Level Crossing Safety Impact Assessment (LCSIA)

Lincoln Road level crossing, Addington, Christchurch

Prepared for Christchurch City Council

Prepared by Beca Limited

3 March 2021

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Revision History

Revision №	Prepared By	Description	Date
0	Ben Zmijewski	Draft for internal review	04/02/2021
1	Ben Zmijewski	Draft for client review	19/12/2021
2	Ben Zmijewski	Final issue	03/03/2021

Document Acceptance

Action	Name	Signed	Date
Prepared by	Ben Zmijewski		04/02/2021
Reviewed by	Murray Fletcher		17/02/2021
Approved by	Bryce Carter		18/12/2021
on behalf of	Beca Limited		

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Executive summary

Christchurch City Council (CCC) are planning to reallocate space on Lincoln Road to provide bus lanes in both directions. The scope of work extends across the Lincoln Road level crossing.

This is considered a change in use of the existing level crossing. This change has triggered the need to reassess the safety risk at this level crossing for pedestrians, cyclists, and motorists. KiwiRail have therefore requested a Level Crossing Safety Impact Assessment (LCSIA) to document this change in risk and any required mitigation treatments.
The Level Crossing Safety Score (LCSS) procedure assesses and scores the risk of each crossing point at each assessment stage of the project. The tables below detail the progression of the LCSS for the level crossings through the three stages of this LCSS, while aiming to achieve the two KiwiRail LCSIA Criteria.

LCSIA summary - Road crossing #2344

There were five recommendations made by the LCSIA Assessor for the road crossing to reduce the risk and achieve Criterion 1 and Criterion 2 as listed below:

1. Install a standalone active warning system that detects vehicles stopped on the far side of the rail corridor and warns other drivers on the near side not to cross.
2. Install gated RPX1 assemblies with flashing lights and bells on the southbound approach for two traffic lanes. This requires the raised central median width to be increased to a minimum 1.7m.
3. Install new asphalt crossing panel on the westbound line to address cracking and rutting in the pavement surface
4. Install RAIL X pavement marking on all approach lanes
5. Remark the cross hatched clear zone across new asphalt crossing panels

The updated existing LCSS is **MEDIUM**. The proposed design and future scores are both **MEDIUM-LOW** and achieves both **Criterion 1** and **Criterion 2**. Summary LCSS results are shown in

Table 1. ALCAM results for the crossing are shown in

Table 2.

A modified crash and incident history score has been used to estimate the risk of this category. This is based on site observations and locomotive engineer anecdotal evidence. Locomotive engineers stated on site that they have had near miss type incidents that are not recorded in the IRIS database. There were no red flag scenarios raised at this road crossing for any of the assessment stages.

Further road crossing considerations

Although the LCSS achieves both criteria, mitigating the potential for queued traffic on both the far side and nearside of the crossing is critical.

- Linking the traffic signals at Harman Street and Moorhouse Avenue with the level crossing is unlikely to reduced potential for stacking across the rail corridor.
  - Queued traffic originates from the two nearby signalised intersections on Harman Street and Moorhouse Avenue both over 100m away from the level crossing
  - KiwiRail have noted that queueing sometimes originates from other intersections further away
- Grade separation, although not recommended for this assessment, should be seriously considered by KiwiRail and CCC. This approach may lead to a more cost effective and safer solution in the long-term.

Table 1: LCSS summary results for the road crossing #2344

	Updated existing	Proposed design	Future score
Total LCSS	35 / 60	27 / 60	28 / 60
LCSS risk band	**Medium**	**Medium-low**	**Medium-Low**
Criterion met	-	**Criterion 1** **Criterion 2**	**Criterion 1** **Criterion 2**

Table 2: ALCAM summary results for the road crossing #2344

	Updated existing	Proposed design	Future score
ALCAM risk band	**MEDIUM LOW**	**MEDIUM LOW**	**MEDIUM LOW**
ALCAM risk score change (%)	-	**0%**	**+23%**
Fatal return period	**1982**	**2094**	**1689**

LCSIA summary – Eastern pedestrian crossing #2345

There were four recommendations made by the LCSIA Assessor for the road crossing to reduce the risk and achieve Criterion 1 and Criterion 2 as listed below:

1. Re-align the pedestrian crossing to cross the rail corridor at 90 degrees.
2. Install 3.5m wide strail crossings as shared paths to accommodate the high volume of pedestrians and cyclists
3. Install dual automatic gates (with emergency exit gate) and back-to-back pedestrian flashing lights and bells at all crossing points
4. Construct paths to new crossing locations with guide fencing to direct pedestrians and cyclists to the crossing location

The updated existing LCSS is **HIGH**. The proposed design and future scores are both **MEDIUM** and achieves **Criterion 2** only. Summary LCSS results are shown in Table 3. ALCAM results for the crossing are shown in Table 4.

Modified crash and incident history scores have been used to estimate the risk of this crossing

- There are no recorded incidents in the IRIS database
- However, anecdotal evidence from the KiwiRail Locomotive Engineers suggest that near miss events happen frequently
- This is due to the passive controls, long crossing distance, non-compliant crossing layout, and distracted users. A score of 8 has been used to represent the risk of the crossing.

Further eastern pedestrian crossing considerations

As the crossing has not met Criterion 1 for the proposed design or the future score, the solution is to grade separate it from the railway line.

- Grade separation (road over rail or rail over road) is not currently practicable on this section of the Main South Line. This is due to technical difficulties and cost constraints.
- KiwiRail have acknowledged the need to upgrade the entire section of Main South Line due to ageing infrastructure. Grade separation, from a Christchurch City corridor perspective, should be seriously considered in the long term to satisfy both safety and network efficiency perspectives.
- In the interim all recommendations listed above should be installed

There are concerns that realigning the pedestrian crossing and the associated **increased path of travel may result in high non-compliance rates**.

- The current crossing distance is 35m
- The crossing distance will be reduced to 15m but the **total distance pedestrians need to walk**, using the automatic gates, is approximately 58m.
- Pedestrian behaviour may require an alternative alignment with a smaller travel distance.
  - Pedestrians will always try to find the shortest route between any two points
  - The current design assessed in this LCISA is compliant with KiwiRail standards
  - There is a large risk that some pedestrians will avoid the fencing and use the current alignment within the road corridor
  - This will result in pedestrians **crossing the rail corridor without any control measures**
  - We recommend that the final design should compromise between a crossing that achieves a suitable skew angle and a path of travel distance like the current arrangement.

Table 3: LCSS summary results for the eastern pedestrian crossing #2345

	Updated existing	Proposed design	Future score
Total LCSS	56	33	39
LCSS risk band	High	Medium	Medium
Criterion met	-	**Criterion 2**	**Criterion 2**

Table 4: ALCAM summary results for the eastern pedestrian crossing #2345

	Updated existing	Proposed design	Future score
ALCAM risk band	**HIGH**	**MEDIUM HIGH**	**HIGH**
ALCAM risk score change (%)	**-**	**-91%**	**-80%**

LCSIA summary – Western pedestrian crossing #2346

There were four recommendations made by the LCSIA Assessor for the road crossing to reduce the risk and achieve Criterion 1 and Criterion 2 as listed below:

1. Re-align the pedestrian crossing to cross the rail corridor at an angle close to 90 degrees. The exact angle should be optimised between providing a perpendicular crossing and crossing length. This is due to the splay of the tracks on the west side of the road corridor.
2. Install 3.5m wide strail crossings as shared paths to accommodate the high volume of pedestrians and cyclists
3. Install dual automatic gates (with emergency exit gate) and pedestrian flashing lights and bells at all crossing points
4. Construct paths to new crossing locations with fencing to direct pedestrians and cyclists to the crossing location

The updated existing LCSS is **HIGH**. The proposed design score is **MEDIUM** and achieves **Criterion 2** only. The future score is **HIGH**. Summary LCSS results are shown in Table 3. ALCAM results for the crossing are shown in Table 4.

A modified SSSS of 24/30 has been used to estimate the risk of this crossing

- A person was fatally injured while a train was completing shunting movements
- No safety improvements have been made to the crossing since these events took place.

Further western pedestrian crossing considerations

As the crossing has not met Criterion 1 for the proposed design or the future score, the solution is to grade separate it from the railway line.

- Grade separation (road over rail or rail over road) is not currently practicable on this section of the Main South Line. This is due to technical difficulties and cost constraints.
- KiwiRail have acknowledged the need to upgrade the entire section of Main South Line due to ageing infrastructure. Grade separation, from a Christchurch City corridor perspective, should be seriously considered in the long term to satisfy both safety and network efficiency perspectives.
- In the interim all recommendations listed above should be installed

There are concerns that realigning the pedestrian crossing and the associated **increased path of travel may result in high non-compliance rates**.

- The current crossing distance is 38m
- The crossing distance will be reduced to 23m, but the **total distance pedestrians need to walk**, using the automatic gates, is approximately 70m.
- Pedestrian behaviour may require an alternative alignment with a smaller travel distance.
  - Pedestrians will always try to find the shortest route between any two points
  - The current design assessed in this LCISA is compliant with KiwiRail standards
  - There is a large risk that some pedestrians will avoid the fencing and use the current alignment within the road corridor
  - This will result in pedestrians **crossing the rail corridor without any control measures**
  - We recommend that the final design should compromise between a crossing that achieves a suitable skew angle and a path of travel distance like the current arrangement.

Table 5: LCSS summary results for the western pedestrian crossing #2346

	Updated existing	Proposed design	Future score
Total LCSS	57	38	40
LCSS risk band	High	Medium	High
Criterion met	-	**Criterion 2**	**Criterion 2**

Table 6: ALCAM summary results for the western pedestrian crossing #2346

	Updated existing	Proposed design	Future score
ALCAM risk band	**HIGH**	**HIGH**	**HIGH**
ALCAM risk score change (%)	**-**	**-91%**	**-80%**

1 Introduction

1.1 Purpose

Traditionally, the Australian Level Crossing Assessment Model (ALCAM) risk model developed in Australia has been used to assess existing and modified railway level crossings. The model identifies many key risk factors; however, it is only one methodology for assessing the risk level, and does not account for all data sources.

Kiwi Rail's Level Crossing Safety Impact Assessment (LCSIA) includes a new risk scoring system, the Level Crossing Safety Score (LCSS), rating the level crossing from 0 to 60, with 60 being a very unsafe crossing.

The LCSS consists of the following components:

- ALCAM Score (30 points)
- Crash and incident history (10 points)
- Site Specific Safety Score (10 points)
- Engineers' risk score assessment (10 points).

The LCSS of the crossing places it into a risk band as shown in Figure 1.

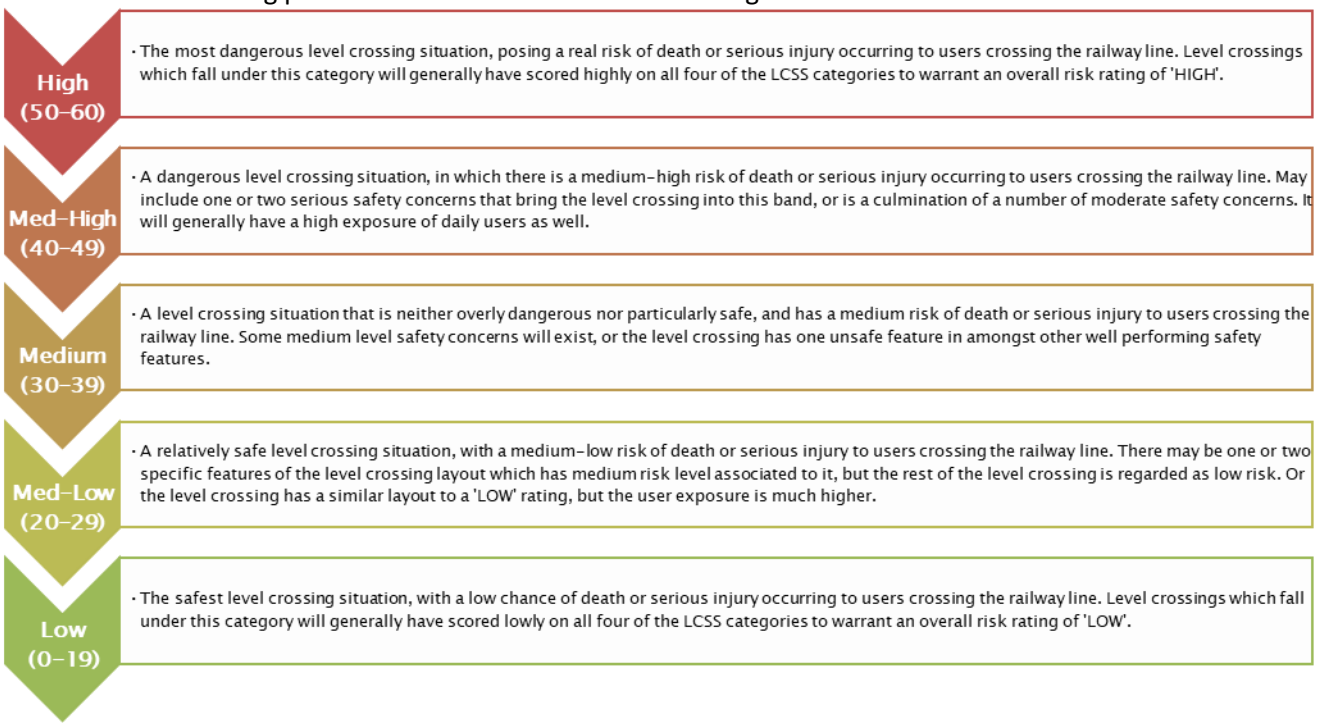


Figure 1: Level crossing safety score (LCSS) risk bands

1.2 LCSIA criteria

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

- Criterion 1: requires the Proposed Design and Future Score of a level crossing to achieve a 'Low' or 'Medium-Low' level of risk as determined by the LCSS.
- Criterion 2: requires the Proposed Design and Future Score of a level crossing to achieve an LCSS number (out of 60) lower than, or equal to, the Updated Existing LCSS number.

1.3 Level Crossing Safety Score stage assessment

A key component of an LCSIA is the risk scoring system called the Level Crossing Safety Score (LCSS). The LCSS assesses the risk at four stages as described below:

1. **Updated existing**: an LCSS of the existing level crossings conditions as found on site.

2. **Change in use:** an LCSS of the forecast ten-year user volumes (and demographic percentage of pedestrians in ALCAM) over the crossing in its Updated Existing state. **This assessment is not required** when the change is unlikely to result in increased demand at the crossing i.e. an infrastructure led or safety improvement project.
3. **Proposed design:** an LCSS that incorporates all the LCSIA Assessors recommendations and is intended to inform the design process and aims to achieve Criterion 1(of a "Low" or "Medium-Low" LCSS).
4. **Future score:** an LCSS that aims to achieve Criterion 1 ten years post opening. Includes a forecast increase in user numbers which may require an increase in the form of control.

1.4 The LCSIA safety review team

The Updated Existing LCSS was conducted by the following people as shown in Table 7.

Table 7: LCSIA safety review team personnel

Name	Organisation	Role
Ben Zmijewski	Beca	Accredited LCSIA assessor
Murray Fletcher	Beca	Senior Design Engineer

1.5 Process and Independence

The existing LCSS assessment was undertaken by the design team listed above. The design team also identified other existing safety problems at the site in order to help refine the proposed design. The accredited LSCIA assessor has had no previous involvement with the project.

1.6 Documents Provided

Background information, such as level crossing and road data, was obtained from several sources including KiwiRail and Waka Kotahi NZ Transport Agency. These have been used on the assumption that they are the latest available and are accurate for the purposes of this assessment.

2 Site details

2.1 General

The level crossing is located on Lincoln Road, Addington, Christchurch as shown in Figure 2.
The crossing is on the Mail South Line (MSL) at Rail KM 12.53. The current daily volume of rail traffic is 35 trains per day. Train speeds through the level crossing are a maximum 50km/h. There is a road crossing with two adjacent pedestrian crossings on either side of Lincoln Road.

The area is urban with a mix of residential, commercial, hospitality, and industrial businesses surrounding the level crossing. Hagley Park is located 170 north of the level crossing which is a major Christchurch recreational asset that contains sporting facilities such as netball courts. There are multiple schools located within a 500m radius of the level crossing. There are several off-street car parks near the level crossing as well as a multi-level on Hazeldean Road.

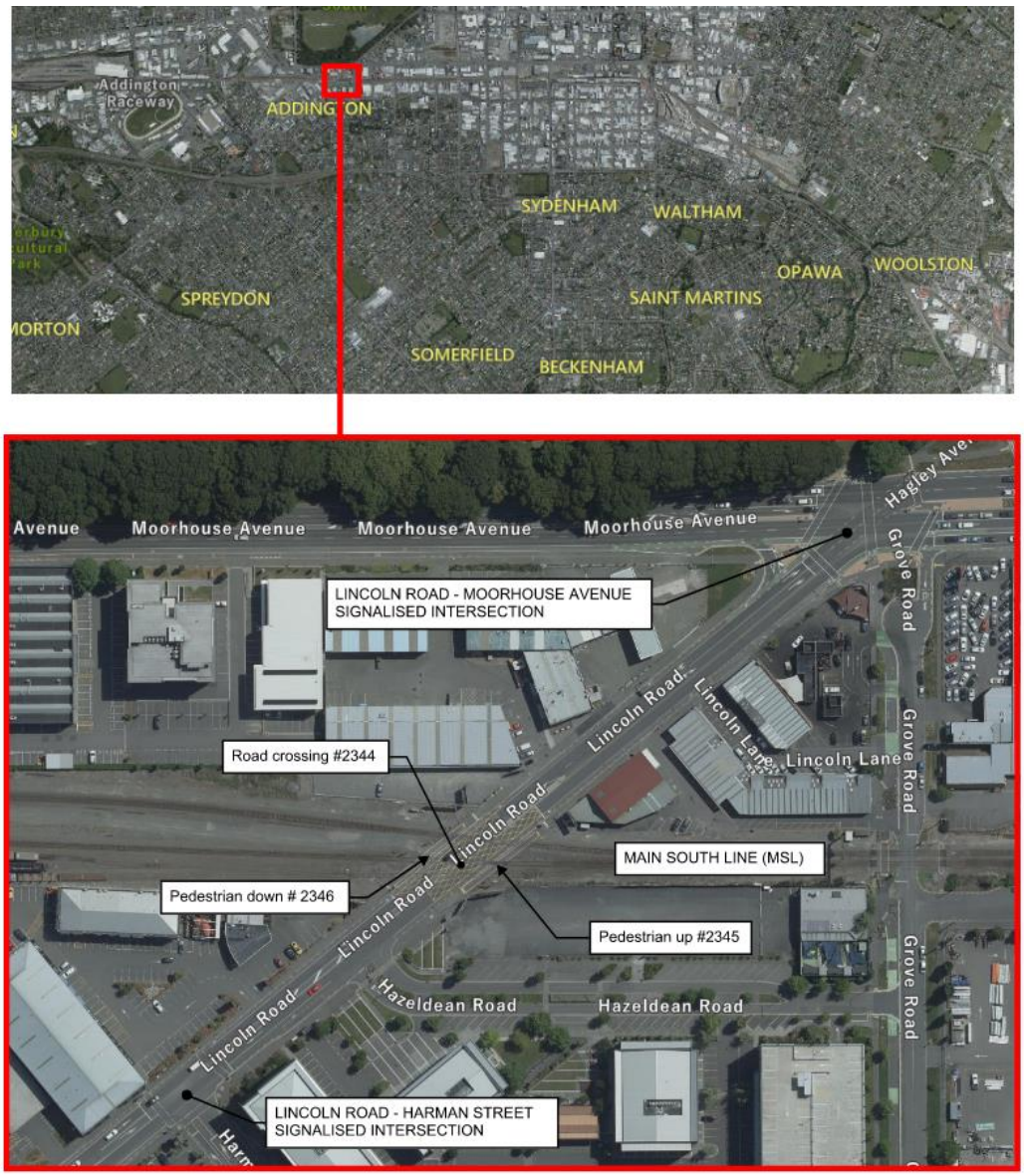


Figure 2: Lincoln Road level crossing site location, Christchurch

3 Site assessment

3.1 Site visit attendees

The site visit was undertaken between 3pm and 5pn on Wednesday 09 December 2020. The following people were in attendance as listed in Table 8. Bill Homewood, Road Controlling Authority engineer, was originally scheduled to represent Christchurch City Council but couldn't attend due to illness. Lachlan Beban represented CCC. Axel Wilke from ViaStrada was involved in the scheme design and was able to provide context around the project.

Table 8: Walnut Avenue LCSIA site visit attendees

Name	Organisation	Role
Ben Zmijewski	Beca	Accredited LCSIA assessor
Malcolm Thornton	KiwiRail	STE Manager Southern
Tom Shortt	KiwiRail	Signals Field Engineer
Ryan O'Sullivan	KiwiRail	Project Manager - Observer
Matthew Croton	KiwiRail	Locomotive Engineer
Tim Dunlop	KiwiRail	Operations Manager
Axel Wilke	ViaStrada	Scheme designer
Lachlan Beban	Christchurch City Council	Road Controlling Authority Engineer

3.2 Site observations

3.2.1 Site geometry

Lincoln Road crosses the Main South Line rail corridor at approximately 50 degrees. There are three tracks, two tracks carry through trains with the third train being exclusively for shunting movements. There is a shunting yard located directly west of Lincoln Road.

The Lincoln Road level crossing is situated near two major intersections and one minor intersection.

- Moorhouse Avenue - Lincoln Road: 125 m between the rail corridor and the intersection limit line
- Harman Street – Lincoln Road: 80m between the rail corridor and the intersection limit line
- There is also a give-way controlled intersection 40m south of the level crossing Hazeldean Road – Lincoln Road

The road approach has a single lane of traffic travelling in each direction. The road crossing length is 45m measured from the limit line to the end of the clear zone hatch. On Lincoln Road north of the rail corridor, there are two lanes to accommodate turning traffic. There are raised traffic islands on both approaches of the level crossing.

The vertical geometry is flat on the northbound approach. There is a slight rise in the road on the southbound approach. This seems to be impacting driver's ability to effectively judge whether there is enough space for them to clear the rail corridor before the vehicle queue. There is no risk of vehicles grounding out on either approach.

There are visibility restrictions caused by properties and billboards on both approaches. On the southbound approach visibility is restricted in the up track direction by billboards and fencing. The down track direction is partially obscured by stationary train carriages in the shunting yard.

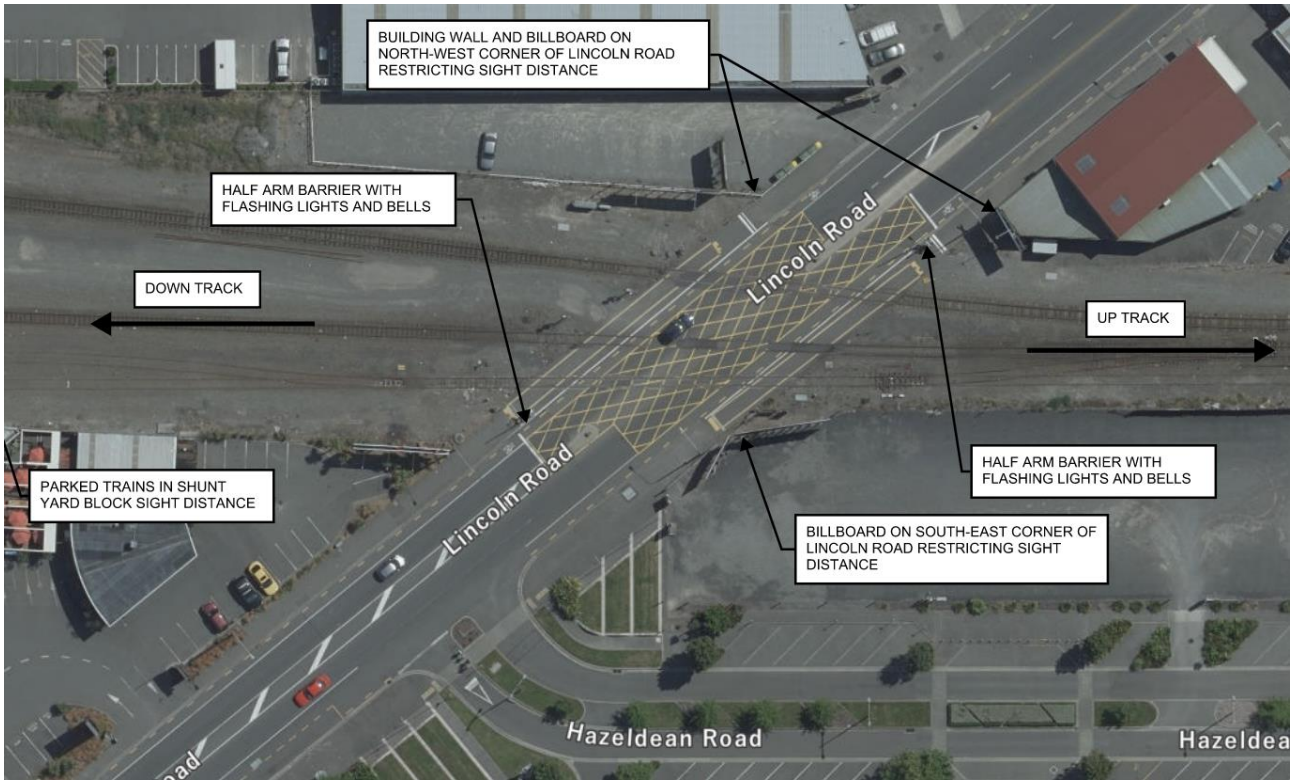


Figure 3: Lincoln Road level crossing key crossing features and visibility restrictions

3.2.2 Rail use

The Main South Line serves a high number of freight trains travelling between the Lyttleton port and the inland port. The current number of daily train movements is 35 as of December 2020.

The shunting yard is located just east of the level crossing on the southern line. Shunting movements occur frequently. The other two tracks are for through movements. KiwiRail Engineer's stated that reverse tracking can occur on these tracks although it is very infrequent. Locomotive engineers commented that trains travelling in opposite directions can mask each other.

Locomotive engineers travelling east have approximately 250m of sight distance due to a curve in the tracks. Engineers stated on site that it is very difficult to stop a heavily loaded train before the crossing if traffic was queued across the rail corridor.

Locomotive engineers travelling west have much greater sight distance as the track alignment is straight.

3.2.3 Road crossing use and volumes

The average weekday traffic and the percentage of heavy vehicles (%HV) of the four roads near the level crossing was obtained from the CCC traffic link counts database as shown in Table 9. The key road features are described below:

- Lincoln Road is a major arterial route in Christchurch. It has a 50km/h speed limit and is the most direct route connecting the central city to the southern motorway and state highway 75.
- There is a high proportion of heavy vehicles using Lincoln Road as evidenced by the data in Table 8.
- The Orange Line travels along Lincoln Road in both directions. In the southbound direction there is a bus stop on either side of the rail corridor. In the northbound direction there is a bus stop south of the Harman Street intersection.
- The road is also a popular commuter route with cycle lanes marked on both sides of the road. The Little River Link Cycleway runs along Grove Road just east of Lincoln Road.

- The two signalised intersections create large queues that frequently stack the rail corridor. Drivers were observed to frequently enter the rail corridor without being able to clear the other side as shown in
- Emergency breaking was also observed due to this issue however drivers normally ended up in the clear zone hatch area either within or directly under the half arm barrier. This can result in drivers driving onto the footpath to clear the rail corridor when a train is coming as shown
- Queueing also block the adjacent signalised intersections during busy peak hour times. This is a significant road safety issue for drivers and cyclists. Large queues also cause other safety issues related to reverse priority behaviour at commercial accessways. This behaviour has led several rear end and cycle crashes as evidenced in the CAS crash database.

These elements result in a complex and unsafe environment for all road users especially during peak hours.

Table 9: Traffic count data and road classification for roads near the Lincoln Road level crossing

	Road classification	Average weekday traffic	%HV	Year of count
Lincoln Road	Arterial	19,817	5.4	2019
Moorhouse Avenue	Regional	53,532	3.7	2020
Harman Street	Secondary collector	3,748	6.0	2016
Hazeldean Road	Secondary collector	975	2.7	2016

Figure 4: Traffic queues stacked across the multiple tracks within the rail corridor at the Lincoln Road level crossing

Figure 5: Vehicle observed driving onto the cycle lane and footpath to clear the rail corridor as a train travelling eastbound approaches the Lincoln Road level crossing

3.2.4 Level crossing controls and advance warning

The road crossing is controlled by single half arm barriers and flashing lights and bells. A railway crossing crossbuck sign is present on the southbound approach but is not mounted to the flashing lights and bells assembly. There is no crossbuck on the northbound approach.

Clear zone cross-hatching is marked across the length of the crossing. There is single level crossing ahead steam train signs on both approaches. There are no RAIL X road markings present on either approach.

3.2.5 Pedestrian crossings

There are formalised pedestrian crossings on both sides of Lincoln Road. Both crossings cross the rail corridor at 50 degrees with a crossing length of 33m.

Visibility up track and down track is restricted for both pedestrian crossings. It is not possible to get clear sight distance when standing on the warning tactiles when looking up track from several of the crossing points. Pedestrians must walk past the flashing lights and bells assembly and enter the rail corridor before being able to see if a train is coming.

Both pedestrian crossing points have passive measures installed such as WX8 ‘LOOK FOR TRAINS’ and tactile pavers with yellow crosswalk lines. Each pedestrian crossing has one approach that has an adjacent flashing lights and bells assembly and one approach that does not.

The tactiles are installed after the flashing lights and bells assembly due to the skew of the crossing as shown in Figure 6 . A 150mm white holding line has been painted the footpath to help warn pedestrians of the correct stopping point.

There are large flange gaps on both pedestrian crossings that present a trip hazard to pedestrians. The flange gaps present an entrapment hazard for wheelchair users and e-scooter riders. The westbound line (middle track) asphalt panel has lifted above the surrounding surface. This is a tripping hazard on the eastern pedestrian crossing and adds to the likelihood of a wheeled pedestrian getting stuck.

Figure 6:Tactile indicators installed behind the flashing lights and bells assembly on the eastern crossing

Figure 7: Western pedestrian crossing with passive warning control layout shown. There is no adjacent flashing lights and bells assembly on this approach

Figure 8: Pedestrian sight line from the western pedestrian crossing looking up track (east) severely restricted by property

Figure 9: Pedestrian sight line from the western pedestrian crossing looking down track (west) is limited by the curve in the rail track

3.2.6 Pedestrian and cyclist volumes

Two full day pedestrian and cyclist surveys were carried out on Wednesday 02 December and Thursday 03 December 2020 from 6:00am to 8:00pm. The weather was fine both days.

The maximum volume of pedestrians and cyclists travelling over the level crossing over both days is shown in Table 10. Cyclists travelling on Lincoln Road were counted and added to the total vehicle volume for the ALCAM assessment.

- During the site visit we observed several pedestrians crossing Lincoln Road diagonally through the cross hatch area and using the raised central median as a stopping point.
- The KiwiRail Locomotive Engineer, Matthew Croton, noted on site that they frequently saw pedestrians make non-compliant crossings daily.
- Pedestrians have been also been known to be get stuck within the rail corridor between trains travelling in opposite directions. Distraction through mobile phones, and headphones was a major concern for all KiwiRail staff on site.

Table 10: Pedestrian survey results at the Lincoln Road level crossing (02 and 03 December, 2020)

	Western pedestrian crossing	Eastern pedestrian crossing
Total daily volume	532	299
Peak hour	07:30-08:30	17:00-18:00
Peak hour volume	104	40

3.2.7 General site condition

The crossing panels are constructed of asphalt. The eastbound line and the siding line have recently been replaced and are in good condition. The westbound line (middle track) has not been replaced and the asphalt surface is lifting creating a tripping hazard on the eastern pedestrian crossing.

There is some graffiti on signs as shown in Figure 10.

The road surface on approach to the crossing in good condition. The clear hatch cross zone is not faded and is easily recognisable but has not been repainted on the new asphalt surface.

Figure 10: New asphalt panel on the siding line. Lifting of the asphalt surface is visible on the westbound lane (middle track). Note the graffiti on the look for trains signs.

Figure 11: Southbound approach surface in good condition

3.3 Current safety issues

The following issues were identified as the main safety problems at the Walnut Avenue level crossing:

- **Extremely frequent queuing across the rail corridor** – adjacent signalised intersections cause large queues to develop which block multiple tracks across the rail corridor as shown in Figure 12
- **Drivers stopping within the clear zone marked area** - drivers have difficulty judging whether there is enough space to cross the rail corridor due to the large crossing distance and vertical elevation difference north of the rail corridor
- **High volume of traffic in a complex environment** - large volume of road traffic, cyclists, and pedestrians, interacting with a train volume of 35 trains per day at a level crossing
- **Poor pedestrian warning of rail crossing** - many pedestrians distracted by phones and listening to music, long crossing distance, and two approaches with adjacent flashing lights and bells only
- **Restricted visibility** – due to the skew angle of the track, and sight restrictions up track and down track due to buildings, billboards and stationary trains in the nearby shunting yard
- **Tripping and entrapment** hazards - large flange gaps and lifting asphalt panel on the middle track which creates both a

Figure 12: Queues forming at the Lincoln Road – Moorhouse Avenue signalised intersection stacking across multiple tracks at the Lincoln Road level crossing

Figure 13: Vertical rise north of the rail corridor makes it difficult for drivers to judge whether there is enough space to clear the rail corridor when queues develop

4 LCSS stage assessment

4.1 Updated existing

The updated existing stage assessment incorporates the conditions as found on site on Wednesday 09 December 2020. This assessment factors in current user volumes, most recent crash and incident history scores, and engineer risk scores.

4.2 Change in use

A **change in use stage assessment is not required.** The project is an infrastructure led project by Christchurch City Council. The bus lanes are being installed on both directions of Lincoln Road and are unlikely to cause an increase in pedestrians, cyclists, or road traffic.
The bus lanes are being installed to increase the journey time reliability of bus services that use Lincoln Road. The southbound approach will have a dedicated bus lane and a general traffic lane. The preliminary design is shown in Figure 14.

4.3 Proposed design

The proposed design stage assessment aims to achieve Criterion 1 – a “Low” or “Medium-Low” LCSS.

Road crossing

- Install a standalone active warning system that detects vehicles stopped on the far side of the rail corridor and warns other drivers on the near side not to cross.
- Install new asphalt crossing panel on the westbound line to address cracking and rutting in the pavement surface
- Install RAIL X pavement marking on all approach lanes
- Remark the cross hatched clear zone across new asphalt crossing panels

Pedestrian crossings

- Re-align both pedestrian crossings to cross the rail corridor at a more perpendicular angle. The exact angle should be optimised between providing a perpendicular crossing and crossing length. This is due to the splay of the tracks on the west side of the road corridor.
- Install 3.5m wide strail crossings as shared paths to accommodate the high volume of pedestrians and cyclists
- Install dual automatic gates (with emergency exit gate) and pedestrian flashing lights and bells at all crossing points
- Construct paths to new crossing locations with fencing to direct pedestrians and cyclists to the crossing location

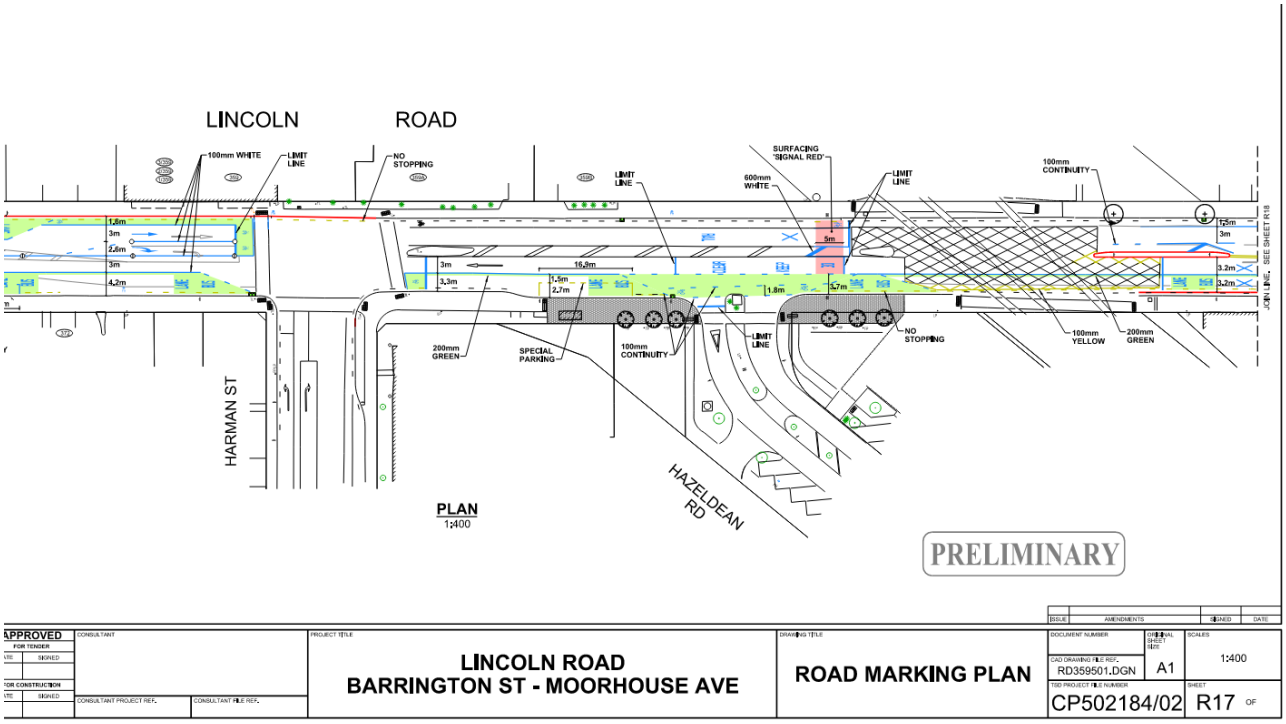


Figure 14: Proposed design for bus lanes on Lincoln Road

4.4 Future score

The future score stage assessment assumes all treatments in the proposed design are implemented. The risk is calculated 10 years from the year of this assessment, and takes into account the following:

- An increase of 3% per annum in road traffic to 26,771 vehicles per day (including on road cyclists). Heavy vehicle percentage is assumed to remain at 5.4%
- Pedestrian volumes are assumed to increase at 3% per annum for both pedestrian crossings.
  - Eastern pedestrian crossing 390 pedestrians per day with a peak volume of 52
  - Western pedestrian crossing 694 pedestrians per day with a peak volume of 136
-
- We have assumed that the number of trains will increase to 60 trains per day. This estimated number is based on conversations with KiwiRail staff during the site visit who informed us of the following developments:
- A new Synlait milk factory in Bankside is currently being developed which is likely to increase freight movements
- A new KiwiRail mechanical depot east of the Lincoln Road level crossing is also under construction and is expected to be completed in the next 12-18 months
- An increase in the importance of rail freight as New Zealand moves away from carbon intensive forms of transport

5 Road crossing #2344 Level Crossing Safety Score assessment

5.1 ALCAM assessment – road crossing #2344

The ALCAM risk score and risk band comes from the LXM database which includes scores and risk bands for all public and most private level crossings in Australia and New Zealand.

The updated existing score represents the risk as observed during the site visit alongside previous data already entered in the ALCAM system. The ALCAM score represents 30 points out of the 60 LCSS points. Table 11 shows the list of changes made in the LXM database for each assessment stage for the crossing.

The updated existing changes should be considered to improve the accuracy of the LXM database.

- These changes are based on recent site observations (December 2020)
- This will assist KiwiRail with improvements to the ALCAM database and allow for better safety prioritisation works on their network
- These changes are duplicated in Appendix A

Table 11: Road crossing #2344 ALCAM assessment

Assessment stage	ALCAM LCSS score ALCAM risk band	Fatality return period	Risk % change	Comments
Updated existing	**10 / 30** **Medium-low**	**1982**	-	**Crossing location detail** • Surrounds – urban **Rail traffic** • 35 train movements daily • Volume date 09/12/2020 **Details** • Road width – 3.8m • Road clearance width – 6m • Road profile humped (minor) • AADT – 20518 • Heavy vehicle percentage – 5.4% • Heavy vehicle percentage – not estimated • AADT date – 01/01/2019 • AADT measured • Panel surface condition – fair • Panel surface material – asphalt • Vehicle routes – bus route • Shunting over crossing - present **Sighting** • Immediate left approach surface material – asphalt • Immediate right approach surface material – asphalt **Characteristics** • Level of service F – forced flow • Traffic known to queue back • Visual impediments which may impact the visibility of an oncoming train

Change in use	Change in use assessment not required			
Proposed design	**10 / 30** **Medium-low**	**2094**	**0%**	**Details** • Panel surface condition – good • Shortest warning time – 20 seconds **Control measures** • Rail-X pavement marking • Detectors in crossing conflict zone • Coordinate with adjacent traffic signals
Future score	**11 / 30** **Medium-low**	**1689**	**23%**	**Rail traffic** • 60 train movements daily • Volume date 09/12/2030

5.2 Crash and incident history score – road crossing #2344

This score is based on the number of incidents reported in the KiwiRail IRIS database, supported by the number of crashes in the New Zealand CAS database. The most recently available 10-year history (2010 - 2019) of IRIS and CAS data recorded at the Lincoln Road crossing is detailed in Table 12.

There were no crashes in the CAS database that related to interactions with trains or nearby rail infrastructure. There were several rear end crashes and cyclist-vehicle crashes within a 50m radius of the crossing. These crashes are largely related to queues forming from the signalised intersections at Moorhouse Avenue and Harman Street.

It should be noted that the databases used for this section of the assessment provide a very limited view of near miss incidents at this crossing. A modified crash and incident history score has been used to estimate the risk at this crossing.

KiwiRail Locomotive Engineers stated on site that they do not record all near miss incidents at this crossing. This is due to:

- the sheer number of similar incidents they encounter at this crossing that these incidents have become 'normalised'
- they are focused on the next crossing on Grover Road and Selwyn Street

The score at different stages of the assessment are shown in

Table 13.

Table 12: IRIS and CAS data for the road crossing #2344

Data base	Incident type	No.	Incident description	Score
IRIS	NCHV	1	Waste management truck travelling across level crossing while alarms were operating	1 x 3
-	-	3	During the site visit, all observers witnessed several incidents over a one hour period that would qualify as queueing near miss incidents. A modified crash and incident history score has been used to estimate this risk.	3
			Total	**6**

Table 13: Crash and incident scoring summary for the road crossing #2344

Category	Updated existing	Proposed design	Future score	Comments
Road crossing #2344	**6/10**	**2/10**	**2/10**	The proposed design will decrease the chance of queued vehicles and the frequency of near miss events occurring at the Lincoln Road level crossing.

5.3 Site Specific Safety Score – road crossing #2344

This site-based score aims to analyse elements of the site layout that are not well covered or missing from the ALCAM risk rating. The urban road scoring scheme was used to assess the level crossing as the posted speed limit is less than 70km/h.

Each crossing has been assessed at the updated existing, proposed design, and future score stage as shown in Table 14. There were no red flag scenarios for the road crossing.

Table 14: SSSS assessment for the road crossing #2344

Assessed category	Updated existing	Proposed design	Future score	Comments
Crossing controls	**1/5**	**1/5**	**1/5**	The road crossing currently has the highest form of protection with half arm barriers and flashing lights and bells.
Queuing back from a bisecting intersection	**6/6**	**2/6**	**2/6**	Two adjacent signalised intersections - Moorhouse Avenue and Harman Street) cause queues to form across the rail corridor frequently Proposed design incorporates flashing lights and bells on one approach only due to the addition of the bus lane. A standalone active warning system is proposed to help provide drivers with more information to prevent queueing on the far side of the level crossing. This treatment may still result in some queueing across the rail corridor. Implementation of automatic gates will require linking rail signals to increase the shortest warning time to 20 seconds.
Short stacking / grounding out	**10/10**	**6/10**	**6/10**	Buses and HCV were witnessed stacking across the rail corridor due to queues during the site visit. Although HCV cannot by themselves block the rail corridor this score has been added to reflect the risk of a HCV or bus being hit by a train. Providing a dedicated bus lane with the active warning system should result in decreased frequency of this
Adjacent accessways / side-roads & bisecting	**6/6**	**6/6**	**6/6**	The bisecting signalised intersections are not complex for road drivers as the signals make them easy to navigate. However, given the extent of queueing that these intersections cause and the subsequent demand on the

complex intersections				driver to negotiate the queues the maximum score has been assigned. The proposed design will not have an effect on this score
Non-compliance	**3/3**	**2/3**	**2/3**	Vehicles queue on clear zone hatched area frequently
Total score	**26/30**	**17/30**	**17/30**	
Red flag / modified SSSS	-	-	-	No red flag scenarios
SSSS	**9/10**	**6/10**	**6/10**	

5.4 Engineers Site Specific Safety Score – road crossing #2344

This risk score reflects the level of crash risk that Locomotive Engineers (train drivers) and RCA engineers give to each railway crossing compared with other crossings they encounter regularly within their jurisdiction.

The Lincoln Road level crossing gathered scores from the following people. The scores for each assessment stage and their comments on the existing crossing and the proposed design are provided in Table 15.

- Engineer scores for KiwiRail were provided by Matthew Croton
- Engineer scores for the RCA, Christchurch City Council, were provided by Lachlan Beban
- The future score has remained the same as the proposed design score

Table 15: Engineers' risk SSSS crossing #2344

Category	Updated existing	Proposed design	Future score	Comments
KiwiRail	**10/10**	**8/10**	**8/10**	KiwiRail representative noted the frequent occurrence of queues from adjacent intersections having difficulty clearing the level crossing. LE's also noted that they are unable to stop at the crossing when trains are fully loaded. An active warning system to help warn drivers not to cross will mitigate the problem somewhat although compliance may still be an issue. There were also concerns about how effectively the active warning system would work as it would be a new system, although there are similar systems in place around New Zealand.
RCA (CCC)	**5/5**	**4/5**	**4/5**	CCC noted the same concerns as KiwiRail. Peak hour volumes are causing LOS F traffic flow, and this leads to driver's making poor decisions about gaps. The long crossing distance was noted as an issue in entering the clear hatch zone. An active warning system to help warn drivers not to cross will mitigate the problem somewhat although compliance may still be an issue.
Total	**10/10**	**9/10**	**9/10**	

5.5 LCSS summary results - road crossing #2344

The LCSS results for the road crossing are shown in Table 16. The following recommendations in the proposed design **will achieve Criterion 1 and Criterion 2.**

- Although the LCSS achieves both criteria, mitigating queued traffic is critical
- Difficulties in linking the adjacent traffic signal controllers with the rail signal controllers is unlikely to resolve the issue. KiwiRail also noted other limitations with this solution i.e. queueing sometimes originates from intersections further away.
- Installation of the standalone warning system will provide motorists with more information about when it is safe to cross the level crossing.
- Implementation of a dedicated bus lane will also have multiple safety benefits
  - Provide a pseudo-escape area for the southbound approach. While this is not the primary purpose of the bus lane it will help to reduce the likelihood of a collision if a vehicle needs to clear the rail corridor quickly.
  - Remove buses from queued traffic thereby reducing the change of a passenger bus being stuck on the rail corridor

Lincoln Road - road crossing recommendations

- Install a standalone active warning system that detects vehicles stopped on the far side of the rail corridor and warns other drivers on the near side not to cross.
- Install gated RPX1 assemblies with flashing lights and bells on the southbound approach for two traffic lanes. This requires the raised central median width to be increased to a minimum 1.7m.
- Install new asphalt crossing panel on the westbound line to address cracking and rutting in the pavement surface
- Install RAIL X pavement marking on all approach lanes
- Remark the cross hatched clear zone across new asphalt crossing panels

Table 16: LCSS summary scores for the road crossing #2344

Assessed category	Updated existing	Proposed design	Future score
ALCAM score	**10/30**	**10/30**	**11/30**
Crash and incident history score	**6/10**	**2/10**	**2/10**
Site specific safety score	**9/10**	**6/10**	**6/10**
Engineers' risk score	**10/10**	**9/10**	**9/10**
Total LCSS	**35/60**	**27/60**	**28/60**
LCSS risk band	**MEDIUM**	**MEDIUM-LOW**	**MEDIUM-LOW**
Criterion met	**-**	**Criterion 1** **Criterion 2**	**Criterion 1** **Criterion 2**

6 Eastern pedestrian crossing #2345 Level Crossing Safety Score assessment

6.1 ALCAM assessment – eastern pedestrian crossing #2345

The ALCAM risk score and risk band come from the LXM database which includes scores and risk bands for all public and most private level crossings in Australia and New Zealand.

The updated existing score represents the risk as observed during the site visit alongside previous data already entered in the ALCAM system. The ALCAM score represents 30 points out of the 60 LCSS points. Table 17 shows the list of changes made in the LXM database for each assessment stage for the crossing.

The updated existing changes should be considered to improve the accuracy of the LXM database.

- These changes are based on recent site observations (December 2020)
- This will assist KiwiRail with improvements to the ALCAM database and allow for better safety prioritisation works on their network
- These changes are duplicated in Appendix A

Table 17: Western pedestrian crossing #2345 ALCAM assessment

Assessment stage	ALCAM LCSS score ALCAM risk band	Risk % change	Comments
Updated existing	**29 / 30** **High**	-	**Crossing location detail** • Surrounds - Urban **Rail traffic** • 35 train movements daily • Volume date 09/12/2020 **Details** • Daily volume – 299 • Peak hourly volume – 40 • Volume date 09/12/2020 **Sighting** • Pedestrian crossing distance – 31.9m • Path over tracks - fair **Characteristics** • Presence of adjacent distractions (visual) • Proximity to siding / shunting yard – less than 100m • Ambient noise level / audibility of alarm – train and/or alarm is only partially audible to pedestrians due to background noise • Conspicuity of pedestrian control – some wear and tear but the message is understandable • Visibility of pedestrian control – not visible from the approach • likelihood of vandalism to controls – some history of vandalism negating controls • Low proportion of wheel pedestrians (cyclists, prams, wheelchairs) < 25% • Angle of crossing – 30 to 70 degrees • Condition of crossing – path in poor condition • Masking of trains – first train masks second train occasionally

			Control measures • Adjacent boom gates and audio – removed • Fault reporting number – removed • Path lighting at crossing – removed • Maintenance of vegetation - removed
Change in use	**Change in use assessment not required**		
Proposed design	**20 / 30** **Medium-high**	**-91%**	**Rail** • Longest warning time –25sec • Shortest warning time – 20sec **Sighting** • Pedestrian crossing distance – 19.3m • Maze condition left – good • Maze condition right – good • Path over tracks surface condition - good • Path over tracks – surface material - rubber **Characteristics** • Presence of adjacent distractions (visual) – crossing stands out • Ambient noise level – train or alarm is easily audible to pedestrians over background noise • Conspicuity of pedestrian control – some wear and tear but the message is understandable • Visibility of pedestrian control – easily observed from the approach • Angle of crossing – 70-90 degrees • Condition of crossing – Maze fencing in good condition, path in good condition • Crossing fully meets Waka Kotahi NZ Transport Agency TCD Part 9 requirements • No know visual impediments which may impact the visibility of approaching trains **Controls** • Automatic gates – added • Path – removed • Visual and audible alarm – added • Signs only – removed • Emergency egress (with latch (including holding enclosure) • Guide fencing - added • Funnel pathway – added • Adjacent corridor fencing – added • Flange gap filler - added
Future score	**26 / 30** **High**	**-80%**	Changes to the future score assessment based on the proposed design assessment **Rail traffic** • 60 train movements daily • Volume date 09/12/2030 **Details** • Daily volume – 390 • Peak hourly volume – 52 • Volume date 09/12/2030

6.2 Crash and incident history score – eastern pedestrian crossing #2345

This score is based on the number of incidents reported in the KiwiRail IRIS database, supported by the number of crashes in the New Zealand CAS database. The most recently available 10-year history (2010 - 2019) of IRIS and CAS data recorded at the crossing is shown in Table 18Table 24.

It should be highlighted that at this crossing the locomotive engineers state that they encounter frequent near miss incidents. These events are not recorded in the database for a variety of reasons explained further in Section 6.4.

- A score of 8 was used to represent the number of near miss incidents at the crossing. It is assumed that happen frequently based on LE comments.

The score at different stages of the assessment are shown in Table 19

Table 18: IRIS and CAS data (2010-2019) for the eastern pedestrian crossing #2345

Data base	Incident type	No.	Incident description	Score
None	None	0	No recorded crashes in CAS or IRIS. However, anecdotal evidence from the KiwiRail Locomotive Engineers suggest that near miss events happen frequently. This is due to the passive controls, long crossing distance, non-compliant crossing layout, and distracted users. A score of 8 has been used to represent the risk of the crossing.	**8**
			Total	**8**

Table 19: Crash and incident scoring summary for the eastern pedestrian crossing #2345

	Updated existing	Proposed design	Future score	Comments
Eastern pedestrian crossing #2345	**10/10**	**3/10**	**3/10**	Passive signs, poor sightlines, crossing does not stan LE being unable to stop prior to the crossing, and shunting movements have contributed to a fatal incident and two near misses. Automatic gates with flashing lights and bells and realigning the crossing will help to make people aware that a train is approaching the crossing. However, the extra distance resulting from crossing realignment may result in low compliance rates. Pedestrians who do not use this facility would be crossing the road without any pedestrian controls (passive or active) or adjacent road controls on the northbound approach.

6.3 Site Specific Safety Score – eastern pedestrian crossing #2345

This site-based score aims to analyse elements of the site layout that are not well covered or missing from the ALCAM risk rating. The pedestrian scoring scheme was used to assess the crossing as per Level Crossing Risk Assessment Guidance (2020) Version 3, Appendix 4.

The crossing is scored on its weakest approach. Each crossing has been assessed at the updated existing, proposed design, and future score stage as shown in Table 20. There were no red flag scenarios at this crossing.

Table 20: SSSS assessment for the western pedestrian crossing #2345

Assessed category	Updated existing	Proposed design	Future score	Comments
Crossing type	**10/10**	**1/10**	**1/10**	Poor visibility due to angle of crossing and adjacent building walls. Automatic gates and realigning the crossing will reduce the risk significantly.
Distraction / inattention	**5/5**	**3/5**	**3/5**	There is evidence for a very high level or distraction from LE due to phones, nearby music. The adjacent road environment is also very busy during peak hour and the crossing does not stand out. Automatic gates with flashing lights and bells will raise awareness of the crossing so that users cannot physically enter the rail corridor when there is a train approaching. However, the extra distance resulting from crossing realignment may result in low compliance rates. Pedestrians who do not use this facility would be crossing the road without any controls (passive or active)
Flange gap wheel entrapment for wheeled pedestrians	**4/5**	**0/5**	**0/5**	Crossing panels have all been replaced on two tracks recently. The crossing panel that has not been replaced has asphalt that is lifting and causing a trip hazard. STRAIL surfaces and realigning the crossing will mean that wheel entrapment is not a concern for pedestrians.
Volume of 'vulnerable' user	**3/6**	**3/6**	**3/6**	The survey was carried out after the school term in December 2020 had ended. We estimate the number of vulnerable users, mostly school children to be at 51-100 per day.
Cycle patronage	**2/4**	**2/4**	**2/4**	Cycle lanes are provided on the road. However, the footpath connects to the cycle crossing at Moorhouse Avenue and cyclists have been noted to ride along the footpath. We estimate up to 50 cyclist per day use the crossing
Total score	**24/30**	**9/30**	**9/30**	
Red flag / modified SSSS	**-**	**-**	**-**	
SSSS	**8/10**	**3/10**	**3/10**	

6.4 Engineers Site Specific Safety Score – eastern pedestrian crossing #2345

This risk score reflects the level of crash risk that Locomotive Engineers (train drivers) and RCA engineers give to each railway crossing compared with other crossings they encounter regularly within their jurisdiction.

The Lincoln Road level crossing gathered scores from the following people. The scores for each assessment stage and their comments on the existing crossing and the proposed design are provided in Table 21

- Engineer scores for KiwiRail were provided by Matthew Croton
- Engineer scores for the RCA, Christchurch City Council, were provided by Lachlan Beban
- The future score has remained the same as the proposed design score

Table 21: Engineers' risk SSSS crossing #2345

Category	Updated existing	Proposed design	Future score	Comments
KiwiRail	**10/10**	**8/10**	**8/10**	KiwiRail LE noted the passive signs, poor sight distance for pedestrians, and being unable to stop in time if they have a heavy load as major risk factor. The LE stated that they have frequent near miss incidents at this crossing which are generally not recorded in IRIS. Providing automatic gates that increase the total path of travel may mean that users avoid the facility and cross the rail corridor on the road carriageway.
RCA (CCC)	**4/5**	**2/5**	**2/5**	The RCA engineer noted that the crossing does not grab the attention of users, especially approaches without adjacent flashing lights and bells. The RCA engineer is confident that automatic gates will reduce the risk of an incident occurring at this crossing.
Total	**9/10**	**7/10**	**7/10**	

6.5 LCSS summary results – eastern pedestrian crossing #2345

The LCSS results for the road crossing are shown in Table 22Table 16. The following recommendations in the proposed design **will achieve Criterion 2 only** in both the proposed design and future assessments.

- Due to the high number of pedestrian movements and train movements the risk of an at grade crossing is high regardless of the type of control
- Grade separation (road over rail or rail over road) is not currently practicable on this section of the Main South Line. This is due to technical difficulties and cost constraints.
- KiwiRail have acknowledged the need to upgrade this entire section through Christchurch eventually. Grade separation should be seriously considered from both safety and network efficiency perspectives.

Lincoln Road – eastern pedestrian crossing recommendations

- Re-align both pedestrian crossings to cross the rail corridor at 90 degrees
- Install 3.5m wide strail crossings as shared paths to accommodate the high volume of pedestrians and cyclists
- Install dual automatic gates (with emergency exit gate) and pedestrian flashing lights and bells at all crossing points
- Construct paths to new crossing locations with fencing to direct pedestrians and cyclists to the crossing location

There are concerns that realigning the pedestrian crossing and the associated **increased path of travel may result in high non-compliance rates**.

- The current crossing distance is 35m
- The crossing distance will be reduced to 15m, but the **total distance pedestrians need to walk**, using the automatic gates, is approximately 58m.
- Pedestrian behaviour may require an alternative alignment with a smaller travel distance.
  - Pedestrians will always try to find the shortest route between any two points
  - The current design assessed in this LCISA is compliant with KiwiRail standards
  - There is a large risk that some pedestrians will avoid the fencing and use the current alignment within the road corridor
  - This will result in pedestrians **crossing the rail corridor without any control measures**
  - We recommend that the final design should compromise between a crossing that achieves a suitable skew angle and a path of travel distance like the current arrangement.

Table 22: LCSS summary scores for the eastern pedestrian crossing #2345

Assessed category	Updated existing	Proposed design	Future score
ALCAM score	**29/30**	**20/30**	**26/30**
Crash and incident history score	**10/10**	**3/10**	**3/10**
Site specific safety score	**8/10**	**3/10**	**3/10**
Engineers' risk score	**9/10**	**7/10**	**7/10**
Total LCSS	**56/60**	**33/60**	**39/60**
LCSS risk band	**HIGH**	**MEDIUM**	**MEDIUM**
Criterion met	**-**	**Criterion 2**	**Criterion 2**

7 Western pedestrian crossing #2346 Level Crossing Safety Score assessment

7.1 ALCAM assessment – western pedestrian crossing #2346

The ALCAM risk score and risk band come from the LXM database which includes scores and risk bands for all public and most private level crossings in Australia and New Zealand.
The updated existing score represents the risk as observed during the site visit alongside previous data already entered in the ALCAM system. The ALCAM score represents 30 points out of the 60 LCSS points.
Table 23 shows the list of changes made in the LXM database for each assessment stage for the crossing.

The updated existing changes should be considered to improve the accuracy of the LXM database.

- These changes are based on recent site observations (December 2020)
- This will assist KiwiRail with improvements to the ALCAM database and allow for better safety prioritisation works on their network
- These changes are duplicated in Appendix A

Table 23: Western pedestrian crossing #2346 ALCAM assessment

Assessment stage	ALCAM LCSS score ALCAM risk band	Risk % change	Comments
Updated existing	**30 / 30** **High**	-	Changes to the updated existing assessment from the published details stored in the ALCAM LXM system. **Crossing location detail** • Surrounds - Urban **Rail traffic** • 35 train movements daily • Volume date 09/12/2020 **Details** • Daily volume – 532 • Peak hourly volume – 104 • Volume date 09/12/2020 **Sighting** • Pedestrian crossing distance – 33.4m **Characteristics** • Presence of adjacent distractions (visual) – crossing does not stand out • Proximity to siding / shunting yard – less than 100m • Ambient noise level / audibility of alarm – train and/or alarm is only partially audible to pedestrians due to background noise • Conspicuity of pedestrian control – some wear and tear but the message is understandable • Visibility of pedestrian control – not visible from the approach • Low proportion of wheel pedestrians (cyclists, prams, wheelchairs) < 25% • Angle of crossing – 30 to 70 degrees • Condition of crossing – path in poor condition • Crossing partially meets Waka Kotahi NZ Transport Agency TCD Part 9 requirements

			• Masking of trains – first train masks second train occasionally **Control measures** • Adjacent boom gates and audio – removed • Fault reporting number – removed • Path lighting at crossing – removed • Maintenance of vegetation - removed
Change in use	**Change in use assessment not required**		
Proposed design	**25 / 30**	**-91%**	**Rail** • Longest warning time –25sec • Shortest warning time – 20sec **Sighting** • Pedestrian crossing distance – 24m • Maze condition left – good • Maze condition right – good • Path over tracks – rubber **Characteristics** • Presence of adjacent distractions (visual) – crossing stands out • Ambient noise level – train or alarm is easily audible to pedestrians over background noise • Conspicuity of pedestrian control – complete and in good condition • Visibility of pedestrian control – easily observed from the approach • Angle of crossing – 70-90 degrees • Condition of crossing – Maze fencing in good condition, path in good condition • Crossing fully meets Waka Kotahi NZ Transport Agency TCD Part 9 requirements • No know visual impediments which may impact the visibility of approaching trains **Controls** • Automatic gates – added • Path only - removed • Visual and audible alarm – added • Signs only – removed • Emergency egress (with latch (including holding enclosure) • Funnel pathway – added • Adjacent corridor fencing – added • Flange gap filler - added
Future score	**27 / 30** **High**	**-80%**	Changes to the future score assessment based on the proposed design assessment **Rail traffic** • 60 train movements daily • Volume date 09/12/2030 **Details** • Daily volume – 694 • Peak hourly volume – 136 • Volume date 09/12/2030

7.2 Crash and incident history score – western pedestrian crossing #2346

This score is based on the number of incidents reported in the KiwiRail IRIS database, supported by the number of crashes in the New Zealand CAS database. The most recently available 10-year history (2010 - 2019) of IRIS and CAS data recorded at the crossing is shown in Table 24.

It should be highlighted that at this crossing the locomotive engineers state that they encounter frequent near miss incidents. These events are not recorded in the database for a variety of reasons explained further in Section 7.4.

- A fatal incident at the crossing means that this stage of the assessment will score a maximum 10/10.
- No further amendments to the score have been made due to the incompleteness of incident database

The score at different stages of the assessment are shown in Table 25.

Table 24: IRIS and CAS data (2010-2019) for the western pedestrian crossing #2346

Data base	Incident type	No.	Incident description	Score
Pedestrian west crossing #2346				
IRIS	CPN	1	Person fatally injured when hit by a train completing shunting movements	**10**
IRIS	NCPN	1	Near miss with two people	**2**
			Total	**12**

Table 25: Crash and incident scoring summary for the western pedestrian crossing #2346

	Updated existing	Proposed design	Future score	Comments
Western pedestrian crossing #2346	**10/10**	**3/10**	**3/10**	Passive signs, poor sightlines, crossing does not stand out, LE being unable to stop prior to the crossing, and shunting movements have contributed to a fatal incident and two near misses. Automatic gates with flashing lights and bells and realigning the crossing will help to make people aware that a train is approaching the crossing. However, the extra distance resulting from crossing realignment may result in low compliance rates. Pedestrians who do not use this facility would be crossing the road without any pedestrian controls (passive or active) or adjacent road controls on the northbound approach.

7.3 Site Specific Safety Score – western pedestrian crossing #2346

This site-based score aims to analyse elements of the site layout that are not well covered or missing from the ALCAM risk rating. The pedestrian scoring scheme was used to assess the crossing as per Level Crossing Risk Assessment Guidance (2020) Version 3, Appendix 4.

The crossing is scored on its weakest approach. Each crossing has been assessed at the updated existing, proposed design, and future score stage as shown in Table 26.

A modified SSSS has been used for the updated existing assessment due to the fatal incident. No safety treatments have been made to the crossing since this incident occurred.

Table 26: SSSS assessment for the western pedestrian crossing #2346

Assessed category	Updated existing	Proposed design	Future score	Comments
Crossing type	**10/10**	**1/10**	**1/10**	Poor visibility and only look for train's signs present. Only one approach has adjacent traffic controls. Automatic gates will be installed for the proposed design
Distraction / inattention	**5/5**	**3/5**	**3/5**	There is evidence for a very high level or distraction from LE due to phones, nearby music. The adjacent road environment is also very busy during peak hour and the crossing does not stand out. Automatic gates with flashing lights and bells will raise awareness of the crossing so that users cannot physically enter the rail corridor when there is a train approaching. However, the extra distance resulting from crossing realignment may result in low compliance rates. Pedestrians who do not use this facility would be crossing the road without any pedestrian controls (passive or active) or adjacent road controls on the northbound approach.
Flange gap wheel entrapment for wheeled pedestrians	**3/5**	**1/5**	**1/5**	Crossing panels have all been replaced recently. Flange gaps are small and the crossing is at approximately 35 degrees to the tracks. STRAIL surfaces and realigning the crossing will mean that wheel entrapment is not a concern for pedestrians.
Volume of 'vulnerable' user	**3/6**	**3/6**	**3/6**	The survey was carried out after the school term in December 2020 had ended. We have estimated the number of vulnerable users, mostly school children to be at 51-100 per day.
Cycle patronage	**1/4**	**1/4**	**1/4**	Cycle lanes are provided on the road. However, the footpath connects to the cycle crossing at Moorhouse Avenue and cyclists have been noted to ride along the footpath. We estimate up to 50 cyclist per day use the crossing
Total score	**22/30**	**9/30**	**9/30**	
Red flag / modified SSSS	**24/30**	**-**	**-**	A modified SSSS of 24/30 has been used for this crossing. A person was fatally injured when a train was completing shunting movements. There has also been a near miss. No safety improvements have been made to the crossing since these events took place.
SSSS	**8/10**	**3/10**	**3/10**	

7.4 Engineers Site Specific Safety Score – western pedestrian crossing #2346

This risk score reflects the level of crash risk that Locomotive Engineers (train drivers) and RCA engineers give to each railway crossing compared with other crossings they encounter regularly within their jurisdiction.

The Lincoln Road level crossing gathered scores from the following people. The scores for each assessment stage and their comments on the existing crossing and the proposed design are provided in Table 27.

- Engineer scores for KiwiRail were provided by Matthew Croton
- Engineer scores for the RCA, Christchurch City Council, were provided by Lachlan Beban
- The future score has remained the same as the proposed design score

Table 27: Engineers' risk SSSS crossing #2346

Category	Updated existing	Proposed design	Future score	Comments
KiwiRail	**10/10**	**8/10**	**8/10**	KiwiRail LE noted the passive signs, poor sight distance for pedestrians, and being unable to stop in time if they have a heavy load as major risk factor. The LE stated that they have frequent near miss incidents at this crossing which are generally not recorded in IRIS. Providing automatic gates that increase the total path of travel may mean that users avoid the facility and cross the rail corridor on the road carriageway.
RCA (CCC)	**4/5**	**2/5**	**2/5**	The RCA engineer noted that the crossing does not grab the attention of users, especially approaches without a adjacent flashing lights and bells. The RCA engineer is confident that automatic gates will reduce the risk of an incident occurring at this crossing.
Total	**9/10**	**7/10**	**7/10**	

7.5 LCSS summary results – western pedestrian crossing #2346

The LCSS results for the road crossing are shown in Table 16. The following recommendations in the proposed design **will achieve Criterion 2 only** in both the proposed design and future assessments.

- Due to the high number of pedestrian movements and train movements the risk of an at grade crossing is high regardless of the type of control
- Grade separation (road over rail or rail over road) is not currently practicable on this section of the Main South Line. This is due to technical difficulties and cost constraints.
- KiwiRail have acknowledged the need to upgrade this entire section through Christchurch eventually. Grade separation should be seriously considered from both safety and network efficiency perspectives.

Lincoln Road – western pedestrian crossing recommendations

- Re-align both pedestrian crossings to cross the rail corridor at 90 degrees
- Install 3.5m wide strail crossings as shared paths to accommodate the high volume of pedestrians and cyclists
- Install dual automatic gates (with emergency exit gate) and pedestrian flashing lights and bells at all crossing points
- Construct paths to new crossing locations with fencing to direct pedestrians and cyclists to the crossing location

There are concerns that realigning the pedestrian crossing and the associated **increased path of travel may result in high non-compliance rates**.

- The current crossing distance is 38m
- The crossing distance will be reduced to 23m but the **total distance pedestrians need to walk**, using the automatic gates, is approximately 70m.
- Pedestrian behaviour may require an alternative alignment with a smaller travel distance.
  - Pedestrians will always try to find the shortest route between any two points
  - The current design assessed in this LCISA is compliant with KiwiRail standards
  - There is a large risk that some pedestrians will avoid the fencing and use the current alignment within the road corridor
  - This will result in pedestrians **crossing the rail corridor without any control measures**
  - We recommend that the final design should compromise between a crossing that achieves a suitable skew angle and a path of travel distance like the current arrangement.

Table 28: LCSS summary scores for the western pedestrian crossing #2346

Assessed category	Updated existing	Proposed design	Future score
ALCAM score	**30/30**	**25/30**	**27/30**
Crash and incident history score	**10/10**	**3/10**	**3/10**
Site specific safety score	**8/10**	**3/10**	**3/10**
Engineers' risk score	**9/10**	**7/10**	**7/10**
Total LCSS	**57/60**	**38/60**	**40/60**
LCSS risk band	**HIGH**	**MEDIUM**	**HIGH**
Criterion met	**-**	**Criterion 2**	**Criterion 2**

A

Appendix A – Recommended ALCAM updates in LXM

Recommended ALCAM updates in LXM

To assist KiwiRail with improvements to the ALCAM database, the following changes are recommended for the existing level crossing database.

Recommended ALCAM updates

Road crossing: ALCAM ID # 2344

Crossing location detail

- Surrounds – urban

Rail traffic

- 35 train movements daily
- Volume date 09/12/2020

Details

- Road width – 3.8m
- Road clearance width – 6m
- Road profile humped (minor)
- AADT – 20,518
- Heavy vehicle percentage – 5.4%
- Heavy vehicle percentage – not estimated
- AADT date – 01/01/2019
- AADT measured
- Panel surface condition – fair
- Panel surface material – asphalt
- Vehicle routes – bus route
- Shunting over crossing - present

Sighting

- Immediate left approach surface material – asphalt
- Immediate right approach surface material – asphalt

Characteristics

- Level of service F – forced flow
- Traffic known to queue back
- Visual impediments which may impact the visibility of an oncoming train

Pedestrian up: ALCAM ID #2345

Crossing location detail

- Surrounds - Urban

Rail traffic

- 35 train movements daily
- Volume date 09/12/2020

Details

- Daily volume – 299
- Peak hourly volume – 40
- Volume date 09/12/2020

Sighting

- Pedestrian crossing distance – 31.9m
- Path over tracks - fair

Characteristics

- Presence of adjacent distractions (visual)
- Proximity to siding / shunting yard – less than 100m
- Ambient noise level / audibility of alarm – train and/or alarm is only partially audible to pedestrians due to background noise
- Conspicuity of pedestrian control – some wear and tear but the message is understandable

- Visibility of pedestrian control – not visible from the approach
- likelihood of vandalism to controls – some history of vandalism negating controls
- Low proportion of wheel pedestrians (cyclists, prams, wheelchairs) < 25%
- Angle of crossing – 30 to 70 degrees
- Condition of crossing – path in poor condition
- Masking of trains – first train masks second train occasionally

Control measures

- Adjacent boom gates and audio – removed
- Fault reporting number – removed
- Path lighting at crossing – removed
- Maintenance of vegetation - removed

Pedestrian down: ALCAM ID #2346

Crossing location detail

- Surrounds - Urban

Rail traffic

- 35 train movements daily
- Volume date 09/12/2020

Details

- Daily volume – 532
- Peak hourly volume – 104
- Volume date 09/12/2020

Sighting

- Pedestrian crossing distance – 33.4m

Characteristics

- Presence of adjacent distractions (visual) – crossing does not stand out
- Proximity to siding / shunting yard – less than 100m
- Ambient noise level / audibility of alarm – train and/or alarm is only partially audible to pedestrians due to background noise
- Conspicuity of pedestrian control – some wear and tear but the message is understandable
- Visibility of pedestrian control – not visible from the approach
- Low proportion of wheel pedestrians (cyclists, prams, wheelchairs) < 25%
- Angle of crossing – 30 to 70 degrees
- Condition of crossing – path in poor condition
- Crossing partially meets Waka Kotahi NZ Transport Agency TCD Part 9 requirements
- Masking of trains – first train masks second train occasionally

Control measures

- Adjacent boom gates and audio – removed
- Fault reporting number – removed
- Path lighting at crossing – removed

Maintenance of vegetation - removed

B

Appendix B – ALCAM LXM output

Search Criteria

Crossing Number: 2344

Jurisdiction: NZ

Crossing Name: Lincoln Road Addington

Crossing KM: 12.530

Road Proposal Summary

	Proposal Name	Proposal Description	Risk Score	Type	Status	Modified Date	Modifier
1	Updated existing	Conditions as of Wednesday 09 December	0.0005	General Crossing Proposal	Active	15/02/2021 05:34:03 AM	ben.zmijewski@beca.com

2344 Lincoln Road KM:12.530 Main South Line - to MNL

Addington Proposal

Proposal Name: Updated existing Proposal Updated Date: 15/02/2021 05:34:03 AM

Proposal Type: General Crossing Proposal Proposal Modifier: xxx.xxxxxxxxx@xxxx.xxx

Proposal Status: Active

Proposal Description: Conditions as of Wednesday 09 December

Characteristics	*Condition*	*Points*	*Score*	*% of total*
CONTROL DETAILS				
11. Effectiveness of equipment inspection and maintenance	Good	0	0	0%
12. Longest approach warning time	20 to <30 secs	2	7	5%
ROAD GEOMETRY				
21. Proximity to intersection/control point	50 to 200m	1	1	1%
22. Proximity to siding/shunting yard	<50m	5	7	5%
23. Proximity to station	100 to 200m	1	2	1%
24. Possibility of short stacking	Low	0	0	0%
25. Number of lanes (number of lines of traffic)	1 lane(s)	0	0	0%
26. Vulnerability to road user fatigue	Low	0	0	0%
ROAD TRAFFIC CONTROL				
31. Presence of adjacent distractions	High	5	9	6%
32. Condition of traffic control at crossing	Good	0	0	0%
33. Visibility of traffic control at crossing	Average	3	13	9%
34. Distance from advance warning to crossing	Good	0	0	0%
35. Conformance with AS 1742.7 and NZTA Part 9	Partly	3	13	9%
36. Likelihood of vandalism to controls	Low	0	0	0%
ROAD VEHICLES				
41. Heavy vehicle proportion	5 to <11%	3	6	4%
42. Level of service (vehicle congestion)	Lvl F - Forced Flow	5	12	8%
43. Queueing from adjacent intersections	High	5	46	31%
44. Road traffic speed (85th percentile vehicle speed)	<=60 kph	0	0	0%
RAIL VEHICLES				
51. Seasonal/Infrequent train patterns	Regular trains	0	0	0%
52. Slowest train speed at crossing (typical)	<20 kph	5	17	12%
53. Longest train length (typical)	>300 to 1000m	3	11	7%
54. High train speed	<=60 kph	0	0	0%
CROSSING GEOMETRY				
61. Number of operational rail tracks	>2 tracks	5	2	1%
62. Road surface on approach/departure (not Xing panel)	Good	0	0	0%
63. Is the crossing on a hump, dip or rough surface?	No	0	0	0%
VISIBILITY				
71. SSD - advance visibility of crossing from road	>100%	0	0	0%

Surveyed: 30/09/2011 Rating Last Updated: 15/02/2021 Rating Model: ALCAM Rd 2c.1.1.1

72. S2 - approach visibility to train (vehicle approaching crossing)	<50%	5	0	0%
73. S3 - visibility to train (vehicle stopped at crossing)	<50%	5	0	0%
74. Possible sun glare sighting crossing on road approach	Known sunglare issue	5	1	1%
75. Possible sun glare sighting train	Known sunglare issue	5	0	0%
76. Temporary visual impediments - sighting of crossing	1 day/month	3	0	0%
77. Temporary visual impediments - sighting of train	1 day/week	5	0	0%
			146	100%

Controls

Controls at Crossing	Half Boom Flashing Lights
Additional Crossing Controls	"Keep Tracks Clear" signs and yellow box marking
Advance Warning	SINGLE Standard Advance Warning (W7-4, W7-7, NZ WX1 OR NZ WX3)
Human Factors	Public response phone number
Train Related	Whistle board / location board for train
Crossing Environment	Maintenance programme for vegetation etc (Road)

Crossing Volume (AADT) Road: 20518 Rail: 35

Outputs

Raw Infrastructure Factor:	**146**		
Infrastructure Factor:	**1.07559**		
Exposure Factor:	**0.03696**		
Likelihood Factor:	**0.03975**	Years Between Collisions:	**25**
Consequence Factor:	**0.01269**		
Risk Score:	**0.0005**	Years Between Fatalities:	**1982**

Risk / Likelihood Bands

Across Control Classes

Risk Band All:	**Medium**	Likelihood Band All:	**High**
Risk Band Jur.	**Medium Low**	Likelihood Band Jur:	**Medium Low**

Within Boom Barrier Control Class

Risk Band All:	**Medium Low**	Likelihood Band All:	**High**
Risk Band Jurisdiction:	**Medium Low**	Likelihood Band Jurisdiction :	**High**

Flags:

Multiple Tracks

Queueing

Sun Glare Sighting Crossing on Road

Mechanisms

UNABLE TO AVOID

Unable to stop in time	20
Stuck on tracks	0
Stopped on tracks	14

UNAWARE

Distracted	9
Could not see control	8
Could not see train from road approach (S2)	0
Could not see train from at crossing (S3)	0
Assumes train will stop	0
Does not expect second train	0
Finds crossing protection is ambiguous	0
Is fatigued	0
Mislead by Controls	0

UNWILLING TO RECOGNISE

Queued on tracks	48
Overhangs on tracks	0
Racing train or misjudged train speed	10
Driving through passive warning without looking	0
Driving through flashing lights	0
Driving around boom gates	37

146

Search Criteria

Crossing Number: 2344

Jurisdiction: NZ

Crossing Name: Lincoln Road Addington

Crossing KM: 12.530

Road Proposal Summary

	Proposal Name	Proposal Description	Risk Score	Type	Status	Modified Date	Modifier
1	Proposed design	Proposed design to achieve criteria 1 and criteria 2.	0.00048	General Crossing Proposal	Active	15/02/2021 05:43:32 AM	ben.zmijewski@beca.com

2344 Lincoln Road **KM:12.530** **Main South Line - to MNL**

Addington Proposal

Proposal Name: Proposed design Proposal Updated Date: 15/02/2021 05:43:32 AM

Proposal Type: General Crossing Proposal Proposal Modifier: xxx.xxxxxxxxx@xxxx.xxx

Proposal Status: Active

Proposal Description: Proposed design to achieve criteria 1 and criteria 2.

Characteristics	*Condition*	*Points*	*Score*	*% of total*
CONTROL DETAILS				
11. Effectiveness of equipment inspection and maintenance	Good	0	0	0%
12. Longest approach warning time	20 to <30 secs	2	7	7%
ROAD GEOMETRY				
21. Proximity to intersection/control point	50 to 200m	1	0	0%
22. Proximity to siding/shunting yard	<50m	5	6	6%
23. Proximity to station	100 to 200m	1	1	1%
24. Possibility of short stacking	Low	0	0	0%
25. Number of lanes (number of lines of traffic)	1 lane(s)	0	0	0%
26. Vulnerability to road user fatigue	Low	0	0	0%
ROAD TRAFFIC CONTROL				
31. Presence of adjacent distractions	High	5	7	7%
32. Condition of traffic control at crossing	Good	0	0	0%
33. Visibility of traffic control at crossing	Average	3	12	12%
34. Distance from advance warning to crossing	Good	0	0	0%
35. Conformance with AS 1742.7 and NZTA Part 9	Partly	3	13	13%
36. Likelihood of vandalism to controls	High	5	1	1%
ROAD VEHICLES				
41. Heavy vehicle proportion	5 to <11%	3	2	2%
42. Level of service (vehicle congestion)	Lvl F - Forced Flow	5	7	7%
43. Queueing from adjacent intersections	High	5	16	16%
44. Road traffic speed (85th percentile vehicle speed)	<=60 kph	0	0	0%
RAIL VEHICLES				
51. Seasonal/Infrequent train patterns	Regular trains	0	0	0%
52. Slowest train speed at crossing (typical)	<20 kph	5	17	17%
53. Longest train length (typical)	>300 to 1000m	3	11	11%
54. High train speed	<=60 kph	0	0	0%
CROSSING GEOMETRY				
61. Number of operational rail tracks	>2 tracks	5	2	2%
62. Road surface on approach/departure (not Xing panel)	Good	0	0	0%
63. Is the crossing on a hump, dip or rough surface?	No	0	0	0%
VISIBILITY				
71. SSD - advance visibility of crossing from road	>100%	0	0	0%

Surveyed: 30/09/2011 Rating Last Updated: 15/02/2021 Rating Model: ALCAM Rd 2c.1.1.1

72. S2 - approach visibility to train (vehicle approaching crossing)	<50%	5	0	0%
73. S3 - visibility to train (vehicle stopped at crossing)	<50%	5	0	0%
74. Possible sun glare sighting crossing on road approach	Known sunglare issue	5	1	1%
75. Possible sun glare sighting train	Known sunglare issue	5	0	0%
76. Temporary visual impediments - sighting of crossing	1 day/month	3	0	0%
77. Temporary visual impediments - sighting of train	1 day/week	5	0	0%
			105	100%

Controls

Controls at Crossing	Half Boom Flashing Lights
Additional Crossing Controls	"Keep Tracks Clear" signs and yellow box marking
Advance Warning	SINGLE Standard Advance Warning (W7-4, W7-7, NZ WX1 OR NZ WX3)
Advance Warning	Rail-X Pavement Marking
Human Factors	Public response phone number
Train Related	Whistle board / location board for train
Crossing Environment	Maintenance programme for vegetation etc (Road)
Signalling / Detection Systems	Coordinate with adjacent traffic signals
Signalling / Detection Systems	Detectors in crossing conflict zone

Crossing Volume (AADT) Road: 20518 Rail: 35

Outputs

Raw Infrastructure Factor:	**105**		
Infrastructure Factor:	**1.01813**		
Exposure Factor:	**0.03696**		
Likelihood Factor:	**0.03763**	Years Between Collisions:	**27**
Consequence Factor:	**0.01269**		
Risk Score:	**0.00048**	Years Between Fatalities:	**2094**

Risk / Likelihood Bands

Across Control Classes

Risk Band All:	**Medium**	Likelihood Band All:	**High**
Risk Band Jur.	**Medium Low**	Likelihood Band Jur:	**Medium Low**

Within Boom Barrier Control Class

Risk Band All:	**Medium Low**	Likelihood Band All:	**High**
Risk Band Jurisdiction:	**Medium Low**	Likelihood Band Jurisdiction :	**High**

Flags:

Multiple Tracks

Queueing

Sun Glare Sighting Crossing on Road

Mechanisms

UNABLE TO AVOID	
Unable to stop in time	20
Stuck on tracks	0
Stopped on tracks	14
UNAWARE	
Distracted	7
Could not see control	6
Could not see train from road approach (S2)	0
Could not see train from at crossing (S3)	0
Assumes train will stop	0
Does not expect second train	0
Finds crossing protection is ambiguous	0
Is fatigued	0
Mislead by Controls	2
UNWILLING TO RECOGNISE	
Queued on tracks	10
Overhangs on tracks	0
Racing train or misjudged train speed	10
Driving through passive warning without looking	0
Driving through flashing lights	0
Driving around boom gates	37
	105

Search Criteria

Crossing Number: 2344

Jurisdiction: NZ

Crossing Name: Lincoln Road Addington

Crossing KM: 12.530

Road Proposal Summary

	Proposal Name	Proposal Description	Risk Score	Type	Status	Modified Date	Modifier
1	Future score	Future score with Proposed design to achieve criteria 1 and criteria 2.	0.00059	General Crossing Proposal	Active	15/02/2021 05:45:07 AM	ben.zmijewski@beca.com

2344 Lincoln Road KM:12.530 Main South Line - to MNL

Addington Proposal

Proposal Name: Future score Proposal Updated Date: 15/02/2021 05:45:07 AM

Proposal Type: General Crossing Proposal Proposal Modifier: xxx.xxxxxxxxx@xxxx.xxx

Proposal Status: Active

Proposal Description: Future score with Proposed design to achieve criteria 1 and criteria 2.

Characteristics	*Condition*	*Points*	*Score*	*% of total*
CONTROL DETAILS				
11. Effectiveness of equipment inspection and maintenance	Good	0	0	0%
12. Longest approach warning time	20 to <30 secs	2	7	7%
ROAD GEOMETRY				
21. Proximity to intersection/control point	50 to 200m	1	0	0%
22. Proximity to siding/shunting yard	<50m	5	6	6%
23. Proximity to station	100 to 200m	1	1	1%
24. Possibility of short stacking	Low	0	0	0%
25. Number of lanes (number of lines of traffic)	1 lane(s)	0	0	0%
26. Vulnerability to road user fatigue	Low	0	0	0%
ROAD TRAFFIC CONTROL				
31. Presence of adjacent distractions	High	5	7	7%
32. Condition of traffic control at crossing	Good	0	0	0%
33. Visibility of traffic control at crossing	Average	3	12	12%
34. Distance from advance warning to crossing	Good	0	0	0%
35. Conformance with AS 1742.7 and NZTA Part 9	Partly	3	13	13%
36. Likelihood of vandalism to controls	High	5	1	1%
ROAD VEHICLES				
41. Heavy vehicle proportion	5 to <11%	3	2	2%
42. Level of service (vehicle congestion)	Lvl F - Forced Flow	5	7	7%
43. Queueing from adjacent intersections	High	5	16	16%
44. Road traffic speed (85th percentile vehicle speed)	<=60 kph	0	0	0%
RAIL VEHICLES				
51. Seasonal/Infrequent train patterns	Regular trains	0	0	0%
52. Slowest train speed at crossing (typical)	<20 kph	5	17	17%
53. Longest train length (typical)	>300 to 1000m	3	11	11%
54. High train speed	<=60 kph	0	0	0%
CROSSING GEOMETRY				
61. Number of operational rail tracks	>2 tracks	5	2	2%
62. Road surface on approach/departure (not Xing panel)	Good	0	0	0%
63. Is the crossing on a hump, dip or rough surface?	No	0	0	0%
VISIBILITY				
71. SSD - advance visibility of crossing from road	>100%	0	0	0%

Surveyed: 30/09/2011 Rating Last Updated: 15/02/2021 Rating Model: ALCAM Rd 2c.1.1.1

72. S2 - approach visibility to train (vehicle approaching crossing)	<50%	5	0	0%
73. S3 - visibility to train (vehicle stopped at crossing)	<50%	5	0	0%
74. Possible sun glare sighting crossing on road approach	Known sunglare issue	5	1	1%
75. Possible sun glare sighting train	Known sunglare issue	5	0	0%
76. Temporary visual impediments - sighting of crossing	1 day/month	3	0	0%
77. Temporary visual impediments - sighting of train	1 day/week	5	0	0%
			105	100%

Controls

Controls at Crossing	Half Boom Flashing Lights
Additional Crossing Controls	"Keep Tracks Clear" signs and yellow box marking
Advance Warning	SINGLE Standard Advance Warning (W7-4, W7-7, NZ WX1 OR NZ WX3)
Advance Warning	Rail-X Pavement Marking
Human Factors	Public response phone number
Train Related	Whistle board / location board for train
Crossing Environment	Maintenance programme for vegetation etc (Road)
Signalling / Detection Systems	Coordinate with adjacent traffic signals
Signalling / Detection Systems	Detectors in crossing conflict zone

Crossing Volume (AADT) Road: 20518 Rail: 60

Outputs

Raw Infrastructure Factor:	**105**		
Infrastructure Factor:	**1.01813**		
Exposure Factor:	**0.04581**		
Likelihood Factor:	**0.04664**	Years Between Collisions:	**21**
Consequence Factor:	**0.0127**		
Risk Score:	**0.00059**	Years Between Fatalities:	**1689**

Risk / Likelihood Bands

Across Control Classes

Risk Band All:	**Medium**	Likelihood Band All:	**High**
Risk Band Jur.	**Medium Low**	Likelihood Band Jur:	**Medium Low**

Within Boom Barrier Control Class

Risk Band All:	**Medium Low**	Likelihood Band All:	**High**
Risk Band Jurisdiction:	**Medium Low**	Likelihood Band Jurisdiction :	**High**

Flags:

Multiple Tracks

Queueing

Sun Glare Sighting Crossing on Road

Mechanisms

UNABLE TO AVOID	
Unable to stop in time	20
Stuck on tracks	0
Stopped on tracks	14
UNAWARE	
Distracted	7
Could not see control	6
Could not see train from road approach (S2)	0
Could not see train from at crossing (S3)	0
Assumes train will stop	0
Does not expect second train	0
Finds crossing protection is ambiguous	0
Is fatigued	0
Mislead by Controls	2
UNWILLING TO RECOGNISE	
Queued on tracks	10
Overhangs on tracks	0
Racing train or misjudged train speed	10
Driving through passive warning without looking	0
Driving through flashing lights	0
Driving around boom gates	37
	105

Search Criteria

Crossing Number: 2345

Jurisdiction: NZ

Crossing Name: Lincoln Road Ped Up Addington

Crossing KM: 12.530

Pedestrian Proposal Summary

	Proposal Name	Proposal Description	Risk Score	Type	Status	Modified Date	Modifier
1	Updated existing	Conditions as observed during site visit December 2020	5224893.678	General Crossing Proposal	Active	02/02/2021 08:29:28 AM	ben.zmijewski@beca.com

02345-1 **Lincoln Road Ped Up** **KM:12.530** **Main South Line - to MNL**

Addington Proposal (Ped)

Proposal Name: Updated existing Proposal Updated Date: 02/02/2021 08:29:28 AM

Proposal Type: General Crossing Proposal Proposal Modifier: xxx.xxxxxxxxx@xxxx.xxx

Proposal Status: Active

Proposal Description: Conditions as observed during site visit December 2020

Characteristics	*Condition*	*Points*	*Score*	*% of total*
CONTROL DETAILS				
11. Effectiveness of equipment inspection and maintenance	High	0	0	0%
12. Shortest approach warning time from start of flashing lights to train	<20 secs	5	0	0%
13. Longest approach warning time from start of flashing lights to train	<20 secs	0	0	0%
ADJACENT ACTIVITY				
21. Presence of adjacent distractions (visual)	Many	5	13	3%
22. Proximity to passenger station	>500m	0	0	0%
23. Proximity to siding / shunting yard	<100m	5	38	8%
24. Proximity to licensed / special event venue (eg. pub, club, sports	200-500m	1	12	2%
25. Proximity to school playground or aged facilities	200-500m	1	9	2%
26. Ambient noise level / audibility of alarm	Medium	3	15	3%
27. Adjacent road traffic activity	Busy	5	16	3%
PEDESTRIAN TRAFFIC CONTROL				
31. Conspicuity of pedestrian control	Average	3	11	2%
32. Visibility of pedestrian control	Poor	5	5	1%
33. Likelihood of vandalism to control	Some History	3	43	9%
PEDESTRIAN TRAFFIC				
41. Volume of pedestrians (peak flow)	>20 to 50 pedestrians per hour	3	5	1%
42. Type of pedestrians (children)	High Risk	5	96	19%
43. Type of pedestrians (physically disabled)	Low Risk	0	0	0%
44. Type of pedestrians (sensory disabled)	Low Risk	0	0	0%
45. Type of pedestrians (intellectually disabled)	Low Risk	0	0	0%
46. Type of pedestrians (cyclists, wheelchairs, prams etc)	Low Risk	0	0	0%
47. Type of pedestrians elderly	Low Risk	0	0	0%
RAIL VEHICLES				
51. Train volume (high is bad) (if high then greater probability of	>10 to 60 trains per day	4	23	5%
52. Infrequent / seasonal movements / special trains	Low	0	0	0%
53. Highest train speed at crossing (typical)	<=60 kph	0	0	0%
54. Longest train length (typical)	>300 to 1000m	3	7	1%
CROSSING GEOMETRY				
61. Number of operational rail tracks (including sidings)	>2 tracks	5	39	8%
62. Angle of crossing & condition / width of flange gap	30-70deg	3	10	2%
63. Condition of crossing (fencing/path surface etc)	Poor	5	64	13%
64. Freight trains stand across crossing	Rarely	0	0	0%

65. Gradients, widths and manoeuvring space of pathway/maze	Fully meets DDA	0	0	0%
66. Change of path alignment between pedestrian maze and track	Adequate	0	0	0%
67. Crossing to Australian/NZ Standards (signage & path marking)	Partially meets AS	3	6	1%
VISIBILITY				
71. Visibility from crossing to train (from pedestrian holding point)	<50%	5	37	7%
72. Sun glare issues at crossing	Yes	5	15	3%
73. Temporary visual impediments	Yes	5	5	1%
74. Masking of trains (moving or stationary) timetabling etc	Occasionally	3	30	6%

499.27317 100%

Controls

Physical Controls	Path
Audio Visual Controls	Signs only
Pedestrian Signage / Path Marking	Holding line (painted only)
Pedestrian Signage / Path Marking	Delineation line marking (painted only)
Pedestrian Signage / Path Marking	Tactile ground surface indicators
Crossing Environment	Whistle boards
Operational	Train lights

Crossing Volume (AADT) Pedestrian: 299 Rail: 35

Outputs

Infrastructure Factor: **499.27317**

Exposure Factor: **10,465**

Risk Score: **5,224,894**

Risk Bands

Across Control Classes

Risk Band All: **High**

Risk Band Jurisdiction: **High**

Within Passive Only Control Class

Risk Band All: **High**

Risk Band Jurisdiction: **High**

Mechanisms

UNABLE TO AVOID

Unable to stop in time, late recognition of danger	35
Caught in tracks (stuck, slip, trip, fall)	15
Unable to cross quickly enough	22
Trapped by controls (if no gates then all values are zero)	0
Unable to determine the orientation of the crossing	3

UNAWARE

Distracted	33
Did not see train or visual warning signals	75

Did not hear train or audio warning signals	35
Has limited capacity to recognise danger and react	5
Under the influence of alcohol	6
Does not recognise crossing	22
Does not expect second train	86
Assumes train would stop	0
Misjudges train speed	44
Does not expect train	8
Does not expect train movement(s)	28
Mislead by infrastructure	0
Mislead by controls	29

UNWILLING TO RECOGNISE

Deliberately ignored control	14
Bypassing active control	0
Crawling under wagons (if no trains stopping then all values are zero)	0
Skylarking	40

499

Search Criteria

Crossing Number: 2345

Jurisdiction: NZ

Crossing Name: Lincoln Road Ped Up Addington

Crossing KM: 12.530

Pedestrian Proposal Summary

	Proposal Name	Proposal Description	Risk Score	Type	Status	Modified Date	Modifier
1	Proposed design	Conditions as observed during site visit December 2020 + proposed design for automatic gates on eastern ped crossing	448613.80111	General Crossing Proposal	Active	15/02/2021 05:50:29 AM	ben.zmijewski@beca.com

02345-1 **Lincoln Road Ped Up** **KM:12.530** **Main South Line - to MNL**

Addington Proposal (Ped)

Proposal Name: Proposed design Proposal Updated Date: 15/02/2021 05:50:29 AM

Proposal Type: General Crossing Proposal Proposal Modifier: xxx.xxxxxxxxx@xxxx.xxx

Proposal Status: Active

Proposal Description: Conditions as observed during site visit December 2020 + proposed design for automatic gates on eastern ped crossing

Characteristics	*Condition*	*Points*	*Score*	*% of total*
CONTROL DETAILS				
11. Effectiveness of equipment inspection and maintenance	High	0	0	0%
12. Shortest approach warning time from start of flashing lights to train	20 to 28 secs	3	1	2%
13. Longest approach warning time from start of flashing lights to train	20 to 28 secs	3	0	0%
ADJACENT ACTIVITY				
21. Presence of adjacent distractions (visual)	Few	0	0	0%
22. Proximity to passenger station	>500m	0	0	0%
23. Proximity to siding / shunting yard	<100m	5	0	0%
24. Proximity to licensed / special event venue (eg. pub, club, sports	200-500m	1	0	0%
25. Proximity to school playground or aged facilities	200-500m	1	3	7%
26. Ambient noise level / audibility of alarm	Low	0	0	0%
27. Adjacent road traffic activity	Busy	5	0	0%
PEDESTRIAN TRAFFIC CONTROL				
31. Conspicuity of pedestrian control	Good	0	0	0%
32. Visibility of pedestrian control	Good	0	0	0%
33. Likelihood of vandalism to control	Some History	3	29	67%
PEDESTRIAN TRAFFIC				
41. Volume of pedestrians (peak flow)	>20 to 50 pedestrians per hour	3	3	7%
42. Type of pedestrians (children)	High Risk	5	3	7%
43. Type of pedestrians (physically disabled)	Low Risk	0	0	0%
44. Type of pedestrians (sensory disabled)	Low Risk	0	0	0%
45. Type of pedestrians (intellectually disabled)	Low Risk	0	0	0%
46. Type of pedestrians (cyclists, wheelchairs, prams etc)	Low Risk	0	0	0%
47. Type of pedestrians elderly	Low Risk	0	0	0%
RAIL VEHICLES				
51. Train volume (high is bad) (if high then greater probability of	>10 to 60 trains per day	4	0	0%
52. Infrequent / seasonal movements / special trains	Low	0	0	0%
53. Highest train speed at crossing (typical)	<=60 kph	0	0	0%
54. Longest train length (typical)	>300 to 1000m	3	0	0%
CROSSING GEOMETRY				
61. Number of operational rail tracks (including sidings)	>2 tracks	5	4	9%
62. Angle of crossing & condition / width of flange gap	70-90deg	0	0	0%
63. Condition of crossing (fencing/path surface etc)	Good	0	0	0%

Surveyed: 13/09/2019 Rating Last Updated: 15/02/2021 Rating Model: ALCAM Ped 1b.0.1.0

64. Freight trains stand across crossing	Rarely	0	0	0%
65. Gradients, widths and manoeuvring space of pathway/maze	Fully meets DDA	0	0	0%
66. Change of path alignment between pedestrian maze and track	Adequate	0	0	0%
67. Crossing to Australian/NZ Standards (signage & path marking)	Fully meets AS	0	0	0%
VISIBILITY				
71. Visibility from crossing to train (from pedestrian holding point)	50 to 80%	4	0	0%
72. Sun glare issues at crossing	Yes	5	0	0%
73. Temporary visual impediments	No	0	0	0%
74. Masking of trains (moving or stationary) timetabling etc	Occasionally	3	0	0%

42.86802 100%

Controls

Physical Controls	Automatic Gates
Audio Visual Controls	Visual and audible alarm
Emergency Egress	With latch (including holding enclosure)
Pedestrian Signage / Path Marking	Holding line (painted only)
Pedestrian Signage / Path Marking	Delineation line marking (painted only)
Pedestrian Signage / Path Marking	Tactile ground surface indicators
Crossing Environment	Whistle boards
Crossing Environment	Wing/funnel/guide fencing
Crossing Environment	Funnel pathway
Crossing Environment	Adjacent corridor fencing
Pathway Works	Flange Gap Filler?
Operational	Train lights

Crossing Volume (AADT) Pedestrian: 299 Rail: 35

Outputs

Infrastructure Factor: **42.86802**

Exposure Factor: **10,465**

Risk Score: **448,614**

Risk Bands

Across Control Classes		**Within Train Activated Gates Control Class**	
Risk Band All:	**Medium**	Risk Band All:	**Medium Low**
Risk Band Jurisdiction:	**Medium High**	Risk Band Jurisdiction:	**Medium Low**

Mechanisms

UNABLE TO AVOID

Unable to stop in time, late recognition of danger	0
Caught in tracks (stuck, slip, trip, fall)	4
Unable to cross quickly enough	5

Trapped by controls (if no gates then all values are zero)	2
Unable to determine the orientation of the crossing	0

UNAWARE

Distracted	0
Did not see train or visual warning signals	0
Did not hear train or audio warning signals	0
Has limited capacity to recognise danger and react	0
Under the influence of alcohol	0
Does not recognise crossing	0
Does not expect second train	0
Assumes train would stop	0
Misjudges train speed	0
Does not expect train	0
Does not expect train movement(s)	0
Mislead by infrastructure	0
Mislead by controls	29

UNWILLING TO RECOGNISE

Deliberately ignored control	1
Bypassing active control	0
Crawling under wagons (if no trains stopping then all values are zero)	0
Skylarking	2

43

Search Criteria

Crossing Number: 2345

Jurisdiction: NZ

Crossing Name: Lincoln Road Ped Up Addington

Crossing KM: 12.530

Pedestrian Proposal Summary

	Proposal Name	Proposal Description	Risk Score	Type	Status	Modified Date	Modifier
1	Future score	Conditions as observed during site visit December 2020 + proposed design for automatic gates on eastern ped crossing + increase in user volumes in ten years time	1027216.41298	General Crossing Proposal	Active	15/02/2021 05:52:08 AM	ben.zmijewski@beca.com

02345-1 **Lincoln Road Ped Up** **KM:12.530** **Main South Line - to MNL**

Addington Proposal (Ped)

Proposal Name: Future score Proposal Updated Date: 15/02/2021 05:52:08 AM

Proposal Type: General Crossing Proposal Proposal Modifier: xxx.xxxxxxxxx@xxxx.xxx

Proposal Status: Active

Proposal Description: Conditions as observed during site visit December 2020 + proposed design for automatic gates on eastern ped crossing + increase in user volumes in ten years time

Characteristics	*Condition*	*Points*	*Score*	*% of total*
CONTROL DETAILS				
11. Effectiveness of equipment inspection and maintenance	High	0	0	0%
12. Shortest approach warning time from start of flashing lights to train	20 to 28 secs	3	1	2%
13. Longest approach warning time from start of flashing lights to train	>28 secs	5	0	0%
ADJACENT ACTIVITY				
21. Presence of adjacent distractions (visual)	Few	0	0	0%
22. Proximity to passenger station	>500m	0	0	0%
23. Proximity to siding / shunting yard	<100m	5	0	0%
24. Proximity to licensed / special event venue (eg. pub, club, sports	200-500m	1	0	0%
25. Proximity to school playground or aged facilities	200-500m	1	3	7%
26. Ambient noise level / audibility of alarm	Low	0	0	0%
27. Adjacent road traffic activity	Busy	5	0	0%
PEDESTRIAN TRAFFIC CONTROL				
31. Conspicuity of pedestrian control	Good	0	0	0%
32. Visibility of pedestrian control	Good	0	0	0%
33. Likelihood of vandalism to control	Some History	3	29	66%
PEDESTRIAN TRAFFIC				
41. Volume of pedestrians (peak flow)	>50 to 100 pedestrians per hour	4	4	9%
42. Type of pedestrians (children)	High Risk	5	3	7%
43. Type of pedestrians (physically disabled)	Low Risk	0	0	0%
44. Type of pedestrians (sensory disabled)	Low Risk	0	0	0%
45. Type of pedestrians (intellectually disabled)	Low Risk	0	0	0%
46. Type of pedestrians (cyclists, wheelchairs, prams etc)	Low Risk	0	0	0%
47. Type of pedestrians elderly	Low Risk	0	0	0%
RAIL VEHICLES				
51. Train volume (high is bad) (if high then greater probability of	>10 to 60 trains per day	4	0	0%
52. Infrequent / seasonal movements / special trains	Low	0	0	0%
53. Highest train speed at crossing (typical)	<=60 kph	0	0	0%
54. Longest train length (typical)	>300 to 1000m	3	0	0%
CROSSING GEOMETRY				
61. Number of operational rail tracks (including sidings)	>2 tracks	5	4	9%
62. Angle of crossing & condition / width of flange gap	70-90deg	0	0	0%
63. Condition of crossing (fencing/path surface etc)	Good	0	0	0%

64. Freight trains stand across crossing	Rarely	0	0	0%
65. Gradients, widths and manoeuvring space of pathway/maze	Fully meets DDA	0	0	0%
66. Change of path alignment between pedestrian maze and track	Adequate	0	0	0%
67. Crossing to Australian/NZ Standards (signage & path marking)	Fully meets AS	0	0	0%
VISIBILITY				
71. Visibility from crossing to train (from pedestrian holding point)	50 to 80%	4	0	0%
72. Sun glare issues at crossing	Yes	5	0	0%
73. Temporary visual impediments	No	0	0	0%
74. Masking of trains (moving or stationary) timetabling etc	Occasionally	3	0	0%

43.89814 100%

Controls

Physical Controls	Automatic Gates
Audio Visual Controls	Visual and audible alarm
Emergency Egress	With latch (including holding enclosure)
Pedestrian Signage / Path Marking	Holding line (painted only)
Pedestrian Signage / Path Marking	Delineation line marking (painted only)
Pedestrian Signage / Path Marking	Tactile ground surface indicators
Crossing Environment	Whistle boards
Crossing Environment	Wing/funnel/guide fencing
Crossing Environment	Funnel pathway
Crossing Environment	Adjacent corridor fencing
Pathway Works	Flange Gap Filler?
Operational	Train lights

Crossing Volume (AADT) Pedestrian: 390 Rail: 60

Outputs

Infrastructure Factor: **43.89814**

Exposure Factor: **23,400**

Risk Score: **1,027,216**

Risk Bands

Across Control Classes

Risk Band All: **Medium High**

Risk Band Jurisdiction: **High**

Within Train Activated Gates Control Class

Risk Band All: **Medium**

Risk Band Jurisdiction: **Medium**

Mechanisms

UNABLE TO AVOID

Unable to stop in time, late recognition of danger	0
Caught in tracks (stuck, slip, trip, fall)	4
Unable to cross quickly enough	6

Trapped by controls (if no gates then all values are zero)	2
Unable to determine the orientation of the crossing	0

UNAWARE

Distracted	0
Did not see train or visual warning signals	0
Did not hear train or audio warning signals	0
Has limited capacity to recognise danger and react	0
Under the influence of alcohol	0
Does not recognise crossing	0
Does not expect second train	0
Assumes train would stop	0
Misjudges train speed	0
Does not expect train	0
Does not expect train movement(s)	0
Mislead by infrastructure	0
Mislead by controls	29

UNWILLING TO RECOGNISE

Deliberately ignored control	1
Bypassing active control	0
Crawling under wagons (if no trains stopping then all values are zero)	0
Skylarking	2

44

Search Criteria

Crossing Number: 2346

Jurisdiction: NZ

Crossing Name: Lincoln Road Ped Dn Addington

Crossing KM: 12.530

Pedestrian Proposal Summary

	Proposal Name	Proposal Description	Risk Score	Type	Status	Modified Date	Modifier
1	Updated existing	Updated existing ALCAM assessment from site visit in December 2020	9352709.91547	General Crossing Proposal	Active	02/02/2021 07:55:19 AM	ben.zmijewski@beca.com

02346-1 **Lincoln Road Ped Dn** **KM:12.530** **Main South Line - to MNL**

Addington Proposal (Ped)

Proposal Name: Updated existing Proposal Updated Date: 02/02/2021 07:55:19 AM

Proposal Type: General Crossing Proposal Proposal Modifier: xxx.xxxxxxxxx@xxxx.xxx

Proposal Status: Active

Proposal Description: Updated existing ALCAM assessment from site visit in December 2020

Characteristics	*Condition*	*Points*	*Score*	*% of total*
CONTROL DETAILS				
11. Effectiveness of equipment inspection and maintenance	High	0	0	0%
12. Shortest approach warning time from start of flashing lights to train	<20 secs	5	0	0%
13. Longest approach warning time from start of flashing lights to train	<20 secs	0	0	0%
ADJACENT ACTIVITY				
21. Presence of adjacent distractions (visual)	Many	5	13	3%
22. Proximity to passenger station	>500m	0	0	0%
23. Proximity to siding / shunting yard	<100m	5	38	8%
24. Proximity to licensed / special event venue (eg. pub, club, sports	200-500m	1	12	2%
25. Proximity to school playground or aged facilities	200-500m	1	9	2%
26. Ambient noise level / audibility of alarm	Medium	3	15	3%
27. Adjacent road traffic activity	Busy	5	16	3%
PEDESTRIAN TRAFFIC CONTROL				
31. Conspicuity of pedestrian control	Average	3	11	2%
32. Visibility of pedestrian control	Poor	5	5	1%
33. Likelihood of vandalism to control	Some History	3	43	9%
PEDESTRIAN TRAFFIC				
41. Volume of pedestrians (peak flow)	>100 pedestrians per hour	5	8	2%
42. Type of pedestrians (children)	High Risk	5	96	19%
43. Type of pedestrians (physically disabled)	Low Risk	0	0	0%
44. Type of pedestrians (sensory disabled)	Low Risk	0	0	0%
45. Type of pedestrians (intellectually disabled)	Low Risk	0	0	0%
46. Type of pedestrians (cyclists, wheelchairs, prams etc)	Low Risk	0	0	0%
47. Type of pedestrians elderly	Low Risk	0	0	0%
RAIL VEHICLES				
51. Train volume (high is bad) (if high then greater probability of	>10 to 60 trains per day	4	23	5%
52. Infrequent / seasonal movements / special trains	Low	0	0	0%
53. Highest train speed at crossing (typical)	<=60 kph	0	0	0%
54. Longest train length (typical)	>300 to 1000m	3	7	1%
CROSSING GEOMETRY				
61. Number of operational rail tracks (including sidings)	>2 tracks	5	39	8%
62. Angle of crossing & condition / width of flange gap	30-70deg	3	10	2%
63. Condition of crossing (fencing/path surface etc)	Poor	5	64	13%
64. Freight trains stand across crossing	Rarely	0	0	0%

65. Gradients, widths and manoeuvring space of pathway/maze	Fully meets DDA	0	0	0%
66. Change of path alignment between pedestrian maze and track	Adequate	0	0	0%
67. Crossing to Australian/NZ Standards (signage & path marking)	Partially meets AS	3	6	1%
VISIBILITY				
71. Visibility from crossing to train (from pedestrian holding point)	<50%	5	37	7%
72. Sun glare issues at crossing	Yes	5	15	3%
73. Temporary visual impediments	Yes	5	5	1%
74. Masking of trains (moving or stationary) timetabling etc	Occasionally	3	30	6%

502.29377 100%

Controls

Physical Controls	Path
Audio Visual Controls	Signs only
Pedestrian Signage / Path Marking	Holding line (painted only)
Pedestrian Signage / Path Marking	Delineation line marking (painted only)
Pedestrian Signage / Path Marking	Tactile ground surface indicators
Crossing Environment	Whistle boards
Operational	Train lights

Crossing Volume (AADT) Pedestrian: 532 Rail: 35

Outputs

Infrastructure Factor: **502.29377**

Exposure Factor: **18,620**

Risk Score: **9,352,710**

Risk Bands

Across Control Classes

Risk Band All: **High**

Risk Band Jurisdiction: **High**

Within Passive Only Control Class

Risk Band All: **High**

Risk Band Jurisdiction: **High**

Mechanisms

UNABLE TO AVOID

Unable to stop in time, late recognition of danger	35
Caught in tracks (stuck, slip, trip, fall)	15
Unable to cross quickly enough	24
Trapped by controls (if no gates then all values are zero)	0
Unable to determine the orientation of the crossing	3

UNAWARE

Distracted	34
Did not see train or visual warning signals	75

Did not hear train or audio warning signals	35
Has limited capacity to recognise danger and react	5
Under the influence of alcohol	6
Does not recognise crossing	22
Does not expect second train	86
Assumes train would stop	0
Misjudges train speed	44
Does not expect train	8
Does not expect train movement(s)	28
Mislead by infrastructure	0
Mislead by controls	29

UNWILLING TO RECOGNISE

Deliberately ignored control	14
Bypassing active control	0
Crawling under wagons (if no trains stopping then all values are zero)	0
Skylarking	40

502

Search Criteria

Crossing Number: 2346

Jurisdiction: NZ

Crossing Name: Lincoln Road Ped Dn Addington

Crossing KM: 12.530

Pedestrian Proposal Summary

	Proposal Name	Proposal Description	Risk Score	Type	Status	Modified Date	Modifier
1	Proposed design	Updated existing ALCAM assessment from site visit in December 2020	830973.68225	General Crossing Proposal	Active	15/02/2021 06:03:49 AM	ben.zmijewski@beca.com

02346-1 **Lincoln Road Ped Dn** **KM:12.530** **Main South Line - to MNL**

Addington Proposal (Ped)

Proposal Name: Proposed design Proposal Updated Date: 15/02/2021 06:03:49 AM

Proposal Type: General Crossing Proposal Proposal Modifier: xxx.xxxxxxxxx@xxxx.xxx

Proposal Status: Active

Proposal Description: Updated existing ALCAM assessment from site visit in December 2020

Characteristics	*Condition*	*Points*	*Score*	*% of total*
CONTROL DETAILS				
11. Effectiveness of equipment inspection and maintenance	High	0	0	0%
12. Shortest approach warning time from start of flashing lights to train	20 to 28 secs	3	1	2%
13. Longest approach warning time from start of flashing lights to train	20 to 28 secs	3	0	0%
ADJACENT ACTIVITY				
21. Presence of adjacent distractions (visual)	Few	0	0	0%
22. Proximity to passenger station	>500m	0	0	0%
23. Proximity to siding / shunting yard	<100m	5	0	0%
24. Proximity to licensed / special event venue (eg. pub, club, sports	200-500m	1	0	0%
25. Proximity to school playground or aged facilities	200-500m	1	3	7%
26. Ambient noise level / audibility of alarm	Low	0	0	0%
27. Adjacent road traffic activity	Busy	5	0	0%
PEDESTRIAN TRAFFIC CONTROL				
31. Conspicuity of pedestrian control	Good	0	0	0%
32. Visibility of pedestrian control	Good	0	0	0%
33. Likelihood of vandalism to control	Some History	3	29	66%
PEDESTRIAN TRAFFIC				
41. Volume of pedestrians (peak flow)	>100 pedestrians per hour	5	4	9%
42. Type of pedestrians (children)	High Risk	5	3	7%
43. Type of pedestrians (physically disabled)	Low Risk	0	0	0%
44. Type of pedestrians (sensory disabled)	Low Risk	0	0	0%
45. Type of pedestrians (intellectually disabled)	Low Risk	0	0	0%
46. Type of pedestrians (cyclists, wheelchairs, prams etc)	Low Risk	0	0	0%
47. Type of pedestrians elderly	Low Risk	0	0	0%
RAIL VEHICLES				
51. Train volume (high is bad) (if high then greater probability of	>10 to 60 trains per day	4	0	0%
52. Infrequent / seasonal movements / special trains	Low	0	0	0%
53. Highest train speed at crossing (typical)	<=60 kph	0	0	0%
54. Longest train length (typical)	>300 to 1000m	3	0	0%
CROSSING GEOMETRY				
61. Number of operational rail tracks (including sidings)	>2 tracks	5	4	9%
62. Angle of crossing & condition / width of flange gap	70-90deg	0	0	0%
63. Condition of crossing (fencing/path surface etc)	Good	0	0	0%
64. Freight trains stand across crossing	Rarely	0	0	0%

65. Gradients, widths and manoeuvring space of pathway/maze	Fully meets DDA	0	0	0%
66. Change of path alignment between pedestrian maze and track	Adequate	0	0	0%
67. Crossing to Australian/NZ Standards (signage & path marking)	Fully meets AS	0	0	0%
VISIBILITY				
71. Visibility from crossing to train (from pedestrian holding point)	50 to 80%	4	0	0%
72. Sun glare issues at crossing	Yes	5	0	0%
73. Temporary visual impediments	No	0	0	0%
74. Masking of trains (moving or stationary) timetabling etc	Occasionally	3	0	0%

44.62802 100%

Controls

Physical Controls	Automatic Gates
Audio Visual Controls	Visual and audible alarm
Emergency Egress	With latch (including holding enclosure)
Pedestrian Signage / Path Marking	Holding line (painted only)
Pedestrian Signage / Path Marking	Delineation line marking (painted only)
Pedestrian Signage / Path Marking	Tactile ground surface indicators
Crossing Environment	Whistle boards
Crossing Environment	Wing/funnel/guide fencing
Crossing Environment	Funnel pathway
Crossing Environment	Adjacent corridor fencing
Pathway Works	Flange Gap Filler?
Operational	Train lights

Crossing Volume (AADT) Pedestrian: 532 Rail: 35

Outputs

Infrastructure Factor: **44.62802**

Exposure Factor: **18,620**

Risk Score: **830,974**

Risk Bands

Across Control Classes

Risk Band All: **Medium High**

Risk Band Jurisdiction: **High**

Within Train Activated Gates Control Class

Risk Band All: **Medium Low**

Risk Band Jurisdiction: **Medium**

Mechanisms

UNABLE TO AVOID

Unable to stop in time, late recognition of danger	0
Caught in tracks (stuck, slip, trip, fall)	4
Unable to cross quickly enough	6
Trapped by controls (if no gates then all values are zero)	2

Unable to determine the orientation of the crossing	0
UNAWARE	
Distracted	0
Did not see train or visual warning signals	0
Did not hear train or audio warning signals	0
Has limited capacity to recognise danger and react	0
Under the influence of alcohol	0
Does not recognise crossing	0
Does not expect second train	0
Assumes train would stop	0
Misjudges train speed	0
Does not expect train	0
Does not expect train movement(s)	0
Mislead by infrastructure	0
Mislead by controls	29
UNWILLING TO RECOGNISE	
Deliberately ignored control	1
Bypassing active control	0
Crawling under wagons (if no trains stopping then all values are zero)	0
Skylarking	2
	45

Search Criteria

Crossing Number: 2346

Jurisdiction: NZ

Crossing Name: Lincoln Road Ped Dn Addington

Crossing KM: 12.530

Pedestrian Proposal Summary

	Proposal Name	Proposal Description	Risk Score	Type	Status	Modified Date	Modifier
1	Future score	Future score based on proposed design + 10 year increase in user volumes at 3% per annum	1858310.64065	General Crossing Proposal	Active	15/02/2021 06:05:59 AM	ben.zmijewski@beca.com

02346-1 **Lincoln Road Ped Dn** **KM:12.530** **Main South Line - to MNL**

Addington Proposal (Ped)

Proposal Name: Future score Proposal Updated Date: 15/02/2021 06:05:59 AM

Proposal Type: General Crossing Proposal Proposal Modifier: xxx.xxxxxxxxx@xxxx.xxx

Proposal Status: Active

Proposal Description: Future score based on proposed design + 10 year increase in user volumes at 3% per annum

Characteristics	*Condition*	*Points*	*Score*	*% of total*
CONTROL DETAILS				
11. Effectiveness of equipment inspection and maintenance	High	0	0	0%
12. Shortest approach warning time from start of flashing lights to train	20 to 28 secs	3	1	2%
13. Longest approach warning time from start of flashing lights to train	20 to 28 secs	3	0	0%
ADJACENT ACTIVITY				
21. Presence of adjacent distractions (visual)	Few	0	0	0%
22. Proximity to passenger station	>500m	0	0	0%
23. Proximity to siding / shunting yard	<100m	5	0	0%
24. Proximity to licensed / special event venue (eg. pub, club, sports	200-500m	1	0	0%
25. Proximity to school playground or aged facilities	200-500m	1	3	7%
26. Ambient noise level / audibility of alarm	Low	0	0	0%
27. Adjacent road traffic activity	Busy	5	0	0%
PEDESTRIAN TRAFFIC CONTROL				
31. Conspicuity of pedestrian control	Good	0	0	0%
32. Visibility of pedestrian control	Good	0	0	0%
33. Likelihood of vandalism to control	Some History	3	29	66%
PEDESTRIAN TRAFFIC				
41. Volume of pedestrians (peak flow)	>100 pedestrians per hour	5	4	9%
42. Type of pedestrians (children)	High Risk	5	3	7%
43. Type of pedestrians (physically disabled)	Low Risk	0	0	0%
44. Type of pedestrians (sensory disabled)	Low Risk	0	0	0%
45. Type of pedestrians (intellectually disabled)	Low Risk	0	0	0%
46. Type of pedestrians (cyclists, wheelchairs, prams etc)	Low Risk	0	0	0%
47. Type of pedestrians elderly	Low Risk	0	0	0%
RAIL VEHICLES				
51. Train volume (high is bad) (if high then greater probability of	>10 to 60 trains per day	4	0	0%
52. Infrequent / seasonal movements / special trains	Low	0	0	0%
53. Highest train speed at crossing (typical)	<=60 kph	0	0	0%
54. Longest train length (typical)	>300 to 1000m	3	0	0%
CROSSING GEOMETRY				
61. Number of operational rail tracks (including sidings)	>2 tracks	5	4	9%
62. Angle of crossing & condition / width of flange gap	70-90deg	0	0	0%
63. Condition of crossing (fencing/path surface etc)	Good	0	0	0%
64. Freight trains stand across crossing	Rarely	0	0	0%

65. Gradients, widths and manoeuvring space of pathway/maze	Fully meets DDA	0	0	0%
66. Change of path alignment between pedestrian maze and track	Adequate	0	0	0%
67. Crossing to Australian/NZ Standards (signage & path marking)	Fully meets AS	0	0	0%
VISIBILITY				
71. Visibility from crossing to train (from pedestrian holding point)	50 to 80%	4	0	0%
72. Sun glare issues at crossing	Yes	5	0	0%
73. Temporary visual impediments	No	0	0	0%
74. Masking of trains (moving or stationary) timetabling etc	Occasionally	3	0	0%

44.62802 100%

Controls

Physical Controls	Automatic Gates
Audio Visual Controls	Visual and audible alarm
Emergency Egress	With latch (including holding enclosure)
Pedestrian Signage / Path Marking	Holding line (painted only)
Pedestrian Signage / Path Marking	Delineation line marking (painted only)
Pedestrian Signage / Path Marking	Tactile ground surface indicators
Crossing Environment	Whistle boards
Crossing Environment	Wing/funnel/guide fencing
Crossing Environment	Funnel pathway
Crossing Environment	Adjacent corridor fencing
Pathway Works	Flange Gap Filler?
Operational	Train lights

Crossing Volume (AADT) Pedestrian: 694 Rail: 60

Outputs

Infrastructure Factor: **44.62802**

Exposure Factor: **41,640**

Risk Score: **1,858,311**

Risk Bands

Across Control Classes

Risk Band All: **Medium High**

Risk Band Jurisdiction: **High**

Within Train Activated Gates Control Class

Risk Band All: **Medium**

Risk Band Jurisdiction: **Medium**

Mechanisms

UNABLE TO AVOID

Unable to stop in time, late recognition of danger	0
Caught in tracks (stuck, slip, trip, fall)	4
Unable to cross quickly enough	6
Trapped by controls (if no gates then all values are zero)	2

Unable to determine the orientation of the crossing	0
UNAWARE	
Distracted	0
Did not see train or visual warning signals	0
Did not hear train or audio warning signals	0
Has limited capacity to recognise danger and react	0
Under the influence of alcohol	0
Does not recognise crossing	0
Does not expect second train	0
Assumes train would stop	0
Misjudges train speed	0
Does not expect train	0
Does not expect train movement(s)	0
Mislead by infrastructure	0
Mislead by controls	29
UNWILLING TO RECOGNISE	
Deliberately ignored control	1
Bypassing active control	0
Crawling under wagons (if no trains stopping then all values are zero)	0
Skylarking	2
	45

C

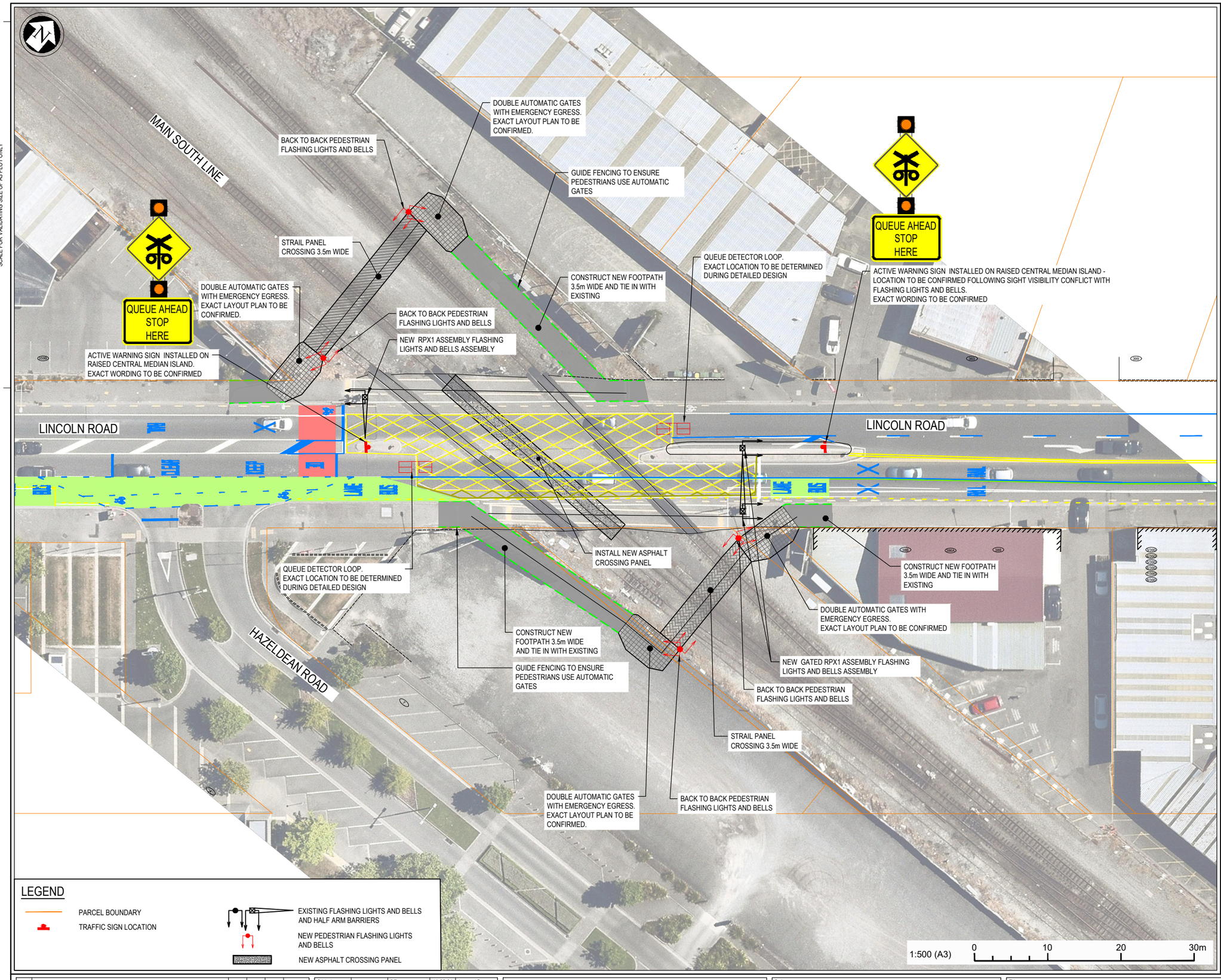
Appendix C – Concept design sketch

Drawing Plotted: 19 Feb 2021 9:26 AM

100mm

SCALE FOR VALIDATING SIZE OF A3 PLOT ONLY

0



NOTES

1. SIGNS AND MARKINGS ARE TO BE REVIEWED TO COMPLY WITH TCD PART 9 AS PART OF THE DETAILED DESIGN. TO AVOID CONFUSION, SIGNS AND MARKINGS OTHER THAN THOSE RELATING TO THE RAILWAY SIGNALING ARE NOT SHOWN.
2. UNDERGROUND SERVICES ARE NOT SHOWN AT THIS STAGE BUT WILL BE LOCATED FOR DETAILED DESIGN.

LEGEND

- PARCEL BOUNDARY
- TRAFFIC SIGN LOCATION
- EXISTING FLASHING LIGHTS AND BELLS AND HALF ARM BARRIERS
- NEW PEDESTRIAN FLASHING LIGHTS AND BELLS
- NEW ASPHALT CROSSING PANEL

ORIGINAL DRAWING IN COLOUR

DRAFT ONLY
NOT FOR CONSTRUCTION

CONCEPT DESIGN
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
A	FOR REVIEW	PS	BZ	MF	17.02.21

Original Scale (A3) 1:500

Design	BZ	15.02.21	Approved For Construction*
Drawn	PS	16.02.21	
Dsg Verifier	BZ	17.02.21	
Dwg Check	KSA	17.02.21	Date 31.07.19

* Refer to Revision 1 for Original Signature

Beca | Christchurch City Council

Project: CCC TRANSPORT PANEL
SOUTH WEST LINCOLN ROAD
PHASE 1 LCSIA

Title: RAIL CROSSING
CONCEPT PLAN

Status: **FOR REVIEW**

Drawing No. 3811906 - TA - K001

Rev. A

Document No. P:\3813811906\Category C\C105 - South West Lincoln Road Phase 1 LCSIA\CAD\3811906-TA-K001.dwg

DO NOT SCALE

IF IN DOUBT ASK.