



Memorandum

TO
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FROM
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LOCATION

LOCATION
Surrey

RE
Kicking Horse Mountain Resort Phase 1
Development Traffic Impact Analysis

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2111-02500-0

The Kicking Horse Mountain Resort (KHMR) has a plan to expand their current operations with the addition of accommodation units in forms of condominiums, townhouses, and single-family dwellings. The proposed expansion will be located in their current site vicinity which is on the west side of the Town of Golden, BC.

McElhanney Consulting Services Ltd. was commissioned to prepare a traffic impact study to assess potential traffic impacts to adjacent roadways and intersections in the project vicinity. This memo summarises the results of KHMR Development traffic impact analysis for 2018 horizon year (Phase 1 completion only).

This analysis utilized the *Synchro 6* traffic analysis Software.

1.0 Background Traffic and KHMR 2018 (Phase 1) Development Traffic

2018 background traffic was based on a projection at 3 % per annum from 2008 traffic counts. During Phase 1 (2008-2018) an estimated 4102 bed units will be added to the existing 1576 bed units. The proposed resort expansion includes a combination of hotel rooms, condominiums, townhouses, and single-family units. Development trips generated by the resort expansion were estimated by comparing the existing number of bed units with the additional bed units created by the expansion.

2.0 Traffic Analysis

Capacity analysis for the AM and PM peak hour volumes for the study intersections was conducted for the combined traffic volumes under the 2018 planning horizon. The following two scenarios were analyzed in this study:

- *2008 Existing Scenario* – Background 2008 Traffic (Including trips generated by existing resort operations);
- *2018 Project Scenario* – Background 2018 Traffic + Accumulated Development Trips up to 2018;

The potential impacts of the following three study intersections and a one-lane bridge which will have added development traffic is reviewed:

- Highway 1 and 10 Avenue connector intersection
- Highway 1 On/Off Ramps and 10 Avenue N intersection

- 10 Avenue N and 7th Street intersection
- One-Lane Bridge on resort access road;

2.1 Highway 1 and 10 Avenue Connector Intersection

This T-intersection serves as a primary access point for the Town of Golden to Highway 1. The intersection is currently stop-controlled on the Connector approach with the following lane layouts:

- The northbound Highway 1 approach consists of one through lane and one left turn lane with channelization;
- The southbound approach consists of two through lanes and one right turn lane, and
- The eastbound 10 Avenue connector approach consists of one left turn lane and one right turn lane with channelization.

Under the 2008 Existing and 2018 background Scenarios, all intersection approaches achieve acceptable LOS B or above. However, under the 2018 Combined Scenario, the left turn movement on the Connector approach will operate at LOS F with existing lane conditions during both peak periods.

In order to bring the intersection to an acceptable LOS D or above for the eastbound connector approach, signalization is needed at the Highway 1 and 10th Avenue Connector intersection.

With the proposed signalization, the intersection achieved LOS A under 2018 Combined Scenario. See **Table 1** below:

Table 1 Summary of Level of Service and Delay with Signalization

Highway 1 and 10 Avenue Connector				
		Peak Period	Signalized Intersection	
			LOS	Delay
				sec/veh
2018	Combined	AM	A	9.9
		PM	A	8.6

2.2 Highway 1 On/Off Ramps and 10 Avenue Intersection

This on/off ramp T-intersection provides access for Highway 1. The intersection is currently stop-controlled on the Highway 1 off-ramp approach with the following lane layouts:

- The northbound 10th Avenue approach consists of one through lane and one left turn lane.
- The southbound approach consists of one through lane and one right turn lane with channelization.
- The off ramp approach consists of one left turn lane and one right turn lane with channelization.

Under the 2018 Combined Scenario, the EB approach will operate at LOS F during both AM and PM peak periods.

By 2018, in order to maintain acceptable LOS D or above for the eastbound connector approach, signalization is needed at the Highway 1 On/Off Ramps and 10th Avenue intersection. Also dual left turn lanes on northbound 10 Avenue approach will be required by 2018. See **Table 2** below for a summary of level of service and delay results.

Table 2 Summary of Level of Service and Delay with Signalization

Highway 1 On/Off Ramp and 10 Avenue				
		Peak Period	Signalized Intersection	
			LOS	Delay
				sec/veh
2018	Combined	AM	B	18.3
		PM	B	19.2

2.3 10 Avenue and 7th Street Intersection

This T-intersection provides primary access for the Kicking Horse Mountain Resort site. At present, the intersection is stop-controlled on the 7th Street approach. The lane layout is as follows:

- The northbound 10th Avenue approach consists of one through lane and one left turn lane;
- The southbound approach consists of one through lane and one shared through/right turn lane; and
- The 7th Street approach consists of one left turn lane and one right turn lane with channelization.

Under the 2018 Combined Scenario, the EB left turn approach operates at unacceptable LOS F with excessive delays during the PM peak period with existing intersection laning.

By 2018, signalization is needed at the intersection in order to maintain acceptable LOS D or above for the eastbound approach. See **Table 3** below for a summary of level of service and delay results.

Table 3 Summary of Level of Service and Delay with Signalization

10 Avenue and 7th Street				
		Peak Period	Signalized Intersection	
			LOS	Delay
				sec/veh
2018	Combined	AM	A	4.9
		PM	C	20.8

2.4 One-Lane Bridge on KHMR Access Road at Columbia River

This one-lane bridge crossing the Columbia River serves as the one and only access to the KHMR site. The traffic control on the bridge uses a first-come-first-serve based operation. Traffic arriving at both ends of the bridge would yield to vehicles already on the bridge deck and whichever arrived prior.

A summary of the queuing and delay analysis is shown in **Table 4** for the approaches to the bridge.

Table 4 Summary of Queue Length and Delay with existing laninig

One-Lane Bridge Access to KHMR						
		Peak Period	WB (Inbound)		EB (Outbound)	
			Queue Length (m)	Delay	Queue Length (m)	Delay
				sec/veh		sec/veh
2008	Existing	AM	29.0	4.8	6.5	6.3
		PM	6.6	8.5	46.7	4.5
2018	Combined	AM	276.3	28.5	46.8	40.4
		PM	22.3	26.3	193.2	17.2

Under the 2018 AM Combined Scenario, Westbound approach on the one-lane bridge operates at acceptable LOS D based on the 35-second delay unsignalized control threshold. The 95th percentile queue lengths will be about 276 metres (approximately 35 vehicles). However the Eastbound (outbound) approach will experience LOS E.

Two alternatives are recommended to alleviate the excessive delays and queuing at the bridge approaches before 2018:

1. Widen the existing bridge deck to accommodate two lanes for two-way traffic operations.
2. Install traffic signals with a two-phase operation at both ends of the one-lane bridge to assign right-of-way to either approach alternatively based on current traffic demand detected by loop detectors.

3.0 Development Phasing Analysis

A development phasing analysis is carried out to determine the improvements needed with 50 percent completion of Phase 1 development in 2014. Results are compiled in the **Table 5** below.

Table 5 Phasing of Intersection upgrades

Planning Scenarios	Improvement Description
2014 + 50 % Dev Trips	<ul style="list-style-type: none">• Signalization Of two intersections i.e.<ul style="list-style-type: none">▪ 10 Ave /7th Street Intersection▪ Highway 1 On/Off Ramps and 10 Avenue Intersection
2018 + 100% Dev Trips (Phase 1 Completion)	<ul style="list-style-type: none">• Signalization of all three intersections.• Dual Left turn lanes on northbound 10 Avenue approach.• Widen the loop on-ramp to two lanes and merge back to one lane before the overpass to adapt to the newly added dual northbound left turn lanes.

4.0 Conclusions

At the completion of Phase 1 development at KHRM (2018), intersection upgrades are required in order to move the traffic at an acceptable LOS. A summary of required improvements are as follows:

- Signalization at the three study intersections.
- Provision of dual left turn lanes on northbound 10 Avenue approach at Highway 1 On/Off Ramps and 10 Avenue Intersection. Also widening the loop on-ramp to two lanes and merge back to one lane before the overpass to adapt to the newly added dual northbound left turn lanes.
- For one lane bridge, one of the following two alternatives can be implemented to alleviate the excessive delays and queuing at the approaches:
 - Widen the existing bridge deck to accommodate two lanes for two-way traffic operations.
 - Install traffic signals with a two-phase operation at both ends of the one-lane bridge to assign right-of-way to either approach alternatively based on current traffic demand detected by loop detectors.

Although all these upgrades are necessary to carry the additional traffic at an acceptable LOS, however they can be phased over the 10 year of phase 1 development i.e. from 2009 to 2018 and may not be required on the 2009 opening day.

It is recommended that signalization of two intersections, i.e. 10 Ave intersections at 7th Street and Highway 1 On/Off ramps, be carried out before 2014 with the assumption that 50 percent of phase 1 development trips are on the network at that stage. However, at Phase 1 completion in 2018, signalization of all three intersections will be required along with a provision of dual left turn lanes on Northbound 10 Avenue approach.