

Calgary



Glenmore Trail East Interchanges Functional Planning Study

Appendix H - Road Safety Audit Report

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PARSONS

ISL Engineering
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Glenmore Trail: 100 Street SE to Rainbow Road Road Safety Audit



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Glenmore Trail - 100 Street SE to Rainbow Road Interchange Functional Plan Road Safety Audit

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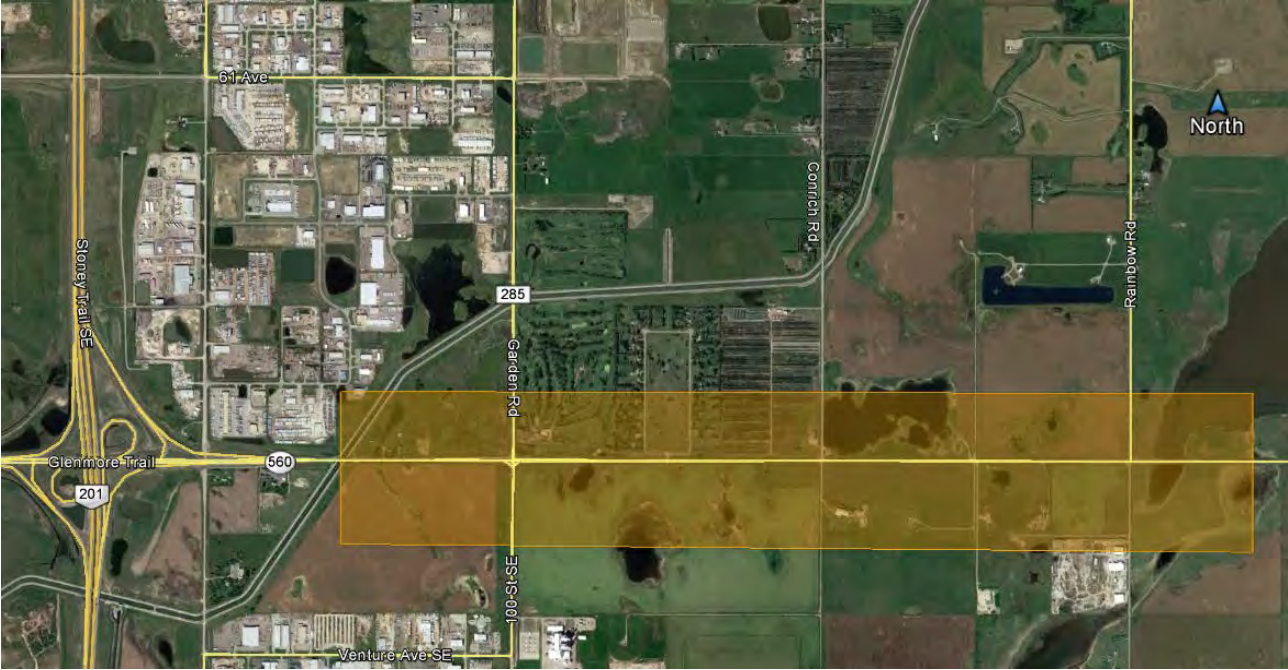
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1. Introduction

McElhanney Consulting Services Ltd. (MCSL) was retained by Parsons Corporation (Parsons) to carry out a Road Safety Audit (RSA) of an interchange functional plan for three intersections along Glenmore Trail in Southeast Calgary.

The study area, as shown in Figure 1, includes proposed interchanges on Glenmore Trail at 100 Street SE (Garden Road), Conrich Road (Range Road 284), and Rainbow Road (Range Road 283).



Source: Google Earth Image

Figure 1: Study Area

MCSL has conducted an RSA of the proposed plans for the study area. The RSA was conducted in accordance with the Transportation Association of Canada’s (TAC) *The Canadian Road Safety Audit Guide* (2001) for the area under review to identify deficiencies that should be mitigated prior to finalization of the designs. The potential safety issues identified in this report are based on the Functional Planning Study Plan and Profile drawing package prepared by Parsons and received by McElhanney on July 19, 2017 (included as Appendix A). The findings of the audit are documented in this report.

2. Road Safety Audit Process

A road safety audit is a formal evaluation of the safety performance of an existing or future road, intersection, or interchange by an audit team. Road safety audits help to promote road safety by identifying safety issues at the design and implementation stages, promoting awareness of safe design practices, integrating multimodal safety concerns, and considering human factors in the design.

The safety audit was conducted based on the functional planning design drawings, and the identified safety issues and mitigation suggestions have been developed with consideration for the type of improvements that are feasible at the current design stage. The purpose of the RSA is not to review the validity of design concepts, nor to be a design standards check. Rather the intent is to identify and quantify potential safety and collision risks and suggest potential improvements.

The audit team has conducted this audit to the best of its professional abilities. While every attempt has been made to identify significant safety issues, the project owner is reminded that no road is immune to the occurrence of collisions. In addition to the road characteristics, there are other factors, such as driver behaviour and adverse weather that are outside the control of the design team that may contribute to a collision. The purpose of this audit is to identify potential safety issues related to the road design and recommend improvement options to reduce the risk of collisions. The design team and project owner are reminded that the responsibility for the design, construction, and performance of the project remains with the engineers of record.

2.1. Audit Team

According to the Transportation Association of Canada's (TAC) *Canadian Guide to In-Service Road Safety Reviews* (2004), a Road Safety Audit is a "formal and independent safety performance review". Road Safety Audits are considered independent because the individuals that conduct the audit are typically detached from the project team undertaking the design. The Road Safety Auditors were not involved in any stage of the roadway planning or design.

2.2. Risk Assessment

A collision risk assessment was carried out for each identified safety issue. The expected frequency and severity of collisions related to each potential safety issue was evaluated and rated according to the categories noted in Table 1. The two risk elements of frequency and severity were then combined to obtain a risk assessment rating. In this way, safety issues were assigned a ranking between F (highest risk and highest priority) and A (lowest risk and lowest priority).

The frequency and severity assessments for each issue evaluated are based on engineering judgment and are therefore subjective. However, the risk assessment still provides a useful tool for prioritizing risk mitigation and safety improvement recommendations.

Table 1: Risk Assessment Matrix

Expected Frequency	Expected Severity			
	Property Damage Only	Minor Injury	Major Injury	Fatal
> 5 per year	C	D	E	F
1 – 4 per year	B	C	D	E
< 1 per year, > 1 per 5 years	A	B	C	D
< 1 per 5 years	A	A	B	C

For each safety issue identified, possible mitigation measures have been suggested. The suggestions focus on actions and measures that can be incorporated into the proposed designs and drawings, or otherwise cost-effectively implemented at the detailed design stage.

2.3. Scope of Audit

The scope of this audit was to review the plan and profile drawings included in the package received from Parsons titled “Functional Planning Study Glenmore Trail East – Stoney Tr to Rainbow Rd (Range Road 283).” This included the proposed designs of the diverging diamond interchanges at the intersections of Glenmore Trail SE with 100 Street SE (basket weave and non-basket weave options), Conrich Road, and Rainbow Road. The drawing elements reviewed included the geometric design, alignment, and roadway configuration proposed for the new diverging diamond interchanges.

It should be noted that at this stage, the plans were not sufficiently detailed to allow a review of elements such as pavement markings, signage, and illumination.

3. Diverging Diamond Interchange

Diverging diamond interchanges are proposed for construction at the intersections of Glenmore Trail SE with 100 Street SE, Conrich Road, and Rainbow Road. The diverging diamond interchange design involves allowing traffic movements to cross-over from driving on the right-hand side of the road to the left side on the interchange approach in advance of the intersecting roadway, such that left turn movements can be made as free-flow movements without conflicts with opposing traffic. A second cross-over point then switches the roadway configuration back to standard right-side driving after traversing the intersection.

This is a relatively new type of interchange in both Canada and in Calgary, with the first such interchange opening in Calgary on August 14, 2017. As with any new infrastructure design, there is a risk of issues associated with user unfamiliarity and reduced driver comfort levels. These risks are expected to reduce over time and have not been identified as a specific issue in the audit. Suggestions have been made to help provide positive guidance through the interchange and to reduce any risks that may be associated with driver unfamiliarity.

4. Audit Findings

4.1. Safety Benefits

The construction of the diverging diamond interchanges and the upgrades to the intersections of Glenmore Trail with 100 Street SE, Rainbow Road, and Conrich Road are expected to improve safety in the following ways:

- Grade separation will reduce the number of at-grade intersections along Glenmore Trail.
- The twinning of Glenmore Trail reduces the risk of head-on collisions and improves the capacity of the roadway, which may reduce delays, stop-and-go traffic, and erratic driver behavior.
- Where provided, wide medians eliminate the fixed-object collision risk associated with a median barrier, and reduce the risk of head-on collisions.
- Wide shoulders and clear zones reduce the collision risk associated with run-off-road movements.
- The design of diverging diamond interchanges may result in several safety improvements, including:
 - A reduced number conflict points (14 instead of 32 for typical intersections and 26 for conventional diamond interchanges).
 - Decreased stacking of vehicles making turning movements due to increased capacity.
 - Conflict points spread out throughout interchange.
 - Improved sight distance at turns.
 - Wrong way entry to ramps is difficult.
 - Pedestrian crossings are shorter.
 - Simplified signal phasing at intersections.
- All three diverging diamond interchanges proposed have a largely consistent design. This consistency will help improve driver expectation, thereby reducing the risk of driver confusion and related collision risks.

4.2. Summary of Potential Safety Issues Identified


A summary of the potential safety issues identified during the Road Safety Audit, along with the risk assessment ratings for each issue, is provided in Table 2. The identified safety issues, including potential mitigation strategies, are discussed in detail in Section 4.3.

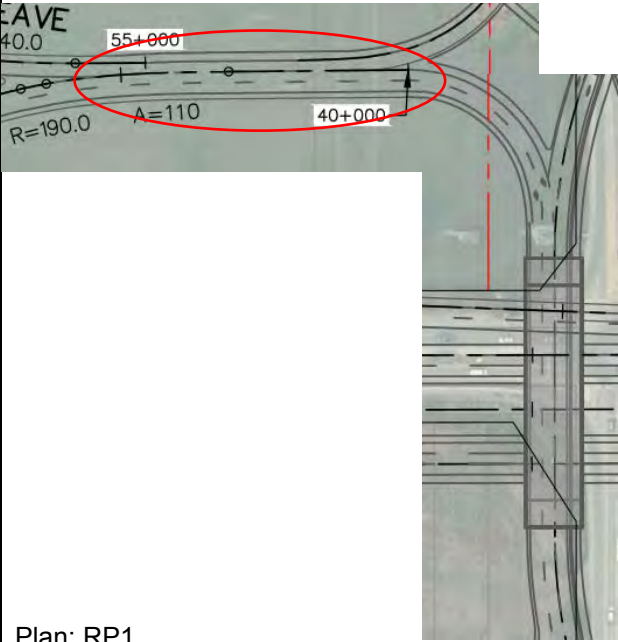
Table 2: Summary of Potential Safety Issues


SAFETY ISSUE		RISK RATING
ISSUE #	DESCRIPTION	
1	Lane Balance on WB Glenmore Trail	C - D
2	Inadequate Weave and Decision Sight Distance	C - D
3	Visibility of Traffic Lights at Terminal Intersections	C - D
4	Offset Stop Lines	C - D
5	Potential for Wrong-Way Movements	C
6	Left-Turns Entering Exit Lane	C
7	Lack of Pedestrian Facilities	C
8	Lane Drops Obscured by Bridge	B
9	Merge on a Horizontal Curve	B
10	Pedestrian Crosswalks on High Speed Ramps	B
11	Short Merge Lengths on Glenmore On-Ramps	B
12	Limited Through Lane Storage Space	B
13	Close Proximity of Exit Ramps	B
14	Through Traffic May Enter Long Left-Turn Lanes	B

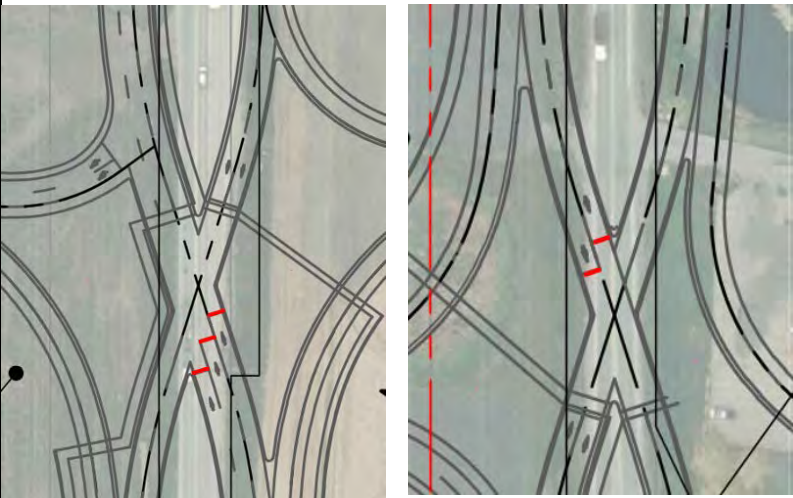
4.3. Potential Safety Issues


The potential safety issues identified during the Road Safety Audit, including recommended mitigation strategies, have been summarized in the following tables.

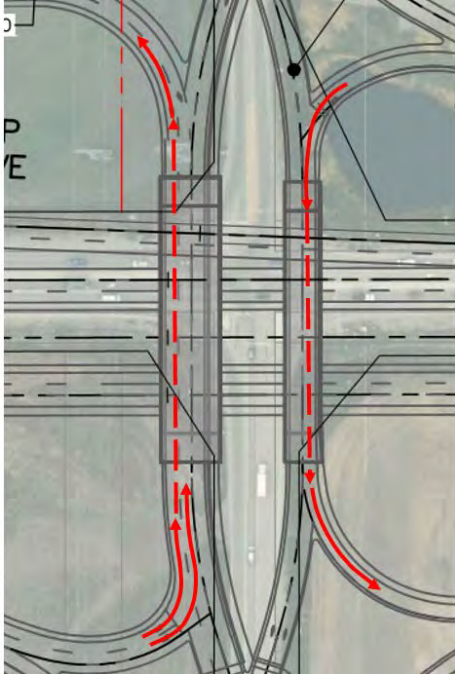
Issue 1	Lane Balance on WB Glenmore Trail	
Description	On WB Glenmore Trail there are numerous lane drops and additions due to added lanes, exit lanes and lane drops. The number of lanes on WB Glenmore Trail transitions from 5 > 4 > 3 > 5 > 4 > 3 > 5 > 4 > 3. This could result in numerous lane changes in the right lanes, creating turbulence and the potential for sideswipe and rear-end collisions.	
Location(s)	WB Glenmore Trail.	
Drawing(s)	 <p>Plans: RP1, PP2, Conrich Interchange, Rainbow Road Interchange</p>	
Risk Assessment	Expected Severity:	Property Damage Only - Minor Injury
	Expected Frequency:	> 5 per year
	Risk Rating:	C- D
Mitigation Suggestions	Merging the on-ramps upstream of Glenmore Trail such that there is one added lane instead of two at each interchange could result in four core lanes along Glenmore Trail and reduce the amount of lane changing taking place.	

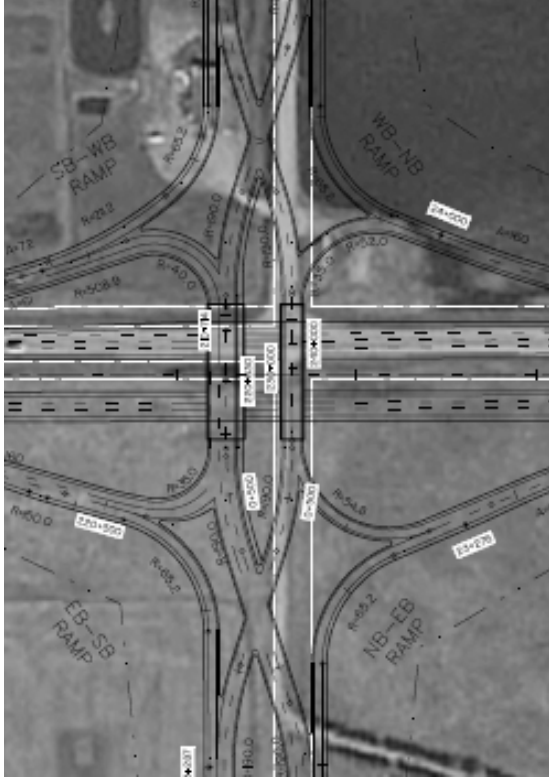
Issue 2	Inadequate Weave and Decision Sight Distance	
Description	<p>For the basket weave option at 100 Street SE, there is a very short weave for SB-WB and NB to Stoney Trail traffic. The short weaving distance may result in sideswipe and rear-end collisions. The risk is amplified by the likely high traffic volumes (particularly trucks) and limited sight distance due to the horizontal curves on both approaches. Furthermore, there is not adequate distance to provide guidance (through guide signs) to motorists at the fork due to the close proximity to 100 Street SE.</p>	
Location(s)	<p>Weaving section in northwest quadrant of 100 Street SE interchange.</p>	
Drawing(s)	 <p>Plan: RP1</p>	
Risk Assessment	<p>Expected Severity:</p>	<p>PDO – Minor Injury</p>
	<p>Expected Frequency:</p>	<p>> 5 per year</p>
	<p>Risk Rating:</p>	<p>C - D</p>
Mitigation Suggestions	<ul style="list-style-type: none"> • Increase the length of the weaving section • Relocate the weave further west of intersection • Consider alternate basket weave or interchange configuration 	

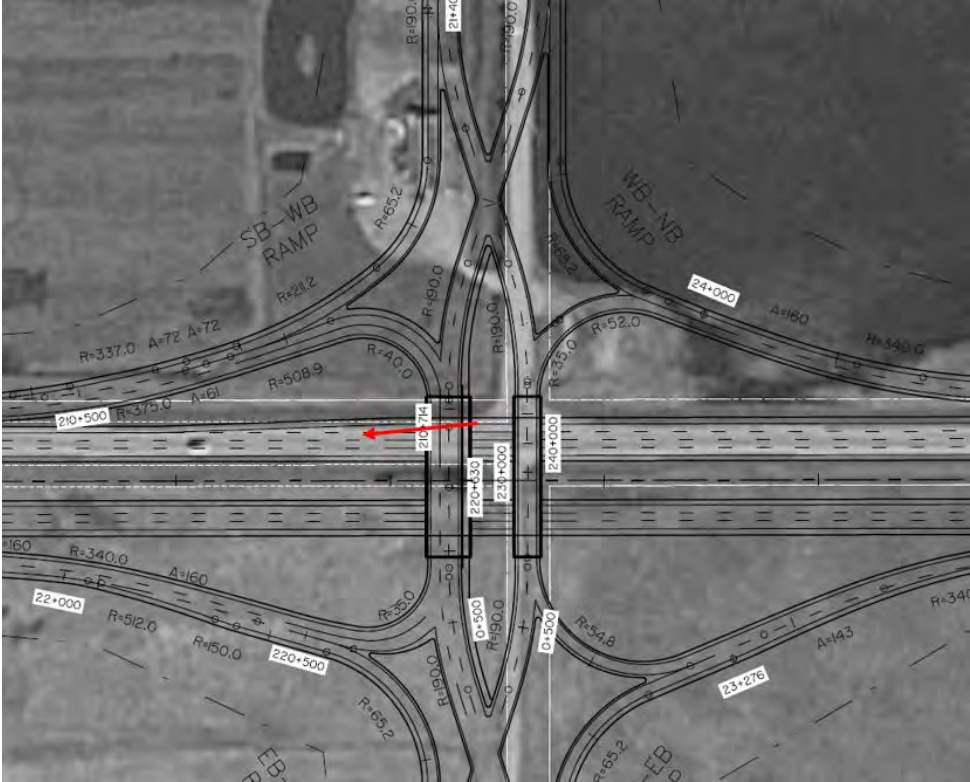
Issue 3	Visibility of Traffic Lights at Terminal Intersections	
<p>Description</p>	<p>It is assumed that the ramp terminal intersections are signalized for the left-turns onto the cross-streets. The positioning of the signal heads may introduce driver confusion if the signals are visible to motorists travelling NB and SB. This may result in NB or SB traffic stopping when not required to do so, which could result in rear-end collisions.</p> <p>Due to the curvature of the ramp approaches, the signals may be difficult to see further in advance of the signal, which increases the risk that motorists will not see the signal (potential red light running) or will see the signal at the last second (sudden braking).</p>	
<p>Location(s)</p>	<p>All off-ramp terminal intersections.</p>	
<p>Drawing(s)</p>	 <p>Plans: RP1, PP2, Conrich Interchange, Rainbow Road Interchange</p>	
<p>Risk Assessment</p>	<p>Expected Severity:</p>	<p>Minor Injury – Major Injury</p>
	<p>Expected Frequency:</p>	<p>1 – 4 per year</p>
	<p>Risk Rating:</p>	<p>C - D</p>
<p>Mitigation Suggestions</p>	<ul style="list-style-type: none"> • Optimize the angle of the traffic signal heads to maximize the sight distance for the vehicles on the ramp, while minimizing the visibility of the signal for through traffic. • Provide lane designation signs over the signal heads. • Provide a secondary signal that is visible further upstream on the ramps. 	

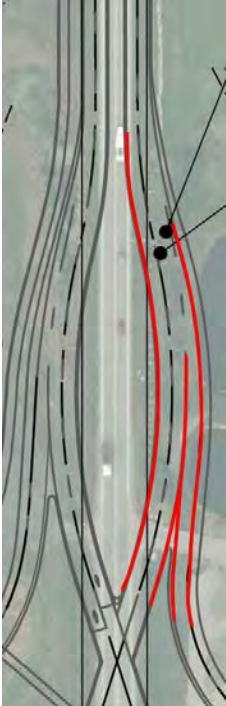
Issue 4		Offset Stop Lines	
Description	<p>The stop bars at the cross-over intersections at the 100 Street SE interchange appear to have significant offsets. This, may result in motorists in the left-hand lanes encroaching into the opposing through lanes if they align with adjacent vehicles rather than the stop bar, particularly if the stop bar is deteriorated or covered in snow. It is noted that pavement markings are not developed at this stage and may not be the intended location for the stop bars, but the comment is still provided for consideration.</p>		
Location(s)	<p>Stop bars at the cross-over intersections at 100 Street SE</p>		
Drawing(s)	 <p>Plans: RP1, PP2</p>		
Risk Assessment	Expected Severity:	Major Injury - Fatal	
	Expected Frequency:	<p>< 1 per year, > 1 per 5 years</p>	
	Risk Rating:	C - D	
Mitigation Suggestions	<ul style="list-style-type: none"> Align stop bars with the stop bar furthest from the intersection. Ensure signal timings and clearance provide sufficient yellow and red times to clear the intersection. 		

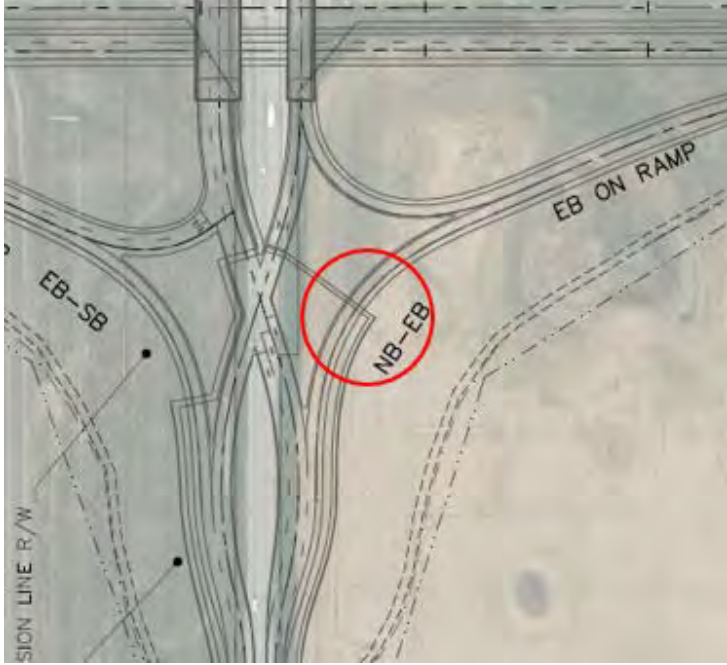
Issue 5	Potential for Wrong-Way Movements	
<p>Description</p>	<p>The geometry of the cross-over intersections is such that opposing traffic lanes align closely with approach lanes at the intersections. This may result in driver confusion with lane designation and the potential for motorists to travel into oncoming traffic lanes. This risk is increased given that driver expectations typically involve travelling on the right-hand side of the road. As such, driver confusion at the cross-over intersections may result in erratic maneuvers, abrupt stopping and traffic blockages, or potentially head-on collisions.</p>	
<p>Location(s)</p>	<p>Cross-over intersections at all interchanges.</p>	
<p>Drawing(s)</p>	 <p>Plans: RP1, PP2, Conrich Interchange, Rainbow Road Interchange</p>	
<p>Risk Assessment</p>	<p>Expected Severity:</p>	<p>Major Injury</p>
	<p>Expected Frequency:</p>	<p>< 1 per year, > 1 per 5 years</p>
	<p>Risk Rating:</p>	<p>C</p>
<p>Mitigation Suggestions</p>	<p>This risk is common with diverging diamonds, particularly in areas unfamiliar with the configuration. The risk of wrong-way movements can be mitigated during future design stages through clear pavement markings (potentially including leader lines) and signage, including “Do Not Enter” and “Turns Prohibited” signs.</p>	

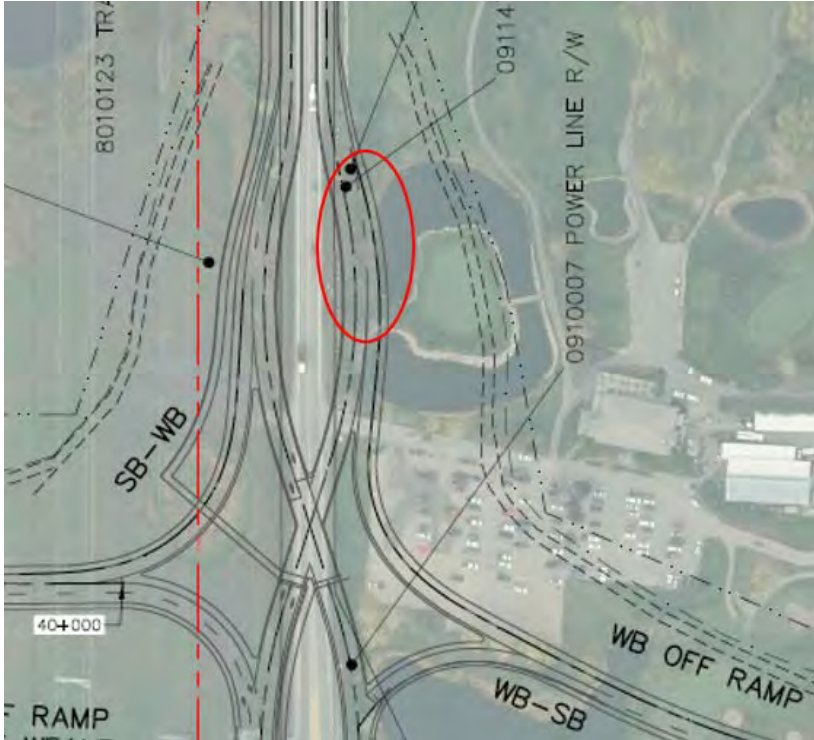
Issue 6	Left-Turns Entering Exit Lane	
<p>Description</p>	<p>At all three interchanges, the eastbound dual left-turn lanes enter three northbound lanes, the left-most of which becomes an exit lane to westbound Glenmore Trail. Motorists are typically required to turn into the lane nearest the left side of the road. This would result in EB-NB motorists in the left-hand lane entering the exit lane. This may result in erratic maneuvers braking as motorists attempt to change lanes into the northbound through lane prior to the exit. As a result, there may be an increased risk of rear-end and sideswipe collisions. A similar issue exists with WB to SB left-turn traffic entering the SB to EB exit lane.</p>	
<p>Location(s)</p>	<p>EB to NB and WB to SB left-turn lanes.</p>	
<p>Drawing(s)</p>	 <p>Plans: RP1, PP2, Conrich Interchange, Rainbow Road Interchange</p>	
<p>Risk Assessment</p>	<p>Expected Severity:</p>	<p>Property Damage Only</p>
	<p>Expected Frequency:</p>	<p>> 5 per year</p>
	<p>Risk Rating:</p>	<p>C</p>
<p>Mitigation Suggestions</p>	<p>The addition of leader line pavement markings and appropriate overhead guide signage may improve lane delineation and help guide motorists to turn into the appropriate travel lanes.</p>	

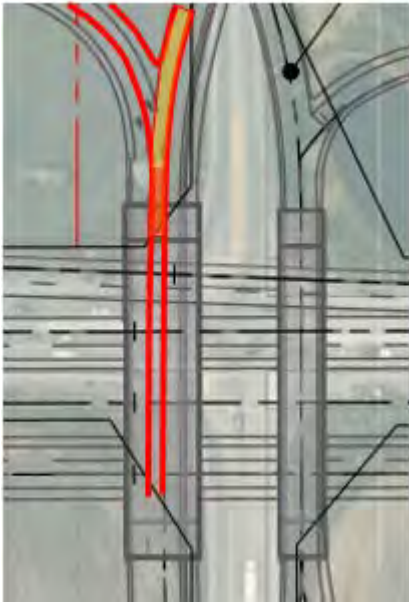
Issue 7	Lack of Pedestrian Facilities	
Description	<p>The drawings provided do not indicate any pedestrian or bicycle facilities at the Conrich Road or Rainbow Road interchanges. Although the interchanges will be in a predominantly industrial area, there still may be desire lines for crossing Glenmore Trail. Failure to provide facilities could result in pedestrians crossing or walking along Glenmore Trail or the cross-streets. Due to the vulnerability of pedestrians, any collisions have the potential to be severe.</p>	
Location(s)	Conrich Road and Garden Road Interchanges	
Drawing(s)	 <p>Plans: Conrich Interchange, Rainbow Road Interchange</p>	
Risk Assessment	Expected Severity:	Fatal
	Expected Frequency:	< 1 per 5 years
	Risk Rating:	C
Mitigation Suggestions	<ul style="list-style-type: none"> • Provide pedestrian (and potentially bicycle) facilities on Conrich Road and Rainbow Road; or, • Provide multi-use trail overpasses over Glenmore Trail. 	


Issue 8	Lane Drops Obscured by Bridge	
Description	<p>On westbound Glenmore Trail, there are lane drops under the Conrich Road and Rainbow Road interchanges. Due to the location of the lane drops under the bridge, they may be difficult for motorists to identify due to obstructions from the bridge, including shadows and poor illumination. The bridge abutment may also make it difficult to sign the location of the lane drop and could pose a hazard in the event of a run-off-road incident. Lane drops under bridges are atypical and may not be anticipated by motorists. Motorists that are not aware of the lane drop might make an erratic lane change or run-off-road.</p>	
Location(s)	<p>WB Glenmore Trail under Conrich Road and Rainbow Road</p>	
Drawing(s)	 <p>Plans: Conrich Interchange, Rainbow Road Interchange</p>	
Risk Assessment	<p>Expected Severity:</p>	<p>Minor Injury</p>
	<p>Expected Frequency:</p>	<p>< 1 per year, > 1 per 5 years</p>
	<p>Risk Rating:</p>	<p>B</p>
Mitigation Suggestions	<ul style="list-style-type: none"> Relocate lane drop east of bridge structure See Issue 1 regarding suggestions for WB Glenmore laning 	


Issue 9	Merge on a Horizontal Curve	
Description	<p>The right-turn from WB Glenmore Trail to NB 100 Street SE merges with NB traffic on a horizontal curve. WB-NB traffic must negotiate a series of reverse curves to complete the movement while at the same time trying to assess gaps in traffic and adjust their speed. Tracking the road alignment and gaps in traffic could be difficult and result in lane departures (sideswipe and run-off-road collision potential).</p>	
Location(s)	WB Glenmore Trail to NB 100 Street SE	
Drawing(s)	 <p>Plan: RP1, PP2</p>	
Risk Assessment	Expected Severity:	Property Damage Only
	Expected Frequency:	1 – 4 per year
	Risk Rating:	B
Mitigation Suggestions	<p>Consideration should be given to extending the merge lane to enter 100 Street SE on a tangent section north of the reverse curve to improve the visibility of the ending lane and vehicles in adjacent lanes.</p>	

Issue 10 Pedestrian Crosswalks on High Speed Ramps							
Description	<p>The pedestrian cross-walks on the NB to EB and SB to WB ramps at the 100 Street interchange are located mid way down the ramps. At this location, motorists may already be accelerating as they approach the mainline. Furthermore, they may not anticipate pedestrians so far down the ramp. Both of these factors may reduce motorists' ability to stop in the event of a pedestrian crossing.</p>						
Location(s)	<p>NB to EB and SB to WB ramps at the 100 Street interchange.</p>						
Drawing(s)	 <p>Plans: RP1, PP2</p>						
Risk Assessment	<table border="1"> <tr> <td data-bbox="483 1276 1052 1335">Expected Severity:</td> <td data-bbox="1052 1276 1466 1335">Major Injury</td> </tr> <tr> <td data-bbox="483 1335 1052 1402">Expected Frequency:</td> <td data-bbox="1052 1335 1466 1402">< 1 per 5 years</td> </tr> <tr> <td data-bbox="483 1402 1052 1472">Risk Rating:</td> <td data-bbox="1052 1402 1466 1472">B</td> </tr> </table>	Expected Severity:	Major Injury	Expected Frequency:	< 1 per 5 years	Risk Rating:	B
Expected Severity:	Major Injury						
Expected Frequency:	< 1 per 5 years						
Risk Rating:	B						
Mitigation Suggestions	<p>Consider relocating the pedestrian crosswalks further upstream, closer to the slower speed cross-street, where operating speeds are likely lower and motorists are more likely to anticipate pedestrians.</p>						

Issue 11 Short Merge Lengths on Glenmore On-Ramps		
Description	<p>At each interchange, the merge of the right-turn with the left-turn exit is relatively short considering the added complexities of the curved approach for the left-turn exit, free-flow left-turns and curvature of the road at the merge location. These factors result in a high workload for motorists who may not have time to adjust their speed and merge accordingly, increasing the risk of rear-end and sideswipe collisions.</p>	
Location(s)	<p>All Glenmore Trail on-ramps</p>	
Drawing(s)	 <p>Plans: RP1, PP2, Conrich Interchange, Rainbow Road Interchange</p>	
Risk Assessment	<p>Expected Severity:</p>	<p>Property Damage Only</p>
	<p>Expected Frequency:</p>	<p>1 - 4 per year</p>
	<p>Risk Rating:</p>	<p>B</p>
Mitigation Suggestions	<ul style="list-style-type: none"> Extend the parallel section of the right-turn lanes where they merge with the left-hand exit 	

Issue 12	Limited Through Lane Storage Space	
Description	<p>There is limited storage space available for NB through traffic on 100 Street at the north intersection. If the left-hand lane queue was to extend approximately 40m, it would block access to the right-hand NB-WB left-turn lane. In addition to operational issues, there is an increased risk for rear-end collisions for the back of the queue. Left-turn traffic in the middle lane may also make erratic lane changes to avoid the lane blockage, which could result in sideswipe collisions. This issue is not as pronounced in the SB direction or at the other two intersections, but it applies to both options at the 100 Street interchange.</p>	
Location(s)	NB on 100 Street SE at the left-turn exit	
Drawing(s)	 <p>Plans: RP1, PP2</p>	
Risk Assessment	Expected Severity:	Property Damage Only
	Expected Frequency:	1 – 4 per year
	Risk Rating:	B
Mitigation Suggestions	<ul style="list-style-type: none"> • Advance overhead signage could encourage through traffic to use the right-most lane. • Review traffic model for likelihood of queue spillback. Consider timing revisions to minimize blockage. • Consider storage extension if feasible. 	

Issue 13	Close Proximity of Exit Ramps	
Description	<p>The exit ramps on westbound Glenmore Trail for 100 Street SE and Stoney Trail are in close proximity (380m) in the basket weave option. This limits the decision sight distance available to inform motorists of the exit locations. Providing adequate guide signage could be a challenge. With limited decision sight distance, there is an increased risk of erratic driver behaviors and abrupt lane changes that may potentially result in sideswipe and rear-end collisions.</p>	
Location(s)	<p>WB Glenmore Trail off-ramp to NB 100 Street SE and Stoney Trail.</p>	
Drawing(s)	 <p>Plan: RP1</p>	
Risk Assessment	<p>Expected Severity:</p>	<p>Property Damage Only</p>
	<p>Expected Frequency:</p>	<p>1 – 4 per year</p>
	<p>Risk Rating:</p>	<p>B</p>
Mitigation Suggestions	<ul style="list-style-type: none"> • Increase separation distance between interchange off-ramps 	

Issue 14	Through Traffic May Enter Long Left-Turn Lanes	
<p>Description</p>	<p>An additional left-turn lane is added on the northbound approaches of all three interchanges. The additional lane provides capacity for traffic headed to westbound Glenmore Trail. The start of the left-turn lane begins upstream of the preceding intersection. Given the distance from the exit, through traffic may mistake the lane as an additional through lane, only to discover they need to get back to the right-hand lanes. This could result in sudden or erratic lane changes or braking.</p>	
<p>Location(s)</p>	<p>NB approach at 100 Street, Conrich Road, and Rainbow Road interchanges</p>	
<p>Drawing(s)</p>	 <p>The drawing is a technical plan view of a highway interchange. It shows a central north-south corridor with several east-west ramps. Key features include: <ul style="list-style-type: none"> WB OFF RAMP BASKET WEAVE: A weaving section for westbound off-ramp traffic with a radius of R=340.0 and a taper of A=100. WB OFF RAMP: A ramp for westbound off-ramp traffic. WB-SB: A section for westbound-southbound traffic with a taper of 25:1. EB OFF RAMP: A ramp for eastbound off-ramp traffic. EB-SB: A section for eastbound-southbound traffic. NB-EB: A section for northbound-eastbound traffic. EB ON RAMP: A ramp for eastbound on-ramp traffic. ST WEAVE: A weaving section for southbound traffic with a radius of R=340.0. SB: Southbound mainline. NB: Northbound mainline. EB: Eastbound mainline. WB: Westbound mainline. 50+000 and 40+000: Stationing markers. 1+500, 1+300, 1+100: Vertical curve markers. SEION LINE R/W: Right-of-way line. </p> <p>Plans: RP1, PP2, Conrich Interchange, Rainbow Road Interchange</p>	
<p>Risk Assessment</p>	<p>Expected Severity:</p>	<p>Property Damage Only</p>
	<p>Expected Frequency:</p>	<p>1 – 4 per year</p>
	<p>Risk Rating:</p>	<p>B</p>
<p>Mitigation Suggestions</p>	<p>Guide signs could be used to inform motorists of the lane designation. However, consideration should be given to where those signs can be placed as the curvilinear alignments could make it difficult for motorists to see the signs on the approach.</p>	

5. Assumptions / Considerations

In addition to the issues detailed in the previous section, a number of considerations and assumptions were identified through the audit process as follows:

- Transitions at project limits on 100 Street SE are not shown and could not be assessed at this stage.
- A pedestrian pathway is shown to be constructed along the centre island of the diverging diamond interchange (along the east side of the northbound traffic lanes) at 100 Street SE. A physical separation should be provided between the traffic lane and the pedestrian pathway to provide a buffer for increased safety.
- The left-turn ramp terminal intersections from Glenmore Trail onto the northbound / southbound cross-streets were assumed to be signalized.

6. Conclusion

The proposed construction of the diverging diamond interchanges along Glenmore Trail SE at 100 Street SE, Conrich Road and Rainbow Road are expected to increase safety within the study area. Features of the road design that could be altered to further improve safety have been identified by this road safety audit, and are described in detail in Section 4.3.

Appendix A – Interchange Plan and Profile Drawing Package

DRAWING NUMBER	DRAWING TITLE	REVISION NO. & DATE	
		NO	YYYY-MM-DD
TI	TITLE PAGE		
DI	DRAWING INDEX		
PP1	GLENMORE TRAIL PLAN AND PROFILE		
PP2	GLENMORE TRAIL PLAN AND PROFILE		
PP3	GLENMORE TRAIL PLAN AND PROFILE		
PP4	GLENMORE TRAIL PLAN AND PROFILE		
IP1	INTERCHANGE PLAN - 100 STREET		
IP2	INTERCHANGE PLAN - CONRICH ROAD		
RP1	ROADWAY PLAN - BASKETWEAVE OPTION		
RP2	ROADWAY PLAN - BASKETWEAVE OPTION		
PR1	PROFILES - 100 ST. AND RAMPS		
PR2	PROFILES - 100 ST. AND RAMPS		
PR3	PROFILES - 100 ST. AND RAMPS		
PR4	PROFILES - BASKET WEAVE OPTION		
PR5	PROFILES - BASKET WEAVE OPTION		
PR6	PROFILES - CONRICH RD AND RAMPS		
PR7	PROFILES - CONRICH RD AND RAMPS		
PR8	PROFILES - CONRICH RD AND RAMPS		
TS1	TYPICAL SECTIONS		
TS2	TYPICAL SECTIONS		
ST1	STORMWATER PLAN		
ST2	STORMWATER PLAN		
ST3	STORMWATER PLAN		
ST4	STORMWATER PLAN		

DRAWING NUMBER	DRAWING TITLE	REVISION NO. & DATE	
		NO	YYYY-MM-DD
B1	STRUCTURAL DRAWINGS		
B2	STRUCTURAL DRAWINGS		
B3	STRUCTURAL DRAWINGS		
B4	STRUCTURAL DRAWINGS		
B5	STRUCTURAL DRAWINGS		
B6	STRUCTURAL DRAWINGS		
B7	STRUCTURAL DRAWINGS		
U1	UTILITIES IMPACT PLAN		
U2	UTILITIES IMPACT PLAN		
U3	UTILITIES IMPACT PLAN		
U4	UTILITIES IMPACT PLAN		
WI	WETLAND IMPACT PLAN		
CS1	CONSTRUCTION STAGING PLAN - 100 ST.		
CS2	CONSTRUCTION STAGING PLAN - 100 ST.		
CS3	CONSTRUCTION STAGING PLAN - 100 ST.		
CS4	CONSTRUCTION STAGING PLAN - 100 ST.		
CS5	CONSTRUCTION STAGING PLAN - CONRICH RD.		
CS6	CONSTRUCTION STAGING PLAN - CONRICH RD.		
CS7	CONSTRUCTION STAGING PLAN - CONRICH RD.		
CS8	CONSTRUCTION STAGING PLAN - CONRICH RD.		
PA1	PROPERTY ACQUISITION PLAN		
PA2	PROPERTY ACQUISITION PLAN		
PA3	PROPERTY ACQUISITION PLAN		
PA4	PROPERTY ACQUISITION PLAN		

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LEGEND

KEY PLAN

SCALE

FUNCTIONAL PLANNING STUDY
GLENMORE TRAIL EAST - STONEY TR TO RAINBOW RD (RANGE ROAD 283)
INDEX OF SHEETS



JOB No.

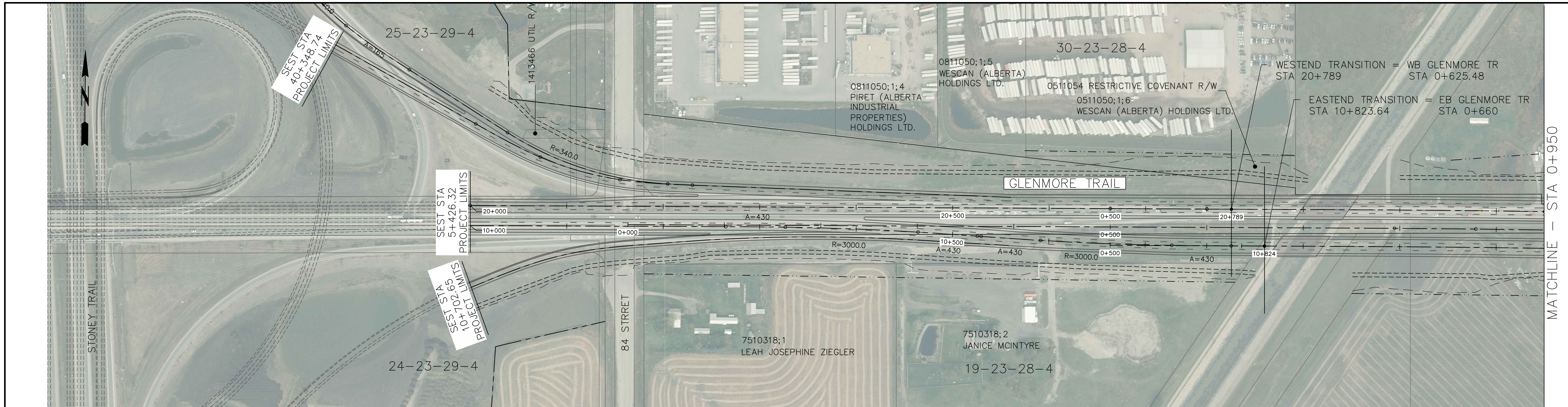
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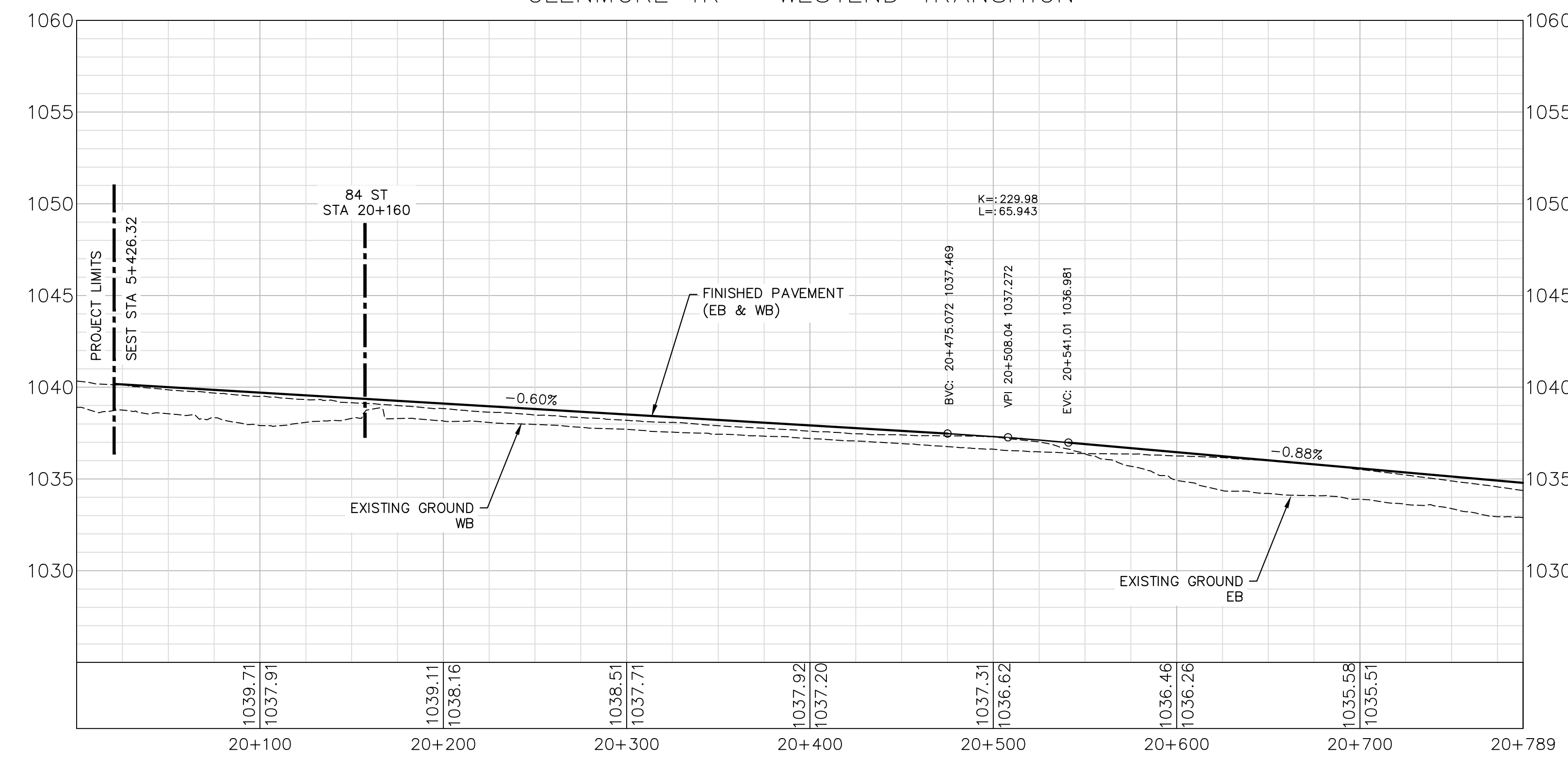
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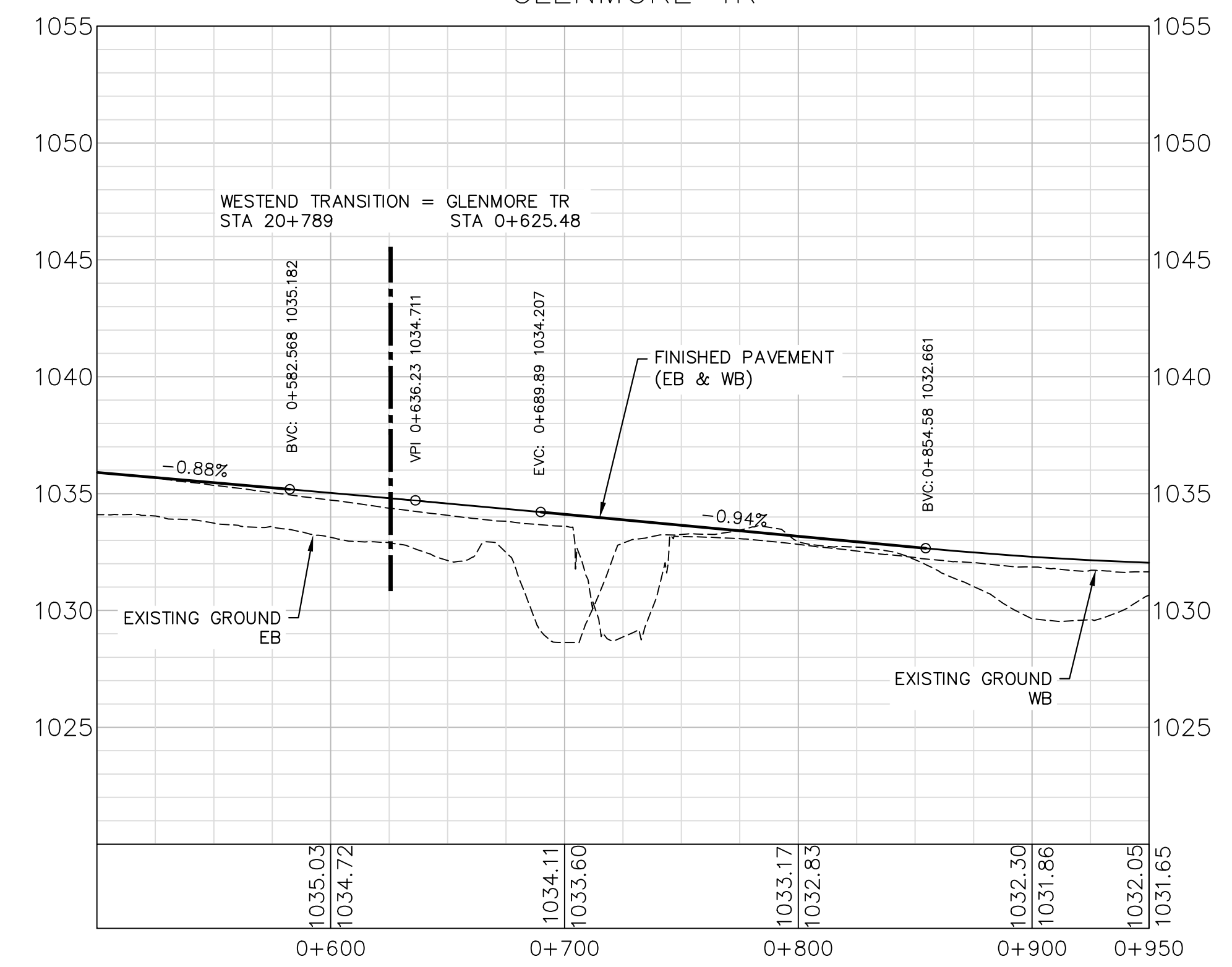
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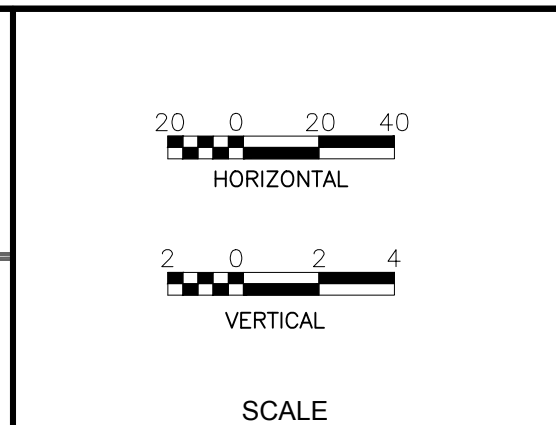
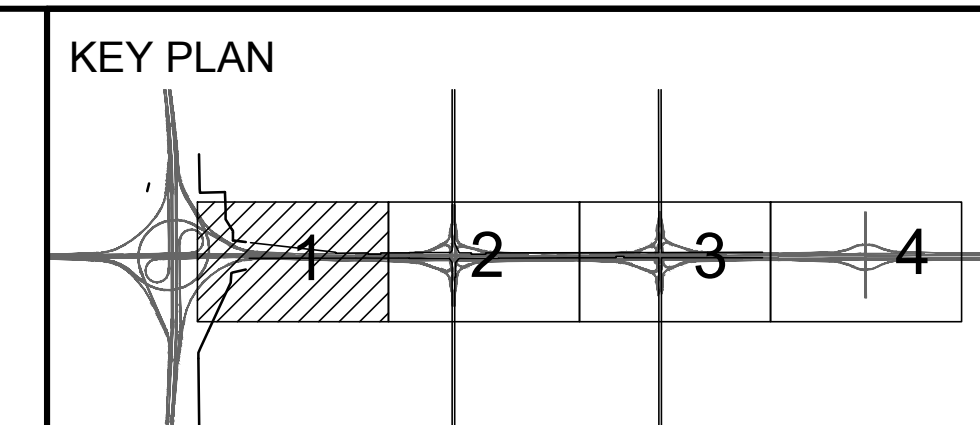


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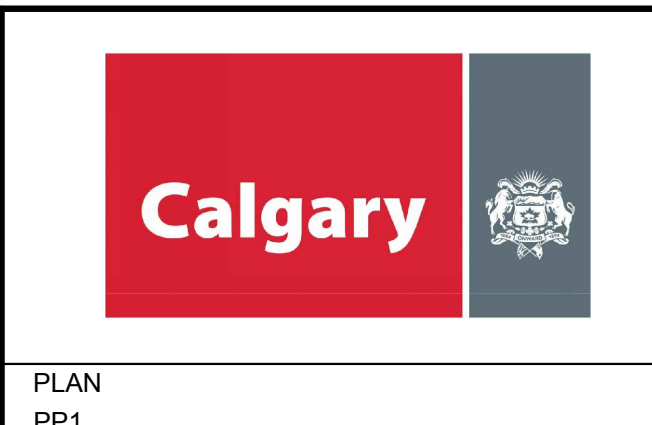
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	ROAD CLOSURE		EDGE OF PAVEMENT
	PROPOSED GRADING LIMIT		PAVEMENT MARKINGS
	PROPOSED R/W		GEOMETRIC POINT MARKER
	PROPOSED PATHWAY		UTIL & TRANSP CORRIDOR

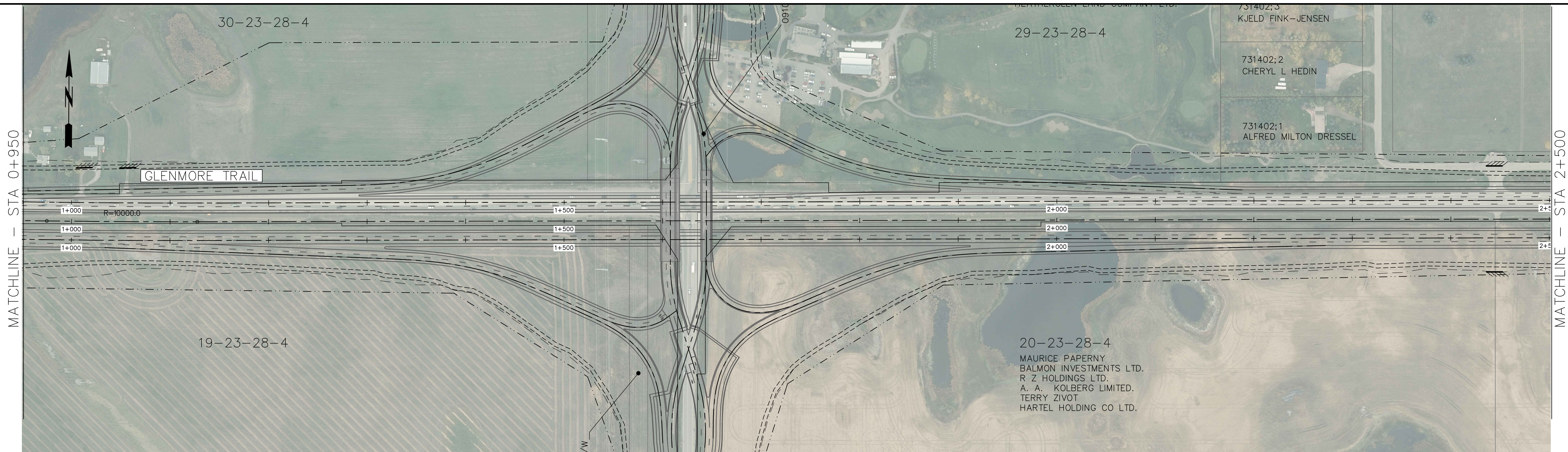


FUNCTIONAL PLANNING STUDY
GLENMORE TRAIL EAST - STONEY TR TO RAINBOW RD (RANGE ROAD 283)
PLAN AND PROFILE
 GLENMORE TRAIL STA 0+000 TO STA 0+950
 WB GLENMORE TR - WESTEND TRANSITION ALIGNMENT STA 20+000 TO STA 20+763

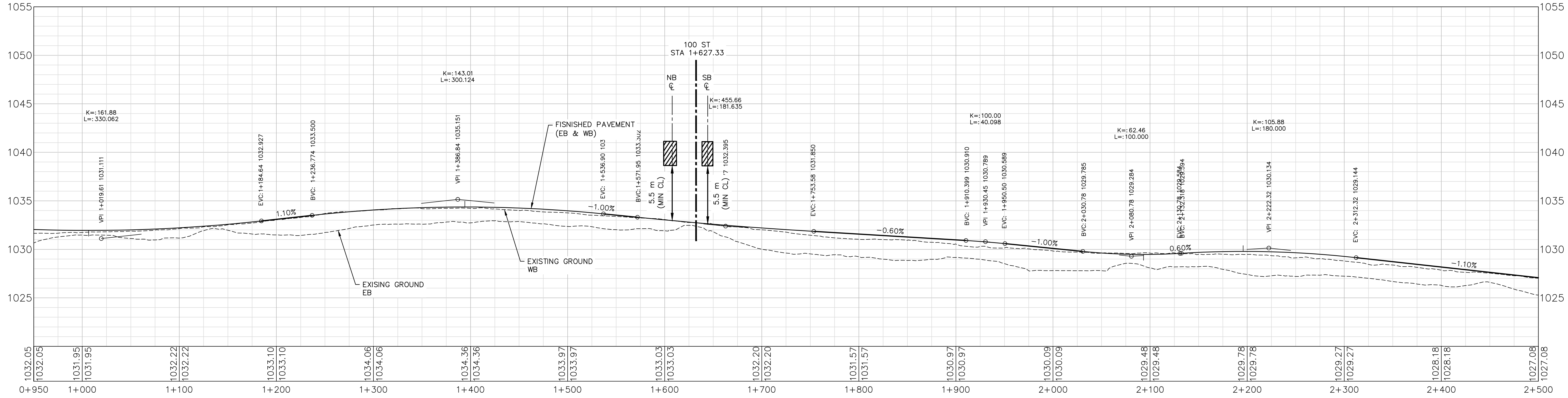
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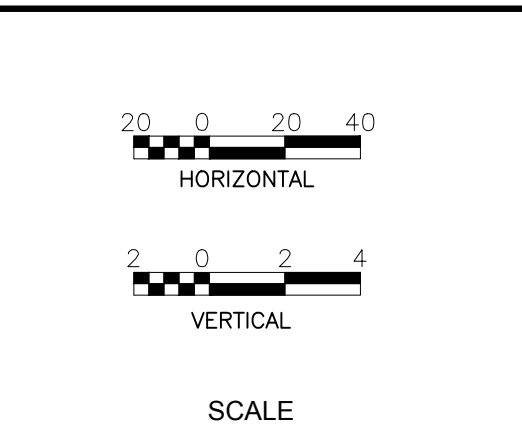
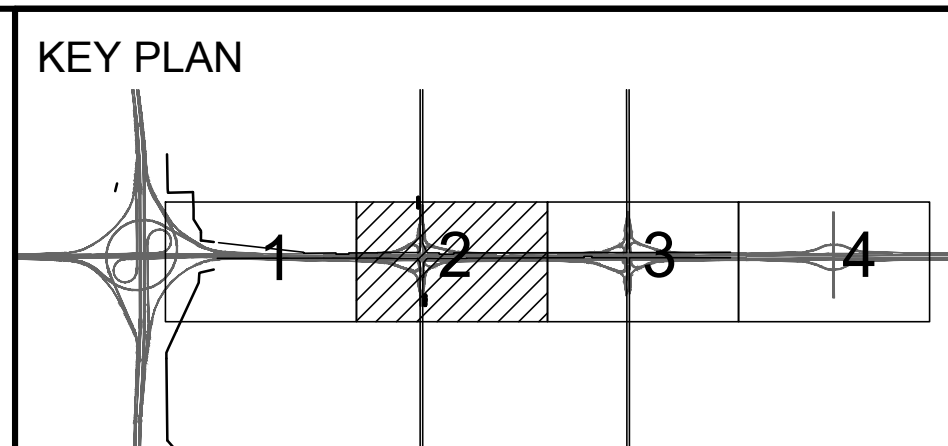


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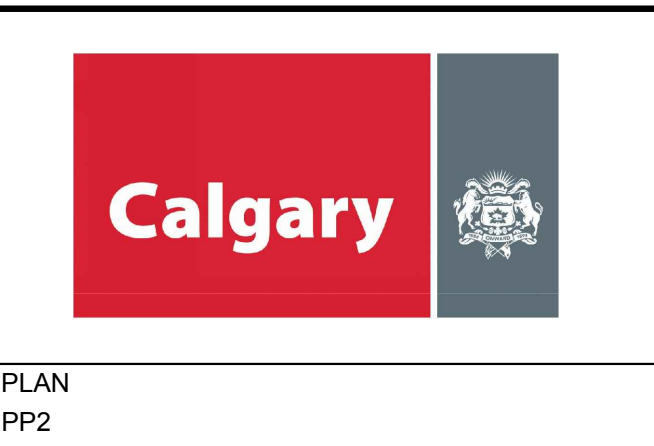
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	PROPOSED GRADING LIMIT		PAVEMENT MARKINGS
	PROPOSED R/W		GEOMETRIC POINT MARKER
	PROPOSED PATHWAY		UTIL & TRANSP CORRIDOR



FUNCTIONAL PLANNING STUDY
GLENMORE TRAIL EAST - STONEY TR TO RAINBOW RD (RANGE ROAD 283)
PLAN AND PROFILE
GLENMORE TRAIL STA 0+950 TO STA 2+500

PHOTOGRAPHY DATE	HIGHWAY 560.02	DATE	SHEET 2 OF 2
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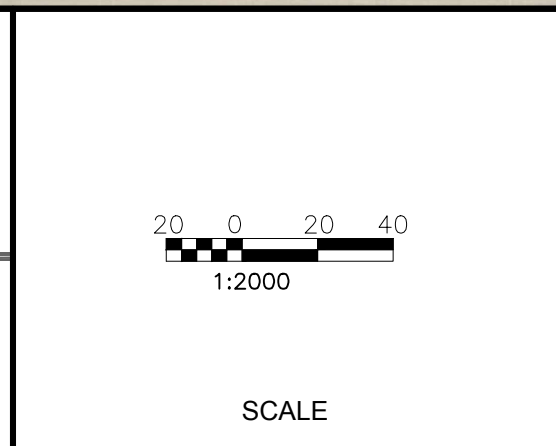
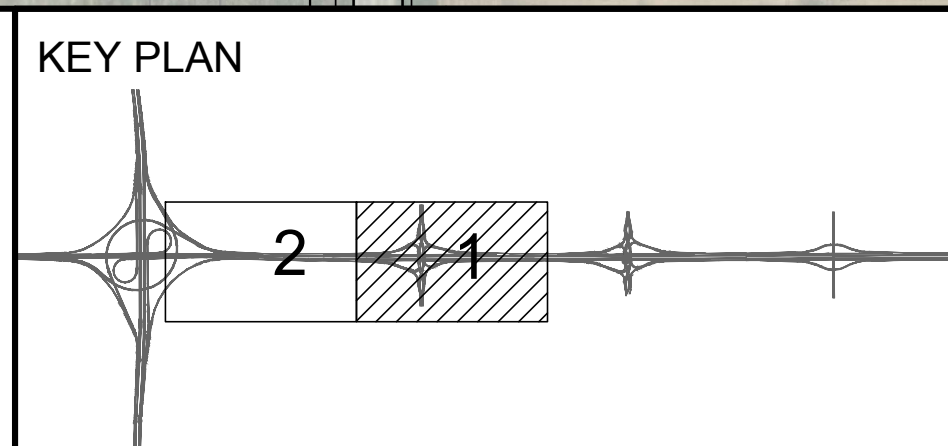
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MATCHLINE - STA 2+500



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PARSONS
ISL Engineering and Land Services

LEGEND	
	EXISTING R/W
	ROAD CLOSURE
	PROPOSED GRADING LIMIT
	PROPOSED R/W
	PROPOSED PATHWAY
	PROPOSED DITCH RIGHT
	EDGE OF PAVEMENT
	PAVEMENT MARKINGS
	GEOMETRIC POINT MARKER
	UTIL & TRANSP CORRIDOR



FUNCTIONAL PLANNING STUDY
GLENMORE TRAIL EAST - STONEY TR TO RAINBOW RD (RANGE ROAD 283)
100 ST SE (GARDEN ROAD) INTERCHANGE PLAN
BASKET WEAVE OPTION

PHOTOGRAPHY DATE	HIGHWAY 560.02	DATE	SHEET 1 OF 4
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Calgary

PLAN RP1

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