27 February 2019

Fulton Hogan Ltd
PO Box 16064
Hornby
Christchurch

Attention: **Don Chittock**

Dear Don

Roydon Quarry SDC RFI Transport Matters

We have received the Selwyn District Council Request for Further Information and respond to the transport related matters as follows. The Council requests are in italics and our responses follow.

CSM2 Opening

15.1: The quarry relies on improvements being carried out to the state highway network (section 6 of the report). Please advise of the expected opening year of the quarry relative to the expected opening year of the highway improvements. If the quarry is to be operational prior to the highway improvements, please assess the likely effects on road safety and efficiency.

Stantec Response: NZTA have advised that the CSM2 is scheduled to open in the first half of 2020. They advise that the Dawsons Road roundabout is expected to be the last of the completed works, as construction cannot commence until traffic can be moved to the new motorway. As the roundabout is dependent on other activities, NZTA say it is difficult to be more precise than the first half of 2020.

The quarry opening date will be subject to timelines associated with the consenting process. At best, some works on site establishment could potentially start ahead of the CSM2 opening, although the quarry would not be operating prior to CSM2 opening.

Trip Distribution

15.2: The trip distribution is based upon six weeks of data in 2018 (Table 10-1). This is necessarily a 'snapshot' and we would anticipate that deliveries will be made according to the location of customers, and that these will change over the life of the quarry (and noting that a 35-year consent duration is sought). However, the Transportation Assessment assumes that the distribution will remain the same and does not consider any variability at all in the destinations. Please undertake sensitivity testing to allow for an appropriate amount of variability in the destinations over time and advise whether the extent of works proposed and/or other mitigation measures remain appropriate (including but not limited to re-modelling the heavy vehicle site access).

Stantec New Zealand
Hazeldean Business Park
6 Hazeldean Road
Addington, Christchurch 8024
PO Box 13-052
Armagh
Christchurch 8141
TEL +64 3 366 7449
FAX +64 3 366 7780

Stantec Response: The traffic volumes to/from the various destinations reported in the ITA were reported as ranges based on current data, and the midpoints of those ranges were assessed. The data very clearly demonstrated the major destinations will be to the east of the quarry, focussed on the greater Christchurch area. The Greater Christchurch Settlement Pattern Update (draft November 2018) indicates a high proportion of new dwellings and business land will continue to be developed in Christchurch City, supported by growth in Selwyn and Waimakariri. The scale of existing built area in Christchurch also appears to drive a large part of the demand for quarry material, such as for upgrades and improvements to infrastructure.

If the site generates traffic at the level assessed for the busiest day (1,500vpd), it is expected a similarly high proportion will continue to be from the Christchurch urban areas. Even with Selwyn identified as a growth area, the existing distribution also reflects that with large developments currently being undertaken in the likes of Rolleston and Lincoln.

Two forms of sensitivity test have been undertaken to respond to the reviewer's comments. Firstly, the high end of the observed range has been considered for destinations to the east, and to the south/west. Second, an alternative sensitivity test has been carried out that pushes the high limits beyond those observed with the current operation at Pound Road.

Sensitivity Test 1: High End of Observed Range

Within any of the analysed weeks, the combined proportion of movements to the east[1] varied between 84.2%, and 90.8% of all movements within a week. The ITA assessed movements to the east at 87% of the total. On the busiest day of the quarry, the difference between the assessed level and high level of the observed range (90.8%) is 56 heavy vehicle movements per day, or up to 7 vehicle movements in any one hour. That would generally be one additional vehicle movement in each direction every 10 minutes compared with the distribution in the modelling assessments.

A similar analysis for movement to the south and west to service primary Selwyn District growth areas shows that the proportion of all movements varied between 4.2% and 6.1% for destinations in the "South" area (Lincoln), and between 4.3% and 9.2% in the "Rolleston" area. The assessed distribution was 5% and 7% respectively for areas to the "South" and "Rolleston". The difference between the assessed levels and high levels was 16vpd (2vph based on 12% of daily movements in the busiest hour) and 32vpd (4vph) respectively for areas to the "South" and "Rolleston".

Sensitivity Test 2: Additional Movements to the West

In order to address the reviewers request, some further variability has been tested.

Compared to what was assessed in the ITA, the proportion to the east has been increased by 5% in one test (ie from 87% to 92%), and decreased by 5% in the other test (ie from 87% to 82%). The proportion to remaining destinations has been adjusted on a pro-rata basis. A summary of the resulting tests is shown below.

Table 1: Trip Distribution Sensitivity Tests

Destination	Sensitivity 1	Sensitivity 2
East	92%	82%
South	3%	6%
West	4%	10%
North	1%	2%

[1] To the "east" comprised the following areas: Chch Hornby, Chch Rural Northwest, Chch Halswell, Chch Urban North, Chch Urban South.

The table below summarises the daily and peak hour quarry heavy vehicle volumes on Jones Road, each side of the quarry access, under the ITA assessed scenario and the two sensitivity test scenarios.

Table 2: Traffic Volumes on Jones Road under Assessment Scenarios

Location on Jones Road	Scenario	Daily Quarry Heavy Traffic	AM Peak Quarry Heavy Traffic	PM Peak Quarry Heavy Traffic
West of Access	ITA Assessed Scenario	85vpd	8vph	5vph
	Sensitivity Test 1	55vpd	5vph	3vph
	Sensitivity Test 2	130vpd	12vph	8vph
East of Access	ITA Assessed Scenario	1,415vpd	127vph	85vph
	Sensitivity Test 1	1,451vpd	131vph	87vph
	Sensitivity Test 2	1,370vpd	123vph	82vph

The volumes presented are two-way volumes. Once the hourly volumes are split by direction, the differences between the two sensitivity test scenario traffic volumes and the assessed scenario traffic volumes are minimal i.e. +/- 1-2vph in each direction. These changes in traffic volumes would have a negligible effect on the access performance and the performances of the nearby intersections. To demonstrate this, the quarry access has been modelled during the morning and evening peak periods of the road network, and model output summaries are shown below. There is a negligible change in the access performance across the three scenarios.

Table 3: AM Peak Quarry Access Performance- ITA Assessed Scenario

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: jones e											
5	T1	154	11.6	0.088	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
6	R2	67	100.0	0.139	12.2	LOS B	0.6	9.3	0.51	0.76	38.8
Approach		221	38.6	0.139	3.7	NA	0.6	9.3	0.16	0.23	60.5
North: access											
7	L2	67	100.0	0.173	6.6	LOS A	0.6	10.7	0.51	0.62	33.0
9	R2	4	100.0	0.173	24.7	LOS C	0.6	10.7	0.51	0.62	32.9
Approach		72	100.0	0.173	7.6	LOS A	0.6	10.7	0.51	0.62	33.0
West: jones w											
10	L2	4	100.0	0.004	7.9	LOS A	0.0	0.0	0.00	0.63	51.2
11	T1	254	7.9	0.139	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		258	9.4	0.139	0.1	NA	0.0	0.0	0.00	0.01	79.2
All Vehicles		551	32.9	0.173	2.6	NA	0.6	10.7	0.13	0.18	60.6

Table 4: AM Peak Quarry Access Performance- Sensitivity Test 1

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: jones e											
5	T1	154	11.6	0.088	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
6	R2	69	100.0	0.144	12.2	LOS B	0.6	9.7	0.51	0.76	38.8
Approach		223	39.2	0.144	3.8	NA	0.6	9.7	0.16	0.24	60.1
North: access											
7	L2	69	100.0	0.174	6.6	LOS A	0.7	10.8	0.51	0.61	33.1
9	R2	3	100.0	0.174	28.2	LOS D	0.7	10.8	0.51	0.61	32.9
Approach		73	100.0	0.174	7.6	LOS A	0.7	10.8	0.51	0.61	33.1
West: jones w											
10	L2	3	100.0	0.003	8.0	LOS A	0.0	0.0	0.00	0.63	51.1
11	T1	254	7.9	0.139	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		257	9.0	0.139	0.1	NA	0.0	0.0	0.00	0.01	79.4
All Vehicles		553	33.1	0.174	2.6	NA	0.7	10.8	0.13	0.18	60.4

Table 5: AM Peak Quarry Access Performance- Sensitivity Test 2

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: jones e											
5	T1	154	11.6	0.088	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
6	R2	65	100.0	0.137	12.3	LOS B	0.5	9.2	0.51	0.76	38.8
Approach		219	38.0	0.137	3.7	NA	0.5	9.2	0.15	0.23	60.7
North: access											
7	L2	65	100.0	0.187	6.6	LOS A	0.7	11.6	0.53	0.63	32.8
9	R2	6	100.0	0.187	27.8	LOS D	0.7	11.6	0.53	0.63	32.6
Approach		72	100.0	0.187	8.5	LOS A	0.7	11.6	0.53	0.63	32.8
West: jones w											
10	L2	6	100.0	0.007	8.0	LOS A	0.0	0.0	0.00	0.63	51.1
11	T1	254	7.9	0.139	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		260	10.1	0.139	0.2	NA	0.0	0.0	0.00	0.02	78.9
All Vehicles		551	32.9	0.187	2.7	NA	0.7	11.6	0.13	0.18	60.6

Table 6: PM Peak Quarry Access Performance- ITA Assessed Scenario

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: jones e											
5	T1	183	5.7	0.098	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
6	R2	44	100.0	0.095	12.4	LOS B	0.4	6.0	0.51	0.76	38.7
Approach		227	24.1	0.098	2.4	NA	0.4	6.0	0.10	0.15	66.3
North: access											
7	L2	44	100.0	0.122	6.8	LOS A	0.4	7.2	0.52	0.62	32.9
9	R2	3	100.0	0.122	27.0	LOS D	0.4	7.2	0.52	0.62	32.7
Approach		47	100.0	0.122	8.1	LOS A	0.4	7.2	0.52	0.62	32.9
West: jones w											
10	L2	3	100.0	0.003	8.0	LOS A	0.0	0.0	0.00	0.63	51.1
11	T1	278	5.3	0.150	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
Approach		281	6.4	0.150	0.1	NA	0.0	0.0	0.00	0.01	79.4
All Vehicles		556	21.6	0.150	1.7	NA	0.4	7.2	0.09	0.12	66.1

Table 7: PM Peak Quarry Access Performance- Sensitivity Test 1

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: jones e											
5	T1	183	5.7	0.098	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
6	R2	46	100.0	0.100	12.4	LOS B	0.4	6.4	0.51	0.76	38.7
Approach		229	24.8	0.100	2.5	NA	0.4	6.4	0.10	0.15	65.8
North: access											
7	L2	46	100.0	0.124	6.9	LOS A	0.4	7.4	0.52	0.62	32.9
9	R2	2	100.0	0.124	34.5	LOS D	0.4	7.4	0.52	0.62	32.8
Approach		48	100.0	0.124	8.1	LOS A	0.4	7.4	0.52	0.62	32.9
West: jones w											
10	L2	2	100.0	0.002	8.0	LOS A	0.0	0.0	0.00	0.63	50.9
11	T1	278	5.3	0.150	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
Approach		280	6.0	0.150	0.1	NA	0.0	0.0	0.00	0.00	79.6
All Vehicles		558	21.9	0.150	1.8	NA	0.4	7.4	0.09	0.12	65.8

Table 8: PM Peak Quarry Access Performance- Sensitivity Test 2

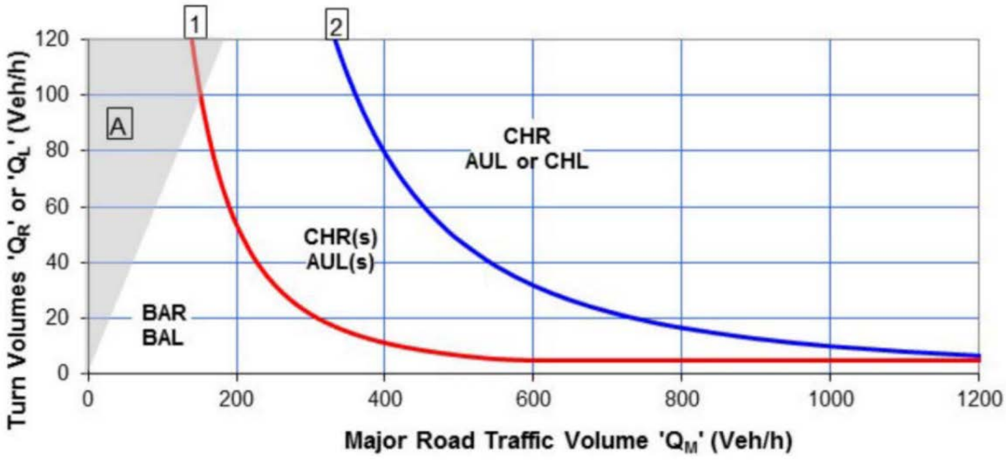
Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: jones e											
5	T1	183	5.7	0.098	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
6	R2	43	100.0	0.093	12.4	LOS B	0.4	6.0	0.51	0.76	38.7
Approach		226	23.7	0.098	2.4	NA	0.4	6.0	0.10	0.14	66.5
North: access											
7	L2	43	100.0	0.124	6.8	LOS A	0.4	7.4	0.53	0.62	32.8
9	R2	4	100.0	0.124	24.0	LOS C	0.4	7.4	0.53	0.62	32.7
Approach		47	100.0	0.124	8.4	LOS A	0.4	7.4	0.53	0.62	32.8
West: jones w											
10	L2	4	100.0	0.004	7.9	LOS A	0.0	0.0	0.00	0.63	51.2
11	T1	278	5.3	0.150	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
Approach		282	6.7	0.150	0.1	NA	0.0	0.0	0.00	0.01	79.3
All Vehicles		556	21.6	0.150	1.7	NA	0.4	7.4	0.08	0.12	66.1

During the evening peak period, there is an increase in average delay for the right turn in the Sensitivity Test 1 scenario, which is counter-intuitive given the reduction in turning traffic. This is due to the very small volume of trucks making that movement and the influence of gap acceptance calculations in SIDRA based on proportions of heavy and large trucks. In practice, it is expected that there will be negligible change in performance.

Light Vehicle Access Design

15.3: Please provide details of whether auxiliary turning lanes are warranted at the light vehicle access, based on the criteria of the Austroads Guide (Section 12.2 of the Transportation Assessment)

Stantec Response: The Austroads auxiliary lane warrants for an 80km/h speed limit are shown below.



(b) 70 km/h < Design Speed < 100 km/h

Figure 1: Warrant Diagram from Austroads Guide to Traffic Management Part 6

The assessed level of traffic generation at the light vehicle access is 15vph in a peak hour. It has been assessed that 90% will be to/from the east, and approximately two-thirds will be in to the site in the morning, and two thirds will be out of the site in the evening. Morning peak turning movements are calculated to be approximately 9vph turning right in, and 1vph turning left in. Evening peak turning movements are calculated to be 5vph turning right in, and 1vph turning left in.

The turning volumes have been compared to the warrants in Figure 2.26 Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings, Figure 2.26 (Speed between 70km/h and 100km/hr). The comparison is set out in the table below and demonstrates that the basic turn provision applies.

Table 9: Light Vehicle Access Turn Lane Warrant Assessment

Period	Movement	Q_M (vph)	Q_R or Q_L (vph)		Turn Provision
			Proposed	BAR/BAL Limit	
AM Peak	Left Turn	241	1	35	Basic
	Right Turn	383	9	12	Basic
PM Peak	Left Turn	258	1	30	Basic
	Right Turn	432	4	10	Basic

The proposed access standard from the Selwyn District Plan provides a comparable “basic” treatment appropriate to the local road environment, and is considered appropriate for the light vehicle access.

Heavy Vehicle Access Design

15.4: Please provide information as to which details for the heavy vehicle access have been sourced from MOTSAM and which from the Austroads Guide, since in some cases, the two provide different design details/dimensions (Section 12.3 of the Transportation Assessment).

Stantec Response: The concept layout has referenced MOTSAM, which also refers to Austroads for details such as deceleration/ acceleration lengths. In this case, we have referred to Austroads for the lengths of the left-turn deceleration lane and the acceleration lane for exiting trucks. The right turn bay is based on MOTSAM provisions. A conservative design approach has been taken for the concept design, to ensure possible extent of works and potential land requirements are understood. The key design elements included in the concept drawings are set out in the table below. It is intended the design will be in general accordance with the layout shown, which is at a concept level of design. The details on provision will be refined through future design stages (eg scheme design, and detailed design) if consent is granted.

Table 10: Heavy Vehicle Access Design Provision

Feature	Provision	Design Source
General		
Design speed	80km/h	Current speed limit
Traffic lane width	3.5m	SDC District Plan, MOTSAM Minimum is 3.5m
Auxiliary right turn lane width	3.5m - allows for high heavy vehicle use	MOTSAM Minimum is 3.0m, Desirable is 3.5m
Auxiliary left turn lane width	3.5m	MOTSAM Desirable Minimum is 3.0m, allowance for high heavy vehicle use
Left turn acceleration lane width	3.5m	MOTSAM Desirable Minimum is 3.0m, allowance for high heavy vehicle use
Safe intersection sight distance	181m	Austroads GRD 4A 80km/h design speed (2sec reaction time)
Approach Sight Distance Site Access	40m	Austroads GRD 4a, 40km/h approach speed
Approach Sight Distance Jones Road	114m	Austroads GRD 4a, 80km/h approach speed
Right Turn Bay Design		
Right turn diverge taper length	130m	MOTSAM (3.5 x 80)/2.16
Right turn storage	25m - Allows for heavy vehicle	MOTSAM minimum is 20m
Right turn merge taper length	75m	MOTSAM (2.0 x 80)/2.16 – 2m back to centreline. Based on lateral shift equation.
Left Turn Bay Design (Left IN)		
Sight Distance initially used for shadowing effect - SISD	170m	Measured 3m back from edge line, Austroads GRD 4A Figure 3.2: Safe intersection sight distance (SISD) and Table 3.2 (80km/h, 1.5sec reaction time)
Sight Distance used for shadowing effect - ASD	114m	Measured 3m back from limit line, Austroads GRD 4A Figure 3.1: Approach Sight Distance

Feature	Provision	Design Source
		(ASD) and Table 3.1 (80km/h, 2sec reaction time)
Left turn lane length	150m initially adopted to satisfy shadowing criteria – 170m SISD superseded	Austroads GRD 4A, Table 5.2 deceleration 100km/h to 20km/h to turn, adopted to satisfy shadowing criteria rather than speeds
Left turn lane length	115m	Austroads GRD 4A, Table 5.2 100m for deceleration 80km/h to 0km/h to turn, increased to allow for Approach Sight Distance visibility line beyond left turning truck
Length of physical taper T for a 3.5 m lane width	25m	Austroads GRD 4A, Table 5.1 (approach 80km/h)
Left Turn Bay Design (Left OUT)		
Acceleration lane length (m) for semi-trailers	320m (adopted)	Austroads GRD 4A, Table 5.7 (truck speed 60km/h approx. (note trucks will typically not start from rest) which is 20km/h less than through design speed, but on approach to roundabout

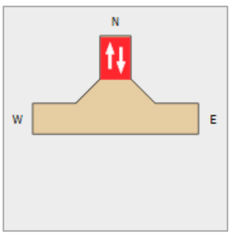
Intersection Models

15.5: Please advise of the gap acceptance parameters for the modelling of the heavy vehicle access (Section 12.4 of the Transportation Assessment).

Stantec Response: SIDRA default gap acceptance parameters have been used for the heavy vehicle access.

Heavy vehicles have also been classified as either "Heavy Vehicles" or "Large Trucks", which results in further model calculated adjustments compared to standard "Light Vehicle" and "Heavy Vehicle" classification.

Approach Selector

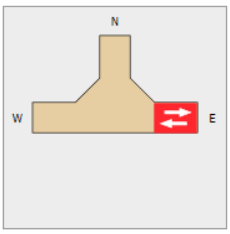


access

Gap Acceptance Data

From North to Exit:	E	W
	L2	R2
Apply TWSC Calibration	☑	☑
Critical Gap	5.00 sec	7.00 sec
Follow-up Headway	3.00 sec	4.00 sec
Minimum Departures (vehicles per minute)	0.1	0.1
Exiting Flow Effect	50 %	50 %
Percent Opposed by Nearest Lane Only	100.0 %	0.0 %
Opposing Peds (Unsig)	Prg(Flow	Prg(Flow

Approach Selector



jones e

Gap Acceptance Data

From East to Exit:	W	N
	T1	R2
Apply TWSC Calibration		☑
Critical Gap		4.50 sec
Follow-up Headway		2.50 sec
Minimum Departures (vehicles per minute)		0.1
Exiting Flow Effect		0 %
Percent Opposed by Nearest Lane Only		0.0 %
Opposing Peds (Unsig)		Prg(Flow

The resultant gap acceptance calculated by SIDRA is:

Table 11: Heavy Vehicle Access SIDRA Assessment – Calculated Gap Acceptance Parameters

Movement	Morning Peak		Evening Peak	
	Critical Gap	Follow-up Headway	Critical Gap	Follow-up Headway
Left turn from access to Jones Road*	8.1 sec	4.9 sec	8.0 sec	4.8 sec
Right turn from access to Jones Road	10.1 sec	5.8 sec	10.6 sec	6.1 sec
Right turn from Jones Road to	8.1 sec	4.5 sec	8.0 sec	4.5 sec

The gap acceptance is a lot higher than normal light vehicle gap acceptance recognising heavy vehicle effects. It is likely the assessed gap acceptance are conservative, and performance may be better than reported.

Rural Roundabout Control

15.6: Please advise of any safety concerns with the installation of a roundabout on a road with a 100km/h speed limit, and in particular, whether measures are required in order for drivers to be able to have appropriate forward sight distance of the roundabout (Section 13 of the Transportation Assessment).

Stantec Response: The proposed Jones Road / Dawsons Road roundabout will be located in an 80km/h environment. The Christchurch City Council at their 6 December 2018 meeting[2] resolved to change the speed limit on Dawsons Road north of Jones Road to 80km/h, and the speed limit on Jones Road east of Dawsons Road to 60km/h. Those new speed limits are now recorded on the CCC speed limit map[3].

Due to the existing road safety issues, the implementation of a roundabout provides a transformational safe systems response, consistent with the advice included in the NZTA High Risk Intersections Guide. A 90% reduction in serious and fatal crashes can be anticipated with the change of intersection form. The intersection form also provides consistency with the adjacent proposed SH1 / Dawsons Road roundabout, and the Jones Road / Weedons Ross Road roundabout.

We consider the roundabout would be a safety improvement on the existing cross-road intersection, addressing the main safety concern of drivers failing to stop on the side road and having higher speed collisions.

Based on the concept designs for the two intersection options, we consider that appropriate approach sight distances (ASD) will be able to be satisfied through design refinement. Austroads recommends a minimum 114m ASD for an 80km/h design speed, or the design speed of an approach curve (which may apply in this case). It is considered unlikely that ASD will significantly influence land requirements, which in any case will be able to be confirmed through design refinement. If the approach sight distance to the limit line is not achievable, a splitter island design can be developed with an appropriate approach sight distance. This is acceptable according to Austroads Guide to Road Design Part 4B.

[2] Meeting minutes are under item 15 at http://christchurch.infocouncil.biz/Open/2018/12/CNCL_20181206_MIN_2399_WEB.htm
[3] https://ccc.govt.nz/the-council/plans-strategies-policies-and-bylaws/policies/streets-roads-and-pavements-policies/speed-limits-policy/speed-limit-maps/#13/-43.5566/172.4831

Traffic Volumes for Analysis

15.7: The traffic volumes presented in Tables 12-1 and 12-2 do not quite show the same volumes of Figures 11-5 and 11-6 (the Sidra appears to use traffic volumes around 4% less than calculated). Please update the Sidra analysis to use the calculated traffic generation in the Tables.

Stantec Response: Tables 12-1 and 12-2 are the SIDRA output tables- the demand traffic volumes reported in the tables include an adjustment (within the SIDRA program) to the hourly traffic volumes entered into SIDRA. The adjustment represents a slight peaking of traffic within the busiest period of the peak hour, based on the "Peak Flow Factor". The traffic volumes that were entered into SIDRA differ from the traffic volumes in Figures 11-5 and 11-6 by 4vph. These figures include one extra vehicle movement to and from Dawsons Road north of Jones Road and one extra vehicle movement to and from Jones Road east of Dawsons Road. The extra 4vph would not make a noticeable difference to the performance of any of the intersections or site accesses.

Level Crossing Safety Impact Assessment

15.8: Please provide the full LCSS report (Section 14 of the Transportation Assessment).

Stantec Response: Please find the LCSIA attached to this letter. The report was produced for Fulton Hogan at the request of KiwiRail, and followed the KiwiRail LCSIA guidelines. The intention of the report is to assist KiwiRail to assess the outcome that the 'change in use' (e.g. the additional quarry traffic) would have on the existing Dawsons Road level crossing. The LCSIA can then inform the future design process. The LCSIA report was supplied to KiwiRail and "approved" by them.

Form of Intersection Improvement

15.9: Please confirm which improvement design is to be progressed for the Jones Road / Dawsons Road intersection. If this preferred option is not progressed for any reason (such as inability to use third party land or obtain any necessary consents), please confirm that the second-best (or third-best options) could be implemented and would operate satisfactorily in terms of efficiency and safety (Section 14 of the Transportation Assessment).

Stantec Response: The Application is for both options that include a roundabout. The preferred option is the four-leg roundabout which relies on CCC land to the north-east being available. This is preferred because it would be more convenient for all vehicle movements, removing the need for the separate T-intersection and associated extra turning movements.

If the CCC land is not available, the second option of a three-leg roundabout and separate T-intersection would also be acceptable. This relies on use of the Applicants land, which will be made available. The low forecast traffic volumes mean that both intersections would be expected to operate efficiently, as indicated by the modelling outputs in the ITA. Furthermore, the Level Crossing Safety Score for this option in the future would satisfy KiwiRail requirements.

Queue Back to Railway

15.10: Although the assessment of the level crossing states that the trains passing are infrequent events, and the maximum traffic generation of the quarry is also an infrequent event, in our view the possibility of a train colliding with a vehicle is a "low probability / high potential impact" effect (s 3 of the RMA). Please therefore undertake an assessment of queue length using the maximum or 95th percentile quarry generation (Section 14.2 of the Transportation Assessment).

Stantec Response: The "low probability / high potential impact" safety concern of a train colliding with a vehicle would be if queuing from either of the adjacent intersections extended back to or across the Dawsons Road railway crossing. The SIDRA modelling carried out for both the Dawsons Road / Jones Road and Dawsons Road / SH1 intersections was carried out using traffic volume forecasts with maximum quarry traffic generation in the peak hour, and therefore reflects a worst case scenario for intersection performance. The modelling results (Table 17.2 and Table 17.4 of the ITA) reported the 95th percentile queue and showed that, even on the busiest quarry day, minimal peak hour queuing would be expected north of the SH1 intersection and south of the Jones Road intersection. As there are also barriers across the railway, it is considered that queues will be able to be accommodated well clear of the railway to avoid the possibility of a train colliding with a vehicle.

Queue Back to Roundabout

15.11: Please comment on the safety effects of vehicles potentially queuing back onto the roundabout – it is correct to say that drivers approach with an expectation that they will need to stop but this means that drivers look to their right whereas the queue will be on their left (Section 14.2.2 of the Transportation Assessment).

Stantec Response: Austroads Guide to Road Design Part 4B Roundabouts sets key sight line criteria on approach to a roundabout. The first is approach sight distance and is provided on the expectation drivers need to see ahead the roundabout geometry, limit lines for give way, and any other obstructions. In this case the geometry is such that there is very good forward visibility due to the scale of the roundabout and any queuing from the left will be visible in the forward view of a driver. The second criterion is that drivers also check for circulating traffic, from near the limit line as a mandatory requirement, but also on approach in some cases. It is considered the roundabout geometry and general higher levels of traffic using the intersection will result in drivers sharing attention between the road geometry and potential obstructions ahead, together with potential gaps in circulating traffic so that they would be aware of a queue on the roundabout well before they look to their right for a gap in traffic.

There will be two circulating through lanes on SH1 in each direction, meaning that for southwestbound traffic, if occasionally the inside lane is blocked, through traffic will be able to continue through on the outside lane. Northeast bound traffic would have to rely on traffic not blocking the through lanes. If the through lanes were momentarily blocked, there would be good visibility from the south on SH1 to the roundabout, meaning that drivers would be able to stop. Advance warning signs have been recommended as a mitigation measure to further inform drivers of the potential queue ahead.

The Dawsons Road / Jones Road roundabout would have lower traffic volumes and any occasional blocking from the railway crossing would only occur over a short time and would be visible to drivers.

Interpeak Traffic Volumes

15.12: How have traffic flows for the inter-peak periods been sourced in order to generate Graphs 14-1 to 14-4?

Stantec Response: Tube counts were carried out for a full week on Dawsons Road and recorded hourly volumes for non-quarry traffic have been scaled up based on forecast traffic growth in modelled future traffic volumes. Quarry traffic forecasts (as set out in Section 11 of the ITA) have then been added.

Vehicle Classification

15.13: The swept paths show that the extracted materials would be moved using a truck+trailer (as we would expect). Please confirm whether the Sidra analyses have used the standard 'heavy vehicle' classification or the analysis has used 'large trucks' (that is User Class 2 or User Class 5 in the 'movement definitions' screen), with regard to the forecast queue lengths at the level crossing (Section 14 of the Transportation Assessment).

Stantec Response: The heavy vehicle volumes have been split into standard 'heavy vehicles' and 'large trucks' in SIDRA. In the SIDRA analysis it has been assessed that 70% of quarry heavy traffic would be single unit trucks and 30% would be truck and trailers. This was based on consideration of heavy vehicle splits calculated from the June / July 2018 weighbridge data at the Pound Road Fulton Hogan quarry.

School Bus Movements

15.14: The peak traffic flows of the proposal would occur up to 3pm. Please provide details of any routes in the area used by school buses, and also assess any road safety effects arising from school-related trips coinciding with peak volumes of heavy vehicles (Section 18 of the Transportation Assessment).

Stantec Response: The Ministry of Education regional transport advisor has provided information about school bus routes in the vicinity of the site. There are no school bus routes along Dawsons Road, Curraghs Road or Jones Road (east of Weedons Ross Road). School buses are generally only provided to schools where public bus services are not available.

The closest bus route is for Weedons School located on Weedons Ross Road. It currently travels along Paiges Road, Larcombs Road, Waterholes Road and Weedons Ross Road to get to the Weedons School. During construction of CSM2, it travels via the SH1 traffic signals in Rolleston. Small parts of the route overlap with potential travel routes between the quarry and Rolleston, which would carry much lower volumes than those nearer the site.

An assessment of road safety records for Selwyn District in the period 2014-2018 shows that there have been no reported crashes involving a school bus. Within the wider Canterbury Region there have been five crashes reported involving a school bus:

- Non-injury crash in Oxford in which the driver of a parked car opened their door into the path of the oncoming bus;
- Injury crash in Cheviot where a school bus did not give way to oncoming traffic when crossing SH1, and had a collision with a milk tanker;
- Fatal crash near Gebbies Pass on SH75 where an SUV lost control on ice and hit an oncoming school bus head-on.
- Two crashes in Christchurch City at traffic lights where car drivers did not stop on the amber/red light and hit a bus.

The crash history indicates that the one crash involving a truck was because of a lapse in concentration of the bus driver whilst manoeuvring at the intersection. No crashes were reported at school bus stops. It is considered there is a negligible road safety effect associated with the increased number of trucks interacting with school buses.

For the quarry, it is considered that the most important part of the road network for assessment is the length of Jones Road and Dawsons Road between the quarry access and SH1. There are no residential properties along that part of Jones Road, as the quarry site is on the northern side and the railway is on the southern side. On Dawsons Road there is commercial property either side of the intersection. There will be limited need for school related movements to be generated onto that part of the road network. It is considered the general assessment around road safety is considered applicable to other school trips. That is, Jones Road will be able to accommodate the additional quarry traffic and the surrounding road network is expected to operate safely such that there will be no road safety effects on school related trips.

Cycle Movements

15.15: Please provide information from the traffic counts regarding the cyclist usage (Section 18.1 of the Transportation Assessment) and comment on whether the proposed Jones Road / Dawsons Road roundabout will provide a suitable level of safety service to these road users.

Stantec Response: Traffic counts at the Dawsons Road / Jones Road intersection on 15th February 2018, as reported in the ITA, were carried out during the 6:00am-9:00am, 11:00am-1:00pm and 3:00pm-7:00pm periods. Eight cycle movements at the intersection were recorded during the three-hour morning period, no cycle movements were recorded during the two-hour midday period and eight cycle movements were recorded during the four-hour evening period. The maximum recorded was four cycle movements per hour in any of the surveyed periods. As reported in Section 4.4 of the ITA, two cycle movements were recorded during the 7:15am-8:15am morning peak hour and four cycle movements were recorded during the 4:30pm-5:30pm evening peak hour.

75% of the cycle movements were straight through the intersection along Jones Road and these movements will be able to move onto the off-road path along Jones Road and not need to use the roundabout. A refuge area is shown on the CSM2 plans for improvements aligned with providing for cyclists (and pedestrians) to cross Dawsons Road from the shared path north of the railway line. The number of other cycle movements to/from Dawsons Road north of the roundabout will be very low, and any cycle infrastructure provision would be a consideration for future design stages.

Pedestrian Movements

15.16: Please provide information from the traffic counts regarding the pedestrian movements (Section 18.12 of the Transportation Assessment).

Stantec Response: At the Dawsons Road / Jones Road intersection, one pedestrian crossing movement was recorded during the 6:00am-9:00am period, no crossings were recorded during the 11:00am-1:00pm period and two crossings were recorded during the 3:00pm-7:00pm period. Although there is clearly some use of the roads by pedestrians, the volume is very low and commensurate with occasional recreational use of the roadsides in the rural road network.

Yours sincerely

Andrew Leckie
Project Transportation Engineer
Stantec New Zealand

Andrew Metherell
Christchurch Traffic Engineering Team Leader
Stantec New Zealand

DAWSONS ROAD LCSIA

PREPARED FOR FULTON HOGAN

August 2018

Stantec

QUALITY STATEMENT

PROJECT MANAGER

Ali Sher Siddiqui

PROJECT TECHNICAL LEAD

Shaun Bosher

PREPARED BY

Shaun Bosher 02/08/2018

CHECKED BY

Jodi Enright 03/08/2018

REVIEWED BY

Shane Turner 03/08/2018

APPROVED FOR ISSUE BY

Ali Sher Siddiqui 03/08/2018

CHRISTCHURCH
Hazeldean Business Park, 6 Hazeldean Road, Addington, Christchurch 8024
PO Box 13-052, Armagh, Christchurch 8141
TEL +64 3 366 7449, FAX +64 3 366 7780

REVISION SCHEDULE

Rev No.	Date	Description	Signature or Typed Name (documentation on file)			
			Prepared by	Checked by	Reviewed by	Approved by
0	31/08/18	Post client feedback	SB	ST	SB	AS
1	3/10/18	Corrected AADT for Updated Existing	SB		SB	AS
2	4/10/18	Removed safety recommendation after KiwiRail review	SB		SB	AS

Executive Summary

Fulton Hogan are planning to open a new quarry on Jones Road which would greatly increase the volume of heavy traffic over the Dawsons Road level crossing. KiwiRail have therefore requested for a Level Crossing Safety Impact Assessment (LCSIA), to assess the safety the change in use has to the railway crossing. The Level Crossing Safety Score (LCSS) procedure assesses and scores the risk of each crossing point at three different assessment stages of the project. The tables below detail the progression of the LCSS for the level crossing through the three stages of the LCSS for the two options.

Dawsons Road Option 1 LCSS: (4-arm roundabout)

- Summary of LCSS changes at Dawsons Road – Option 1 level crossing

	Updated Existing	Proposed Design	Future Score
LCSS	28/60	21/60	23/60
Risk Band	Medium Low	Medium Low	Medium low
Criteria Met	Criteria 1	Criteria 1 & 2	Criteria 1 & 2

There were three recommendations made by the Safety Review Team (SRT) for the Option 1 level crossing to reduce the LCSS to achieve Criteria 1[1], these were:

- Summary of recommendations at Dawsons Road level crossing: Option 1

Rec #	Recommendation	Level of Necessity
1.	Install yellow box hatching and "no stopping" signage at the level crossing.	TCD Pt. 9
2.	Maintenance signage improvements.	Maintenance
3.	Investigate whether a left-turn slip lane on southern leg of roundabout is required in the event of queues forming back over the level crossing during peak hours.	Safety Concern

In addition to the above recommendations, there were three wider issues that the SRT thought might be issues for the functionality of the roundabout (but were unable to determine for certain). Therefore, these should be assessed by the applicant:

i. Additional traffic lane on Jones Road western approach to roundabout.
ii. Left-turn lane on Jones Road eastern approach to roundabout.
iii. Advanced warning sign for queue ahead on east and west approaches.

Dawsons Road Option 1 Conclusion:

The Dawsons Road level crossing has an existing LCSS of 28/60 (Medium Low LCSS risk band), with the Proposed Design LCSS lower at 21/60 (Medium-Low LCSS risk band). Therefore, the change in use achieves Criteria 1 and Criteria 2[2]. The Future Score LCSS is 23/60 (Medium-Low LCSS risk band) and therefore also achieves Criteria 1 and Criteria 2.

The Updated Existing ALCAM risk band was Medium and remained Medium after the Proposed Design changes, with the ALCAM risk score increasing by 29% vs the Updated Existing ALCAM risk score. The Future Score ALCAM risk band was Medium and the ALCAM risk score increased by 43%. The return period on predicted fatal crashes for the Future Score reduced from 1,351 years down to 986 years.

There were no Red Flag issues raised at this road crossing for any of the three assessment stages. A Red Flag issue is a fundamental safety hazard a roading level crossing.

Recommended Improvements:

Option 1 achieves Criteria 1 for the Proposed Design and Future Score, however there is a 'Safety Concern' recommendation that should be strongly considered.

[1] Achieve an LCSS of Low or Medium-Low.

[2] A lower LCSS than the updated existing LCSS.

Dawsons Road Option 2 LCSS: (3-arm roundabout)

- Summary of LCSS changes at Dawsons Road – Option 2 level crossing

	Updated Existing	Proposed Design	Future Score
LCSS	28/60	24/60	28/60
Risk Band	Medium Low	Medium Low	Medium low
Criteria Met	Criteria 1	Criteria 1 & 2	Criteria 1

There were six recommendations made by the SRT for the Option 2 level crossing to reduce the LCSS to achieve Criteria 1, these were;

- Summary of recommendations at Dawsons Road level crossing: Option 2

Rec #	Recommendation	Level of Necessity
1.	Install yellow box hatching and "no stopping" signage at the level crossing.	TCD Pt. 9
2.	Maintenance signage improvements.	Maintenance
3.	Install a Give Way control on Dawsons Road (southbound), to give right turn traffic priority and eliminate short stacking or queuing over the level crossing.	Achieve Criteria 2
4.	Install yellow hatching at the Jones Road intersection to keep intersection clear of queued vehicles.	Safety Concern
5.	Ban right-turn movements from Dawsons Road to Jones Road (east), if give way recommendation is not an option.	Safety Concern
6.	Widen the sealed shoulder opposite the right turn for Jones Road, to permit through vehicles to pass the right turning vehicle.	Safety Concern

In addition to the above recommendations, there were two wider issues that the SRT thought might be issues for the functionality of the roundabout (but were unable to determine for certain). Therefore, these should be assessed by the applicant:

i. Left-turn lane on Jones Road eastern approach to Dawsons Road.
ii. Consider changing the proposed roundabout intersection to a T-intersection.

Dawsons Road Option 2 Conclusion:

The Dawsons Road level crossing has an existing LCSS of 28/60 (Medium Low LCSS risk band), with the Proposed Design LCSS lower at 24/60 (Medium Low LCSS risk band). Therefore, the change in use achieves Criteria 1 and Criteria 2. The Future Score LCSS is 28/60 (Medium Low LCSS risk band) therefore the change in use achieves Criteria 1 and does not achieve Criteria 2 (but is the same as the Updated Existing score).

The Updated Existing ALCAM risk band was Medium and remained Medium after the Proposed Design changes, with the ALCAM risk score increasing by 43% vs the Updated Existing ALCAM risk score. The Future Score ALCAM risk band was Medium and the ALCAM risk score increased by 57%. The return period on predicted fatal crashes for the Future Score reduced from 1,351 years down to 903 years.

If the Give Way treatment was installed on Dawsons Road, then the crossing would achieve Criteria 1 and Criteria 2.

There were no Red Flag issues raised at this road crossing for any of the three assessment stages. A Red Flag issue is a fundamental safety hazard a roading level crossing.

Recommended Improvements:

Option 2 achieves Criteria 1 for the Proposed Design and Future Score, however there are some 'Safety Concern' recommendations that should be strongly considered.

Safety Review Team Preferred Option

The Safety Review Team prefer Option 1 with their recommended changes that address some of the safety concerns. However, it is appreciated that Option 1 proceeding is dependent on acquiring land that Fulton Hogan do not own to build the four-arm roundabout.

We recommend that any Safety Concerns raised in this report are also considered by the Road Safety Audit team should either of these Options progress to detailed design.

Future User Volume Surveys

The applicant is required to conduct additional user volume surveys (including % heavy vehicles) within two years after the opening of the facility and review whether a change in control is required. Subsequent surveys and reviews must be completed in three yearly cycles thereafter.

Recommended Updates in LXM

To assist KiwiRail with improvements to the ALCAM database, the following data should be considered to update the existing Dawsons Road level crossing (#2294) in LXM.

- Changed freight train volumes to 100 weekly movements.
- Added 58 weekly "shunt" movements from iPort in Rolleston to Lyttleton Port (these should be included for all crossings between the iPort and Lyttleton Port).
- Deselected that it is a metropolitan location.

Fulton Hogan

Dawsons Road LCSIA

Contents

1. Contents

1. Introduction

Fulton Hogan propose to open a new metal quarry on Jones Road, west of Dawsons Road. The quarry does not yet have resource consent, however Fulton Hogan wish to assess the viability of two proposed road layout options for the purposes of the Level Crossing Safety Impact Assessment (LCSIA) process.

This report is produced for KiwiRail to assist them to assess the outcome that the 'change in use' (e.g. the additional quarry traffic) would have on the existing Dawsons Road level crossing. KiwiRail would then use this report to discuss the proposed changes with Fulton Hogan and agree on a preferred solution.

The full LCSIA process is outlined in the Risk Guidance document located on the KiwiRail website[3].

[3] http://www.kiwirail.co.nz/uploads/Publications/LevelCrossingRiskAssessmentGuide.pdf

2. Level crossing safety impact assessment process

2.1 Level crossing safety impact assessment (LCSIA)

There are over 1300 road, 700 pedestrian and many private level crossings in New Zealand. While there are relatively few motor vehicle and pedestrian crashes at level crossings (compared with the rest of the road network), the consequence of a crash at a level crossing is often severe (serious injury or fatality). Given the high consequences of level crossing crashes, it is important that any changes around level crossings go through a thorough risk assessment process.

The LCSIA process has been developed to assess the level of crash risk of existing and new / upgraded level crossings designs. The risk of pedestrian and motor vehicle crashes is assessed using the Level Crossing Safety Score (LCSS). This score is out of 60, with 60 being a very unsafe crossing. The LCSS consists of the following:

- Level crossing ALCAM[4] score (30 points),
- Crash and incident history (10 points),
- Site specific safety score (10 points), and;
- Locomotive engineer and road controlling authority engineer assessment of risk (10 points).

The assessment is undertaken for vehicle and pedestrian crossings separately. Based on the score, the level crossing is placed into risk bands as shown in Figure 2-1.

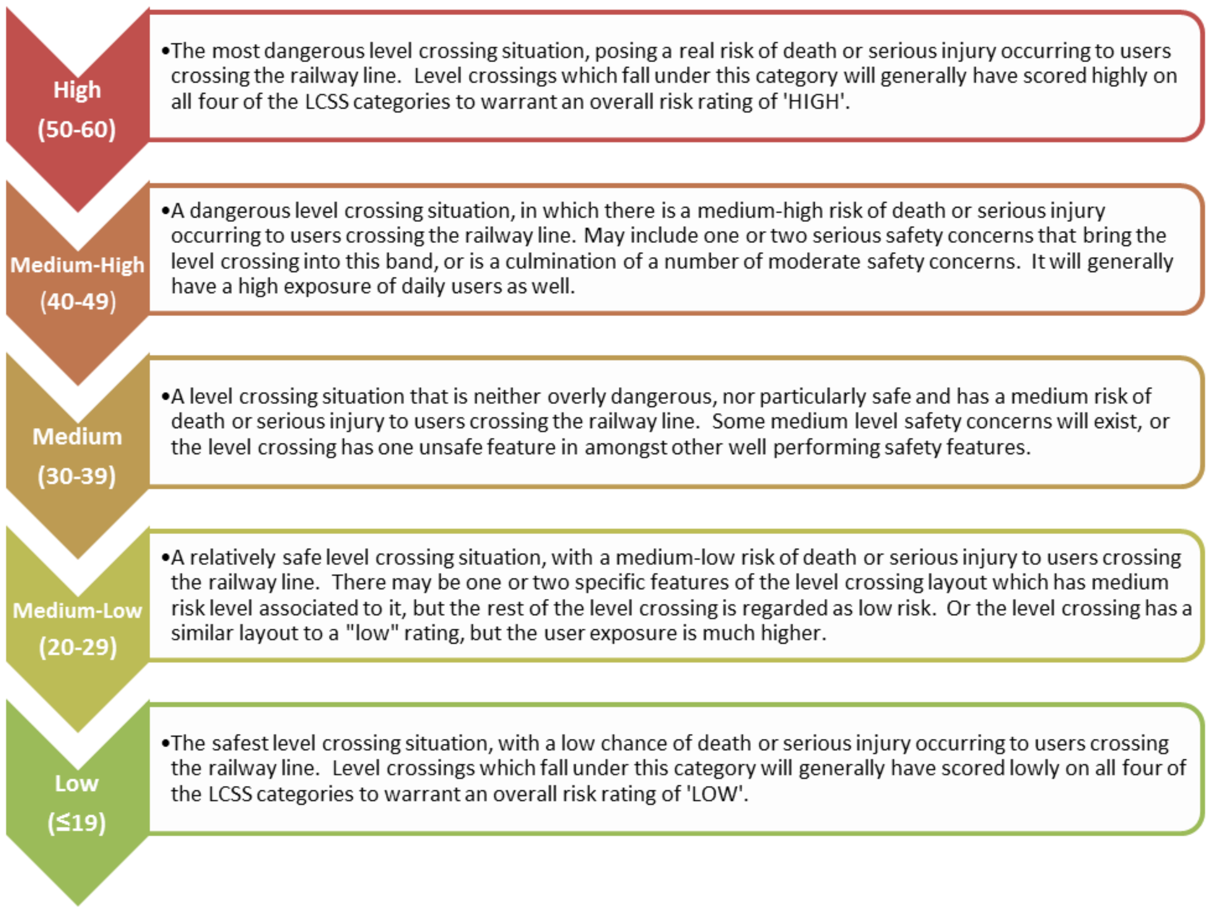


Figure 2-1: Level crossing safety score risk bands

[4] Australian Level Crossing Assessment Model (ALCAM) is a tool used to identify key potential risks at level crossings and to assist in the prioritisation of crossings for upgrades. The risk model is used to support a decision making process for both road and pedestrian level crossings and to help determine the most effective treatments.

2.2 LCSIA criteria

There are two criteria applicable to level crossings, which differ depending on whether the crossing is a new crossing facility or an upgrade to an existing crossing facility.

- **Criteria 1:** the proposed design / upgrade of a level crossing to achieve a "Low" or "Medium-Low" level of risk, as determined by the LCSS.
- **Criteria 2:** the proposed design / upgrade of a level crossing to achieve a LCSS lower number than the existing LCSS[5].

New proposed facility:

Where a new facility is proposed, the new crossing must meet ***Criteria 1***. This will ensure that any new infrastructure constructed over/within the railway corridor is safe for all users and the risk of death or serious injury is low. Where user exposure is high, then it may not be possible to achieve a "Low" or "Medium-Low" risk without grade separation.

Existing facility upgrade:

Where changes to an existing facility are proposed the revised crossing must meet ***Criteria 1***. Where the modifications required to meet Criteria 1 are not ***reasonably practicable*[6]*,*** then a documented risk assessment discussion between KiwiRail and the client shall be undertaken to agree on the required crossing treatment. In this case the level of treatment applied must meet or exceed ***Criteria 2***.

The general principal for modifying an existing level crossing is that the Proposed Design and Future Score LCSS achieves ***Criteria 1***. If an LCSS achieves ***Criteria 1*** but not ***Criteria 2***, KiwiRail will give some consideration that the increase risk is acceptable, e.g. if an LCSS of 20/60 for the Updated Existing assessment becomes 29/60 for either the Proposed Design or Future Score (e.g. still achieves ***Criteria 1***), KiwiRail will determine whether they are satisfied with that increase in predicted risk.

2.3 Structure of the report

This report outlines the site observations and subsequent analysis undertaken to the level crossings being upgraded. The elements of the report consist of:

1. Site visit observations by the LCSIA Assessor.
2. The key issues that need to be addressed at the existing crossings.
3. An assessment of the proposed design/upgrade (if applicable) and any recommended modifications to proposed design/upgrade to further reduce the risk of crashes.
4. The LCSS assessment is then conducted, consisting of; ALCAM, CAS & IRIS databases, Site Specific Safety Score and locomotive / road controlling authority engineer assessment of risk. The LCSS is assessed for the following stages;
    a. **UPDATED EXISTING:** an LCSS of the existing level crossings that has allowed for the Christchurch Southern Motorway Stage 2 (CSM2) alterations as the base for assessment of the volume and infrastructure[7].
    b. **PROPOSED DESIGN:** An LCSS of the change in use that aims to achieve Criteria 1[8]. Allows for an initial increase of heavy vehicles to the new quarry, shortly after opening. The LCSS accounts for the improvements recommended by the Safety Review Team (SRT).
    c. **FUTURE SCORE:** An LCSS that aims to achieve Criteria 1 ten years post opening (2030). Includes a forecast increase in user numbers which may require a further increase in the form of control.
5. The LCSS was conducted on both Option 1 and Option 2 designs for this project.

[5] For every assessment of a change to an existing crossing, an existing LCSS will be produced to confirm whether the proposed changes would raise or lower the level crossing safety when compared to the existing scenario. This includes an updated ALCAM 'proposal' that factors in the latest AADT volumes of any applicable users and updates the current conditions found on site.

[6] Refer to section 1.3.1 of the Level Crossing Risk Assessment Guidance.

[7] CSM2 has been set as the base, as it will be constructed and operating prior to the quarry (if it is granted consent). This means that any traffic growth from CSM2 is not calculated as being induced by the proposed quarry.

[8] Short of a grade separated solution, the at grade recommendations put forward by the SRT may not achieve Criteria 1, but every effort has been made to comply.

2.4 The Safety Review Team

The SRT consists of the following members:

Name	Position	Role	Visit Site?
Shaun Bosher	Transportation Engineer	Team Leader	Yes
Ali Siddiqui	Project Manager		Yes
Shane Turner	Principal Road Safety Engineer		No

A site visit was conducted on the 4th July between 10:00 – 12:00, to assess the site specific safety score and met with KiwiRail and Selwyn District Council (SDC) representatives to discuss options and the history of the site. Present on site were;

- Shaun Bosher and Ali Siddiqui — Stantec
- John Gousmett and Peter Ryan — KiwiRail
- Graham Huggins — SDC
- Steve Dejong — Christchurch City Council (CCC)

As the CCC boundary runs immediately east of Dawsons Road, it was thought pertinent to invite a CCC engineer along to the site visit to offer any insights or local knowledge. NZTA were also invited but were unable to attend the site meeting.

2.4.1 SRT Independence

The SRT was not involved with the decision to conduct an LCSIA at this level crossing. The LCSIA was conducted prior to the detailed design phase.

3. The Change in Use

Fulton Hogan propose to open a new metal quarry on Jones Road, west of Dawsons Road. The quarry does not yet have resource consent, however Fulton Hogan wish to assess the viability of two proposed road layout options for the purposes of the Level Crossing Safety Impact Assessment (LCSIA) process.

With the quarry in full operation, the volumes of vehicles (particularly heavy vehicles) of the Dawsons Road level crossing would greatly increase over time. The prediction is that the heavy vehicle movements to and from the quarry will predominantly cross over the Dawsons Road level crossing, hence why it is being assessed in this report.

3.1 Documents Provided

There were two concept designs provided by the client, as well as a copy of the NZTA plans for the roundabout constructed on Main South Road (current SH1) and Dawsons Road for CSM2.

- Concept Drawings of options: Drawing Number: 14942_C1E (5 sheets)
- CSM2 Drawings: Drawing number: CSM2-C-01-216 & CSM2-C-01-052

3.2 Level Crossing – Forecast Traffic Volumes

The modelled AADT for the crossing location has been provided by the client (Table 3-1), which has considered the expected traffic volume increases from CSM2. The figures below detail interpolated volumes from the CSM2 model plus the estimated Heavy Commercial Vehicle (HCV) volumes from the quarry project. The 2021 figures are based on the quarry in full operation; approximately one year after opening. The data provided assumes that 90% of the HCV traffic generated from the quarry (that heads towards the east) would go over the level crossing to access CSM2 or Main South Road.

Table 3-1: Forecast volumes across the Dawsons Road level crossing

	Do min			CSM			Quarry			CSM + Quarry		
YEAR	Total	Heavy	HCV %	Total	Heavy	HCV %	Total	Heavy	HCV %	Total	Heavy	HCV %
2018	1037	86	8.3%									
2021				1548	128	8.3%	789	719	91.1%	2337	847	36.2%
2030				1923	160	8.3%	789	719	91.1%	2712	879	32.4%

4. Dawsons Road LCSIA

4.1 Site details

The Dawsons Road level crossing is located approximately 1.5 km south of Templeton and crosses over the Main South Line (MSL). The level crossing is currently controlled by half-arm barriers with flashing lights and bells.

Figure 4-1 shows the level crossing location in relation to nearby towns and CSM2 which is still under construction. There are no key activities which operate nearby to the crossing. The proposed quarry entrance is SW of the Dawsons Road level crossing. The CSM2 cannot be accessed via Curraghs Road, as that is grade separated underneath CSM2, hence why the majority of HCVs will use the Dawsons Road crossing to access CSM2, as well as to travel west.

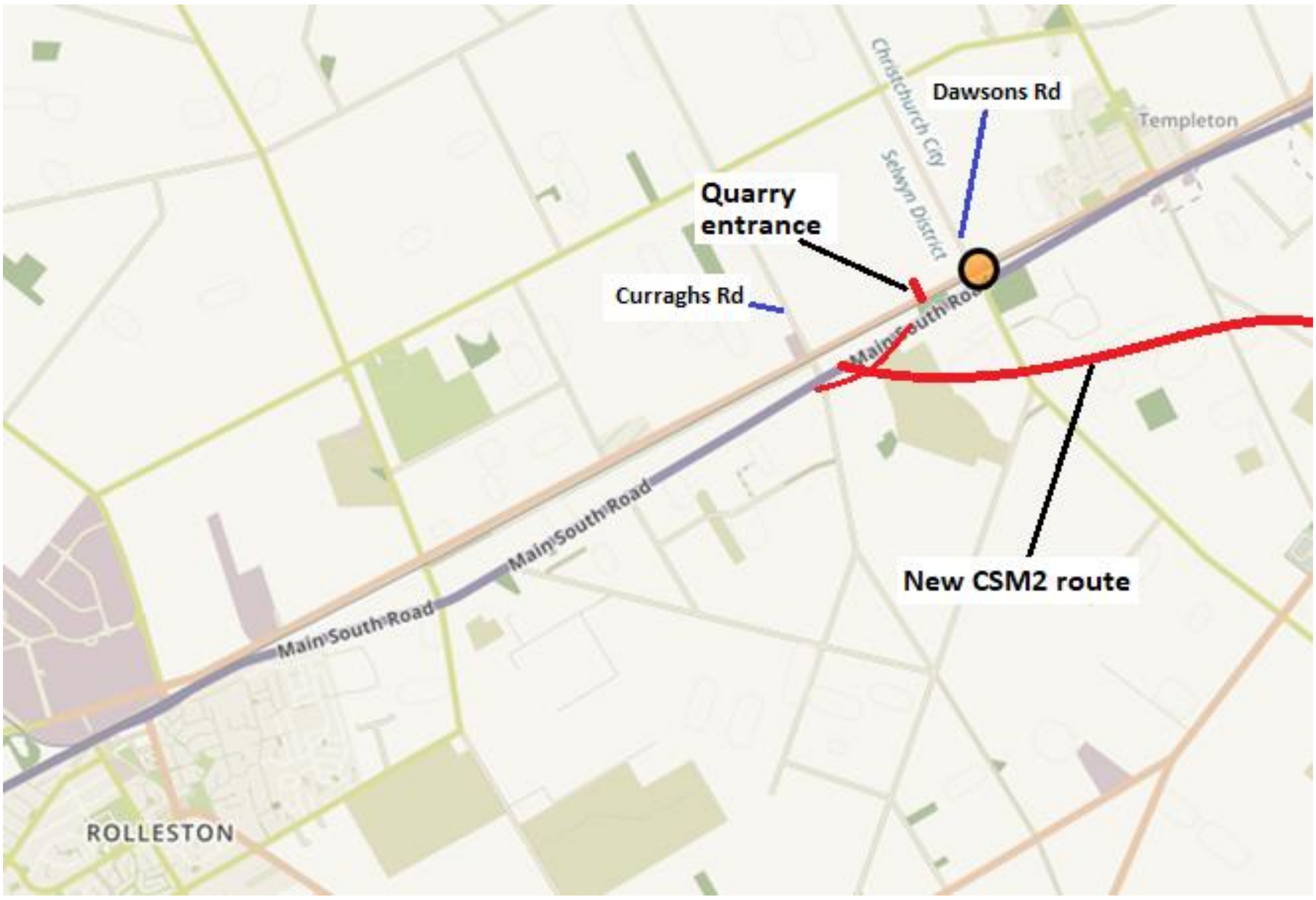


Figure 4-1: Dawson Road level crossing location (Source: OpenStreet Maps)

Figure 4-2 shows the aerial view of the level crossing and identifies some of the key features. The Dawsons Road level crossing is in a posted 100 km/h speed zone. The surrounding area consists of rural farmland.

Figure 4-2: Dawsons Road level crossing aerial (Source: Google Maps)

The level crossing is approximately 85m north of the intersection of Dawsons Road and State Highway 1, and approximately 17m south of the intersection of Dawsons Road and Jones Road. The Dawsons Road approaches to both intersections are stop controlled.

SDC had recently lowered the speed limit on Jones Road to 80 km/h at the location indicated in Figure 4-2, which now left an approximately 850 m section of 100 km/h of Jones Road in the CCC boundary, before the 50 km/h threshold signs on the approach to Templeton. CCC Engineer Steve Dejong noted that it seemed inappropriate to have a sequence of 80 km/h – 100 km/h – 50 km/h for eastbound traffic, so was going to try and get the 100 km/h section in the CCC boundary reduced to 80 km/h as well.

4.1.1 Existing traffic volumes

The Mobile Road website shows an estimated AADT of 489 vehicles per day (vpd) on Dawsons Road from 2010 (10% HCV. ALCAM had the same traffic volume data. The CSM2 model predicts a 2018 AADT of 1,037 vpd (8.3% HCV) on Dawsons Road. This was adopted as the base volume for the assessment.

Mobile Road records the Jones Road AADT as 3,430 vpd (est.) to the east of Dawsons Road (SDC side) and 2,745 vpd (est.) to the west (CCC side). Both counts are from 2015. The Main South Road (SH1) volume is recorded as 24,933 vpd from 2016.

4.1.2 Existing train volumes

The Locomotive Engineers who attended the site visit later provided some updated train volumes for this assessment. There are currently; 100 freight train movements per week, 58 "shunts" per week from the Rolleston iPort to Lyttleton Harbour and, 14 Trans Alpine passenger train movements per week.

4.2 Existing conditions at site visit

4.2.1 Site observations

During the site visit there was not many vehicles using the crossing, nor was there much traffic on Jones Road. However, during peak hour periods at either end of the day, the SRT was told that it can be difficult to exit Dawsons Road onto Jones Road due to the higher traffic volumes.

Figure 4-3 shows the level crossing and active control layout. There are flashing lights and bells facing all approach angles. The crossing is on a flat grade and perpendicular to the railway line.

Figure 4-3: View of crossing from northern approach

The main problem with this crossing is the short stacking, created by the intersection with Jones Road. The distance between the tracks and the limit line is only 17 m as seen in Figure 4-4. The same photo also shows the excellent condition of the crossing panel which has been recently upgraded with rubber inserts. Figure 4-5 shows the signage at the crossing is quite busy with the additional signs for the intersection and other poles nearby.

Figure 4-4: Short stacking due to Jones Road

Figure 4-5: A lot of signage at the crossing

Visibility at the crossing is excellent from the northern approach to the crossing, however as Figure 4-6 and Figure 4-7 show, the visibility from the southern approach is much more restricted by vegetation and fencing respectively.

Figure 4-6: Vegetation along fenceline is restricting visibilty to the east

Figure 4-7: A high fence line is restricting visibilty to the west

The remaining issues for the crossing relate to signage problems. Figure 4-8 shows the Jones Road advanced warning sign for the Dawsons Road crossroads intersection on the eastern approach (CCC section of Jones Road). This sign has the correct application of showing the railway line on the left spur of the crossroad symbol. Figure 4-9 shows the same sign on the western approach of Jones Road (SDC section of Jones Road), where the railway line is not displayed on the right spur of the crossroad symbol.

Figure 4-8: Jones Road intersection advanced warning sign displays level crossing on the left spur of crossroads (CCC sign)

Figure 4-9: Jones Road intersection advanced warning sign does not display level crossing on the right spur of crossroads (SDC sign)

Figure 4-10 shows the WX1L sign (for vehicles approaching from SH1) has lichen growing on it and is a little battered. The sign was installed in the year 2000, as visible on the sticker on the reverse side. The same sign type on the northern Dawsons Road approach is obscured by a stop sign for the opposite side of the intersection, as in Figure 4-11. The stop sign should be relocated slightly to eliminate this from occurring.

Figure 4-10: WX1L sign has lichen growing on it and is very old

Figure 4-11: The WX1L sign facing the Dawsons Road (north) traffic at the limit line is obscured

4.3 Christchurch Southern Motorway Stage 2 upgrade

The main changes applicable to the level crossing from the CSM2 project are the introduction of street lighting and median islands either side of the crossing. Figure 4-12 highlights these additions to the crossing. These settings will be applied to the "Updated Existing" scenario in ALCAM, as these works have already been agreed to occur to the crossing, prior to the possible opening of the new quarry.

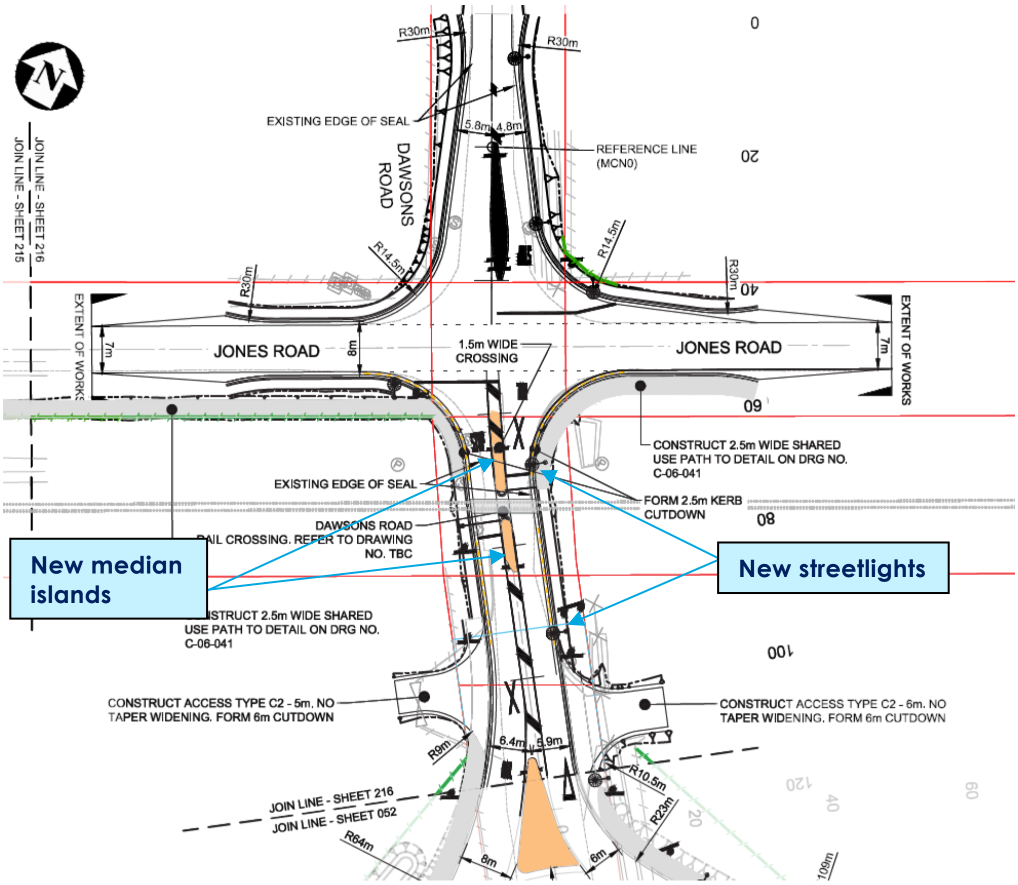


Figure 4-12: CSM2 changes to Dawsons Road crossing

4.4 Proposed Upgrade

Fulton Hogan propose to reconfigure the road layout at the level crossing, in anticipation of the significant volume of HCV that would use the level crossing once the proposed quarry is fully operational. There are two options for assessment as follows, with both connecting to the new dual lane roundabout planned on Main South Road as part of CSM2.

4.4.1 Option 1

This concept design in Figure 4-13 is based on providing a better solution where land acquisition on the eastern side of Dawsons Road was not a limiting factor.

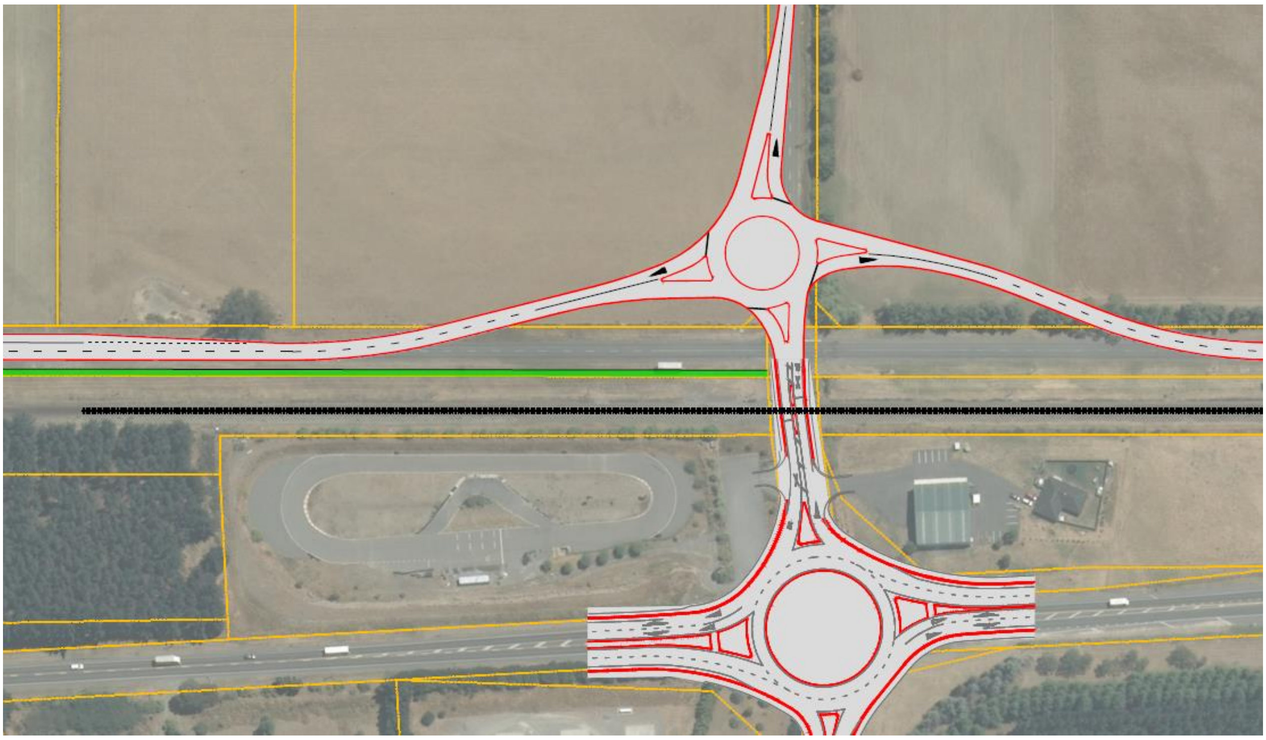


Figure 4-13: Concept Design Option 1

Option 1 has removed the short stacking scenario with Jones Road by moving the new roundabout intersection further away from the railway line.

4.4.2 Option 2

This concept design in Figure 4-14 is based purely on providing a solution within the existing road corridors and land owned by Fulton Hogan to the west of Dawsons Road.

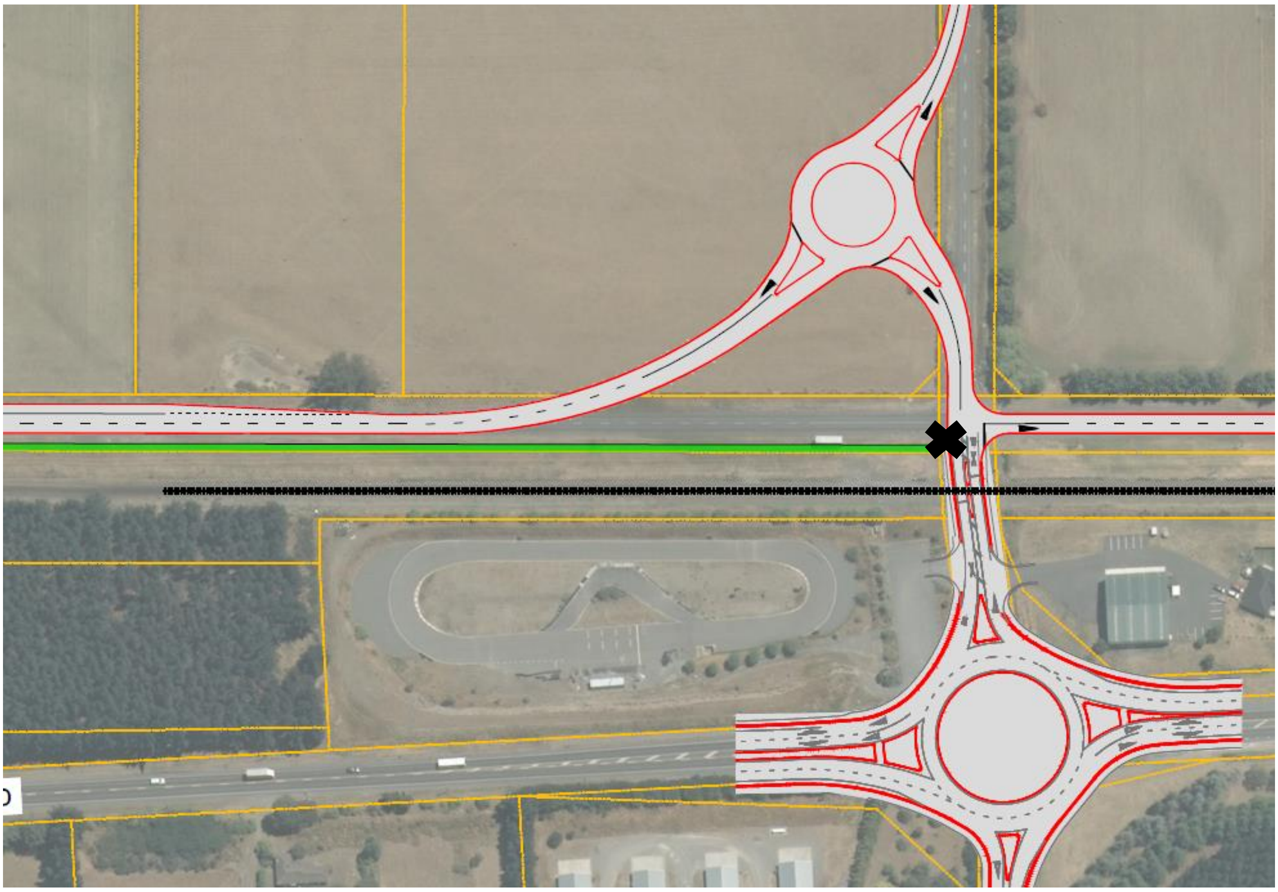


Figure 4-14: Concept Design Option 2

Option 2 has removed the short stacking scenario with Jones Road by moving the new roundabout intersection further north away from the railway line. However, with the eastern leg of Jones Road not relocating to the new roundabout (as the purchase of the land to the north cannot be guaranteed), a new side road has been introduced immediately north of the level crossing.

When an HCV with a trailer waits to turn right onto Jones Road (at the 'X' location in Figure 4-14), their trailer would still foul the railway line as they wait for a gap in the traffic to turn. Therefore, the problem of an HCV fouling the rail corridor has not been fully resolved. If a train was approaching, the waiting HCV would rely on the left-turning traffic (for Jones Road) to reverse the standard traffic priority give way rules and allow the HCV to turn right first to clear the rail corridor. This scenario should not be relied upon as the effective safety solution. A similar problem could arise for a queue of light vehicles, if there are vehicles waiting behind a right-turning vehicle looking for a gap in the opposing traffic flow.

The new Jones Road side road has not moved from its current location, so the distance from the limit line (at the level crossing for southbound vehicles) back to Jones Road remains approximately 15 m. Therefore, any HCV and trailer waiting for a passing train at the level crossing would block the Jones Road intersection for vehicles wishing to exit and possibly restrict vehicles behind the HCV from turning left into Jones Road.

The HCV waiting at the limit line would also restrict any traffic on the north side of the crossing wishing to turn right, so those vehicles would need to do a U-turn via the roundabout. This would not be a regular occurrence, as the turning vehicle would need to have just cleared the level crossing as the half-arm barriers were lowered.

4.5 Key safety issues that need to be addressed by the upgrade

There are some key safety issues which need to be addressed by the future upgrade of this road crossing and its interaction with the rail corridor.

4.5.1 Current safety issues

1. Short stacking of 17 m with Jones Road. Can be difficult for long HCVs to clear the tracks when a train is coming and there is traffic approaching on Jones Road, which has priority over Dawsons Road.
2. A short queue of light vehicles could form back over the level crossing, due to the Jones Rd limit line.
3. Vegetation restricting sight distance to the east from the southern approach of Dawsons Road.
4. A high fence line restricting sight distance to the west from the southern approach of Dawsons Road. This restricts HCV drivers from looking further down track for a train light, prior to the train activating the signals.
5. The WX1L sign on the southern approach of Dawsons Road is old (installed in 2000) and has lichen growing on it and should be replaced.
6. The WX1L sign on the northern approach of Dawsons Road is obscured by a stop sign for the intersection with Jones Road.
7. No street lighting at the crossing[9] currently.

4.5.2 Future issues

The main concern lies with the projected increase in HCVs over the crossing when the proposed quarry is fully operational. The 2030 additional vehicle movements over the crossing is predicted at 809 vehicles (719 HCV) per day. With the current short stacking layout mixed with the increase in HCVs, it would be unsafe to leave the current road layout in place.

4.6 SRT safety recommendations

The SRT recommendations to improve safety at the road level crossing are outlined Table 4-1 to Table 4-3. The column on the left states the recommendation's 'level of necessity', such as:

- Achieve 'Criteria 1' (and/or Criteria 2),
- To meet 'TCD Pt. 9' or 'maintenance' issues, or
- A 'Safety Concern' for road users at the level crossing.

Figure 4-15 has annotations of the recommendations for Option 1 and Figure 4-16 has annotations of the recommendations for Option 2.

4.6.1 Both Options

Table 4-1: Safety recommendations for both options

1. Install yellow box hatching and "no stopping" signage at the level crossing.	
For both options there is a possibility of queues forming back over the crossing from the roundabout, much more so with Option 2 than Option 1. As per TCD Pt 9 Figure A12.	TCD Pt. 9
2. Maintenance signage improvements.	
There are some general signage improvements that need to be made by the RCA. These include the intersection advanced warning sign without the railway tracks indicated, the WX1L obscured on the northern approach and the WX1L with lichen growing on it. An email was sent to the SDC Engineer to highlight these issues, so are not relevant for the applicant to address. In the end, both options would need a range of new signs for the new road layout.	TCD Pt. 9 & Maintenance

[9] CSM2 plans show street lighting for this crossing. This will be accounted for in the Updated Existing assessment.

4.6.2 Option 1

Table 4-2: Safety recommendations for Option 1

3. Investigate whether a left-turn slip lane on southern leg of roundabout is required in the event of queues forming back over the crossing during peak hours.	
At the southern roundabout approach, the predominant movement will become the left-turn by the quarry HCV traffic. There is a possibility of a queue forming over the level crossing during peak hours. This could be virtually eliminated by providing a left-turn slip lane with a merge into the western leg of the roundabout. Applicant to assess the likelihood of this occurring via modelling. Furthermore, it needs to be confirmed if the space exists to fit in the additional lane.	Safety Concern

The following recommendations are outside the normal remit of the LCSIA, as they are concerned with the efficiency of Jones Road traffic at the roundabout. If Option 1 proceeds to the design safety audit stage, the Safety Auditors should be provided with the below recommendations (and this report).

The SRT cannot confirm whether the two following recommendations are necessary, as the SRT do not know how the Jones Road traffic peak hour volumes would change after CSM2 is open and the quarry is in operation. Therefore, modelling of the scenarios during peak hours may need to occur to determine the likelihood of any capacity problems.

- **Additional traffic lane on Jones Road western approach to roundabout:** HCVs waiting at the limit line for the train to clear the level crossing would block Jones Road through traffic for Templeton. Therefore, an additional lane for through and right turn movements may be necessary to keep traffic flowing.
- **Left-turn lane on Jones Road eastern approach to roundabout:** Any left-turning vehicles unable to occupy the storage space immediately north of the level crossing, may need to wait at the limit line for the train to clear the level crossing before proceeding. This would block Jones Road through traffic towards Rolleston. Therefore, a left-turn lane may be necessary to keep traffic flowing, but is less important than the additional lane needed on the western approach (given the lower volume of trucks expected from this approach).
- **Advanced warning sign for queue ahead on east and west approaches:** If the additional lanes (above) are deemed unnecessary, it may instead require advanced warning signs for queues ahead installed on the western and eastern approaches. These should be activated by detection loops located back from the limit line.

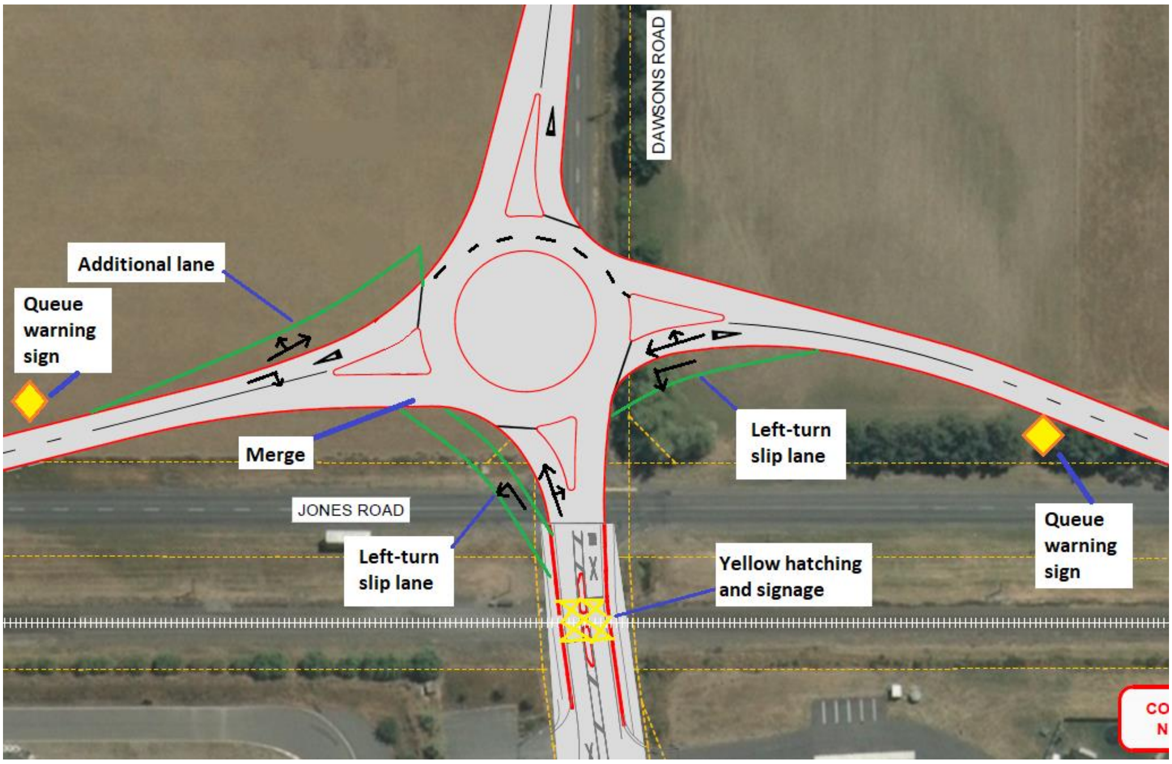


Figure 4-15: Recommended changes to layout of Option 1

4.6.3 Option 2

Table 4-3: Safety recommendations for Option 2

4. Install a Give Way control on Dawsons Road (southbound), to give Dawsons Road right turn traffic priority and eliminate short stacking or queuing over the level crossing.	
By installing a Give Way control on Dawsons Road (southbound), it permits right turn vehicles to turn as the priority vehicle. This particularly assists HCVs, which would otherwise have to short stack and wait for a gap in traffic to turn right in this design.	Safety Concern
5. Install yellow hatching at the Jones Road intersection to keep intersection clear of queued vehicles	
To reduce the likelihood of queued vehicles blocking the Jones Road intersection, hatched road markings are necessary. Otherwise the flow of Jones Road through traffic would be restricted.	Safety Concern
6. Ban right-turn movements from Dawsons Road to Jones Road (east), if give way recommendation is not a viable option.	
If a Give Way on Dawsons Road is not an option that the RCA is happy with, then a ban on right turn movements for all vehicles (after exiting the level crossing) should be implemented. Right turn movements can be performed by informing motorists to use the roundabout to perform a U-turn and then turn left into Jones Road. Motorists could also use other roads on the network to access Jones Road.	Safety Concern
7. Widen the sealed shoulder opposite the right turn for Jones Road, to permit through vehicles to pass the right turning vehicle.	
This would permit through vehicles to pass around right-turning vehicles without being delayed at all. This could also be useful if vehicles attempt to illegally turn right (if that movement was banned), so that no queues form over the crossing. This needs to accommodate for an HCV to pass around the waiting vehicle.	Safety Concern

The following recommendations are outside the remit of the LCSIA, as they are concerned with the efficiency of Jones Road traffic at the roundabout. If Option 2 proceeds to the design safety audit stage, the Safety Auditors should be provided with the below recommendations (and this report).

The SRT cannot confirm whether the two following recommendations are necessary, as the SRT do not know how the Jones Road traffic peak hour volumes would change after CSM2 is open and the quarry is in operation. Therefore, modelling of the scenarios during peak hours may need to occur to determine the likelihood of any capacity problems.

- **Left-turn lane on Jones Road eastern approach to Dawsons Road:** Any left-turning vehicles unable to occupy the storage space immediately north of the level crossing, may need to wait at the limit line for the train to clear the level crossing before proceeding. This would block Jones Road traffic heading towards Rolleston. Therefore, a separate left-turn and right turn lane may be necessary to keep traffic flowing.
- **Consider changing the proposed roundabout intersection to a T-intersection:** This would put a Stop control on the Dawsons Road northern approach, allowing the Jones Road traffic to flow unimpeded to / from the new T-intersection as shown in Figure 4-16. The alignment of Jones Road would follow a similar curvilinear alignment as shown in Figure 4-16, just without the roundabout control.
- This would then minimise any possibility of queues forming back from the roundabout over the level crossing if this was shown to be an issue during peak hour traffic. Although Option 2 provides more storage capacity by moving the roundabout further away from the level crossing, the queue on this approach is the combination of Jones Road traffic (from Templeton) and Dawsons Road traffic from the level crossing (the queue issues in Option 1 consists of Dawsons Road traffic only). The Give Way recommended on Dawsons Road would still need to be in place, so Dawsons Road traffic turning right onto Jones Road (immediately after the level crossing), still has priority as not to form a queue back over the level crossing.
- This option would need to consider whether a safe design can be built without speed management around the curvilinear horizontal alignment in the road. It would be a tight radius curve, so the speed of vehicles approaching from the west may cause a safety issue.

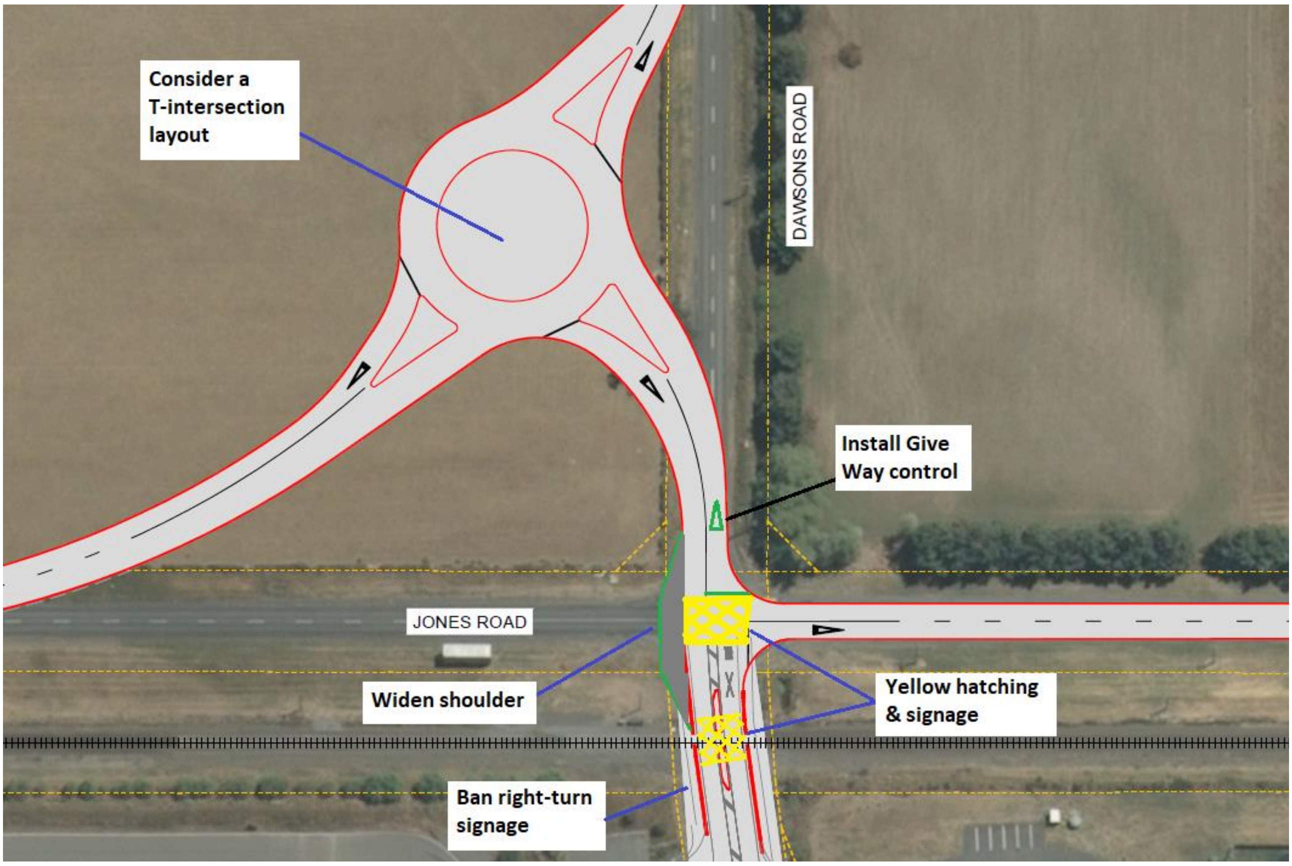


Figure 4-16: Recommended changes to layout of Option 2

4.7 Level Crossing Safety Score (LCSS)

The following four sections display the individual scores that make up the overall LCSS (out of 60 points).

4.7.1 ALCAM score

ALCAM scores are assessed in 'Proposals' mode in the LXM database[10]. Updates to the traffic count data were made, as these can have a significant impact on the ALCAM score. The return period for fatalities is reported for the road score for each stage. Some changes to measured distances in ALCAM were made and reviewed by Jodi Enright, who is an ALCAM accredited assessor at Stantec.

Table 4-4: ALCAM ID 2294 – Dawsons Road roadway crossing ALCAM score – OPTION 1

Stage	Score	Fatality return	Risk % change	Comments
Published Score	**16/30**	**1,040 years**	**-**	The 2016 published ALCAM risk score is 10 and the risk band is Medium for all control classes. This is based on an estimated vehicle crossing volume (AADT) of 489 vehicles and 29 trains per day.
Updated Existing	**13/30**	**1,351 years**	**-**	The following changes were made based on conditions found on site; • Changed freight train volumes to 100 weekly movements. • Added 58 weekly "shunt" movements from iPort in Rolleston to Lyttleton Port, as advised by KiwiRail Locomotive Engineers. These are effectively short distance freight train movements. • HCV % changed from 10% (est.) to 8.3% (est.) • Unchecked that it is a metropolitan location. As CSM2 is in operation prior to the quarry, the following improvements from the CSM2 project were adopted. • Traffic volume increased from 489 (est.) to 1,515 (est.) AADT in year 2020. • Stated that street lighting was installed. • Stated that central median islands are included. **ALCAM risk score is 7 and the risk band is Medium.**
Proposed Design Option 1	**15/30**	**1,072 years**	**+29%**	Changes to the road crossing are stated below: • Traffic volume increased from 1,515 (est.) to 2,337 (est.) AADT. • HCV % changed from 8.3% (est.) to 36.2% (est.) • Altered the length of both immediate approach distances to allow for new road layout. Left was 17m, now 40m; right was 84m, now 62m. • Removed the left approach down and up track approaches (the two Jones Road approaches) from sighting. • Selected the characteristic that stated Short Stacking was no longer possible. • Stated that queuing could occur back over the crossing, due to the proximity of the roundabout. • Recommend installing yellow box hatching and "Keep tracks clear signs". **ALCAM risk score is 9 and the risk band is Medium.**
Future Score (2030)	**16/30**	**986 years**	**+43%**	Changes to the road crossing are stated below: • Increased weekly "shunt" movements by four per day (28 per week) to a total of 86 movements per week from iPort in Rolleston to Lyttleton Port. Estimated increase by KiwiRail Locomotive Engineers. • Traffic volume increased from 2,337 (est.) to 2,712 (est.) AADT. • HCV % changed from 36.2% (est.) to 32.4% (est.) **ALCAM risk score is 10 and the risk band is Medium.**

Table 4-4 shows the Future Score ALCAM score has increased by 43%. This has decreased the expected return period of a fatal collision from 1,351 years, down to 986 years.

[10] Note that the SRT are not ALCAM accredited, so they use best engineering judgement when scoring ALCAM.

Table 4-5: ALCAM ID 2294 – Dawsons Road level crossing ALCAM score – OPTION 2

Stage	Score	Fatality return	Risk % change	Comments
Proposed Design Option 2	16/30	997 years	+43%	Changes to the road crossing are stated below: • Traffic volume increased from 1,515 (est.) to 2,337 (est.) AADT. • HCV % changed from 8.3% (est.) to 36.2% (est.) • Altered the length of both immediate approach distances to allow for new road layout. Left was 17m, now 86m; right was 84m, now 62m. • Removed the left approach down track (Jones Road west approach) from sighting. • Stated that queuing could occur back over the crossing, due to the right turn movement from Dawsons Road to Jones Road forcing vehicles to queue behind the right turning vehicle. • Recommend installing yellow box hatching and "Keep tracks clear signs". **ALCAM risk score is 10 and the risk band is Medium.**
Future Score (2030)	17/30	903 years	+57%	Changes to the road crossing are stated below: • Increased weekly "shunt" movements by four per day (28 per week) to a total of 86 movements per week from iPort in Rolleston to Lyttleton Port. Estimated increase by KiwiRail Locomotive Engineers. • Traffic volume increased from 2,337 (est.) to 2,712 (est.) AADT. • HCV % changed from 36.2% (est.) to 32.4% (est.) **ALCAM risk score is 11 and the risk band is Medium.**

Table 4-5 shows the Future ALCAM score has increased by 57%. This has decreased the expected return period of a fatal collision from 1,351 years, down to 903 years.

4.7.2 Crash and incident history analysis

	Updated Existing	Proposed Design	Future Score
Option 1 road score	2/10	1/10	1/10
Option 2 road score	2/10	1/10	2/10

IRIS data:

The 10-year IRIS[11] data for 2008 -2017 was analysed (including any incidents from 2018). The following incident in Table 4-6 occurred.

Table 4-6: IRIS Data

Incident Type	Number	Comments
CLV – Collision Light Road Vehicle	1	Train struck a vehicle at Dawsons Road level crossing (2008). Two vehicles had an accident at the level crossing and the train then struck one of them. There was no comment of persons injured.
TOTAL	**1**	

There is one recorded road incident from the past 10 years, therefore the IRIS score is 1/10 for the road score.

CAS data

The 10-year CAS data for 2008 -2017 was analysed (including any crashes from 2018) and no crashes were recorded. Therefore, the CAS score is 0/5.

[11] IRIS = Incident Reporting Information System. This is the KiwiRail database that records incidents and near misses as reported by the locomotive engineers.

KiwiRAP score

Dawsons Road level crossing has a Low Collective risk rating. However, the SH1 intersection is nearby and has a high collective risk near the crossing. Because of SH1 nearby, this means that the KiwiRAP element scores a 3/5.

Existing Score

After analysing the IRIS, CAS and KiwiRAP data a score of 2 /10 has been scored for the existing road crossing.

<u>OPTION 1:</u>

Proposed Design Score

As the proposed design removes the short stacking scenario, the crossing score reduces by one point. Difficult to make the reduction any greater given the Updated Existing Score. The opportunity exists for occasional queuing back from the proposed roundabout to the level crossing, with the Dawsons Road southern approach still required to give way to Jones Road through traffic approaching from the east. However, motorists' visibility of the level crossing relative to the proposed roundabout (approaching from SH1), combined with a low speed environment, should mean that vehicles are less likely to queue over the railway tracks. Score = 1/10.

Future Score

As the HCV volume significantly increases, the (occasional) queue back from the proposed roundabout is likely to increase in frequency. As explained for the Proposed Design score, the speed environment and visibility of the level crossing / proposed roundabout, should mean that vehicles are less likely to queue over the railway tracks. Score = 1/10.

<u>OPTION 2:</u>

Proposed Design Score

As the proposed design removes the short stacking scenario, the crossing score reduces by one point. Difficult to reduce score any further given the Updated Existing Score. Still a queuing problem when vehicles want to right turn from Dawsons Road to Jones Road, but the frequency should be lower.
Score = 1/10.

Future Score (2030)

As the HCV volume significantly increases, the likelihood of a right turning vehicle creating a queue (or just one queued HCV) behind it increases. This assumes that some motorists would ignore any road marking or signage that indicate to them to not wait over the railway tracks. Score = 2/10.

4.7.3 Site specific safety score (SSSS)

This site based score aims to analyse elements of the layout that are not well covered or missing from the ALCAM risk rating. To achieve a score out of ten, the site specific safety score is simply prorated and then rounded up to the nearest whole number, i.e. 19/35 = 0.54x10 = 5.4 ∴ 6/10.

ID: 2294 – Dawsons Road level crossing

Table 4-7: SSSS assessment of the Dawsons Road level crossing – OPTION 1

Assessed Item	Updated Existing	Proposed Design	Future Score	Comments
Side road and intersection proximity	6/10	6/10	6/10	Existing scenario has the bisecting intersection closer to the level crossing than the Proposed Design. The Proposed Design still has an intersection close to a level crossing, so queuing issues could arise during peak hours.
Horizontal and vertical alignment of crossing	0/10	0/10	0/10	No horizontal or vertical alignment concerns with the existing or Option 1.
Road surface condition	0/5	0/5	0/5	There were minor issues with the existing approaches, but not enough for a maintenance intervention. Deducts one point with an excellent crossing panel. Assumes a good surface for the Future Score.
Short stacking / grounding out	8/10	0/10	0/10	Short stacking has been removed by the Proposed Design.
TOTAL SCORE	**14**/35	**6**/35	**6**/35	
SSSS	**4/10**	**2/10**	**2/10**	
MODIFIED SSSS	**6/10**	-	-	**Score to take forward to LCSS for Updated Existing**

Table 4-8: SSSS assessment of the Dawsons Road level crossing – OPTION 2

Assessed Item	Updated Existing	Proposed Design	Future Score	Comments
Side road and intersection proximity	6/10	2/10	2/10	Existing scenario has the bisecting intersection much closer to the level crossing than the Proposed Design. The Proposed Design introduces a side road that creates a short stacking right-turn movement for Jones Road as well as a queuing problem as through vehicles cannot get around a waiting right turn vehicle.
Horizontal and vertical alignment of crossing	0/10	0/10	0/10	No horizontal or vertical alignment concerns with the existing or Option 1.
Road surface condition	0/5	0/5	0/5	There were minor issues with the existing approaches, but not enough for a maintenance intervention. Deducts one point with an excellent crossing panel. Assumes a good surface for the Future Score.
Short stacking / grounding out	8/10	5/10	5/10	The short stacking from a bisecting intersection has been removed, only to be replaced by short stacking for right-turning HCV for Dawsons Road. However, HCV can escape the short stacking by continuing north on Dawsons Road towards the roundabout (score = 2+3).
TOTAL SCORE	**14**/35	**7**/35	**7**/35	
SSSS	**4/10**	**2/10**	**2/10**	
MODIFIED SSSS	**6/10**	-	-	**Score to take forward to LCSS for Updated Existing**

The site visit attendees all agreed that a SSSS of 4/10 did not appropriately capture the risk of the existing crossing. Therefore it was felt appropriate to raise this to 6/10, due to the short stacking component but weary of the low opposing traffic volumes on Jones Road for most of the day.

4.7.4 Locomotive / RCA Engineer's assessment of risk

	Updated Existing	Proposed Design	Future Score
Option 1	7/10	3/10	4/10
Option 2	7/10	5/10	7/10

Existing scores

- The SDC Engineer (Graham Huggins) rated the existing road crossing a 4/5 risk.
- The Locomotive Engineers (John Gousmett and Peter Ryan) rated the existing road crossing a 3/5 risk.

Combining the two scores together equates to a 7/10 risk.

OPTION 1:

Proposed Design scores

The scores provided by the engineers are based on the quarry not in full operation.

- The SDC Engineer rated the proposed road crossing a 1/5 risk.
- The Locomotive Engineers rated the proposed road crossing a 2/5 risk.

Combining the two scores together equates to a 3/10 risk.

Future Scores

The scores provided by the engineers factor in the large increase in HCV traffic.

- The SDC Engineer rated the Future Score a 1/5 risk.
- The Locomotive Engineers rated the Future Score a 3/5 risk.

Combining the two scores together equates to a 4/10 risk.

OPTION 2:

Proposed Design scores

The scores provided by the engineers are based on the quarry not in full operation.

- The SDC Engineer rated the proposed road crossing a 2/5 risk.
- The Locomotive Engineers rated the proposed road crossing a 3/5 risk.

Combining the two scores together equates to a 5/10 risk.

Future Scores

The scores provided by the engineers factor in the large increase in HCV traffic.

- The SDC Engineer rated the Future Score a 3/5 risk.
- The Locomotive Engineers rated the Future Score a 4/5 risk.

Combining the two scores together equates to a 7/10 risk.

5. Level Crossing Safety Score results

Table 5-1 and Table 5-2 present the results of the LCSS process for the two Dawsons Road options.

The discussion section provides KiwiRail information to assist their decision on any necessary changes at the level crossing and discuss further with Fulton Hogan to reach an agreement.

5.1.1 Discussion – Option 1

Scored Items	Updated Existing	Proposed Design	Future Score	Comments
ALCAM score	13/30	15/30	16/30	The increase in HCV movements increases the exposure of vehicles at the crossing and raises the risk.
Crash and incident history score	2/10	1/10	1/10	Only one recorded IRIS incident. The proposal is an improvement as short stacking is removed.
Site specific safety score	6/10	2/10	2/10	The updated existing score was Modified from 4 to 6, as the engineers present at the site meeting agreed 4 was too low. The removal of short stacking means the score reduces.
Locomotive / RCA engineer risk score	7/10	3/10	4/10	The engineers preferred this option of the two, as short stacking had been eliminated and was the safer of the two.
LCSS SCORE	**28/60**	**21/60**	**23/60**	
LCSS RISK BAND	Medium Low	Medium Low	Medium Low	
CRITERIA	Criteria 1	Criteria 1 & 2	Criteria 1 & 2	

Table 5-1: Dawsons Road level crossing LCSS – OPTION 1

The Dawsons Road level crossing has an existing LCSS of 28/60 (Medium Low LCSS risk band), with the Proposed Design LCSS lower at 21/60 (Medium-Low LCSS risk band). Therefore, the change in use achieves Criteria 1 and Criteria 2. The Future Score LCSS is 23/60 (Medium-Low LCSS risk band) and therefore also achieves Criteria 1 and Criteria 2.

The Updated Existing ALCAM risk band was Medium and remained Medium after the Proposed Design changes, with the ALCAM risk score increasing by 29% vs the Updated Existing ALCAM risk score. The Future Score ALCAM risk band was Medium and the ALCAM risk score increased by 43%. The return period on predicted fatal crashes for the Future Score reduced from 1,351 years down to 986 years.

5.1.2 Discussion – Option 2

Scored Items	Updated Existing	Proposed Design	Future Score	Comments
ALCAM score	13/30	16/30	17/30	The increase in HCV movements increases the exposure of vehicles at the crossing and raises the risk.
Crash and incident history score	2/10	1/10	2/10	One recorded IRIS incident. The proposal is an improvement as short stacking is reduced, but queuing problems can arise.
Site specific safety score	6/10	2/10	2/10	The updated existing score was Modified from 4 to 6, as the engineers present at the site meeting agreed 4 was too low. The reduction in short stacking means the score reduces.
Locomotive / RCA engineer risk score	7/10	5/10	7/10	The engineers were concerned about the chance for vehicles to queue back over the crossing, when a waiting right-turn vehicle was blocking Dawsons Road.
LCSS SCORE	**28/60**	**24/60**	**28/60**	
LCSS RISK BAND	Medium Low	Medium Low	Medium Low	
CRITERIA	Criteria 1	Criteria 1 & 2	Criteria 1	

Table 5-2: Dawsons Road level crossing LCSS – OPTION 2

The Dawsons Road level crossing has an existing LCSS of 28/60 (Medium Low LCSS risk band), with the Proposed Design LCSS lower at 24/60 (Medium Low LCSS risk band). Therefore, the change in use achieves Criteria 1 and Criteria 2. The Future Score LCSS is 28/60 (Medium Low LCSS risk band) therefore the change in use achieves Criteria 1 and does not achieve Criteria 2 (but is the same as the Updated Existing score).

The Updated Existing ALCAM risk band was Medium and remained Medium after the Proposed Design changes, with the ALCAM risk score increasing by 43% vs the Updated Existing ALCAM risk score. The Future Score ALCAM risk band was Medium and the ALCAM risk score increased by 57%. The return period on predicted fatal crashes for the Future Score reduced from 1,351 years down to 903 years.

If the Give Way is installed on Dawsons Road, then the crossing would achieve Criteria 1 and Criteria 2. It was not assessed with it included, as there was uncertainty whether the RCA would agree to a Give Way control installed on what was effectively the priority route for Jones Road.

5.2 Recommended Improvements

Option 1 achieves Criteria 1 for the Proposed Design and Future Score, however there is a 'Safety Concern' recommendation in Table 5-3 that should be strongly considered.

Table 5-3: Safety recommendations for the Option 1 level crossing

Rec #	Recommendation	Level of Necessity
1.	Install yellow box hatching and "no stopping" signage at the level crossing.	TCD Pt. 9
2.	Maintenance signage improvements.	Maintenance
3.	Investigate whether a left-turn slip lane on southern leg of roundabout is required in the event of queues forming back over the crossing during peak hours	Safety Concern

There were also three other recommendations that the SRT wanted to highlight that were wider than the remit of the LCSIA.

- Additional traffic lane on Jones Road western approach to roundabout.
- Left-turn lane on Jones Road eastern approach to roundabout.
- Advanced warning sign for queue ahead on east and west approaches.

Option 2 achieves Criteria 1 for the Proposed Design and Future Score, however there are some 'Safety Concern' recommendations in Table 5-4 that should be strongly considered.

Table 5-4: Safety recommendations for the Option 2 level crossing

Rec #	Recommendation	Level of Necessity
1.	Install yellow box hatching and "no stopping" signage at the level crossing.	TCD Pt. 9
2.	Maintenance signage improvements.	Maintenance
3.	Install a Give Way control on Dawsons Road (southbound), to give right turn traffic priority and eliminate short stacking or queuing over the level crossing.	Achieve Criteria 2
4.	Install yellow hatching at the Jones Road intersection to keep intersection clear of queued vehicles.	Safety Concern
5.	Ban right-turn movements from Dawsons Road to Jones Road (east), if give way recommendation is not an option.	Safety Concern
6.	Widen the sealed shoulder opposite the right turn for Jones Road, to permit through vehicles to pass the right turning vehicle.	Safety Concern

There were also two other recommendations that the SRT wanted to highlight that were wider than the remit of the LCSIA.

- Left-turn lane on Jones Road eastern approach to Dawsons Road.
- Consider changing the proposed roundabout intersection to a T-intersection.

5.3 Future User Volume Surveys

The applicant is required to conduct additional user volume surveys (including % heavy vehicles) two years after the opening of the facility and review whether a change in control is required. Subsequent surveys and reviews must be completed in three yearly cycles thereafter.

5.4 Recommended ALCAM updates

To assist KiwiRail with improvements to the ALCAM database, the following data in Table 5-5 should be considered for update the existing level crossings in LXM.

Table 5-5: ALCAM updates for KiwiRail consideration at road crossing #2294

- Changed freight train volumes to 100 weekly movements.
- Added 58 weekly "shunt" movements from iPort in Rolleston to Lyttleton Port (these should be included for all crossings between the iPort and Lyttleton Port).
- Unchecked that it is a metropolitan location.

Christchurch

Hazeldean Business Park, 6 Hazeldean Road
Addington, Christchurch 8024
PO Box 13-052, Armagh
Christchurch 8141
Tel +64 3 366 7449
Fax +64 3 366 7780

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