	11	11	11	12
# Nightime:	45	Nightime	4	9	4	11	5
		Unknown	1	2	1	1	4

Modify Outliners for Non Animal Collision

	2013	2014	2015	2016	2017
F and Maj Inj.	0	1.3	1	2.3	1
Min. Inj.	4	2	4	5	4
Non ani	15	22	16	22.3	21

Three Similar Collisions Over Five Yrs Period

(excluding off road and animal collision)

Year: 2017

Prim. evt.: REAR END (12), RIGHT ANGLE (8), SIDESWIPE:SAME DIR. (20), STRUCK OBJECT (19),

Collision Frequency Over Last 15 Yrs

Severity - non ani.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	**Last 5 yrs**
FATAL																**0**
MAJOR		2	1	2	1	1		1				2	1	3	1	**7**
MINOR	3	3	2	2	2			5	2	2	4	2	4	7	4	**21**
PDO	8	2	11	14	23	10	12	18	19	13	11	18	11	13	16	**69**
TOTAL	**13**	**9**	**16**	**19**	**28**	**15**	**14**	**27**	**24**	**16**	**17**	**27**	**17**	**25**	**30**	**116**
TOTAL-non ani.	**11**	**7**	**14**	**18**	**26**	**11**	**12**	**24**	**21**	**15**	**15**	**22**	**16**	**23**	**21**	**97**

Collision Summary Last 5 Yrs (2013 - 2017)

(Non animal collisions)

Month	Freq	Hour	AM	PM	Weekday	Freq
Jan:	8	0:	1	5	Mon:	14
Feb:	10	1:		2	Tue:	14
Mar:	10	2:	2	10	Wed:	11
Apr:	8	3:	1	6	Thu:	21
May:	5	4:		2	Fri:	15
Jun:	3	5:		5	Sat:	7
Jul:	3	6:	7	7	Sun:	14
Aug:	2	7:	14	6	unknown:	1
Sep:	6	8:	4	3		
Oct:	13	9:	4	4		
Nov:	16	10:	6	2		
Dec:	12	11:	4	1		
unknown:	1	unknown:	1			

INT polygon yr: 31-Mar-2019

Collision event	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	**Last 5 yrs**
ANIMAL	2	2	2	1	2	4	2	3	3	1	2	5	1	2	9	**19**
BACKING							2									**0**
HEAD ON																**0**
LEFT TURN:ACROSS PATH														1		**1**
OFF ROAD LEFT	3		2	3	7	4	3	10	3	3	5	3	4	1	2	**15**
OFF ROAD RIGHT	2	5	5	5	10	3	2	8	8	4	4	4	3	3	5	**19**
OTHER					2						1			1	1	**3**
PASSING:LEFT TURN																**0**
PASSING:RIGHT TURN																**0**
PEDESTRIAN																**0**
REAR END	1	1		4	1	1	2	2	6	4	1	7	1	1	2	**12**
RIGHT ANGLE	1	1	2	1	1	2	1		1	1		2		3	3	**8**
SIDESWIPE:OPP DIR									1							**0**
SIDESWIPE:SAME DIR	3		4	4	5	1	2	4	2	2	1	2	6	7	4	**20**
STRUCK OBJECT	1		1	1						1	3	4	2	6	4	**19**
UNKNOWN																**0**

*The number of collision in this report are collisions at and near the intersection and is calculated using intersection polygon in TIMS.

*Cost of PDO collision had increased from $1,000 to $2,000 in 2011

INT Collision Direction

Report Notes

Number of results found 1

This Section contains information about the direction of collisions occurring at selected intersections.

INT #: 34 LOCATION: HIGHWAY 2:12 AND 2:15 AND 2A:06 AND 552:02

2013 - 2017 Collision Objects: Vehicle 1 and 2 Travel Direction Summary

All non animal:	**NB**	NE	**EB**	SE	**SB**	SW	**WB**	NW	U
FATAL									
MAJOR	1			1		1	1	2	3
MINOR	4	9		6	2	3	1	9	1
PDO	14	20	5	11	6	16	2	19	5
Total	19	29	5	18	8	20	4	30	9

Right angle	**NB**	NE	**EB**	SE	**SB**	SW	**WB**	NW	U
FATAL									
MAJOR				1		1			
MINOR				3	1	3	1		
PDO		1		3		2			
Total	0	1	0	7	1	6	1	0	0

Left turn across path	**NB**	NE	**EB**	SE	**SB**	SW	**WB**	NW	U
FATAL									
MAJOR									
MINOR									
PDO			1				1		
Total	0	0	1	0	0	0	1	0	0

Rear end	**NB**	NE	**EB**	SE	**SB**	SW	**WB**	NW	U
FATAL									
MAJOR									2
MINOR		2						4	
PDO		6	2	2		2		2	2
Total	0	8	2	2	0	2	0	6	4

Other collisions	**NB**	NE	**EB**	SE	**SB**	SW	**WB**	NW	U
BACKING	0	0	0	0	0	0	0	0	0
HEAD ON	0	0	0	0	0	0	0	0	0
OFF ROAD LEFT	2	1	0	1	1	2	0	6	2
OFF ROAD RIGHT	4	4	0	3	1	2	1	4	0
OTHER	2	3	0	0	0	0	0	0	1
PASSING:LEFT TURN	0	0	0	0	0	0	0	0	0
PASSING:RIGHT TURN	0	0	0	0	0	0	0	0	0
PEDESTRIAN	0	0	0	0	0	0	0	0	0
SIDESWIPE:OPP DIR	0	0	0	0	0	0	0	0	0
SIDESWIPE:SAME DIR	10	8	2	4	2	4	0	10	0
STRUCK OBJECT	1	4	0	1	3	4	1	4	2
UNKNOWN	0	0	0	0	0	0	0	0	0

Collision with no dir. data # coll

*U: unknown direction

APPENDIX C
Site Photos

Appendix C: Site Photos

Photo 1: Highway 2:12 NBL/R ramp, looking south at Highway 2

Photo 2: Highway 2:12 NBL/R ramp, looking east at ramp

Photo 3: Highway 2:12 NBL/R ramp, looking east at ramp

Photo 4: Highway 2:12 NBL/R ramp, looking east at gravel access

Photo 5: Highway 2:12 NBL/R ramp, looking south at ramp

Photo 6: Highway 2:12 NBL/R ramp, looking at the left turn onto Highway 522

Photo 7: Highway 2:12 NBL/R ramp, looking at the left turn onto Highway 522

Photo 8: Stop sign on Highway 2:12 NBL/R ramp, at the left turn onto Highway 522

Photo 9: Highway 2:12 NBL/R ramp, looking at the right onto Highway 522

Photo 10: Left turn on Highway 2:12 NBL/R ramp

Photo 11: Highway 2:12 NBL/R ramp, looking at the left onto Highway 522

Photo 12: Highway 522 looking east, west of left turn

Photo 13: Highway 522, looking west at bridge

Photo 14: Highway 522, looking west at bridge

Photo 15: Highway 522, looking west at bridge

Photo 16: Highway 2A, looking west at bridge

Photo 17: Looking north at Highway 2 from overpass

Photo 18: Looking east at Highway 522 from bridge

Photo 19: Highway 522 looking at entrance to Highway 522:2 EBL ramp

Photo 20: Entrance to Highway 522:2 EBL ramp

Photo 21: Highway 2:15 SBL/T/R ramp, looking north

Photo 22: Highway 2:15 SBL/T/R ramp, looking south

Photo 23: Highway 2:15 SBL/T/R ramp, looking right ramp

Photo 24: Highway 2:15 SBL/T/R ramp, looking south at through/left turn

Photo 25: Highway 2:15 SBL/T/R ramp, looking south at through/left turn

Photo 26: Highway 2:15 SBL/T/R ramp, looking south at through/left turn

Photo 27: Highway 2:15 SBL/T/R ramp, looking east at Highway 2A

Photo 28: Highway 2:15 SBL/T/R ramp, looking south at through

Photo 29: Highway 2:15 SBL/T/R ramp, looking west at Highway 2A

Photo 30: Highway 2A looking west, east of Highway 2:15 SBL/T/R ramp

Photo 31: Highway 2A looking east at bridge

Photo 32: Highway 2A looking west

Photo 33: Highway 2A looking east at bridge

Photo 34: Looking north at Highway 2 from overpass

Photo 35: Highway 2A looking east towards overpass

Photo 36: Highway 2A looking west

Photo 37: Highway 2A looking west

Photo 38: Highway 2A at entrance Highway 2A:06 EBR ramp

Photo 39: Highway 2A looking east towards overpass

Photo 40: Highway 2A looking west, east of entrance Highway 2A:06 EBR ramp

Photo 41: Highway 2:12, 2:15 bypass, looking south

Photo 42: Highway 2:12, 2:15 bypass, looking south

Photo 43: Highway 2:12, 2:15 bypass, looking north

Photo 44: Highway 2A looking east at bridge

Photo 45: Highway 2A looking east at bridge

Photo 46: Looking northeast at overpass

Photo 47: Highway 2A:06 EBR ramp, south of the overpass, looking north

Photo 48: Looking north at the overpass from Highway 2

APPENDIX D
Traffic Control Signage

Highway	R or L	Direction	Sign Name	Reference	KM Location	Applicable Guidance	Sign Condition	Lateral Placement (edge of travel way to edge of sign) Requirement - 6m based on AT recommended practice	Vertical Placement (edge of travel way to bottom of sign) Requirement - 1.5 to 2.5 m based on AT recommended practice	Retro-reflectivity
								Approximate	Apprximate Vertical Height	
2:15	R	NB	Maximum speed 110 km/h	RB-1x2	0.117	MUTCD	Good	9 m (right side, on lightpole) 6.5 m (left side)	2.0 m	Good
	R	NB	Merge from Right	WA-16-R	0.26	MUTCD	Good	9 m (on light pole)	2.0 m	Good
	R	NB	Merge from Right	WA-16-R	0.405	MUTCD	Good	6.6 m (on light pole)	2.0 m	Good
	L	SB	Ramp Advisory Speed	WA-10A	0.616	AT	Good	8.5 m (on light pole)	1.5 m	Good
	L	SB	Overhead guide for two lanes/ Overhead exit direction guide	IF-207A/ IF-204A	0.569	AT	Good	10.5 m (to vertical)	not measured (overhead)	Good
	L	SB	Numbered exit sign	IF-205A	0.377	AT	Good	5 m (appr mid between ramp and HWY)	1.5 m	Good
	L	SB	Low clearance	WA-26x2	0.252	MUTCD	Good	5.0 m	2.0 m	Good
	L	SB	Alberta Route Marker for Highway Number 2	IB-2X2	0.168	AT	Good	6.0 m	1.5 m	Good
	L	SB	Low Clearance	WA-27	0.021	MUTCD	Good	n/a (overhead on overpass)	not measured (overhead)	Good
2:12	R	NB	Exit Direction sign	IF-204	27.93	AT	Good	5.0 m	1.5 m	Good
	R	NB	Ramp Advisory Speed	WA-10A	28.006		Good	6.5 m (on light pole)	1.5 m	Good
	R	NB	Numbered exit sign	IF-205A	28.28	AT	Good	5.5 m (mid point between ramp and hwy)	1.0 m	Good
	R	NB	Low clearance	WA-26x2	28.368	MUTCD	Good	7.m (left side), 6.0 m (right side)	1.5 m	Good
	R	NB	Overhead Directional Sign	IF-208?	28.413		Good		not measured (overhead)	Good
	R	NB	Added Lane (right)	WA-112-R	28.563	MUTCD	Good	5.0 m	1.5 m	Good
	R	NB	Low Clearance	WA-27	28.663	MUTCD	Good	n/a (overhead on overpass)	not measured (overhead)	Good
	L	SB	Road Narrows - Loss of Lane	WA-33X-R X 2	27.725	MUTCD	Good	8 m (right side, on light pole), 6.5 m (left side)	2.0 m	Good
	L	SB	South/Alberta Route Marker for Highway Number 2	IB-12-T /IB-2	27.849	AT	Good	5 m (right side, on light pole), 7.5 m (left side)	2.0 m	Good
	L	SB	Maximum speed 110 km/h	RB-1X2	27.972	MUTCD	Good	6 m (both sides)	2.0 m	Good
	L	SB	Road Narrows - Loss of Lane	WA-33X-R X2	28.321	MUTCD	Good	6. 0 m (left side), 8.5 m (right side on light pole)	2.0 m	Good
2A:06	R	EB	Maximum speed 80 km/h	RB-1	5.47	MUTCD	Good	5.0 m	1.5 m	Good
	R	EB	Overhead sign (loop ramp) + Exit Direction		5.538	AT	Good	5.5 m (to vertical)	not measured (overhead)	Good
	R	EB	Ramp Advisory Speed	WA-10A	5.554	AT	Good	4.0 m	1.2 m	Good
	R	EB	Exit	IF-205	5.672	MUTCD	Good	4.5 m (to highway), 2.0 m (to ramp)	2.0 m	Good
	R	EB	Lane control (2 right lanes)	RB-47-R	5.734	MUTCD	Slight tilt, 300 m tab is bent	5.0 m	2.0 m	Good
	R	EB	One Way (right)	RB-21-L	5.776	MUTCD	Good	4.0 m	2.0 m	Good
	R	EB	Hazard Marker- Object on Right	WA-36-R	5.823	AT	Possibly damaged (diffucult to confirm from field video)	2.0 m (on guard rail)	1.0 m	Good
	R	EB	Overhead guide + exit only	IF-207+ IF-207B	5.859	AT	Good	3.5 m (to vertical)	not measured (overhead)	Good
	R	EB	Ramp Advisory Speed	WA-10A	5.877	AT	Good	3.5 m	1.5 m	Good
	R	EB	Truck use right lane	Trucks use right lane	5.978	MUTCD?	Good	2.0 m (top of slope)	1.5 m	Good
	R	EB	Overhead guide + exit direction guide (two lanes)	IF-207 + IF-204A	6.032	AT	Good	2.0 m (to vertical)	not measured (overhead)	Good
	L	WB	Exit direction guide	IF-204	5.912	AT	Damaged	4.0 m (behind guardrail)	2.5 m	Good
	L	WB	South/ Alberta Route Marker for Highway Number 2/ Left Arrow	IB-12-T/ IB-2/ IB-8-TL	5.841	AT	Good	4.0 m (behind guardrail)	2.0 m	Good
	L	WB	Do not enter/Do not enter/Stop	RB-23X2/ RB-23-T/RA-1	5.811	MUTCD	Good	5.5 m (to vertical)	1.5 m	Good
	L	WB	Merge from Right	WA-16-R	5.668	MUTCD	Good	3.0 m (mid point between ramp and hwy)	1.5 m	Good
	L	WB	Maximum speed 80 km/h	RB-1	5.555	MUTCD	Good	6.5 m (on vertical pole)	1.5 m	Good
552:02	R	EB	No right turn + no right turn tab	RB-11-R + RB-11-TR	0.197	MUTCD	Good	4.0 m	1.5 m	Good
	R	EB	Hazard Marker- Object on Left	WA-36-L	0.221	AT	Bent post/sign	In median	1.0 m	Good
	R	EB	Alberta Route Marker for Highway Number 552/east	IB-100/IB-11-T	0.245	AT	Good	4.0 m	2.0 m	Good
	R	EB	Divided highway ends	WA-32/Divided highway end (similar to WA-32-T)	0.575	MUTCD	Discoloured	5.0 m	1.5 m	Good
	R	EB	Two way traffic	RB-24	0.641	MUTCD	Good	4.0 m	1.5 m	Good
	R	EB	One way (left)	RB-21-L	0.659	MUTCD	Good	4.0 m	1.5 m	Good
	R	EB	Alberta Route Marker for Highway Number 552/east	IB-100/IB-11-T	0.707	AT	Good	6.0 m	2.0 m (on light pole)	Good
	L	WB	Hazard Marker- Object on Right/ Keep right	WA-36-R/ RB-25	0.675	AT	Good (flashing light operational)	Median Placement	0.5 m	Good
	L	WB	Exit Direction sign	IF-204	0.531	AT	Good	7.0 m	2.5 m	Good
	L	WB	Ramp Advisory Speed	WA-10A	0.459	AT	Good	5.0 m	2.0 m	Good
	L	WB	Exit	IF-205	0.309	AT	Good	6.5 m	1.5 m	Good

Highway	R or L	Direction	Sign Name	Reference	KM Location	Applicable Guidance	Sign Condition	Lateral Placement (edge of travel way to edge of sign) Requirement - 6m based on AT recommended practice	Vertical Placement (edge of travel way to bottom of sign) Requirement - 1.5 to 2.5 m based on AT recommended practice	Retro-reflectivity
								Approximate	Apprximate Vertical Height	
	L	WB	No left turn + no left turn tab	RB-11-L + RB-11-TL	0.231	MUTCD	Good	5.0 m	2.0 m	Good
	L	WB	Left Checkerboard	WA-8-L	0.213	MUTCD	Good	4.0 m	2.0 m	Good
	L	WB	Hazard Marker- Object on Right/	WA-36-L/WA-36-R	0.153	AT	Good	Median Placement		Good
Highway 2:12 NBL/R Ramp		NBL/R	Single Directional	IA-201	0.173	AT	Good	6.0 m	1.5 m	Good
		NBL/R	Single Guide Sign/municipal airport	IA-200/IC-12	0.222	AT	Good	6.0 m	1.5 m	Good
		NBL/R	Trail-Blazer for converntional highways	IC-217A	0.232	AT	Good	5.0 m (on light pole)	1.0 m	Good
		NBL/R	Single Directional	IA-201	0.284	AT	Good	6.0 m	1.4 m	Good
		NBL/R	Informational Sign	IA sign	0.329	AT	Good	4.5 m	2.0 m	Good
		NBL	Chevron Alignment	WA-9X4	0.402	MUTCD	Good	4.5 m (for all)	1.2 m (for all)	Good
		NBR	Yield	RA-2	0.613	AT	Good	Okay	2.0 m	Good
Highway 552:2 EBR Ramp			Chevron Alignment	WA-9	0.008	MUTCD	Good	3.5 m (behind guardrail)	1.5 m	Covered due to snow/dirt.
			Chevron Alignment	WA-9	0.051	MUTCD	Good	3.5 m (behind guardrail)	1.5 m	Covered due to snow/dirt.
			Chevron Alignment	WA-9	0.102	MUTCD	Good	3.5 m (behind guardrail)	1.5 m	Covered due to snow/dirt.
			Chevron Alignment	WA-9	0.155	MUTCD	Good	3.5 m (behind guardrail)	1.5 m	Covered due to snow/dirt.
			Chevron Alignment	WA-9	0.211	MUTCD	Good	3.5 m (behind guardrail)	1.5 m	Covered due to snow/dirt.
			Chevron Alignment	WA-9	0.265	MUTCD	Good	3.5 m	1.5 m	Good
			Hazard Marker	WA-36-R	0.364	AT	Good	3.5 m (on guardrail)	0.5 m	Good
			Added lane (Right)	WA-112-R	0.375	MUTCD	Good	4.0 m (behind guardrail)	2.0 m	Good
Highway 2:15 SBL/R Ramp		SBL/R	Alberta Route Marker for Highway Number 2/ North/ Alberta Routh Marker for highway 552/ Left Arrow/ Right Arrow	IB-2/ IB-10-T/ IB-100/ IB-8-TL/ IB-8-TR	0.02	AT	Damaged/bent	6.0 m	1.5 m	Good
		SBL/R	Single Right Turn Curve	WA-3-R	0.168	MUTCD	Good	8.0 m (on light pole)	2.0 m	Good
		SBL/R	Hazard marker - centre	WA-36	0.329	AT	Good	4.5 m (mid point between left/right ramps)	1.5 m	Covered due to snow/dirt.
		SBL	Stop ahead	WB-1	0.021	MUTCD	Good	5.0 m	1.5 m	Good
		SBL	East/left arrow/Alberta route marker for highway 552	IB-11-T/IB-8-TL/IB-100	0.041	AT	Good	5.0 m	1.5 m	Good
Highway 2A:06 EBR Ramp			Merge from Right	WA-16-R	0.123	MUTCD	Twisted pole	4.0 m	2.0 m	Good
			Merge from Right	WA-16-R	0.12	MUTCD	Good	4.0 m	2.0 m	Good

APPENDIX E

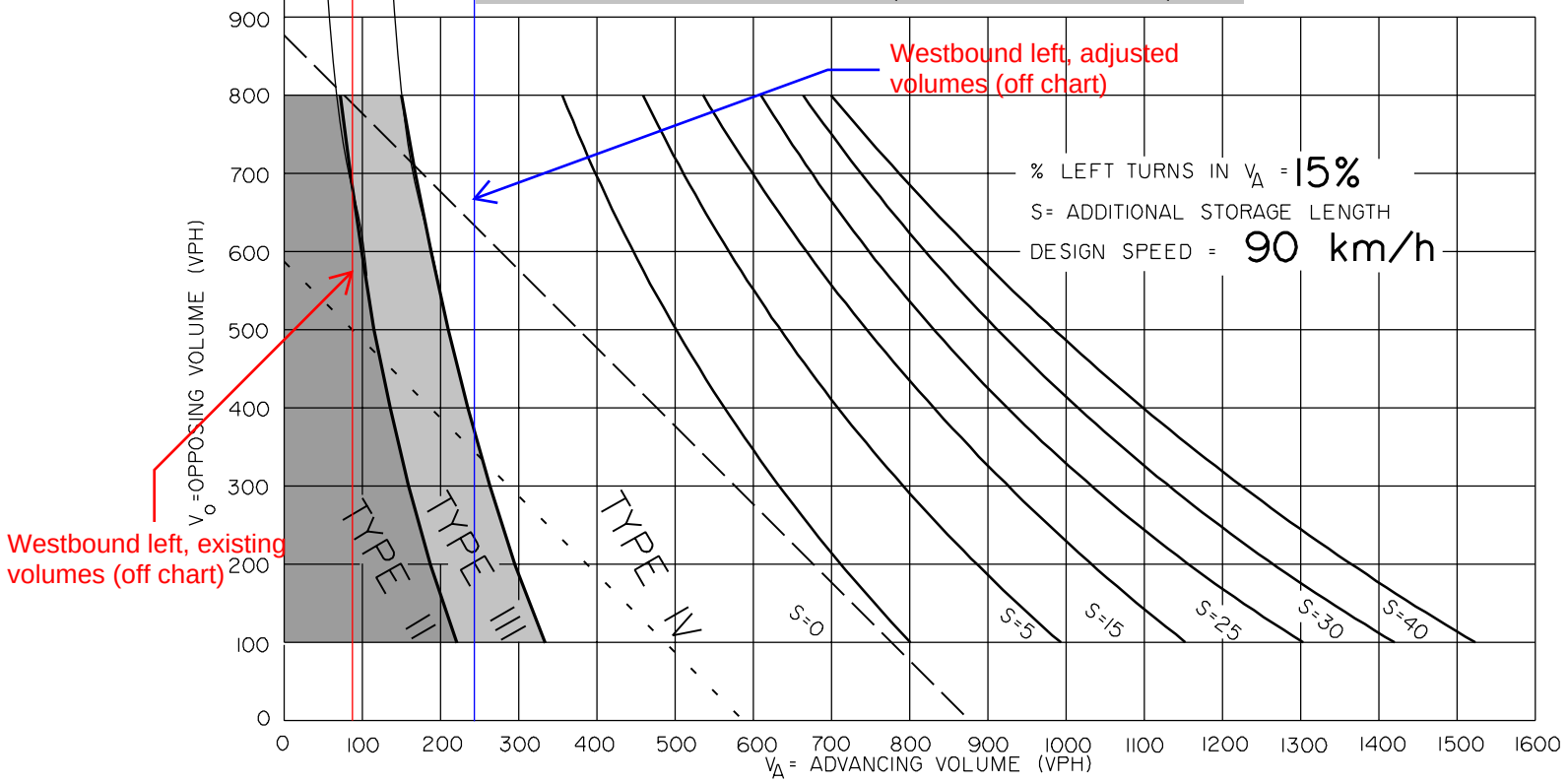
Detailed Collision Reports
(For Digital Viewing)

Collision Id	Collision Date	Collision Time	Collision Type	Primary Event	Primary Event (Updated)	Collision Severity	Vehicle 1 Direction	Vehicle 1 Maneuver	Vehicle 2 Direction	Vehicle 2 Maneuver	Description	Environmental Condition	Surface Condition	NESS Light Condition	Original Road Name	Latitude	Longitude	Total Fatalities	Total Vehicles	Total Vehicles Group	ISL Quality Review Comments	Changes Made
266477	24-Jan-2013	09:15:00 AM	FIXED OBJECT LEFT/MEDIAN DITCH	OFF ROAD LEFT		PROPERTY DAMAGE ONLY	UNKNOWN	Moving Ahead			DRIVER TOOK EVASIVE CAUTION TO AVOID COLLIDING WITH VEHICLE ON PRIOR COLLISION LOST CONTROL ON ICY ROAD SURFACE COMING TO REST ON CONCRETE BARRIER, HIGH CENTERED. DAMAGE STICKER ISSUED.			DAYLIGHT	2A	50.7986818	-113.9679897	0	1	1	No comments	
266507	21-Sep-2013	05:00:00 AM	ANIMAL	STRUCK OBJECT	ANIMAL	PROPERTY DAMAGE ONLY	NORTHBOUND	Moving Ahead			#1 TRAVELLING NORTH BOUND ON HWY 2 @ HWY 2A WHEN DEER CAME ONTO HIGHWAY FROM LEFT, #1 TRAVELLING 100 KM/HR STRUCK DEER WITH FRONT OF VEHCICLE,			DARKNESS	2	50.8048512	-113.9750334	0	1	1	No comments	
268815	22-Jul-2013	09:40:00 PM	STRIKE FIXED OBJECT ON ROADWAY	STRUCK OBJECT		PROPERTY DAMAGE ONLY	UNKNOWN	Moving Ahead			VEH LOST CONTROL FROM HEAVY RAINFALL - HYDRO PLANE STRUCK POLE			DARKNESS	2	50.7989913	-113.9686498	0	1	1	No comments	
268907	04-Jan-2013	08:45:00 PM	ANIMAL	STRUCK OBJECT	ANIMAL	PROPERTY DAMAGE ONLY	NORTHEASTBOUND	Moving Ahead			DAMAGE STICKER 7068956. V1 TRAVELING E ON HWY 552, DEER APPROACHED FROM RIGHT SIDE STRIKING RIGHT FRONT PASSENGER SIDE OF VEHICLE.			DARKNESS	552	50.7988687	-113.9677268	0	1	1	No comments	
268915	28-Jan-2013	09:45:00 PM	RUN OFF ROAD LEFT/MEDIAN SIDE	OFF ROAD LEFT		PROPERTY DAMAGE ONLY	SOUTHBOUND	Moving Ahead			VEH1 WAS EXITING OFF OF HWY 2 SB ONTO HWY 2A. VEHICLE HIT ICE, WENT OFF ROAD STRIKING A LIGHT STANDARD. DRIVER ISSUED VT FOR DRIVING AT UNREASONABLE RATE OF SPEED.			DARKNESS	2	50.79858496	-113.970535	0	1	1	Description does not match location, should be on the SBR ramp east of this location. This should be moved to the ramp on Highway 2	Move to SB ramp to match description, but may not be exact location.
271542	10-Dec-2013	06:00:00 AM	FIXED OBJECT LEFT/MEDIAN DITCH	OFF ROAD RIGHT		PROPERTY DAMAGE ONLY	NORTHBOUND	Moving Ahead			V1 ROUNDED THE LONG SWEEPING BEND NORTH OF OKOTOKS LOST TRACTION SPUN OUT OF CONTROL V1 HIT A STREET LIGHT BEFORE COMING TO STOP.			DAYLIGHT	552	50.7986988	-113.9680113	0	1	1	Description does not match location, should be on a "bend". Delete, location does not make sense.	Deleted from map (uncertain location).
275846	09-Dec-2013	09:15:00 AM	FIXED OBJECT LEFT/MEDIAN DITCH	OFF ROAD LEFT		PROPERTY DAMAGE ONLY	SOUTHWESTBOUND	Moving Ahead			VEHICLE SB ON HWY 2 TOOK OFF RAMP TOWARD HWY 2A, LOST CONTROL ON ICE WENT ACROSS MEDIAN ENTERED HWY 2A AND STRUCK CONCRETE MEDIAN	SNOW	SLUSH/SNOW/ICE	DAYLIGHT	2	50.79848149	-113.9705003	0	1	1	Description does not match location, should be on the SBR ramp east of this location. Move to the off ramp.	Move to SB ramp to match description, but may not be exact location.
276045	26-Dec-2013	06:00:00 AM	ANIMAL	STRUCK OBJECT	ANIMAL	PROPERTY DAMAGE ONLY	NORTHBOUND	Moving Ahead			VEHICLE WAS NORTH BOUND ON HIGHWAY 2 AT OKOTOKS OVERPASS. DEER RAN OUT IN FRONT OF THE VEHICLE AND STRUCK THE DRIVER'S SIDE MIRROR/WINDSHIELD/ BUMPER DUP COLLISION DELETED CASE # 2831641 OFF OF ACIS ONLY	CLEAR	DRY	DARKNESS	2	50.7941122	-113.9622788	0	1	1	No comments	
276805	10-Jun-2013	08:05:00 AM	STRIKE FIXED OBJECT ON ROADWAY	STRUCK OBJECT		MINOR	UNKNOWN	Moving Ahead			V1 WAS PROCEEDING DOWN INTERCHANGE, STRUCK GUARD RAIL. VT ISSUED 12(2)(A) UHRRR.	CLEAR	DRY	DAYLIGHT	2	50.7988297	-113.9678759	0	1	1	No comments	
277967	17-Oct-2013	06:00:00 AM	FIXED OBJECT RIGHT DITCH	OFF ROAD LEFT		MINOR	NORTHWESTBOUND	Moving Ahead			VEH #1 TRAVELLING NORTH ON HWY 2. MEDICAL ISSUE, BLACKED OUT & WENT OFF THE ROAD THROUGH 2 SETS OF FENCES THAT BELONGED TO TWO DIFFERENT PEOPLE	UNKNOWN	UNKNOWN	DARKNESS	2	50.79872218	-113.9677565	0	1	1	Location does not match description. Move to northbound on Highway 2, underneath the overpass.	Moved to NB Hwy 2 close to beneath the overpass
278010	03-Nov-2013	06:00:00 PM	STRIKE NON-FIXED OBJECT ON ROADWAY	STRUCK OBJECT		PROPERTY DAMAGE ONLY	NORTHWESTBOUND	Moving Ahead			VEH1 DRIVING NB ON HWY 2 OUTSIDE LANE. COUCH ON THE ROAD. TRIED TO NOT HIT IT BUT HAD NO TIME AND STRUCK IT WITH RIGHT FRONT END. DAMAGE STICKER 6988128	CLEAR	DRY	DARKNESS	2	50.7975774	-113.9664158	0	1	1	No comments	
278636	13-Jan-2013	12:00:00 PM	SAME DIRECTION SIDESWIPE	SIDESWIPE SAME DIRECTION		PROPERTY DAMAGE ONLY	NORTHBOUND	Moving Ahead	NORTHBOUND	Moving Ahead	D1 NB HWY 2, D2 BEHIND TRIED TO PASS AND LOST CONTROL, SIDESWIPED D1, D1 RAN OFF ROAD RIGHT, HIT SIGN + LIGHT POLE D2 CONTINUED ON BUT RETURNED TO SCENE, NO WHERE TO STOP HE SAID AND CAME BACK	CLEAR	SLUSH/SNOW/ICE	DAYLIGHT	2	50.79842709	-113.9673167	0	2	2	Move location a little to the east to put it on northwest bound lane of Hwy 2.	Moved to NB lanes
278643	25-Dec-2013	10:00:00 AM	RUN OFF ROAD RIGHT	OFF ROAD RIGHT		MINOR	NORTHEASTBOUND	Moving Ahead			V1 TRAVELING EB HIT GRAVEL AND SPUN INTO SIDE DITCH	CLEAR	DRY	DAYLIGHT	552	50.8018665	-113.9635634	0	1	1	No comments	
280703	31-May-2013	07:30:00 AM	STRIKE NON-FIXED OBJECT ON ROADWAY	OTHER		PROPERTY DAMAGE ONLY	NORTHEASTBOUND	Moving Ahead	NORTHEASTBOUND	Moving Ahead	DAMAGE STICKER 7568080. V1 DRIVING ON HWY 2A NB. TRUCK (V2) DRIVING AHEAD OF V1 DROPPED A PIECE OF DEBRIS FROM NETTED LOAD AND HIT V1 FENDER AND PASSENGER SIDE "A" FRAME. NO INFO ON TRUCK.	RAINING	WET	DAYLIGHT	2A	50.7978739	-113.9691502	0	2	2	No comments	
280720	18-Feb-2013	03:30:00 PM	FIXED OBJECT AND OVERTURN IN DITCH LEFT/MEDIAN	OFF ROAD LEFT		PROPERTY DAMAGE ONLY	NORTHBOUND	Moving Ahead			V1 EXITING OFF OKOTOKS OVERPAS TO GO NORTH ON HWY 2, V1 GOING APPROX 60KM/HR HIT GRAVEL, LOST CONTROL & HIT GUARD RAIL CAME TO A STOP	CLEAR	LOOSE SURFACE MATERIAL	DAYLIGHT	2	50.7990323	-113.9681159	0	1	1	No comments	
280760	17-Mar-2013	11:03:00 AM	FIXED OBJECT RIGHT DITCH	OFF ROAD RIGHT		PROPERTY DAMAGE ONLY	NORTHBOUND	Moving Ahead			V1 EXITING ON OFF RAMP TO HWY 2 LOST CONTROL STRUCK LIGHT POLE RIGHT SIDE ENDED UP IN THE DITCH.	SNOW	SLUSH/SNOW/ICE	DAYLIGHT	2A	50.7986818	-113.9679897	0	1	1	No comments	
280763	27-Oct-2013	10:30:00 AM	RUN OFF ROAD RIGHT	OFF ROAD RIGHT		PROPERTY DAMAGE ONLY	NORTHBOUND	Moving Ahead			VEH1 NB HWY 2. HIT ICE AND JACK-KNIFED INTO DITCH.	SNOW	SLUSH/SNOW/ICE	DAYLIGHT	2	50.7987907	-113.9678302	0	1	1	No comments	
283916	11-Oct-2013	07:40:00 AM	REAR END ALL OTHERS	REAR END		MINOR	NORTHEASTBOUND	Stopped/Stopping in Traffic	NORTHEASTBOUND	Moving Ahead	VEHICLE WAS TRAVELLING EAST ON 552. VEHICLE STRUCK GUARD RAIL WHILE GOING OVER OVERPASS. ROAD CONDITIONS WERE SNOW COVERED & ICY. VEHICLE STOPPED ON ROADWAY CAUSED CHAIN REACTION OF REAR ENDING COLLISIONS. V3 & V4 WERE TRAVEL	CLEAR	SLUSH/SNOW/ICE	UNKNOWN	552	50.7988875	-113.9677009	0	5	>3	No comments	
290222	28-Mar-2014	10:00:00 PM	STRIKE FIXED OBJECT ON ROADWAY	STRUCK OBJECT		PROPERTY DAMAGE ONLY	NORTHWESTBOUND	Avoiding A Vehicle			VEHILCLE ONE TRAVELLING N ON HWY 2 TOWARDS CALGARY VEHICLE TWO WAS MERGING TOWARDS VEHICLE ONE, IN ORDER TO PREVENT AN ACCIDENT VEHICLE ONE MOVED OVER STRIKING THE GUARD RAIL DAMAGE STICKER ISSUED	FOG/SMOKE/SMOG/DUST	SLUSH/SNOW/ICE	DAYLIGHT	2	50.8017655	-113.971353	0	1	1	No comments	
290479	29-Apr-2014	05:00:00 PM	STRIKE FIXED OBJECT ON ROADWAY	STRUCK OBJECT		PROPERTY DAMAGE ONLY	NORTHEASTBOUND	Moving Ahead			#1 E/B ON 552 TAKING OVERPASS TO N/B HIGHWAY 2A LOST CONTROL ON GRAVEL COLLIDING WITH GUARD RAIL.	CLEAR	DRY	DAYLIGHT	552	50.7994788	-113.9668861	0	1	1	No comments	
290518	30-Apr-2014	12:00:00 PM	STRIKE NON-FIXED OBJECT ON ROADWAY	STRUCK OBJECT		PROPERTY DAMAGE ONLY	SOUTHEASTBOUND	Moving Ahead			GOING SOUTH ON HIGHWAY 2 JUST PRIOR TO THE 552 EXIT. VEHICLE IN FRONT OF HER SLAMMED ON THEIR BRAKES AND AN OBJECT FLEW OUT OF THE BACK OF THE TRUCK. DAMAGE STICKER ISSUED.	CLEAR	DRY	DAYLIGHT	2	50.8040035	-113.9746388	0	1	1	No comments	
290823	21-May-2014	01:25:00 PM	REAR END ALL OTHERS	REAR END		PROPERTY DAMAGE ONLY	NORTHWESTBOUND	Moving Ahead	NORTHWESTBOUND	Moving Ahead	BOTH VEHICLES WB ON OVERPASS. V2 CLEANING THE STREETS. V1 COULDN'T SEE BEHIND AND REAR ENDED V2	CLEAR	DRY	DAYLIGHT	2	50.7992141	-113.9683311	0	2	2	Description does not match location, should be on the overpass. May be deletable.	Deleted from map (uncertain location).
290905	21-May-2014	04:46:00 PM	ANGLE ALL OTHERS	RIGHT ANGLE		PROPERTY DAMAGE ONLY	SOUTHEASTBOUND	Stopping/Stopped In Traffic	SOUTHWESTBOUND	Moving Ahead	VEHICLE TWO TRAVELLING WB O HWY 2A ONTO OVERPASS VEHICL EONE HAD STOPPED AT STOP SIGN ON HWY 552, PULLED OUT INFRONT OF VEHICLE TWO AND WAS STRUCK. BOTH VEHICLES POSSIBLE WRITE OFFS	CLEAR	DRY	DAYLIGHT	2A	50.80013365	-113.9659568	0	2	2	Location needs to move to the stop sign further southeast. Move to the ramp intersection.	Moved to stop sign intersection
291047	04-Jun-2014	11:30:00 PM	ANIMAL	STRUCK OBJECT	ANIMAL	PROPERTY DAMAGE ONLY	UNKNOWN	Moving Ahead			VEHICLE ONE TRAVELLING HWY 2 STRUCK MOOSE NO INJURIES	CLEAR	DRY	DARKNESS	2	50.794922	-113.9632463	0	1	1	No comments	
291810	22-Mar-2014	02:35:00 AM	FIXED OBJECT AND OVERTURN IN DITCH LEFT/MEDIAN	OFF ROAD LEFT		MAJOR	NORTHBOUND	Moving Ahead			VEHICLE ONE HAD BEEN TRAVELLING N ON HWY 2A VEHICLE ONE WSA TRAVELLING AT HIGH RATE OF SPEED HIT BLVD, VEHICLE ROLLED A NUMBER OF TIMES FRONT PASSENGER WAS EJECTED AND VEHICLE TIRE LANDING ON HIM	SNOW	WET	DARKNESS	2A	50.7965737	-113.9709586	0	1	1	No comments	
291812	10-Jul-2014	05:15:00 AM	ANIMAL	STRUCK OBJECT	ANIMAL	PROPERTY DAMAGE ONLY	NORTHWESTBOUND	Moving Ahead			VEHICLE 1 NORTHBOUND ON HWY 2 JUST SOUTH OF OKOTOKS OVERPASS, DEER CAME FROM RIGHT HAND DITCH AND COLLIDED WITH VEHICLE. DAMAGE STICKER 8079390 ISSUED.	CLEAR	DRY	DAYLIGHT	2	50.7977647	-113.9666393	0	1	1	No comments	
291815	29-Jun-2014	08:00:00 PM	ANIMAL	STRUCK OBJECT	ANIMAL	PROPERTY DAMAGE ONLY	UNKNOWN	Moving Ahead			VEHICLE ONE TRAVELLING ON HWY 2 DEER STRUCK THE DRIVERS SIDE DOOR AND REAR QUARTER PANEL. DAMAGE STICKER ISSUED.	CLEAR	WET	DAYLIGHT	2	50.799347	-113.9689728	0	1	1	No comments	
293553	30-Sep-2014	06:15:00 AM	SAME DIRECTION SIDESWIPE	SIDESWIPE SAME DIRECTION		MINOR	NORTHWESTBOUND	Moving Ahead	NORTHWESTBOUND	Moving Ahead	VEH 1 (OBJECT1_LN(W)) WAS DRIVING NORTH ON HWY 2 AND VEH 2 WAS IN LANE NEXT TO VEH 1 AND SIDE-SWIPED DRIVER'S SIDE OF VEH 1. VEH 1 HAS DAMAGE IN RIGHT UNDERCARRIAGE (FROM GOING IN DITCH) AND ON DRIVER'S SIDE. D	RAINING	WET	UNKNOWN	2	50.7932827	-113.9612877	0	2	2	No comments	
293563	27-Sep-2014	10:30:00 AM	REAR END ALL OTHERS	REAR END		PROPERTY DAMAGE ONLY	UNKNOWN	Moving Ahead	UNKNOWN	Moving Ahead	TRAFFIC SLOWED DOWN FROM 80KM/HR TO 50KM/HR AND VEH 1 WAS ABLE TO SLOW BUT VEH 2 BEHIND VEH 1 WAS NOT ABLE TO AND REAR-ENDED VEH 1. DAMAGE STICKER ISSUED TO VEH 1. VEH 2 INFORMATION RECEIVED FROM VEH 1. VEH 2 H	RAINING	WET	DAYLIGHT	2A	50.7985125	-113.9682258	0	2	2	No comments	
293782	05-Oct-2014	08:25:00 PM	FIXED OBJECT RIGHT DITCH	OFF ROAD RIGHT		PROPERTY DAMAGE ONLY	SOUTHBOUND	Avoiding A Vehicle			VEH1 DRIVING SB ON OKOTOKS OVERPASS. WAS APPROACHING A VEHICLE TRAVELING NB IN SB LANE. TURKED TO AVOID AND ENDED UP IN BARRIER. NO WITNESSES TO MVC. (OFFICER DID NOT STATE IF DAMAGE STICKER WAS ISSUED)	CLEAR	DRY	DARKNESS	2	50.79897383	-113.9677597	0	1	1	Description does not match location. Ok to keep, direction of travel makes sense.	Moved location to overpass.
293979	10-Oct-2014	07:30:00 PM	ANIMAL	STRUCK OBJECT	ANIMAL	PROPERTY DAMAGE ONLY	NORTHEASTBOUND	Moving Ahead			VEHICLE ONE TRAVELLING ON HWY 552 WHEN DEER APPROACHED FROM THE NORTH SIDE STRIKING THE FRONT PASSENGER SIDE. DAMAGE STICKER ISSUED	CLEAR	DRY	DARKNESS	552	50.7986818	-113.9679897	0	1	1	No comments	
294020	23-Sep-2014	05:00:00 PM	REAR END ALL OTHERS	REAR END		PROPERTY DAMAGE ONLY	NORTHEASTBOUND	Moving Ahead	NORTHEASTBOUND	Post-Collision Maneuver	VEHICLES WERE TRAVELING ON OKOTOKS OVERPASS. VEH 3 STRUCK VEH 2 AND VEH 2 STRUCK VEH 1. OFFICER DID NOT SPECIFY IF DAMAGE STICKERS WERE ISSUED AT THE SCENE.	CLEAR	DRY	DAYLIGHT	2A	50.7986228	-113.9681144	0	3	3	No comments	
294496	02-Nov-2014	06:46:00 PM	FIXED OBJECT RIGHT DITCH	OFF ROAD RIGHT		PROPERTY DAMAGE ONLY	NORTHEASTBOUND	Moving Ahead			VEH 1 TRAVELLING EB HIT BLACK ICE ROAD CONDITIONS, VEHICLE SPUN OUT, COLLIDING INTO GUARD RAILS. (RELATED FILE: 2014-1393136)	SNOW	SLUSH/SNOW/ICE	DARKNESS	552	50.7986818	-113.9679897	0	1	1	No comments	
294511	02-Nov-2014	07:03:00 PM	FIXED OBJECT RIGHT DITCH	OFF ROAD RIGHT		PROPERTY DAMAGE ONLY	NORTHEASTBOUND	Avoiding A Vehicle			VEH TRAVELLING EB ON HWY 552 AT HWY 2. SWERVED TO AVOID A COLLISION. LOST CONTROL AND HIT THE GUARDRAIL. BLACK ICE CONDITIONS	SNOW	SLUSH/SNOW/ICE	DARKNESS	552	50.7989058	-113.9676757	0	1	1	No comments	
294545	02-Nov-2014	06:46:00 PM	REAR END ALL OTHERS	REAR END		PROPERTY DAMAGE ONLY	NORTHEASTBOUND	Moving Ahead	NORTHEASTBOUND	Moving Ahead	VEH 1 AND VEH 2 WERE TRAVELING E ON HWY 552 AT HWY 2. BOTH EVADED A CRASHED VEHICLE IN LANE BUT IN DOING SO, VEH 1 REAR-ENDED VEH 2. VEH 1 TOWED. BLACK ICE CONDITIONS. (RELATED FILE: 2014-1393136)	SNOW	SLUSH/SNOW/ICE	DARKNESS	552	50.7986988	-113.9680113	0	2	2	No comments	
294615	02-Nov-2014	06:45:00 PM	REAR END ALL OTHERS	REAR END		MAJOR	UNKNOWN	Stopped/Stopping in Traffic	UNKNOWN	Moving Ahead	VEHICLE 1 STOPPED FOR 4 CAR PILE UP TO HELP AND WAS REAR ENDED BY OBJECT3_LN(D) WHO WAS THEN HIT FROM BEHIND.	CLEAR	SLUSH/SNOW/ICE	DARKNESS	552	50.7988652	-113.9677316	0	4	>3	No comments	
294911	12-Nov-2014	01:30:00 PM	REAR END ALL OTHERS	REAR END		PROPERTY DAMAGE ONLY	EASTBOUND	Diverging	EASTBOUND	Moving Ahead	WAS DRIVING EAST ON HIGHWAY 2A, EXITING TO GO TO HIGHWAY 2 ON THE OVERPASS. VEHICLE REAR-ENDED HER AND HER VEHICLE SPUN ON THE ICE AND HIT THE GUARD RAIL. DAMAGE TO FRONT AND BACK OF THE VEHICLE. DAMAGE STIC	CLEAR	SLUSH/SNOW/ICE	UNKNOWN	2A	50.796754	-113.9706711	0	2	2	No comments	
295202	18-Nov-2014	07:20:00 PM	ANIMAL	STRUCK OBJECT	ANIMAL	MINOR	NORTHBOUND	Moving Ahead			VEHICLE 1 WAS TRAVELLING NORTH TO CALGARY AND WAS AT HIGHWAY 2 AND 2A OVERPASS. STRUCK DEER. VEHICLE WAS DRIVEN TO REPAIR SHOP IN CALGARY SO DAMAGE STICKER NOT ISSUED HERE.	CLEAR	DRY	DARKNESS	552	50.79875283	-113.9676752	0	1	1	Description is vague, location could either be on the overpass or on hwy 2 at the overpass. Move to northbound on Highway 2, underneath the overpass.	Moved NB to Hwy 2 near under the overpass
295297	14-Nov-2014	03:40:00 PM	ANGLE ALL OTHERS	RIGHT ANGLE	LEFT TURN - ACROSS PATH	MINOR	WESTBOUND	Moving Ahead	SOUTHBOUND	Making A Left Turn	OVERPASS OF HWY 2 AT HWY 2A. VEH 2 ATTEMPTED TO TURN LEFT (E/B) ONTO HWY 552 FROM STOP SIGN CONTROLLED INTERSECTION, DID NOT SEE VEH 1 AND WAS HIT VEHICLES TOWED. OFFICER DID NOT SPECIFY IF DAMAGE STICKERS WER	UNKNOWN	UNKNOWN	DAYLIGHT	2A	50.7977592	-113.969309	0	2	2	No comments	
295545	24-Nov-2014	07:45:00 AM	SAME DIRECTION SIDESWIPE	SIDESWIPE SAME DIRECTION		PROPERTY DAMAGE ONLY	SOUTHEASTBOUND	Moving Ahead	SOUTHEASTBOUND	Moving Ahead	VEH 1 AND VEH 2 BOTH TRAVELING S ON HWY 2 APPROX .5KM NORTH OF THE OKOTOKS OVERPASS. VEHICLES COLLIDED CAUSING VEH 1 TO SPIN AROUND ON HWY AND COME TO A STOP FACING N. NO INJURIES BOTH VEHICLES DRIVEABLE. OFFIC	CLEAR	DRY	DAYLIGHT	2	50.8022099	-113.9724928	0	2	2	No comments	
295996	02-Nov-2014	06:30:00 PM	FIXED OBJECT LEFT/MEDIAN DITCH	OFF ROAD LEFT		PROPERTY DAMAGE ONLY	SOUTHEASTBOUND	Moving Ahead			VEHICLE ONE TRAVELLING EAST ON HWY 2 SLID HIT CONCRETE BARRIER. CONDITIONS WERE FOGGY AND ICY. DAMAGE STICKER ISSUED.	FOG/SMOKE/SMOG/DUST	SLUSH/SNOW/ICE	DARKNESS	2	50.79862099	-113.9683371	0	1	1	Description vague, accident is most likely at the underpass on Hwy 2 heading south and east	Moved to SB Hwy 2 near under overpass
296519	07-Dec-2014	06:35:00 AM	FIXED OBJECT RIGHT DITCH	OFF ROAD RIGHT		PROPERTY DAMAGE ONLY	NORTHBOUND	Moving Ahead			SINGLE VEHICLE MVC. ON HWY 2A NORTHBOUND ON THE ROUND ABOUT TO CALGARY JUST BEFORE CALGARY CITY LIMITS. BURGUNDY 2005 PONTIAC GRAND PRIX, PULLED TO THE SIDE OF THE ROAD, PARTIALLY BLOCKING TRAFFIC, NO INJURIE	CLEAR	SLUSH/SNOW/ICE	DARKNESS	2	50.7982019	-113.9671612	0	1	1	Description doesn't match location, delete from database.	Deleted completely from database, description discusses Calgary Roundabout.
298040	20-Mar-2014	02:15:00 PM	FIXED OBJECT LEFT/MEDIAN DITCH	OFF ROAD LEFT		PROPERTY DAMAGE ONLY	NORTHWESTBOUND	Moving Ahead			VEH1 TRAVELING NB ON HWY 2. LOST CONTROL ON UNMAINTAINED ICY HWY. COLLIDED WITH GUARD RAIL PRIOR TO COMING TO REST IN DITCH	SNOW	SLUSH/SNOW/ICE	DAYLIGHT	2	50.798678	-113.9677025	0	1	1	No comments	
301714	04-Feb-2014	07:30:00 PM	STRIKE FIXED OBJECT ON ROADWAY	STRUCK OBJECT		PROPERTY DAMAGE ONLY	NORTHBOUND	Moving Ahead			DRIVER 1 DRIVING ROUNDABOUT EXITING OKOTOKS OVERPASS SLID ON ICE AND COLLIDED W/ GUARDRAILNO STICKER ISSUE VEHICLE NOT HERE	FOG/SMOKE/SMOG/DUST	DRY	DARKNESS	2	50.7983912	-113.9650728	0	1	1	No comments	
301716	04-Feb-2014	04:00:00 PM	REAR END ALL OTHERS	REAR END		PROPERTY DAMAGE ONLY	SOUTHEASTBOUND	Moving Ahead	SOUTHEASTBOUND	Moving Ahead	V1 SB HWY 2 V2 ALSO SB HWY 2 V1 SLOWED FOR TRAFFIC AHEAD OF HIM V2 UNABLE TO SLOW/STOP AND STRUCK V1.	CLEAR	DRY	DAYLIGHT	2	50.7993105	-113.9690307	0	2	2	No comments	
305404	06-Jan-2015	08:24:00 AM	SAME DIRECTION SIDESWIPE	SIDESWIPE SAME DIRECTION		PROPERTY DAMAGE ONLY	NORTHWESTBOUND	Moving Ahead	NORTHWESTBOUND	Moving Ahead	VEHICLES TRAVELLING N ON HWY 2 ON HWY 2A OVERPASS AND VEH 1 SIDE-SWIPED VEH 2 IN SAME DIRECTION. DAMAGE STICKER PREPARED BUT NOT ISSUED TO VEH 2, NOT NECESSARY FOR VEH 1.	SNOW	SLUSH/SNOW/ICE	DAYLIGHT	2	50.7998027	-113.9690282	0	2	2	No comments	
306805	23-Feb-2015	09:00:00 AM	FIXED OBJECT AND OVERTURN IN DITCH LEFT/MEDIAN	OFF ROAD LEFT		PROPERTY DAMAGE ONLY	NORTHWESTBOUND	Moving Ahead			VEHICLE 1 STRUCK LIGHT STANDARD. LIGHT STANDARD KNOCKED DOWN. FIRE ATTENDED VEHICLE NOT AT SCENE. NO PLATE OBTAINED. VEHICLES DRIVER LATER CALLED AND REPORTED COLLISION. NO DAMAGE STICKER ISSUED AS VEHICLE IS	CLEAR	SLUSH/SNOW/ICE	DAYLIGHT	2	50.7987458	-113.9677793	0	1	1	No comments	
306843	21-Feb-2015	09:00:00 AM	FIXED OBJECT RIGHT DITCH	OFF ROAD RIGHT		PROPERTY DAMAGE ONLY	NORTHWESTBOUND	Moving Ahead			VEH 1 TRAVELLING ON HWY 2A AT HWY 2 AND SLID OFF ROAD INTO DITCH AND HIT LIGHT POLE. DAMAGE STICKER ISSUED.	SNOW	SLUSH/SNOW/ICE	DAYLIGHT	2	50.7978319	-113.9667196	0	1	1	Description does not match location. Note for later.	No change made
307104	03-Mar-2015	02:50:00 PM	REAR END ALL OTHERS	REAR END		MINOR	NORTHWESTBOUND	Moving Ahead	NORTHWESTBOUND	Moving Ahead	OBJECT1_LN(F) AND OBJECT3_LN(M) TRAVELLING N ON HWY 2 AT 2A INTERCHANGE AND OBJECT3_LN(M) REAR-ENDED OBJECT1_LN(F). DAMAGE STICKER ISSUED TO OBJECT1_LN(F). STATEMENT NEVER OBTAINED BY OBJECT3_LN(M).	CLEAR	DRY	UNKNOWN	2	50.7988333	-113.9678801	0	2	2	No comments	
307557	23-Mar-2015	12:00:00 PM	SIDESWIPE ALL OTHERS	SIDESWIPE SAME DIRECTION		MINOR	NORTHEASTBOUND	Moving Ahead	NORTHEASTBOUND	Moving Ahead	OBJECT1_LN(S), OBJECT1_FN(B) ATTENDED OKOTOKS DETACHMENT TO REPORT THAT WHILE TRAVELLING N ON 2A, A BLUE NISSAN BELONGING TO OBJECT2_LN(F) SPUN OUT AND WOUND UP IN DITCH AND OBJECT1_LN(S), TO AVOID ACCIDENT, WE	SNOW	SLUSH/SNOW/ICE	DAYLIGHT	2A	50.7959498	-113.9717922	0	2	2	No comments	
309545	11-Jun-2015	11:00:00 PM	STRIKE NON-FIXED OBJECT ON ROADWAY	STRUCK OBJECT		PROPERTY DAMAGE ONLY	NORTHWESTBOUND	Moving Ahead			OBJECT1_LN(L) TRAVELLING N ON HWY 2 NEAR HWY 2A OVERPASS AND STRUCK SOME ROCK OR DEBRIS ON ROAD. NO INJURIES, SPARE TIRE ALREADY PUT ON FRONT RIGHT WHEEL WHEN OFFICER ATTENDED. VOLKER STEVIN CALLED TO CLEAR ROA	CLEAR	DRY	DARKNESS	2	50.8005153	-113.9698721	0	1	1	No comments	
311761	29-Aug-2015	05:00:00 PM	RUN OFF ROAD LEFT/MEDIAN SIDE	OFF ROAD LEFT		MAJOR	NORTHWESTBOUND	Moving Ahead			VEHICLE WAS TRAVELLING WEST ON HWY 552 , TURNING ONTO HWY 2 NORTHBOUND WHEN ONE OF THE TIRES BLEW CAUSING THE VEHICLE TO STRIKE THE DITCH, DAMAGING VEHICLE. NO DAMAGE STICKER ISSUED AS VEHICLE IS A WRITE OFF.	CLEAR	DRY	DAYLIGHT	2	50.8003433	-113.9677497	0	1	1	No change needed, description seems ok.	No change made
311845	10-Sep-2015	12:50:00 PM	SAME DIRECTION SIDESWIPE	SIDESWIPE SAME DIRECTION		MINOR	NORTHWESTBOUND	Moving Ahead	NORTHWESTBOUND	Moving Ahead	VEHICLE 1 (FORD TRUCK) WAS TRAVELLING NORTH ON HWY 2 WHEN IT STRUCK THE WIDE LOAD BEING TRANSPORTED BY VEHICLE 2 (COMMERCIAL TRAILER). NO DAMAGE STICKER ISSUED AS OF YET.	CLEAR	DRY	DAYLIGHT	2	50.7951154	-113.9634774	0	2	2	No comments	
312177	21-Sep-2015	10:15:00 AM	SAME DIRECTION SIDESWIPE	SIDESWIPE SAME DIRECTION		MINOR	NORTHEASTBOUND	Moving Ahead	NORTHEASTBOUND	Other Lane - Changing Maneuver	VEHICLE 1 WAS TRAVELLING EAST ON HWY 552 COMING UP TO HWY 2 OVERPASS WHEN VEHICLE 2 SWITCHED LANES AND HIT VEHICLE 1 BEFORE COLLIDING WITH GUARD RAIL. DAMAGE STICKERS ISSUED TO BOTH VEHICLES.	CLEAR	DRY	DAYLIGHT	2	50.7979543	-113.9689382	0	2	2	No comments	
313088	10-Jul-2015	03:56:00 AM	OVERTURN IN DITCH RIGHT	OFF ROAD RIGHT		PROPERTY DAMAGE ONLY	SOUTHWESTBOUND	Moving Ahead			VEHICLE 1 APPEARED TO BE TRAVELLING SOUTH ON HWY 2A WHEN IT ROLLED OFF ROAD.	UNKNOWN	UNKNOWN	DARKNESS	2	50.79805435	-113.9689926	0	1	1	Move location west a little to be on southwest bound lane.	Moved to be on SWB lane
314262	22-Nov-2015	08:10:00 PM	SIDESWIPE ALL OTHERS	SIDESWIPE SAME DIRECTION		PROPERTY DAMAGE ONLY	SOUTHWESTBOUND	Merging	SOUTHWESTBOUND	Moving Ahead	VEHICLE ONE TRAVELLING ON HWY 2A JUST ENTERING ONTO THE EXIT INTO OKOTOKS WHEN SHE WAS SIDESWIPED ON THE PASSENGER SIDE OF HER VEHICLE. DAMAGE STICKER ISSUED	CLEAR	DRY	DARKNESS	2	50.79630367	-113.9714255	0	2	2	Move location a little to the west to put it on southwest bound lane.	Moved to be on SWB lane
314570	24-Nov-2015	11:45:00 AM	OVERTURN IN DITCH LEFT/MEDIAN SIDE	OFF ROAD LEFT		PROPERTY DAMAGE ONLY	NORTHWESTBOUND	Moving Ahead			BACK TIRE LOST TRACTION AND VEHICLE LOST CONTROL AND ROLLED INTO THE MEDIUM NO DAMAGE STICKER ISSUED.	SNOW	SLUSH/SNOW/ICE	DAYLIGHT	2	50.7950203	-113.9633637	0	1	1	No comments	
314995	28-Nov-2015	04:00:00 PM	ANIMAL	STRUCK OBJECT	ANIMAL	PROPERTY DAMAGE ONLY	SOUTHWESTBOUND	Moving Ahead			VEHICLE ONE TRAVELLING ON HWY 2A APPROACHING EXIT INTO OKOTOKS AND WAS STRUCK BY A DEER CAUSING DAMAGE TO THE PASSENGER FRONT END. DAMAGE STICKER ISSUED	CLEAR	DRY	DAYLIGHT	2	50.79666923	-113.9709406	0	1	1	Move location a little to the west to put it on southwest bound lane.	Moved to be on SWB lane
316102			RUN OFF ROAD RIGHT	OFF ROAD RIGHT		PROPERTY DAMAGE ONLY	SOUTHWESTBOUND	Merging			VEHICLE WAS COMING UP TO THE MERGE PRIOR TO THE OKOTOKS TURNOVER WHEN VEHICLE HIT ICE AND LOST CONTROL AND HIT THE DITCH DAMAGING THE FRONT OF THE VEHICLE. NOTHING ELSE WAS DAMAGED. DAMAGE STICKER ISSUED.	CLEAR	SLUSH/SNOW/ICE	DAYLIGHT	2	50.7962969	-113.971308	0	1	1	Remove from database, location is uncertain.	Deleted from map (uncertain location).
316262	24-Dec-2015	02:00:00 PM	SAME DIRECTION SIDESWIPE	SIDESWIPE SAME DIRECTION	REAR END	PROPERTY DAMAGE ONLY	SOUTHBOUND	Moving Ahead	SOUTHBOUND	Moving Ahead	VEHICLES TRAVELLING SOUTH ON 2 AT 2A RAMP. VEHICLE 2 BRAKED AND LOST CONTROL ON ICE STRIKING THE BACK OF VEHICLE 1. DAMAGE TO VEHICLE 2 ON PASSENGER SIDE. DAMAGE STICKERS ISSUED TO BOTH VEHICLES.	SNOW	SLUSH/SNOW/ICE	DAYLIGHT	2	50.80240475	-113.9730468	0	2	2	Description does not match location. Move location to start of ramp.	Moved to start of ramp
316290	18-Dec-2015	07:20:00 AM	STRIKE FIXED OBJECT ON ROADWAY	STRUCK OBJECT		PROPERTY DAMAGE ONLY	NORTHEASTBOUND	Moving Ahead			VEHICLE ONE TRAVELLING N ON HWY 2A ON OKOTOKS OVERPASS WHEN HE LOST CONTROL AND SKID 3 TIMES AND STRUCK THE GUARD RAIL CAUSING DAMAGE TO THE PASSENGER SIDE FRONT END	SNOW	SLUSH/SNOW/ICE	DARKNESS	2	50.7987893	-113.9678287	0	1	1	No comments	
316384	24-Dec-2015	10:20:00 AM	RUN OFF ROAD LEFT/MEDIAN SIDE	OFF ROAD LEFT		PROPERTY DAMAGE ONLY	NORTHWESTBOUND	Moving Ahead			911/SINGLE MVC FOOTHILLS 911 OKOTOKS OVERPASS, WEST OF OVERPASS, IN WB LANE, EMS ON SITE & WILL WAIT WITH CALLER WITH LIGHTS NO INJURIES, NO FLUIDS, SLID ON ICE & SLID INTO ONCOMING TRAFFIC, BLOCKING WB LANE.	SNOW	SLUSH/SNOW/ICE	DAYLIGHT	2	50.7992284	-113.9683286	0	1	1	No comments	
320756	07-Jan-2016	11:10:00 AM	SAME DIRECTION SIDESWIPE	SIDESWIPE SAME DIRECTION		PROPERTY DAMAGE ONLY	SOUTHEASTBOUND	Moving Ahead	SOUTHEASTBOUND	Moving Ahead	Vehicle #1 was driving ahead of vehicle #2 when he lost control of his vehicle and started spinning on the road. Vehicle #2 tried to stop however was not able to and vehicle #1 collided with vehicle #2 and pushed it to the s	SNOW	SLUSH/SNOW/ICE	DAYLIGHT	2	50.7997433	-113.9696055	0	2	2	No comments	
320843	07-Jan-2016	07:34:00 AM	UNKNOWN	UNKNOWN	SIDESWIPE SAME DIRECTION	PROPERTY DAMAGE ONLY	NORTHEASTBOUND	Moving Ahead	UNKNOWN	Moving Ahead	Vehicle one was travelling North on hwy 2a when another vehicle slid into her vehicle causing damage to the driver front end. Damage sticker was issued. No plate obtained from second vehicle.	SNOW	SLUSH/SNOW/ICE	DARKNESS	0	50.7986603	-113.9676824	0	2	2	Description says Hwy 2A, but location is on Hwy 2. Probably ok to keep.	No change made
321071	17-Jan-2016	05:50:00 PM	TURNING MANOEUVRE	LEFT TURN - ACROSS PATH	REAR END	PROPERTY DAMAGE ONLY	EASTBOUND	Making A Left Turn	WESTBOUND	Moving Ahead	Vehicle one was stopped in the middle of the intersection of highway 552 and highway 2, attempting to complete a left hand turn when vehicle two struck the drivers rear end. A damage sticker was issued.	CLEAR	DRY	DARKNESS	2	50.79779963	-113.9693906	0	2	2	Contradictory descriptions. Possibly move to eastbound at the intersection of 552 and Highway 2 (ramp), vehicle one left turn across path.	Moved to intersection

321716	08-Feb-2016	07:10:00 AM	SAME DIRECTION SIDESWIPE	SIDESWIPE SAME DIRECTION		PROPERTY DAMAGE ONLY	EASTBOUND	Moving Ahead	EASTBOUND	Other Lane - Changing Maneuver	Vehicle one was traveling East on highway 2 A beside a transport truck when he went to change lanes, causing damage to her rear passengers side.	CLEAR	DRY	DARKNESS	2	50.7985446	-113.9681166	0	2	2	No comments	
322379	16-Feb-2016	02:30:00 AM	OVERTURN IN DITCH RIGHT	OFF ROAD RIGHT		MAJOR	NORTHWESTBOUND	Moving Ahead			vehicle one travelling on Hwy 2 N of Hwy 552 when he swerved to miss a deer and rolled his semi-truck and trailer. vehicle towed unsure if a damage sticker was issued	UNKNOWN	UNKNOWN	DARKNESS	2	50.7987668	-113.9678031	0	1	1	No comments	
323604	31-Mar-2016	10:58:00 AM	SIDESWIPE ALL OTHERS	SIDESWIPE SAME DIRECTION		PROPERTY DAMAGE ONLY	NORTHWESTBOUND	Moving Ahead	NORTHWESTBOUND	Moving Ahead	vehicle one travelling on N hwy 2 when a bus struck the drivers side mirror and continued on. no damage sticker issued	CLEAR	DRY	DAYLIGHT	2	50.7994942	-113.9686629	0	2	2	No comments	
323673	01-Apr-2016	02:00:00 PM	STRIKE FIXED OBJECT ON ROADWAY	STRUCK OBJECT		PROPERTY DAMAGE ONLY	NORTHEASTBOUND	Moving Ahead			Vehicle was exiting on the off ramp of the overpass, hit loose gravel and hit the guardrail. . Damage sticker issued.	CLEAR	LOOSE SURFACE MATERIAL	DAYLIGHT	2	50.7995908	-113.9657415	0	1	1	No comments	
324133	13-Apr-2016	08:15:00 AM	ANGLE ALL OTHERS	RIGHT ANGLE		MINOR	SOUTHWESTBOUND	Moving Ahead	SOUTHEASTBOUND	Unknown	vehicle one travelling SW on hwy 552 when d2 pulled out in front of her. both vehicles possible write-offs no damage stickers issued.	CLEAR	DRY	DAYLIGHT	2	50.7977704	-113.9692206	0	2	2	No comments	
324312	21-Apr-2016	02:49:00 PM	ANGLE ALL OTHERS	LEFT TURN - ACROSS PATH		MINOR	SOUTHEASTBOUND	Making A Left Turn	SOUTHWESTBOUND	Moving Ahead	Vehicle 1 travelling south stopped at intersection stop sign, proceeded into intersection without checking oncoming traffic from the left and was struck by D2. Both vehicles towed - no damage sticker issued. D2 taken to hospi	CLEAR	DRY	DAYLIGHT	2	50.7977737	-113.9693161	0	2	2	No comments	
324330	22-Apr-2016	07:30:00 PM	SAME DIRECTION SIDESWIPE	SIDESWIPE SAME DIRECTION		MINOR	NORTHBOUND	Moving Ahead	NORTHBOUND	Other Lane - Changing Maneuver	Vehicles travelling same direction. Veh 2 went into Veh 1's lane striking Veh 1. Damage stickers issued.	CLEAR	DRY	DAYLIGHT	2	50.7981133	-113.9670554	0	2	2	No comments	
324338	23-Apr-2016	05:12:00 PM	SIDESWIPE ALL OTHERS	SIDESWIPE SAME DIRECTION		MINOR	NORTHBOUND	Moving Ahead	NORTHBOUND	Merging	V1 ENTERING HWY 2 FROM THE ON RAMP AT 2A LOST CONTROL SPINNING IN TO THE PATH OF V2 WHICH WAS TRAVELLING NORTH ON HWY 2 . V2 STRUCK BARRIER AS A RESULT, BOTH VEHICLES TOWED. DRIVER OF V1 INJURED.	RAINING	WET	DAYLIGHT	0	50.7982351	-113.9672001	0	2	2	Location is probably okay as driver lost control on the ramp.	No change made
324772	17-Mar-2016	07:00:00 AM	STRIKE FIXED OBJECT ON ROADWAY	STRUCK OBJECT		PROPERTY DAMAGE ONLY	SOUTHWESTBOUND	Moving Ahead			vehicle one travelling on Hwy 552 when vehicle lost control and hit a concrete barrier in medium vehicle towed	SNOW	SLUSH/SNOW/ICE	DARKNESS	2	50.7986425	-113.9682335	0	1	1	No comments	
324865	13-May-2016	03:20:00 PM	SAME DIRECTION SIDESWIPE	SIDESWIPE SAME DIRECTION		PROPERTY DAMAGE ONLY	NORTHBOUND	Moving Ahead	NORTHBOUND	Other Lane - Changing Maneuver	Vehicle 1 travelling north on highway 2 in centre lane. Vehicle 2 attempted to change lanes into the path of vehicle 1 as their lane was closing and collision occurred. VT's issued to both drivers Vehicle 1 for SEC 18 (1) fai	CLEAR	DRY	DAYLIGHT	2	50.7987038	-113.9677317	0	2	2	No comments	
325169	25-May-2016	12:00:00 AM	SAME DIRECTION SIDESWIPE	SIDESWIPE SAME DIRECTION		PROPERTY DAMAGE ONLY	NORTHWESTBOUND	Moving Ahead	NORTHWESTBOUND	Moving Ahead	Vehicle One travelling North on Hwy 2 when was side swiped by a trailer that did not stop.	CLEAR	DRY	UNKNOWN	2	50.795173	-113.9635462	0	2	2	No comments	
327075	20-Jun-2016	10:36:00 PM	ANIMAL	STRUCK OBJECT	ANIMAL	PROPERTY DAMAGE ONLY	SOUTHEASTBOUND	Moving Ahead			COM was driving southbound when a deer struck his vehicle causing damage to the passengers front end	CLEAR	DRY	DARKNESS	2	50.7978761	-113.9673152	0	1	1	No comments	
328743	04-Aug-2016	07:45:00 AM	ANGLE ALL OTHERS	RIGHT ANGLE		MINOR	SOUTHWESTBOUND	Moving Ahead	SOUTHEASTBOUND	Moving Ahead	Vehicle 2 stopped at stop sign pulled out into the path of vehicle 1 . No damage stickers issued. Vehicle 1 towed. VT issued to the driver of vehicle 2 (Object2_LN(K)) for S38(a) Fail to proceed safely after stopping at an in	CLEAR	DRY	DAYLIGHT	2	50.7977089	-113.9694017	0	2	2	No comments	
332599	07-Oct-2016	10:00:00 PM	OVERTURN IN DITCH RIGHT	OFF ROAD RIGHT		MAJOR	WESTBOUND	Moving Ahead			Vehicle travelling W on Hwy 552 near Hwy 2 overpass and went off road right after striking ice and the vehicle rolled. Both driver and Passenger admitted to ER. Damage sticker issued.	SNOW	SLUSH/SNOW/ICE	DARKNESS	552	50.80013656	-113.9660794	0	1	1	Move location a little west onto southwest bound lane on 552.	Moved to SWB lane
332927	09-Oct-2016	07:27:00 AM	STRIKE FIXED OBJECT ON ROADWAY	STRUCK OBJECT		PROPERTY DAMAGE ONLY	SOUTHWESTBOUND	Moving Ahead			Southbound HWY 2 at the 552 overpass lost control and hit barrier.	SNOW	SLUSH/SNOW/ICE	DARKNESS	2	50.7987668	-113.9678031	0	1	1	Description does not match location, can't tell if Hwy 2 or 522. Possibly deletable.	Deleted from map (uncertain location).
333396	15-Nov-2016	12:30:00 PM	REAR END ALL OTHERS	REAR END		PROPERTY DAMAGE ONLY	SOUTHWESTBOUND	Moving Ahead	SOUTHWESTBOUND	Moving Ahead	Vehicles travelling SW on Highway 552 when Veh 2 struck Veh 1. Damage stickers issued to both parties, no injuries.	CLEAR	WET	DAYLIGHT	2	50.7992453	-113.967327	0	2	2	Move location a little west onto southwest bound lane on 552.	Moved to be on SWB lane
333641	18-Nov-2016	05:45:00 PM	ANIMAL	STRUCK OBJECT	ANIMAL	PROPERTY DAMAGE ONLY	NORTHWESTBOUND	Moving Ahead			Veh travelling N on HWY 2 at HWY 552 overpass when it struck deer. Damage sticker issued, no injuries to driver.	CLEAR	DRY	DARKNESS	2	50.7996679	-113.9688685	0	1	1	No comments	
334979	30-Nov-2016	09:00:00 PM	STRIKE FIXED OBJECT ON ROADWAY	STRUCK OBJECT		MINOR	SOUTHBOUND	Moving Ahead			Vehicle one heading South on HWY 2. Struck black ice lost control and hit median.	SNOW	SLUSH/SNOW/ICE	DARKNESS	2	50.7965395	-113.970958	0	1	1	Description does not match location. Remove from map.	Deleted from map (uncertain location).
335104	30-Nov-2016	07:00:00 PM	STRIKE FIXED OBJECT ON ROADWAY	STRUCK OBJECT	OFF ROAD LEFT	PROPERTY DAMAGE ONLY	WESTBOUND	Moving Ahead			Vehicle lost control on Black Ice and high centered on the mediun	SNOW	SLUSH/SNOW/ICE	DARKNESS	2	50.7983317	-113.9679214	0	1	1	Accident suggests it occurred on the overpass on the southwest bound lane on Hwy 552, move location onto southwestbound lane	Moved to be on SWB lane
335113	30-Nov-2016	07:35:00 PM	STRIKE FIXED OBJECT ON ROADWAY	STRUCK OBJECT		PROPERTY DAMAGE ONLY	SOUTHBOUND	Moving Ahead	SOUTHBOUND	Moving Ahead	DR1 spun out on the Hwy 2 exit ramp onto Hwy 2. Struck pole causing it to fall down. DR2 following behind DR1 was hit by pole as it fell. Road conditions were very icy. Volker Stevin called. No injuries.	SNOW	SLUSH/SNOW/ICE	DARKNESS	2	50.7983657	-113.970396	0	2	2	No comments	
336121	30-Nov-2016	09:59:00 PM	FIXED OBJECT LEFT/MEDIAN DITCH	OFF ROAD LEFT		MAJOR	UNKNOWN	Unknown			mvc with injuries 911sb hwy 2 before okotoks turnoff one patient pinned. jeep or van went from median to the other ditch and smashed into pole. no smoke or flame.opposite side of the road from the house that recently burnt	SNOW	SLUSH/SNOW/ICE	DARKNESS	2	50.7994809	-113.9692342	0	1	1	No comments	
336896	23-Dec-2016	02:30:00 PM	FIXED OBJECT RIGHT DITCH	OFF ROAD RIGHT		MINOR	SOUTHEASTBOUND	Moving Ahead			Vehicle Southbound from HWY 2 on to HWY 2A hit ice and lost control hitting a post.	SNOW	SLUSH/SNOW/ICE	DAYLIGHT	2	50.7989468	-113.9685967	0	1	1	Location probably ok despite description.	No change made
338533	05-Jan-2017	07:40:00 AM	ANGLE ALL OTHERS	RIGHT ANGLE		PROPERTY DAMAGE ONLY	NORTHEASTBOUND	Moving Ahead	SOUTHEASTBOUND	Making A Left Turn	Veh 1 travelling E on HWY 552 when Veh 2 exited HWY 2 to turn E on HWY 552, failed to look, and Veh 1 struck him. Damage sticker issued to both parties. VTs issued to Object2_LN(S) for FT have DL. Turn left unsafely and tran	CLEAR	SLUSH/SNOW/ICE	UNKNOWN	2	50.7976957	-113.9693118	0	2	2	No comments	
339699	03-Feb-2017	06:34:00 PM	SAME DIRECTION SIDESWIPE	SIDESWIPE SAME DIRECTION		MINOR	NORTHBOUND	Moving Ahead	NORTHEASTBOUND	Moving Ahead	Both vehicles driveable. VT issued to driver of V2 for Sec 2(1)(a) driving unreasonable rate of speed.	SNOW	SLUSH/SNOW/ICE	DARKNESS	2A	50.7981361	-113.96542	0	2	2	No comments	
340337	17-Feb-2017	06:27:00 PM	ANIMAL	STRUCK OBJECT	ANIMAL	PROPERTY DAMAGE ONLY	NORTHEASTBOUND	Moving Ahead			Vehicle hit deer, damage sticker issued.	CLEAR	DRY	DARKNESS	2A	50.7983186	-113.9684968	0	1	1	No comments	
340521	23-Feb-2017	07:41:00 AM	SAME DIRECTION SIDESWIPE	SIDESWIPE SAME DIRECTION		PROPERTY DAMAGE ONLY	NORTHBOUND	Unknown	NORTHBOUND	Moving Ahead	Vehicle 2 was driving in the merging lane from 552 northbound onto highway x 2 when vehicle 1 came across the grass area causing vehicle 2 to struck vehicle 1	CLEAR	SLUSH/SNOW/ICE	UNKNOWN	2	50.7980871	-113.9684992	0	2	2	No comments	
340701	27-Feb-2017	08:50:00 PM	STRIKE NON-FIXED OBJECT ON ROADWAY	STRUCK OBJECT		PROPERTY DAMAGE ONLY	SOUTHWESTBOUND	Moving Ahead			Vehicle one hit a hay bale that had come off another vehicles trailer. VT issued to hay bale owner.	CLEAR	DRY	DARKNESS	2A	50.7982888	-113.9686666	0	1	1	Move location west a little to be on southwest bound lane.	Moved to be on SWB lane
341181	10-Mar-2017	08:37:00 AM	FIXED OBJECT RIGHT DITCH	OFF ROAD RIGHT		MINOR	SOUTHEASTBOUND	Moving Ahead			VEH 1 went into the ditch and skidded through a fence between highway roads. DRIVER denied medical attention. Truck had heavy damage to the front end. DRIVER states that a strong wind pushed the truck in the ditch, Damage sti	HIGH WIND	SLUSH/SNOW/ICE	DAYLIGHT	2	50.8035921	-113.9741466	0	1	1	Description cut off, note for later.	No change made
341223	03-Mar-2017	07:15:00 PM	SAME DIRECTION SIDESWIPE	SIDESWIPE SAME DIRECTION		PROPERTY DAMAGE ONLY	SOUTHWESTBOUND	Unknown	SOUTHWESTBOUND	Unknown	Vehicles travelling W on HWY 552 when they side-swiped each other. Conflicting stories and no witnesses to confirm.	CLEAR	SLUSH/SNOW/ICE	DARKNESS	2	50.7995598	-113.9665052	0	2	2	Description doesn't match location, move location a little west onto southwest bound lane.	
343966	29-Apr-2017	03:00:00 PM	STRIKE NON-FIXED OBJECT ON ROADWAY	STRUCK OBJECT		PROPERTY DAMAGE ONLY	NORTHWESTBOUND	Moving Ahead			Vehicle 1 travelling northbound on Highway 2 when a piece of debris kicked up by traffic collided with front end	CLEAR	DRY	DAYLIGHT	2	50.7951289	-113.9634935	0	1	1	No comments	
344405	06-Jun-2017	03:40:00 PM	ANIMAL	STRUCK OBJECT	ANIMAL	PROPERTY DAMAGE ONLY		Moving Ahead	SOUTHBOUND		Traveling S on Hwy 2 at Okotoks overpass collision with deer. Totally damage $5400 no injuries. DS issued	CLEAR	DRY	DAYLIGHT	2	50.7987668	-113.9678031	0	1	1	Delete from database, description could be two different locations.	Deleted from map (uncertain location).
345151	17-Feb-2017	06:20:00 PM	ANIMAL	STRUCK OBJECT	ANIMAL	MINOR	NORTHWESTBOUND	Moving Ahead			Heading north on Hwy 2 and struck a dead deer.	CLEAR	DRY	DARKNESS	2	50.801418	-113.9709132	0	1	1	No comments	
345242	24-Jun-2017	05:45:00 AM	ANIMAL	STRUCK OBJECT	ANIMAL	PROPERTY DAMAGE ONLY	SOUTHWESTBOUND	Moving Ahead			MVC w/ Deer V1 travelling SB to Okotoks when deer entered Hwy and collided with drivers side of vehicle. No injury to driver, damage sticker issued.	CLEAR	DRY	DAYLIGHT	2A	50.7967264	-113.9680681	0	1	1	Move location west a little to be on southwest bound lane.	Moved to be on SWB lane
345246	27-Jun-2017	07:30:00 AM	ANGLE ALL OTHERS	RIGHT ANGLE	SIDESWIPE SAME DIRECTION	PROPERTY DAMAGE ONLY	SOUTHEASTBOUND	Making A Left Turn	SOUTHWESTBOUND	Moving Ahead	Vehicle 1 travelling southbound on Highway 2 turning east onto Highway 2A and side swiped Vehicle 2.	CLEAR	DRY	DAYLIGHT	2	50.7977425	-113.9693457	0	2	2	No comments	
345516	03-Jul-2017	07:55:00 AM	ANIMAL	STRUCK OBJECT	ANIMAL	MINOR	SOUTHBOUND	Moving Ahead			Injury MVC with deer. V1 travelling SB on Hwy 2 and collided with deer. Minor injury to driver.	CLEAR	DRY	DAYLIGHT	2	50.8035336	-113.9738743	0	1	1	No comments	
345814	08-Jul-2017	03:53:00 PM	ANGLE ALL OTHERS	RIGHT ANGLE		MAJOR	SOUTHEASTBOUND	Making A Left Turn	SOUTHWESTBOUND	Moving Ahead	Vehicle 2 was heading West on Highway 552 and vehicle 1 was heading south on the exit from Highway 2 entering highway 552 and failed to stop at the stop sign and struck Vehicle 2 causing it to roll.	CLEAR	DRY	DAYLIGHT	2	50.7977382	-113.9693569	0	2	2	No comments	
346524	20-Jul-2017	01:15:00 AM	ANIMAL	STRUCK OBJECT	ANIMAL	PROPERTY DAMAGE ONLY		Moving Ahead	SOUTHBOUND		Single Veh MVC with deer and pole. V1 traveling SB deer exited ditch (right side) and collided with passenger side door causing vehicle to enter ditch and collide with pole. Unknown if vehicle is a write off.	CLEAR	DRY	DARKNESS	2	50.7996235	-113.9694043	0	1	1	No comments	
347265	03-Aug-2017	09:18:00 PM	ANIMAL	STRUCK OBJECT	ANIMAL	PROPERTY DAMAGE ONLY	EASTBOUND	Moving Ahead			V1 collided with 2 deer on Hwy 2A/ Hwy 552 overpass, no injuries, damage over $2000	CLEAR	DRY	DAYLIGHT	552	50.79855111	-113.9682146	0	1	1	Description does not match location, move location to overpass.	Moved to EB lanes on overpass
348551	04-Sep-2017	06:00:00 PM	STRIKE FIXED OBJECT ON ROADWAY	STRUCK OBJECT		PROPERTY DAMAGE ONLY	SOUTHWESTBOUND	Avoiding A Vehicle			Vehicle 1 travelling west on Highway 552 when a vehicle was halfway into the laneway causing Vehicle 1 to swerve into the median striking a sign.	CLEAR	DRY	DAYLIGHT	2	50.7981809	-113.9679381	0	1	1	Description does not match location, location most likely on the 552 overpass on the southwest lane.	Moved to be on SWB lane
349881	06-Oct-2017	02:23:00 PM	RUN OFF ROAD RIGHT	OFF ROAD RIGHT		PROPERTY DAMAGE ONLY	NORTHEASTBOUND	Moving Ahead			Vehicle 1 was heading northbound on highway 2A when it hit snow/ice with high wind and slid into ditch.	HIGH WIND	SLUSH/SNOW/ICE	DAYLIGHT	2	50.7978814	-113.9690383	0	1	1	No comments	
350112	12-Oct-2017	06:30:00 AM	REAR END ALL OTHERS	OTHER		PROPERTY DAMAGE ONLY	NORTHBOUND	Avoiding A Vehicle	NORTHBOUND	Post-Collision Maneuver	VEHICLE ONE SWERVED TO MISS VEHICLE 3, WAS HIT BY VEHICLE 2, PUSHED INTO VEHICLE 3 AND THEN WAS REAR ENDED BY VEHICLE 4, VEHICLE 4 WAS REAR ENDED BY VEHICLE 5	SNOW	SLUSH/SNOW/ICE	UNKNOWN	552	50.7980688	-113.9658379	0	5	>3	No comments	
350124	12-Oct-2017	06:20:00 AM	REAR END ALL OTHERS	REAR END		PROPERTY DAMAGE ONLY	NORTHEASTBOUND	Moving Ahead	NORTHEASTBOUND	Moving Ahead	Veh 1 was travelling east on Highway 552 on bridge over Highway 2. Veh 2 had to brake hard as an unknown vehicle in front of veh 2 braked hard as another unknown vehicle changed from lane 2 to lane 1 from meridian, too close	SNOW	SLUSH/SNOW/ICE	DARKNESS	552	50.7987074	-113.967876	0	2	2	No comments	
350129	12-Oct-2017	07:05:00 AM	STRIKE FIXED OBJECT ON ROADWAY	STRUCK OBJECT		PROPERTY DAMAGE ONLY	NORTHEASTBOUND	Moving Ahead			Vehicle 1 was traveling East on Hwy 2, when coming over the bridge on the overpass outside of the Town of Okotoks. Hit brakes to avoid colliding with the vehicle in front and slid off road to the left into the guard rail.	CLEAR	SLUSH/SNOW/ICE	DAYLIGHT	2	50.7979538	-113.9689253	0	1	1	Location ok, but description should be Highway 2A	No change made
350236	12-Oct-2017	06:20:00 AM	SAME DIRECTION SIDESWIPE	SIDESWIPE SAME DIRECTION		PROPERTY DAMAGE ONLY	NORTHEASTBOUND	Other Lane - Changing Maneuver	NORTHEASTBOUND	Moving Ahead	Object 1 was travelling east on highway 552 (overpass) and was trying to avoid a collision that occurred just in front and was moving over to the left and Object 2 which was travelling East on Highway 552 was side swiped by O	SNOW	SLUSH/SNOW/ICE	DARKNESS	2	50.7985322	-113.9681016	0	2	2	No comments	
350664	12-Oct-2017	07:40:00 AM	REAR END ALL OTHERS	REAR END		MINOR	NORTHWESTBOUND	Moving Ahead	NORTHWESTBOUND	Stopped/Stopping in Traffic	Vehicle 1 travelling northbound on highway 2, approached the overpass. There was a collision that was in the process of being cleared up by officers on scene. Officers were just about to leave and had indicated for driver 1 t	CLEAR	SLUSH/SNOW/ICE	UNKNOWN	2	50.7983204	-113.9672969	0	2	2	Description cut off, note for later.	No change made
354159	24-Nov-2017	11:15:00 PM	ANIMAL	STRUCK OBJECT	ANIMAL	PROPERTY DAMAGE ONLY	SOUTHBOUND	Moving Ahead			DRIVER 1 WAS TRAVELLING SOUTH ON HWY 2 , APPROACHING HWY 2A WHEN THEY STRUCK A DEER.	CLEAR	DRY	DARKNESS	2	50.79860761	-113.9683645	0	1	1	Move to southbound lanes on Highway 2, just north of overpass.	Moved to SB lane north of overpass
355811	19-Dec-2017	02:10:00 PM	FIXED OBJECT LEFT/MEDIAN DITCH	OFF ROAD LEFT		PROPERTY DAMAGE ONLY	SOUTHWESTBOUND	Diverging			DRIVER 1 WAS TRAVELLING SOUTH ON HWY 2 , TAKING THE 2A EXIT WHEN THEY SLID OFF THE ROAD INTO THE OPPOSITE DITCH HITTING A WOODEN POLE	SNOW	SLUSH/SNOW/ICE	DAYLIGHT	2	50.8016073	-113.9719995	0	1	1	No comments	
355914	19-Dec-2017	02:40:00 PM	RUN OFF ROAD RIGHT	OFF ROAD RIGHT		MINOR	SOUTHEASTBOUND	Avoiding A Vehicle			DRIVER 1 WAS TRAVELLING SOUTH ON HWY 2 TAKING THE HWY 2A EXIT WHEN A VEHICLE AHEAD ENTERED HER LANE CAUSING HER TO EXIT THE ROAD TO THE RIGHT HITTING THE DITCH	SNOW	SLUSH/SNOW/ICE	DAYLIGHT	2	50.80104402	-113.9715801	0	1	1	Move to the west so it is on the ramp.	Moved west to ramp
355976	18-Dec-2017	11:00:00 AM	FIXED OBJECT RIGHT DITCH	OFF ROAD RIGHT		PROPERTY DAMAGE ONLY	NORTHWESTBOUND	Moving Ahead			DRIVER 1 WAS HEADING NORTH ON HWY 2 WHEN A UNKNOWN VEHICLE KICKED UP A PIECE OF METAL UNKNOWINGLY CAUSING DRIVER 1 TIRE TO BLOW OUT AND HIS VEHICLE TO HIT A GUARD RAIL	SNOW	SLUSH/SNOW/ICE	DAYLIGHT	2	50.7983285	-113.967306	0	1	1	No comments	
356707	29-Dec-2017	05:20:00 PM	ANIMAL	STRUCK OBJECT	ANIMAL	PROPERTY DAMAGE ONLY	SOUTHBOUND	Moving Ahead			Vehicle 1 southbound HWY 2 Just North of 2A overpass struck deer	SNOW	SLUSH/SNOW/ICE	DARKNESS	2	50.79863107	-113.9683136	0	1	1	Description does not match location; move location to the southbound lane of Hwy 2.	Moved to SB lane north of overpass
356773	21-Dec-2017	02:30:00 PM	OVERTURN IN DITCH RIGHT	OFF ROAD RIGHT		PROPERTY DAMAGE ONLY	NORTHWESTBOUND	Moving Ahead			DRIVER 1 WAS TRAVELLING WEST ON HWY 2 WHEN THEY ROLLED INTO THE DITCH AFTER HITING SOME ICE.	SNOW	SLUSH/SNOW/ICE	DAYLIGHT	2	50.7989665	-113.968038	0	1	1	No comments	
357041	02-Oct-2017	03:20:00 PM	FIXED OBJECT LEFT/MEDIAN DITCH	OFF ROAD LEFT		PROPERTY DAMAGE ONLY	NORTHEASTBOUND	Moving Ahead			DRIVER 1 WAS TRAVELLING NORTH ON HWY 2A WHEN A SEMI PASSED ON THE LEFT COVERING THE VEHICLE WITH SLUSH, DRIVER LOST CONTROL OF THE VEHICLE STRIKING A MEDIAN.	SNOW	SLUSH/SNOW/ICE	DAYLIGHT	2	50.7978784	-113.9690369	0	1	1	No comments	
368805	21-Jan-2018	09:47:00 AM	ANGLE ALL OTHERS	RIGHT ANGLE		PROPERTY DAMAGE ONLY	SOUTHWESTBOUND	Moving Ahead	SOUTHEASTBOUND	Making A Left Turn	Vehicle one was travelling west of highway 552 when vehicle two turned into him from the off ramp.	CLEAR	DRY	DAYLIGHT	2	113.9693832	50.7976604	0	2	2		
364483	26-Nov-2018	10:15:00 AM	ANGLE ALL OTHERS	RIGHT ANGLE		MAJOR	SOUTHWESTBOUND	Moving Ahead	SOUTHBOUND	Moving Ahead	Vehicle 1 travelling west on highway 552. Vehicle 2 stopped at a stop sign proceeded to enter the intersection into the path of vehicle 1 and collided. Driver of vehicle 2 issued a VT for ROR 38(A) Fail to proceed safely aft	CLEAR	DRY	DAYLIGHT	2	113.969356	50.7977282	0	2	2		
363077	11-Nov-2018	10:20:00 AM	SIDESWIPE ALL OTHERS	SIDESWIPE SAME DIRECTION		PROPERTY DAMAGE ONLY	NORTHWESTBOUND	Moving Ahead	NORTHWESTBOUND	Moving Ahead	Vehicle one travelling North on HWY 2 when vehicle 2 was passing on driver side lost control striking vehicle 1	FOG/SMOKE/SMOG/DUST	SLUSH/SNOW/ICE	DAYLIGHT	2	113.9642	50.7957	0	2	2		
363393	14-Nov-2018	10:00:00 PM	ANIMAL	STRUCK OBJECT		PROPERTY DAMAGE ONLY	NORTHBOUND	Moving Ahead			Vehicle one travelling North HWY 2 at 2A when the deer ran from West.	CLEAR	DRY	DARKNESS	2	113.9678	50.7988	0	1	1		
367736	26-Nov-2018	12:30:00 PM	ANIMAL	STRUCK OBJECT		PROPERTY DAMAGE ONLY	NORTHBOUND	Moving Ahead			Vehicle one Northbound HWY 2 at HWY 2A struck deer	CLEAR	DRY	DAYLIGHT	2	113.9678	50.7988	0	1	1		
369551	05-Feb-2018	05:38:00 PM	RUN OFF ROAD RIGHT	OFF ROAD RIGHT		PROPERTY DAMAGE ONLY	SOUTHEASTBOUND	Moving Ahead			DRIVER 1 WAS TRAVELLING SOUTH ON HWY 2 WHEN THEY HIT A PATCH OF ICE CAUSING THE CAR TO HIT THE DITCH	CLEAR	SLUSH/SNOW/ICE	DARKNESS	2	113.9684794	50.7988485	0	1	1		
366579	26-Dec-2018	06:00:00 AM	RUN OFF ROAD LEFT/MEDIAN SIDE	OFF ROAD LEFT		PROPERTY DAMAGE ONLY	NORTHWESTBOUND	Moving Ahead			Vehicle one northbound HWY 2 lost control went into ditch across Southbound lanes and through field.	CLEAR	SLUSH/SNOW/ICE	DARKNESS	2	113.9683	50.7992	0	1	1		
364140	23-Nov-2018	04:48:00 PM	REAR END ALL OTHERS	REAR END		PROPERTY DAMAGE ONLY	NORTHWESTBOUND	Other Lane - Changing Maneuver	NORTHWESTBOUND	Moving Ahead	VEH ONE CHANGED LANES INFRONT OF VEH TWO. VEH ONE FAILED TO USE A SIGNAL LIGHT TO INDICATE A LANE CHANGE CAUSING VEH TWO TO REAR END THE ATTACHMENT ON VEH ONE. VEH TWO LEFT THE SCENE. NO LP OR VEH INFORMATION OBTAINED	SNOW	WET	UNKNOWN	2	113.9688	50.7996	0	2	2		
363644	06-Nov-2018	08:45:00 AM	SAME DIRECTION SIDESWIPE	SIDESWIPE SAME DIRECTION		PROPERTY DAMAGE ONLY	NORTHWESTBOUND	Moving Ahead	NORTHWESTBOUND	Moving Ahead	Vehicle 2 lost control moving over to the right and was struck by vehicle 1	SNOW	SLUSH/SNOW/ICE	DAYLIGHT	2	113.9709	50.8014	0	2	2		
358202	02-Aug-2018	01:30:00 PM	SAME DIRECTION SIDESWIPE	SIDESWIPE SAME DIRECTION		PROPERTY DAMAGE ONLY	NORTHEASTBOUND	Moving Ahead	NORTHEASTBOUND	Other Lane - Changing Maneuver	Vehicle 2 hit the side of vehicle 1 while changing lane	CLEAR	DRY	DAYLIGHT	2A	113.9714	50.7963	0	2	2		
370066	13-Feb-2018	08:00:00 PM	ANIMAL	STRUCK OBJECT	ANIMAL	PROPERTY DAMAGE ONLY	EASTBOUND	Moving Ahead			Vehicle heading to Calgary on the overpass loop and struck a deer.	CLEAR	WET	DARKNESS	2A	113.968	50.7987	0	1	1		
374418	06-Jun-2018	07:30:00 AM	ANIMAL	STRUCK OBJECT	ANIMAL	PROPERTY DAMAGE ONLY	NORTHBOUND	Moving Ahead			VEH TWO STRUCK DEER WHILE DRIVING NORT BOUND ON HWY.	CLEAR	DRY	DAYLIGHT	2A	113.968	50.7987	0	1	1		
359077	17-Aug-2018	04:00:00 AM	ANIMAL	STRUCK OBJECT	ANIMAL	PROPERTY DAMAGE ONLY	NORTHBOUND	Moving Ahead			Vehicle a hit a deer	CLEAR	DRY	DARKNESS	2A	113.968	50.7987	0	1	1		
358589	10-Aug-2018	09:45:00 PM	ANIMAL	STRUCK OBJECT	ANIMAL	PROPERTY DAMAGE ONLY	NORTHBOUND	Moving Ahead			Vehicle hit a moose	CLEAR	DRY	DARKNESS	2A	113.968	50.7987	0	1	1		
360200	19-Sep-2018	08:15:00 PM	SAME DIRECTION SIDESWIPE	SIDESWIPE SAME DIRECTION		PROPERTY DAMAGE ONLY	NORTHEASTBOUND	Moving Ahead	NORTHEASTBOUND	Maneuver	Vehicle 1 was hit by Vehicle 2 while changing/passing to left lane.	CLEAR	DRY	DARKNESS	2A	113.9681	50.7986	0	2	2		
368627	11-Jan-2018	03:05:00 PM	TURNING MANOEUVRE	LEFT TURN - ACROSS PATH		MAJOR	SOUTHWESTBOUND	Making A Left Turn	NORTHEASTBOUND	Moving Ahead	DRIVER 1 WAS TRAVELLING WEST ON HWY 552 ATTEMPTING TO TURN SOUTH ON HWY 2 WHEN THEY COLLIDED WITH A EAST BOUND VEHICLE.	CLEAR	SLUSH/SNOW/ICE	UNKNOWN	552	113.9693308	50.7977392	0	2	2		
364882	01-Dec-2018	04:58:00 PM	FIXED OBJECT RIGHT DITCH	OFF ROAD RIGHT		PROPERTY DAMAGE ONLY	NORTHWESTBOUND	Moving Ahead			HIGHWAY 552 EASTBOUND VEHICLE 1 LOST CONTROL ON ICE AND HIT THE GUARD RAIL TOWED FROM LOCATION AND WRITTEN OFF	SNOW	SLUSH/SNOW/ICE	DARKNESS	552	113.967934	50.7987208	0	1	1		
358640	14-Aug-2018	10:47:00 AM	STRIKE FIXED OBJECT ON ROADWAY	STRUCK OBJECT		MINOR	NORTHEASTBOUND	Moving Ahead			Vehicle was traveling north on highway two when the driver fell asleep. Vehicle collided into guard rails on both side of the road.	CLEAR	DRY	DAYLIGHT	552	113.9678934	50.7987492	0	1	1		

APPENDIX F
Warrant Analysis Sheets

FIGURE D-7.6-5b WARRANTS FOR LEFT TURN TREATMENT AND STORAGE REQUIREMENTS FOR TWO-LANE HIGHWAYS DESIGN SPEED 90 KM/H, LEFT TURN 15%, 20%



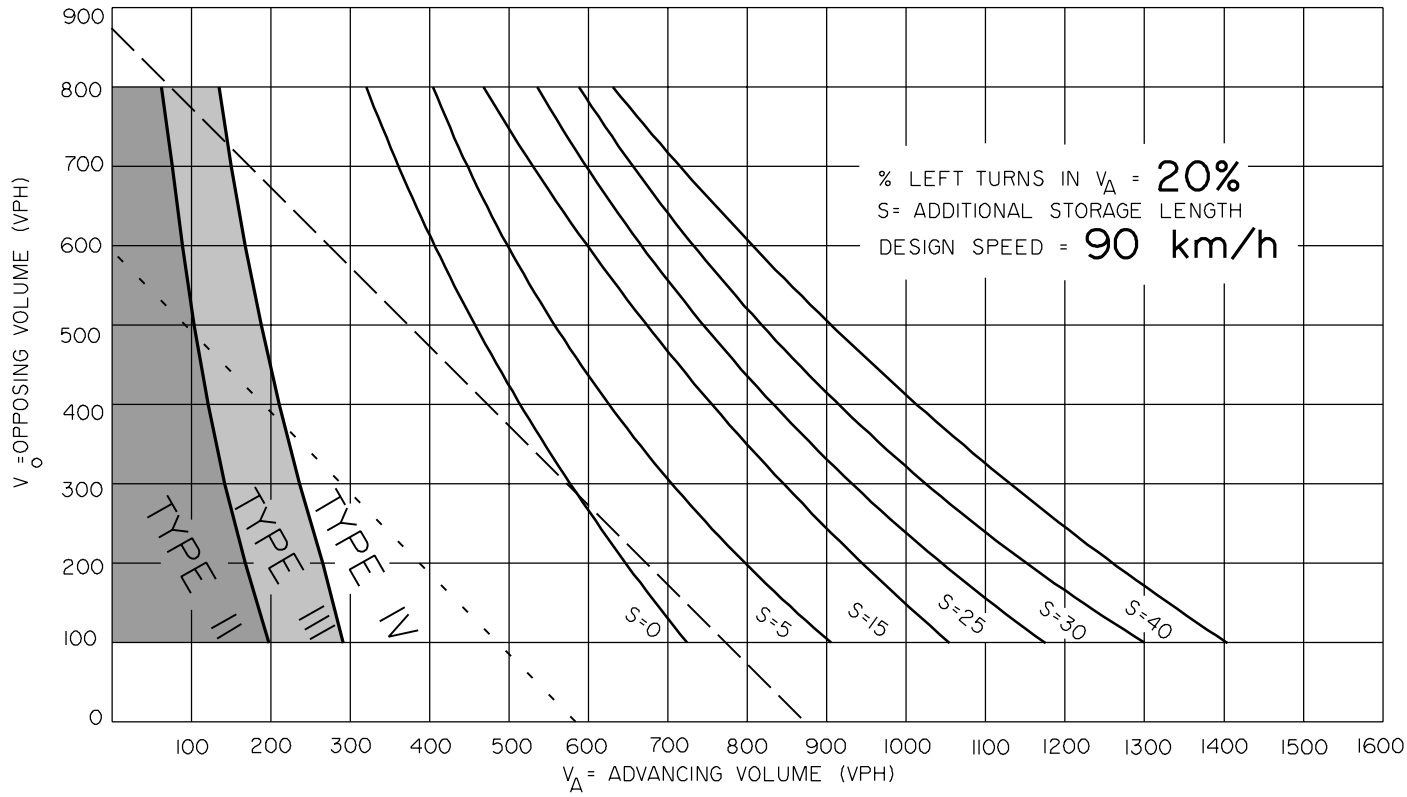
S = Additional storage length required, that is, in addition to what is shown on the appropriate Type IV standard drawing. Designer should check additional storage requirements for trucks, also see Table D.7.6a.

- - - - Traffic signals may be warranted in rural areas, or urban areas, with restricted flow.

—— —— Traffic signals may be warranted in "free flow" urban areas.

Notes:

1. The traffic signal warrant lines are provided for reference only. For detailed analysis of the requirements for signals, contact Roadway Engineering Branch.
2. Warrant for Type I treatment is shown in Figure D-7.4.



GRAPHICS FILE: DEI:[200,221]debd765a.man

AT - Traffic Signal Warrant Analysis

Main Street (name)	HWY 2A/522	Direction (EW or NS)	EW
Side Street (name)	East Ramp	Direction (EW or NS)	NS
Quadrant / Int #		Comments	Existing volumes.
for Warrant Calculation Results, please hit 'Page Down'	CHECK SHEET		

Road Authority:	AT
City:	Okotoks
Analysis Date:	2021 Dec 10, Fri
Count Date:	2019 Dec 10, Tue
Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes
HWY 2A/522	WB			1				20,000	1
HWY 2A/522	EB			1				20,000	1
East Ramp	NB	1							
East Ramp	SB								
							n		

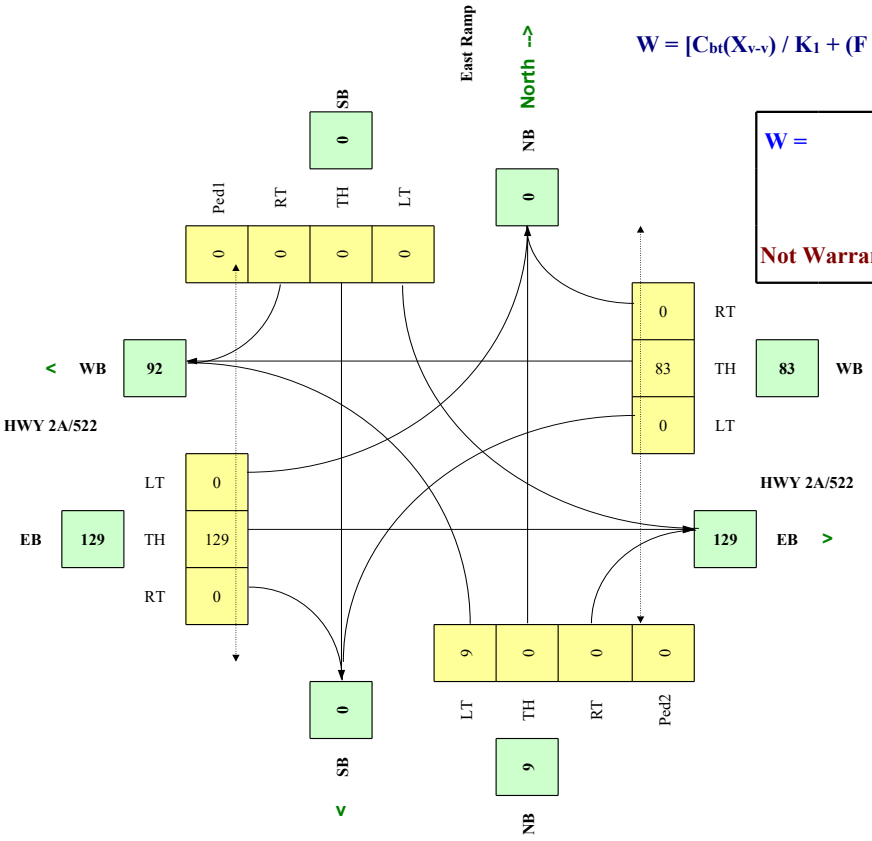
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	10
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
HWY 2A/522	EW	80	4.0%	n	0.0
East Ramp	NS		10.0%	n	

Set Peak Hours

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
7:00 - 8:00	12							80			99					
8:00 - 9:00	12							80			99					
11:00 - 12:00	9							83			129					
12:00 - 13:00	9							83			129					
4:00 - 5:00	5							86			159					
5:00 - 6:00	5							86			159					
Total (6-hour peak)	**52**	**0**	**0**	**0**	**0**	**0**	**0**	**498**	**0**	**0**	**774**	**0**	**0**	**0**	**0**	**0**
Average (6-hour peak)	**9**	**0**	**0**	**0**	**0**	**0**	**0**	**83**	**0**	**0**	**129**	**0**	**0**	**0**	**0**	**0**

Average 6-hour Peak Turning Movements



$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F\,(X_{v\text{-}p})\,L) / K_2] \times C_i$$

W =	2	2	0
		Veh	*Ped*

Not Warranted - Vs<75

RESET SHEET

AT - Traffic Signal Warrant Analysis

Main Street (name)	HWY 2A/522	Direction (EW or NS)	EW
Side Street (name)	East Ramp	Direction (EW or NS)	NS
Quadrant / Int #		Comments	Adjusted volumes. .
for Warrant Calculation Results, please hit 'Page Down'	CHECK SHEET		

Road Authority:	AT
City:	Okotoks
Analysis Date:	2022 Jan 24, Mon
Count Date:	2022 Jan 24, Mon
Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes
HWY 2A/522	WB			1				20,000	1
HWY 2A/522	EB			1				20,000	1
East Ramp	NB	1							
East Ramp	SB								
							n		

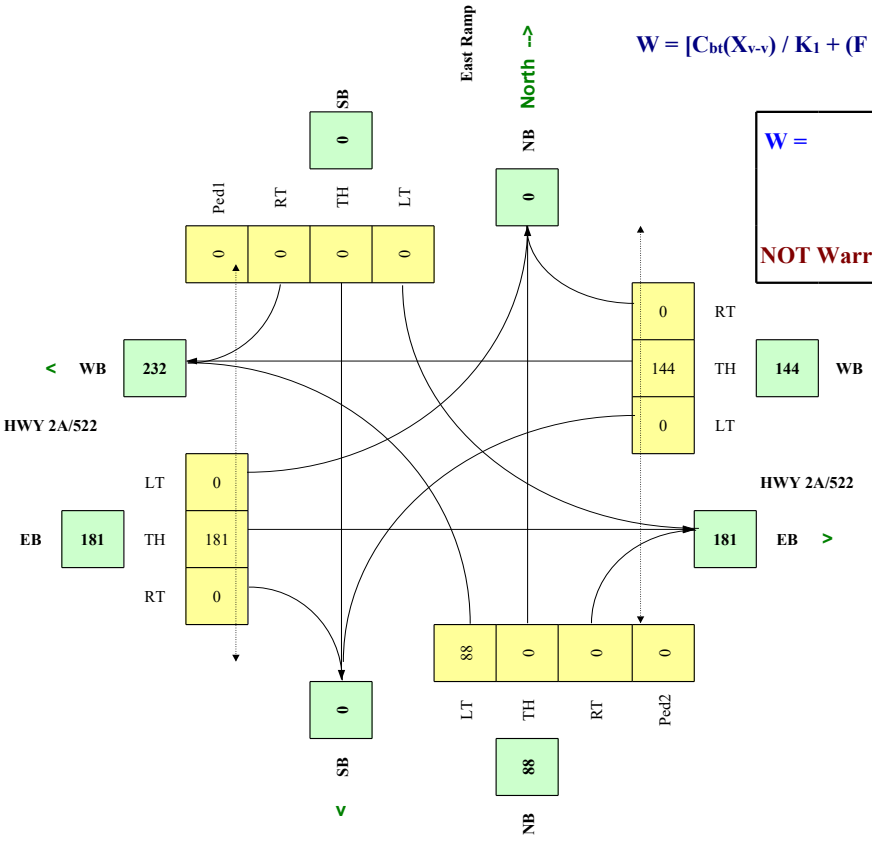
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	10
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
HWY 2A/522	EW	80	4.0%	n	0.0
East Ramp	NS		10.0%	n	

Set Peak Hours

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
7:00 - 8:00	90							149			131					
8:00 - 9:00	90							149			131					
11:00 - 12:00	88							144			181					
12:00 - 13:00	88							144			181					
4:00 - 5:00	85							139			231					
5:00 - 6:00	85							139			231					
Total (6-hour peak)	**526**	**0**	**0**	**0**	**0**	**0**	**0**	**864**	**0**	**0**	**1,086**	**0**	**0**	**0**	**0**	**0**
Average (6-hour peak)	**88**	**0**	**0**	**0**	**0**	**0**	**0**	**144**	**0**	**0**	**181**	**0**	**0**	**0**	**0**	**0**

Average 6-hour Peak Turning Movements



$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F\,(X_{v\text{-}p})\,L) / K_2] \times C_i$$

W =	24	24	0
		Veh	*Ped*

NOT Warranted

RESET SHEET

AT - Traffic Signal Warrant Analysis

Main Street (name)	HWY 2A/522	Direction (EW or NS)	EW
Side Street (name)	SB Ramp	Direction (EW or NS)	NS
Quadrant / Int #		Comments	Existing volumes

for Warrant Calculation Results, please hit 'Page Down'

CHECK SHEET

Road Authority:	AT
City:	Okotoks
Analysis Date:	2021 Dec 10, Fri
Count Date:	2019 Dec 10, Tue
Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes
HWY 2A/522	WB		1					20,000	1
HWY 2A/522	EB			2				20,000	2
SB Ramp	NB								
SB Ramp	SB		1						
							n		

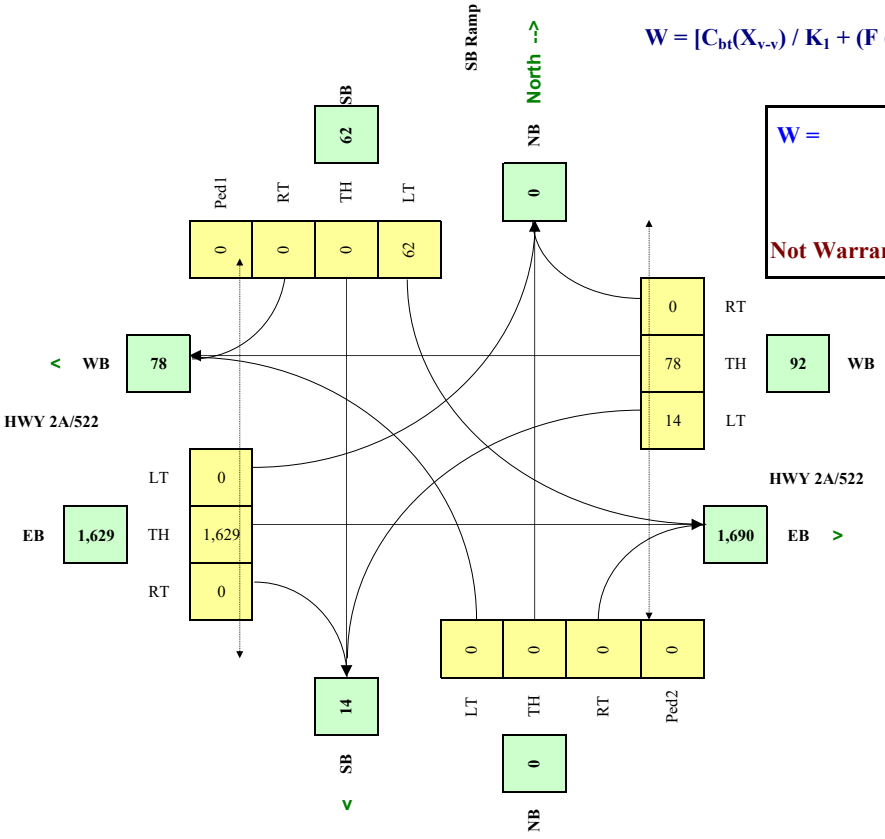
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	10
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
HWY 2A/522	EW	80	4.0%	n	0.0
SB Ramp	NS		4.0%	n	

Set Peak Hours

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
7:00 - 8:00				38	0		13	79			2211					
8:00 - 9:00				38	0		13	79			2211					
11:00 - 12:00				62	0		14	78			1629					
12:00 - 13:00				62	0		14	78			1629					
4:00 - 5:00				85	0		15	76			1046					
5:00 - 6:00				85	0		15	76			1046					
Total (6-hour peak)	0	0	0	370	0	0	84	466	0	0	9,772	0	0	0	0	0
Average (6-hour peak)	0	0	0	62	0	0	14	78	0	0	1,629	0	0	0	0	0

Average 6-hour Peak Turning Movements



$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F\,(X_{v\text{-}p})\,L) / K_2] \times C_i$$

W =	94	94	0
		Veh	*Ped*

Not Warranted - Vs<75

RESET SHEET

AT - Traffic Signal Warrant Analysis

Main Street (name)	HWY 2A/522	Direction (EW or NS)	EW
Side Street (name)	SB Ramp	Direction (EW or NS)	NS
Quadrant / Int #		Comments	Adjusted Volumes

for Warrant Calculation Results, please hit 'Page Down'

CHECK SHEET

Road Authority:	AT
City:	Okotoks
Analysis Date:	2021 Dec 10, Fri
Count Date:	2019 Dec 10, Tue
Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes
HWY 2A/522	WB		1					20,000	1
HWY 2A/522	EB			2				20,000	2
SB Ramp	NB								
SB Ramp	SB	1							

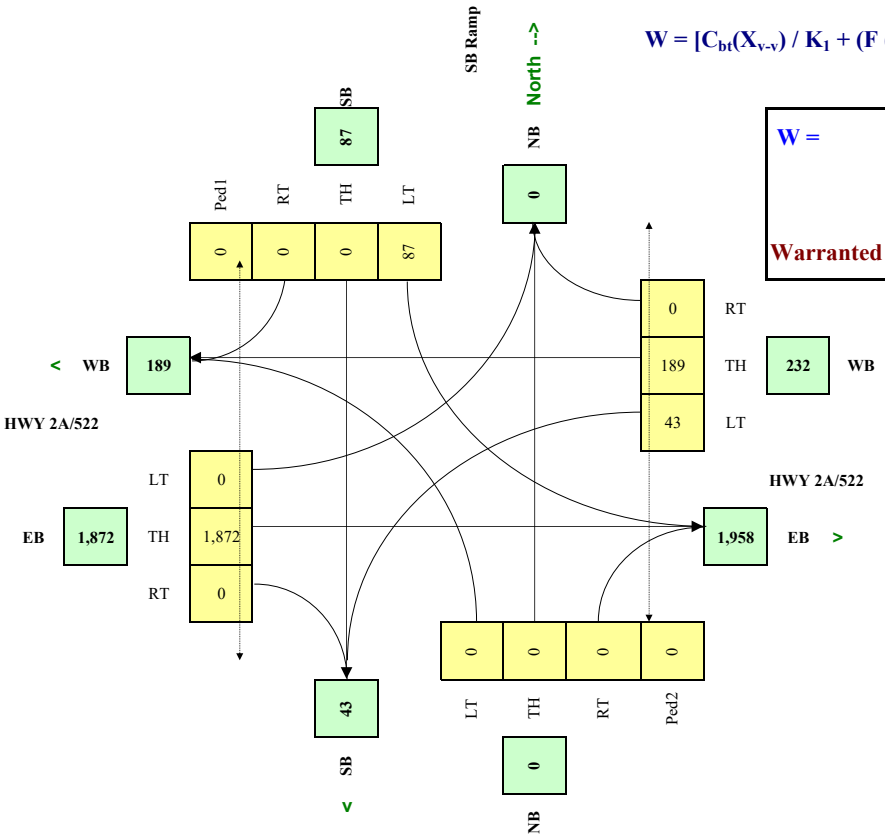
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	10
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
HWY 2A/522	EW	80	4.0%	n	0.0
SB Ramp	NS		4.0%	n	

Set Peak Hours

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
7:00 - 8:00				51			49	190			2515					
8:00 - 9:00				51			49	190			2515					
11:00 - 12:00				87			43	189			1872					
12:00 - 13:00				87			43	189			1872					
4:00 - 5:00				122			36	188			1228					
5:00 - 6:00				122			36	188			1228					
Total (6-hour peak)	**0**	**0**	**0**	**520**	**0**	**0**	**256**	**1,134**	**0**	**0**	**11,230**	**0**	**0**	**0**	**0**	**0**
Average (6-hour peak)	**0**	**0**	**0**	**87**	**0**	**0**	**43**	**189**	**0**	**0**	**1,872**	**0**	**0**	**0**	**0**	**0**

Average 6-hour Peak Turning Movements



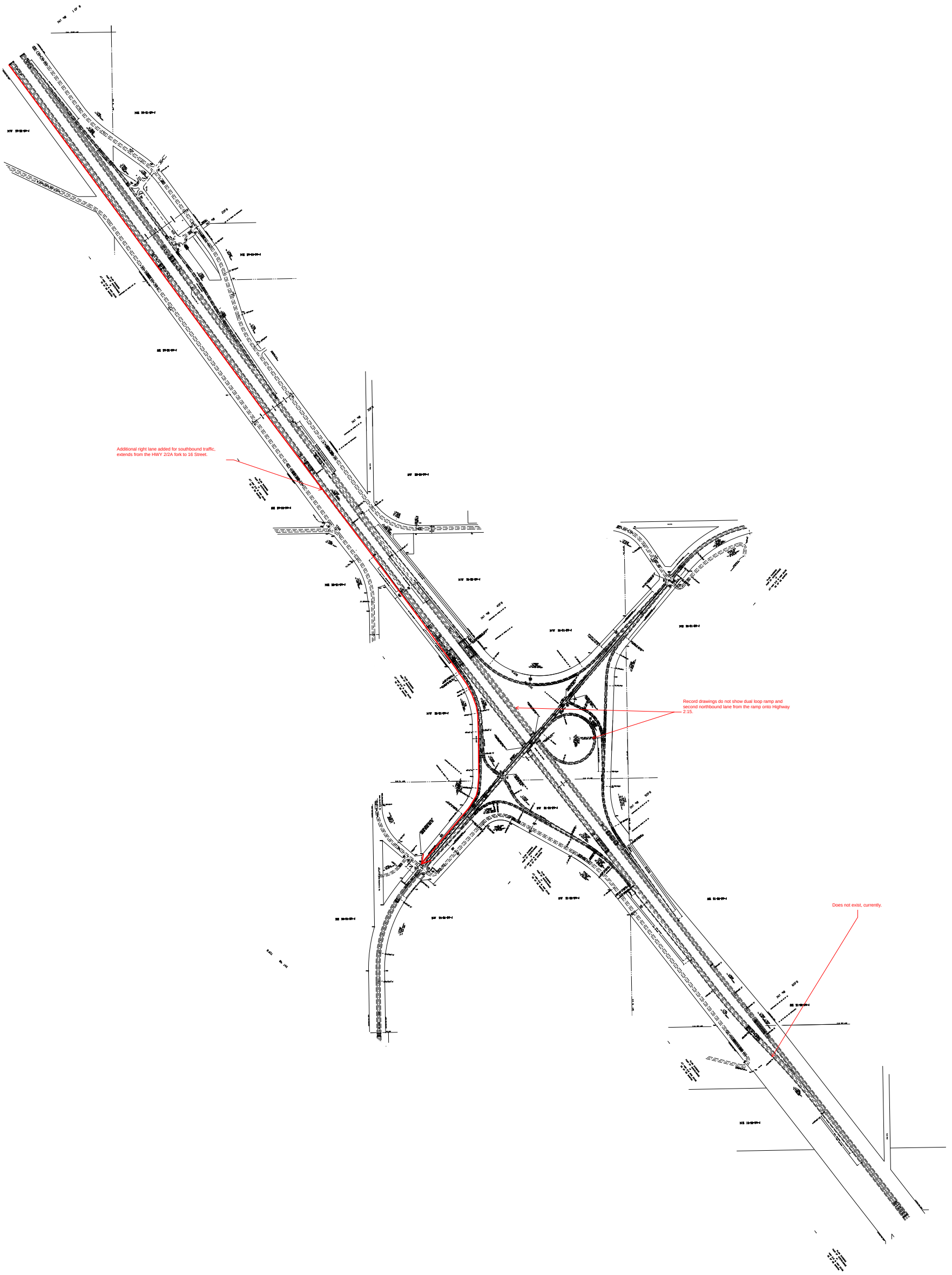
$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F\,(X_{v\text{-}p})\,L) / K_2] \times C_i$$

W =	190	190	0
		Veh	*Ped*

Warranted

RESET SHEET

APPENDIX G
Record Drawings


Additional right lane added for southbound traffic, extends from the HWY 2/2A fork to 16 Street.
Record drawings do not show dual loop ramp and second northbound lane from the ramp onto Highway 2:15.
Does not exist, currently.

APPENDIX H
Synchro Reports

HCM Unsignalized Intersection Capacity Analysis

7: 01-31-2022

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (veh/h)	38	0	0	0	0	0	0	2211	0	13	79	0
Future Volume (Veh/h)	38	0	0	0	0	0	0	2211	0	13	79	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	41	0	0	0	0	0	0	2403	0	14	86	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1316	2517	86	2517	2517	1202	86			2403		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1316	2517	86	2517	2517	1202	86			2403		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	62	100	100	100	100	100	100			93		
cM capacity (veh/h)	109	26	956	13	26	177	1508			196		

Direction, Lane #	SE 1	NE 1	NE 2	SW 1
Volume Total	41	1202	1202	100
Volume Left	41	0	0	14
Volume Right	0	0	0	0
cSH	109	1700	1700	196
Volume to Capacity	0.38	0.71	0.71	0.07
Queue Length 95th (m)	12.2	0.0	0.0	1.8
Control Delay (s)	56.5	0.0	0.0	5.1
Lane LOS	F			A
Approach Delay (s)	56.5	0.0		5.1
Approach LOS	F			

Intersection Summary				
Average Delay	1.1			
Intersection Capacity Utilization	71.1%	ICU Level of Service	C	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
8: 01-31-2022

Movement	WBL	WBR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Volume (veh/h)	12	0	99	0	0	80
Future Volume (Veh/h)	12	0	99	0	0	80
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	13	0	108	0	0	87
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	195	108			108	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	195	108			108	
tC, single (s)	6.5	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.6	3.3			2.2	
p0 queue free %	98	100			100	
cM capacity (veh/h)	772	946			1483	

Direction, Lane #	WB 1	NE 1	SW 1
Volume Total	13	108	87
Volume Left	13	0	0
Volume Right	0	0	0
cSH	772	1700	1700
Volume to Capacity	0.02	0.06	0.05
Queue Length 95th (m)	0.4	0.0	0.0
Control Delay (s)	9.7	0.0	0.0
Lane LOS	A		
Approach Delay (s)	9.7	0.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	15.2%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis

7: 01-31-2022

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (veh/h)	85	0	0	0	0	0	0	1046	0	15	76	0
Future Volume (Veh/h)	85	0	0	0	0	0	0	1046	0	15	76	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	92	0	0	0	0	0	0	1137	0	16	83	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	684	1252	83	1252	1252	568	83			1137		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	684	1252	83	1252	1252	568	83			1137		
tC, single (s)	7.6	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	71	100	100	100	100	100	100			97		
cM capacity (veh/h)	323	167	960	126	167	466	1512			610		

Direction, Lane #	SE 1	NE 1	NE 2	SW 1
Volume Total	92	568	568	99
Volume Left	92	0	0	16
Volume Right	0	0	0	0
cSH	323	1700	1700	610
Volume to Capacity	0.29	0.33	0.33	0.03
Queue Length 95th (m)	9.2	0.0	0.0	0.6
Control Delay (s)	20.5	0.0	0.0	2.0
Lane LOS	C			A
Approach Delay (s)	20.5	0.0		2.0
Approach LOS	C			

Intersection Summary				
Average Delay	1.6			
Intersection Capacity Utilization	40.3%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
8:

01-31-2022

Movement	WBL	WBR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Volume (veh/h)	5	0	159	0	0	86
Future Volume (Veh/h)	5	0	159	0	0	86
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	0	173	0	0	93
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	266	173			173	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	266	173			173	
tC, single (s)	6.5	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.6	3.3			2.2	
p0 queue free %	99	100			100	
cM capacity (veh/h)	708	871			1404	

Direction, Lane #	WB 1	NE 1	SW 1
Volume Total	5	173	93
Volume Left	5	0	0
Volume Right	0	0	0
cSH	708	1700	1700
Volume to Capacity	0.01	0.10	0.05
Queue Length 95th (m)	0.2	0.0	0.0
Control Delay (s)	10.1	0.0	0.0
Lane LOS	B		
Approach Delay (s)	10.1	0.0	0.0
Approach LOS	B		

Intersection Summary			
Average Delay		0.2	
Intersection Capacity Utilization		18.4%	ICU Level of Service A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis

7: 01-31-2022

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (veh/h)	51	0	0	0	0	0	0	2515	0	49	190	0
Future Volume (Veh/h)	51	0	0	0	0	0	0	2515	0	49	190	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	55	0	0	0	0	0	0	2734	0	53	207	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1680	3047	207	3047	3047	1367	207			2734		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1680	3047	207	3047	3047	1367	207			2734		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	100	100	100	100	100	100			63		
cM capacity (veh/h)	44	8	799	4	8	137	1361			145		

Direction, Lane #	SE 1	NE 1	NE 2	SW 1
Volume Total	55	1367	1367	260
Volume Left	55	0	0	53
Volume Right	0	0	0	0
cSH	44	1700	1700	145
Volume to Capacity	1.25	0.80	0.80	0.37
Queue Length 95th (m)	42.2	0.0	0.0	12.2
Control Delay (s)	362.7	0.0	0.0	23.4
Lane LOS	F			C
Approach Delay (s)	362.7	0.0		23.4
Approach LOS	F			

Intersection Summary				
Average Delay	8.5			
Intersection Capacity Utilization	79.5%	ICU Level of Service	D	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis

8: 01-31-2022

Movement	WBL	WBR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Volume (veh/h)	90	0	131	0	0	100
Future Volume (Veh/h)	90	0	131	0	0	100
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	98	0	142	0	0	109
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	251	142			142	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	251	142			142	
tC, single (s)	6.5	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.6	3.3			2.2	
p0 queue free %	86	100			100	
cM capacity (veh/h)	716	906			1441	

Direction, Lane #	WB 1	NE 1	SW 1
Volume Total	98	142	109
Volume Left	98	0	0
Volume Right	0	0	0
cSH	716	1700	1700
Volume to Capacity	0.14	0.08	0.06
Queue Length 95th (m)	3.8	0.0	0.0
Control Delay (s)	10.8	0.0	0.0
Lane LOS	B		
Approach Delay (s)	10.8	0.0	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	3.0		
Intersection Capacity Utilization	18.5%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis

7: 01-31-2022

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (veh/h)	122	0	0	0	0	0	0	1228	0	36	188	0
Future Volume (Veh/h)	122	0	0	0	0	0	0	1228	0	36	188	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	133	0	0	0	0	0	0	1335	0	39	204	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	950	1617	204	1617	1617	668	204			1335		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	950	1617	204	1617	1617	668	204			1335		
tC, single (s)	7.6	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	33	100	100	100	100	100	100			92		
cM capacity (veh/h)	198	95	803	65	95	401	1365			513		

Direction, Lane #	SE 1	NE 1	NE 2	SW 1
Volume Total	133	668	668	243
Volume Left	133	0	0	39
Volume Right	0	0	0	0
cSH	198	1700	1700	513
Volume to Capacity	0.67	0.39	0.39	0.08
Queue Length 95th (m)	32.6	0.0	0.0	2.0
Control Delay (s)	53.9	0.0	0.0	2.9
Lane LOS	F			A
Approach Delay (s)	53.9	0.0		2.9
Approach LOS	F			

Intersection Summary				
Average Delay	4.6			
Intersection Capacity Utilization	54.0%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis

8: 01-31-2022

Movement	WBL	WBR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Volume (veh/h)	85	0	231	0	0	139
Future Volume (Veh/h)	85	0	231	0	0	139
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	92	0	251	0	0	151
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	402	251			251	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	402	251			251	
tC, single (s)	6.5	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.6	3.3			2.2	
p0 queue free %	84	100			100	
cM capacity (veh/h)	591	788			1314	

Direction, Lane #	WB 1	NE 1	SW 1
Volume Total	92	251	151
Volume Left	92	0	0
Volume Right	0	0	0
cSH	591	1700	1700
Volume to Capacity	0.16	0.15	0.09
Queue Length 95th (m)	4.4	0.0	0.0
Control Delay (s)	12.2	0.0	0.0
Lane LOS	B		
Approach Delay (s)	12.2	0.0	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	23.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lanes, Volumes, Timings
7:

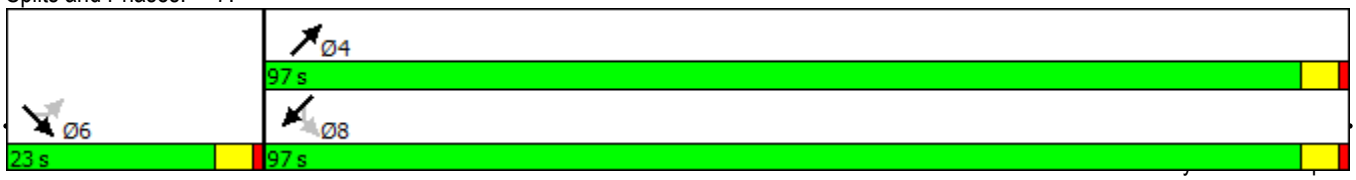
02-03-2022

Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	38	0	0	0	0	0	0	2211	0	13	79	0
Future Volume (vph)	38	0	0	0	0	0	0	2211	0	13	79	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	1.00
Frt												
Flt Protected		0.950									0.993	
Satd. Flow (prot)	0	1770	0	0	0	0	0	3539	0	0	1850	0
Flt Permitted		0.950									0.722	
Satd. Flow (perm)	0	1770	0	0	0	0	0	3539	0	0	1345	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)												
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		32.6			57.7			70.9			129.5	
Travel Time (s)		2.3			4.2			5.1			9.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	41	0	0	0	0	0	0	2403	0	14	86	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	41	0	0	0	0	0	2403	0	0	100	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2						2		1	2	
Detector Template	Left	Thru						Thru		Left	Thru	
Leading Detector (m)	2.0	10.0						10.0		2.0	10.0	
Trailing Detector (m)	0.0	0.0						0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0						0.0		0.0	0.0	
Detector 1 Size(m)	2.0	0.6						0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex						Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0						0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0						0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0						0.0		0.0	0.0	
Detector 2 Position(m)		9.4						9.4			9.4	
Detector 2 Size(m)		0.6						0.6			0.6	
Detector 2 Type		Cl+Ex						Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0						0.0			0.0	
Turn Type	Perm	NA						NA		Perm	NA	
Protected Phases		6						4			8	
Permitted Phases	6									8		
Detector Phase	6	6						4		8	8	
Switch Phase												
Minimum Initial (s)	5.0	5.0						5.0		5.0	5.0	

Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Minimum Split (s)	22.5	22.5						22.5		22.5	22.5	
Total Split (s)	23.0	23.0						97.0		97.0	97.0	
Total Split (%)	19.2%	19.2%						80.8%		80.8%	80.8%	
Maximum Green (s)	18.5	18.5						92.5		92.5	92.5	
Yellow Time (s)	3.5	3.5						3.5		3.5	3.5	
All-Red Time (s)	1.0	1.0						1.0		1.0	1.0	
Lost Time Adjust (s)		0.0						0.0			0.0	
Total Lost Time (s)		4.5						4.5			4.5	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0						3.0		3.0	3.0	
Recall Mode	Min	Min						None		None	None	
Walk Time (s)	7.0	7.0						7.0		7.0	7.0	
Flash Dont Walk (s)	11.0	11.0						11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0	0						0		0	0	
Act Effct Green (s)		8.0						63.7			63.7	
Actuated g/C Ratio		0.10						0.78			0.78	
v/c Ratio		0.24						0.87			0.09	
Control Delay		44.3						9.8			2.1	
Queue Delay		0.0						0.0			0.0	
Total Delay		44.3						9.8			2.1	
LOS		D						A			A	
Approach Delay		44.3						9.8			2.1	
Approach LOS		D						A			A	
Queue Length 50th (m)		6.1						94.3			2.6	
Queue Length 95th (m)		20.4						153.1			6.1	
Internal Link Dist (m)		8.6			33.7			46.9			105.5	
Turn Bay Length (m)												
Base Capacity (vph)		430						3399			1292	
Starvation Cap Reductn		0						0			0	
Spillback Cap Reductn		0						0			0	
Storage Cap Reductn		0						0			0	
Reduced v/c Ratio		0.10						0.71			0.08	

Intersection Summary			
Area Type:	Other		
Cycle Length: 120			
Actuated Cycle Length: 81.3			
Natural Cycle: 90			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.87			
Intersection Signal Delay: 10.1		Intersection LOS: B	
Intersection Capacity Utilization 72.8%		ICU Level of Service C	
Analysis Period (min) 15			

Splits and Phases: 7:



Lanes, Volumes, Timings
7:

02-03-2022

Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	51	0	0	0	0	0	0	2515	0	49	190	0
Future Volume (vph)	51	0	0	0	0	0	0	2515	0	49	190	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	1.00
Frt												
Flt Protected		0.950									0.990	
Satd. Flow (prot)	0	1770	0	0	0	0	0	3539	0	0	1844	0
Flt Permitted		0.950									0.244	
Satd. Flow (perm)	0	1770	0	0	0	0	0	3539	0	0	455	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)												
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		32.6			57.7			70.9			129.5	
Travel Time (s)		2.3			4.2			5.1			9.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	55	0	0	0	0	0	0	2734	0	53	207	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	55	0	0	0	0	0	2734	0	0	260	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2						2		1	2	
Detector Template	Left	Thru						Thru		Left	Thru	
Leading Detector (m)	2.0	10.0						10.0		2.0	10.0	
Trailing Detector (m)	0.0	0.0						0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0						0.0		0.0	0.0	
Detector 1 Size(m)	2.0	0.6						0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex						Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0						0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0						0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0						0.0		0.0	0.0	
Detector 2 Position(m)		9.4						9.4			9.4	
Detector 2 Size(m)		0.6						0.6			0.6	
Detector 2 Type		Cl+Ex						Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0						0.0			0.0	
Turn Type	Perm	NA						NA		Perm	NA	
Protected Phases		6						4			8	
Permitted Phases	6									8		
Detector Phase	6	6						4		8	8	
Switch Phase												
Minimum Initial (s)	5.0	5.0						5.0		5.0	5.0	

Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Minimum Split (s)	22.5	22.5						22.5		22.5	22.5	
Total Split (s)	23.0	23.0						97.0		97.0	97.0	
Total Split (%)	19.2%	19.2%						80.8%		80.8%	80.8%	
Maximum Green (s)	18.5	18.5						92.5		92.5	92.5	
Yellow Time (s)	3.5	3.5						3.5		3.5	3.5	
All-Red Time (s)	1.0	1.0						1.0		1.0	1.0	
Lost Time Adjust (s)		0.0						0.0			0.0	
Total Lost Time (s)		4.5						4.5			4.5	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0						3.0		3.0	3.0	
Recall Mode	C-Max	C-Max						None		None	None	
Walk Time (s)	7.0	7.0						7.0		7.0	7.0	
Flash Dont Walk (s)	11.0	11.0						11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0	0						0		0	0	
Act Effct Green (s)		18.5						92.5			92.5	
Actuated g/C Ratio		0.15						0.77			0.77	
v/c Ratio		0.20						1.00			0.74	
Control Delay		46.6						32.2			23.3	
Queue Delay		0.0						0.0			0.0	
Total Delay		46.6						32.2			23.3	
LOS		D						C			C	
Approach Delay		46.6						32.2			23.3	
Approach LOS		D						C			C	
Queue Length 50th (m)		12.1						~306.2			29.0	
Queue Length 95th (m)		24.9						#412.8			#97.8	
Internal Link Dist (m)		8.6			33.7			46.9			105.5	
Turn Bay Length (m)												
Base Capacity (vph)		272						2727			350	
Starvation Cap Reductn		0						0			0	
Spillback Cap Reductn		0						0			0	
Storage Cap Reductn		0						0			0	
Reduced v/c Ratio		0.20						1.00			0.74	

Intersection Summary			
Area Type:	Other		
Cycle Length: 120			
Actuated Cycle Length: 120			
Offset: 0 (0%), Referenced to phase 2: and 6:SETL, Start of Green			
Natural Cycle: 120			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 1.00			
Intersection Signal Delay: 31.7		Intersection LOS: C	
Intersection Capacity Utilization 81.2%		ICU Level of Service D	
Analysis Period (min) 15			
~ Volume exceeds capacity, queue is theoretically infinite.			
Queue shown is maximum after two cycles.			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			

Splits and Phases: 7:

APPENDIX I
HCS Reports

HCS7 Freeway Weaving Report

Project Information

Analyst	DZ	Date	
Agency		Analysis Year	2022
Jurisdiction	AT	Time Period Analyzed	AM
Project Description	HWY 2:15 Weaving Section	Unit	Metric System

Geometric Data

Number of Lanes (N), ln	2	Segment Type	Freeway
Segment Length (L_S), m	5971	Number of Maneuver Lanes (N_{WL}), ln	0
Weaving Configuration	Two-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	1
Interchange Density (ID), int/km	0.72	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	708	1075	1075	708
Peak Hour Factor (PHF)	0.94	0.86	0.86	0.94
Total Trucks, %	5.00	2.00	2.00	8.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.952	0.980	0.980	0.926
Flow Rate (v_i), pc/h	791	1276	1276	813
Weaving Flow Rate (v_w), pc/h	1276	Freeway Max Capacity (c_{IFL}), pc/h/ln		2390
Non-Weaving Flow Rate (v_{NW}), pc/h	2880	Density-Based Capacity (c_{IWL}), pc/h/ln		2174
Total Flow Rate (v), pc/h	4156	Demand Flow-Based Capacity (c_{IW}), pc/h		-
Volume Ratio (VR)	0.307	Weaving Segment Capacity (c_W), veh/h		4188
Minimum Lane Change Rate (LC_{MIN}), lc/h	1276	Adjusted Weaving Area Capacity, pc/h		4348
Maximum Weaving Length (L_{MAX}), m	8791	Volume-to-Capacity Ratio (v/c)		0.96

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	1245	Average Weaving Speed (S_W), km/h	61.6
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	2331	Average Non-Weaving Speed (S_{NW}), km/h	49.8
Weaving Lane Change Rate (LC_W), lc/h	1458	Average Speed (S), km/h	52.9
Weaving Lane Change Rate (LC_{All}), lc/h	3789	Density (D), pc/km/ln	39.3
Weaving Intensity Factor (W)	0.158	Level of Service (LOS)	E

HCS7 Freeway Weaving Report

Project Information

Analyst	DZ	Date	
Agency		Analysis Year	2022
Jurisdiction	AT	Time Period Analyzed	AM
Project Description	HWY 2:15 Weaving Section adjusted	Unit	Metric System

Geometric Data

Number of Lanes (N), ln	2	Segment Type	Freeway
Segment Length (L_S), m	5971	Number of Maneuver Lanes (N_{WL}), ln	0
Weaving Configuration	Two-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	1
Interchange Density (ID), int/km	0.72	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	566	1218	1218	566
Peak Hour Factor (PHF)	0.94	0.86	0.86	0.94
Total Trucks, %	5.00	2.00	2.00	8.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.952	0.980	0.980	0.926
Flow Rate (v_i), pc/h	632	1445	1445	650
Weaving Flow Rate (v_w), pc/h	1445	Freeway Max Capacity (c_{IFL}), pc/h/ln		2390
Non-Weaving Flow Rate (v_{NW}), pc/h	2727	Density-Based Capacity (c_{IWL}), pc/h/ln		2142
Total Flow Rate (v), pc/h	4172	Demand Flow-Based Capacity (c_{IW}), pc/h		-
Volume Ratio (VR)	0.346	Weaving Segment Capacity (c_W), veh/h		4141
Minimum Lane Change Rate (LC_{MIN}), lc/h	1445	Adjusted Weaving Area Capacity, pc/h		4284
Maximum Weaving Length (L_{MAX}), m	9215	Volume-to-Capacity Ratio (v/c)		0.97

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	1179	Average Weaving Speed (S_W), km/h	61.5
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	2297	Average Non-Weaving Speed (S_{NW}), km/h	48.6
Weaving Lane Change Rate (LC_W), lc/h	1627	Average Speed (S), km/h	52.4
Weaving Lane Change Rate (LC_{All}), lc/h	3924	Density (D), pc/km/ln	39.8
Weaving Intensity Factor (W)	0.162	Level of Service (LOS)	E

HCS7 Freeway Weaving Report

Project Information

Analyst	DZ	Date	
Agency		Analysis Year	2022
Jurisdiction	AT	Time Period Analyzed	PM
Project Description	HWY 2:15 Weaving Section SB	Unit	Metric System

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), m	3609	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/km	0.72	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	751	985	985	751
Peak Hour Factor (PHF)	0.94	0.95	0.95	0.94
Total Trucks, %	8.00	2.00	2.00	8.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.926	0.980	0.980	0.926
Flow Rate (v_i), pc/h	863	1058	1058	863
Weaving Flow Rate (v_w), pc/h	1921	Freeway Max Capacity (c_{IFL}), pc/h/ln		2390
Non-Weaving Flow Rate (v_{NW}), pc/h	1921	Density-Based Capacity (c_{IWL}), pc/h/ln		2067
Total Flow Rate (v), pc/h	3842	Demand Flow-Based Capacity (c_{IW}), pc/h		4800
Volume Ratio (VR)	0.500	Weaving Segment Capacity (c_W), veh/h		4588
Minimum Lane Change Rate (LC_{MIN}), lc/h	1921	Adjusted Weaving Area Capacity, pc/h		4800
Maximum Weaving Length (L_{MAX}), m	7826	Volume-to-Capacity Ratio (v/c)		0.80

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	502	Average Weaving Speed (S_W), km/h	58.4
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1774	Average Non-Weaving Speed (S_{NW}), km/h	49.0
Weaving Lane Change Rate (LC_W), lc/h	2233	Average Speed (S), km/h	53.3
Weaving Lane Change Rate (LC_{All}), lc/h	4007	Density (D), pc/km/ln	24.0
Weaving Intensity Factor (W)	0.245	Level of Service (LOS)	C

HCS7 Freeway Weaving Report

Project Information

Analyst	DZ	Date	
Agency		Analysis Year	2022
Jurisdiction	AT	Time Period Analyzed	PM
Project Description	HWY 2:15 Weaving Section SB adjusted	Unit	Metric System

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), m	3609	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/km	0.33	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	752	983	983	752
Peak Hour Factor (PHF)	0.94	0.94	0.95	0.95
Total Trucks, %	8.00	8.00	2.00	2.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.926	0.926	0.980	0.980
Flow Rate (v_i), pc/h	864	1129	1056	808
Weaving Flow Rate (v_w), pc/h	1937	Freeway Max Capacity (c_{IFL}), pc/h/ln		2390
Non-Weaving Flow Rate (v_{NW}), pc/h	1920	Density-Based Capacity (c_{IWL}), pc/h/ln		2066
Total Flow Rate (v), pc/h	3857	Demand Flow-Based Capacity (c_{IW}), pc/h		4781
Volume Ratio (VR)	0.502	Weaving Segment Capacity (c_W), veh/h		4553
Minimum Lane Change Rate (LC_{MIN}), lc/h	1937	Adjusted Weaving Area Capacity, pc/h		4781
Maximum Weaving Length (L_{MAX}), m	7850	Volume-to-Capacity Ratio (v/c)		0.81

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	231	Average Weaving Speed (S_W), km/h	58.4
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1774	Average Non-Weaving Speed (S_{NW}), km/h	48.9
Weaving Lane Change Rate (LC_W), lc/h	2191	Average Speed (S), km/h	53.3
Weaving Lane Change Rate (LC_{All}), lc/h	3965	Density (D), pc/km/ln	24.1
Weaving Intensity Factor (W)	0.243	Level of Service (LOS)	C

APPENDIX J
SIDRA Reports

MOVEMENT SUMMARY

Existing Volumes - AM

Site: Southbound Ramp Intersection

New Site
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: HWY 2A:06											
2	T1	2327	2.0	0.713	6.5	LOS A	8.8	62.7	0.37	0.45	61.8
Approach		2327	2.0	0.713	6.5	LOS A	8.8	62.7	0.37	0.45	61.8
North: HWY 2A:06											
7	L2	14	2.0	0.054	9.2	LOS A	0.0	0.0	0.00	0.41	58.2
8	T1	83	2.0	0.054	3.5	LOS A	0.0	0.0	0.00	0.41	57.8
Approach		97	2.0	0.054	4.3	LOS A	0.0	0.0	0.00	0.41	57.9
West: HWY 2:15											
10	L2	40	2.0	0.030	9.6	LOS A	0.1	1.0	0.22	0.59	53.6
11	T1	1	2.0	0.030	3.9	LOS A	0.1	1.0	0.22	0.59	53.3
Approach		41	2.0	0.030	9.4	LOS A	0.1	1.0	0.22	0.59	53.6
All Vehicles		2465	2.0	0.713	6.5	LOS A	8.8	62.7	0.35	0.45	61.5

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Adjusted Volumes - AM

Site: Southbound Ramp Intersection

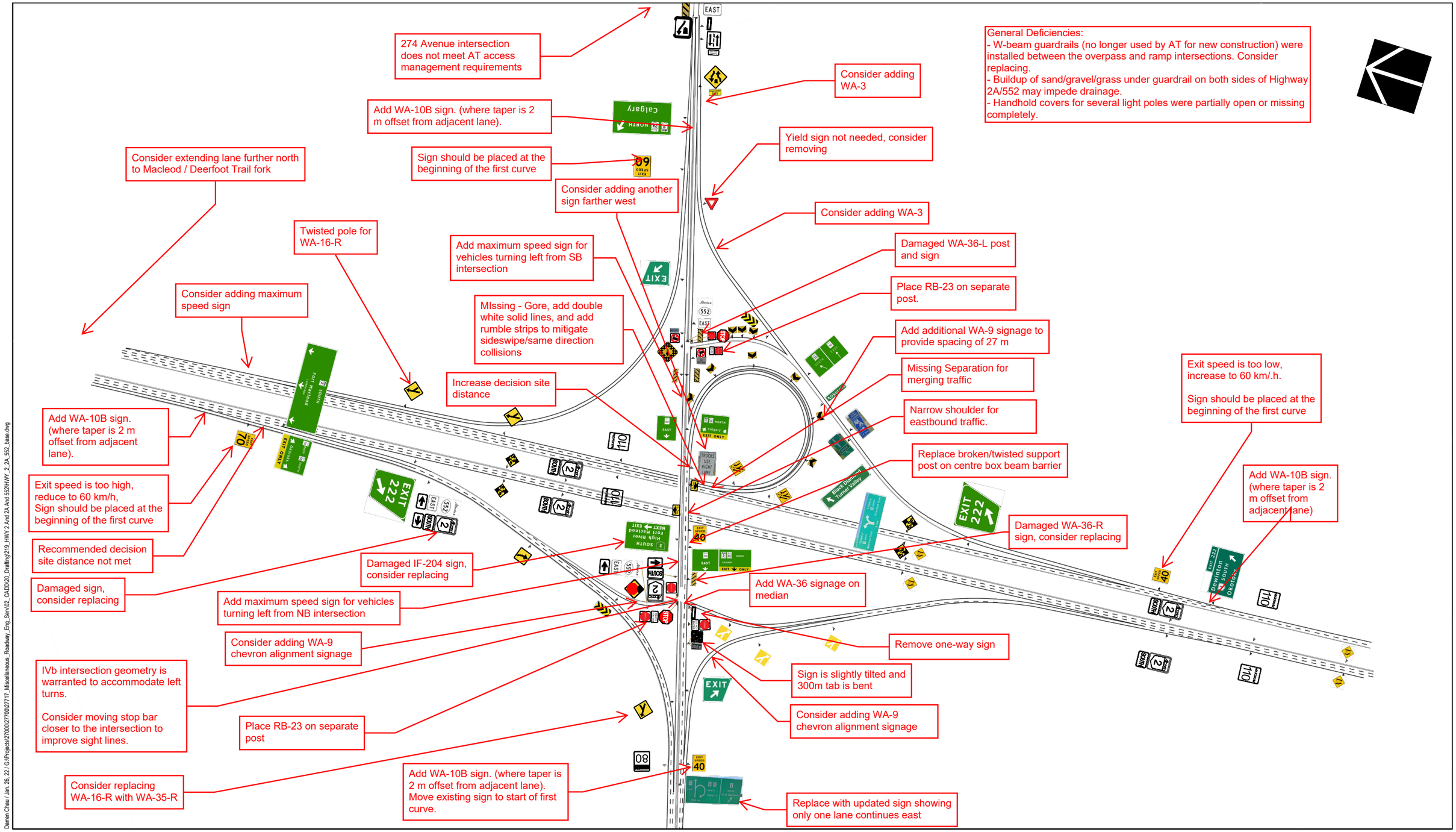
New Site
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: HWY 2A:06											
2	T1	2647	2.0	0.852	7.5	LOS A	15.5	110.5	0.70	0.52	59.6
Approach		2647	2.0	0.852	7.5	LOS A	15.5	110.5	0.70	0.52	59.6
North: HWY 2A:06											
7	L2	52	2.0	0.141	9.2	LOS A	0.0	0.0	0.00	0.43	57.9
8	T1	200	2.0	0.141	3.5	LOS A	0.0	0.0	0.00	0.43	57.5
Approach		252	2.0	0.141	4.7	LOS A	0.0	0.0	0.00	0.43	57.6
West: HWY 2:15											
10	L2	54	2.0	0.044	10.2	LOS B	0.2	1.5	0.37	0.61	53.0
11	T1	1	2.0	0.044	4.5	LOS A	0.2	1.5	0.37	0.61	52.7
Approach		55	2.0	0.044	10.1	LOS B	0.2	1.5	0.37	0.61	53.0
All Vehicles		2954	2.0	0.852	7.3	LOS A	15.5	110.5	0.63	0.51	59.3

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

APPENDIX K
Deficiencies Summary Map



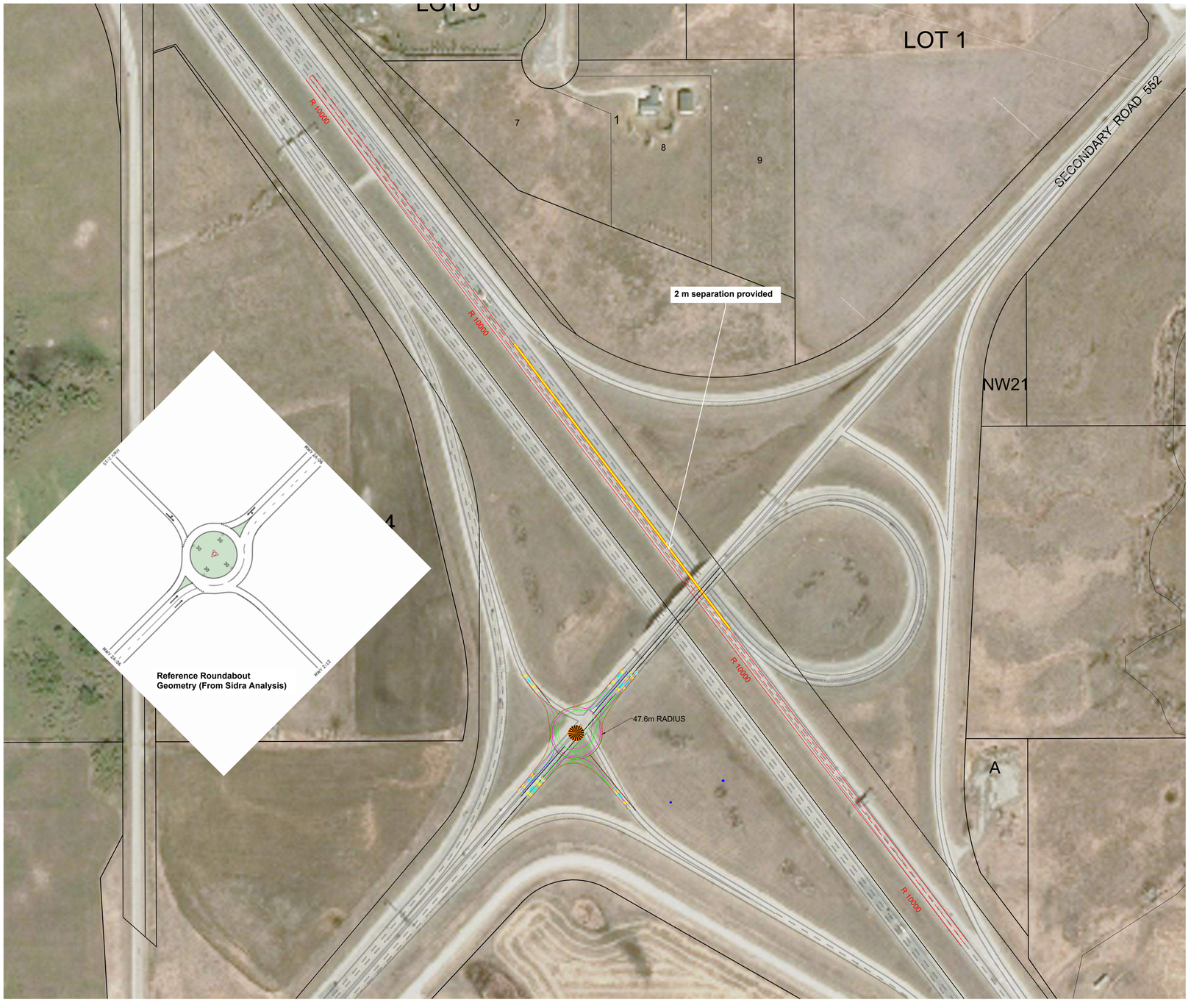
Darren Chau / Jan. 26, 22 / G:\Projects\270002770027717_Miscellaneous_Roadway_Eng_Serv\02_CAD\02D_Drafting\219_HWY 2 And 2A And 552\HWY_2_2A_552_base.dwg

OKOTOKS INTERCHANGE SAFETY AND OPERATIONAL REVIEW

1:1500

DEFICIENCY SUMMARY MAP (Based on Report)

APPENDIX L
Roundabout and Merge Separation Concept


LOT 1
SECONDARY ROAD 552
R 10000
7
1
8
9
2 m separation provided
NW21
A
47.6m RADIUS
Reference Roundabout
Geometry (From Sidra Analysis)