APPENDIX J FLYOVER ALTERNATIVES MCA

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ROLLESTON ACCESS IMPROVEMENTS

TECHNICAL NOTE
FLYOVER ALTERNATIVES ASSESSMENT

WAKA KOTAHI NZ TRANSPORT AGENCY
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QUALITY ASSURANCE

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ACRONYMS / ABBREVIATIONS

Ch	Chainage
CRETS	Christchurch Rolleston and Environs Transportation Study
CSM2	Christchurch Southern Motorway – Stage 2
DBC	Detailed Business Case
DSI	Death and Serious Injury
GH	George Holmes Road
KPI	Key Performance Indicator
LILO	Left in – left out
LO	Left out
LPC	Lyttelton Port Company
MCA	Multi Criteria Analysis
MSQA	Management, Surveillance and Quality Assurance
NOF	Network Operating Framework
NZUP	New Zealand Upgrade Programme
OD	Over-dimension
RDN	Rolleston Drive North
SDC	Selwyn District Council
SH1	State Highway 1
SMEs	Special Matters Experts
VHT	Vehicle Hours Travelled
VKT	Vehicle Kilometres Travelled

1 INTRODUCTION

1.1 Overview

The purpose of this Technical Note is to present the re-assessment of a long list of alternatives and options for the improved connectivity between Rolleston town centre and the industrial area, following consultation and further transport analysis and provide the rationale for how an emerging preferred option was identified. The Technical Note includes key details from technical assessments which have informed the evaluation of alternatives and a recommendation for the preferred connection option.

This work builds on previous evaluation work undertaken at a broader geographical level as part of the New Zealand Upgrade Programme (NZUP) Canterbury Package. This previous work identified a need for a flyover to connect the Rolleston industrial zone with the town centre, and the option identified for consultation was on a skewed elevated alignment between Rolleston Drive North (RDN) and Jones Road. This alignment was used as the basis for public engagement which, although generally supportive of the concept, some feedback identified a need for further work to confirm the exact alignment of the flyover.

This Technical Note outlines the assessment to get to a preferred flyover arrangement, following a 'long list' to 'medium list' to 'short list' to 'preferred option' process. The project team assessment was reviewed by the Waka Kotahi steering committee members with assistance of independent advisors (challenge review) to confirm the robustness and emerging direction. Essentially:

- The **'long list' to 'medium list'** took the form of a fatal flaw analysis. This was documented within ***Technical Note No.9: Short List Overview (21 December 2021)*** and narrowed the range of alternatives down from 25 to eight. The analysis was informed by traffic modelling, concept designs, high-level cost estimates and a multi-criteria assessment (MCA).
- The **'medium list' to 'short list'** process took the form of a 'challenge review' from Waka Kotahi and project partners (Selwyn District Council) of the fatal flaw analysis. This narrowed the range of alternatives down from eight to four.
- The **'short list to preferred option'** process took the form of a refreshed MCA with input for a range of Specialist Matter Experts (SMEs), and additional evidence. The approach aligned with the agreed approach that was undertaken for the assessment of other aspects of the NZUP programme (e.g. Dunns Crossing Road / Walkers Road improvements).

The approach taken to get from the long list to the preferred option is shown in Figure 1.

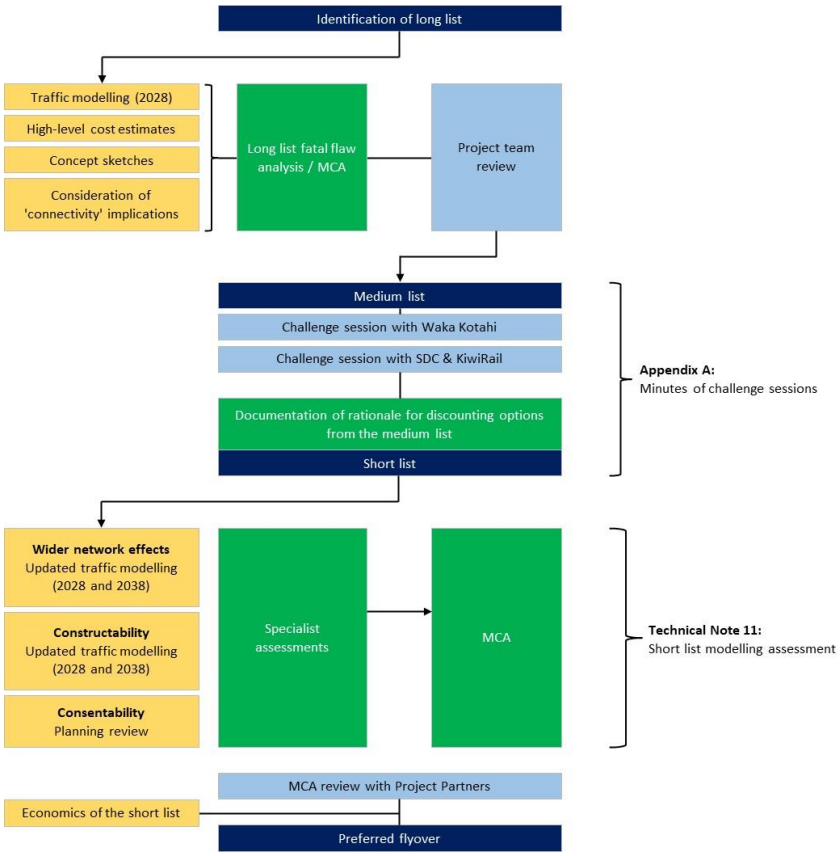


Figure 1 – Approach to identifying a preferred flyover option

A key conclusion of the 'long list' to 'medium list' process was that, to achieve the project Investment Objectives and desired NZUP outcomes, some form of grade-separation across SH1 would be required. Several different *'fully at-grade solutions'* were explored, but traffic modelling analysis and the MCA processes confirmed that there are no feasible solutions that could deliver sufficient network capacity or safety outcomes.

The focus of this Technical Note is around the 'medium list' to 'preferred option' process.

Technical Note No.11 – Short List Modelling Assessment, provides a detailed overview of the modelling results and a summary of the key findings.

The presentations and minutes from key meetings are provided within **Appendix A.**

1.2 Assessment Criteria

A consistent approach to the MCA process has been used through the development of the Detailed Business Case. The MCA criteria, and associated KPIs, are provided within Table 1.

Table 1: MCA Criteria

Category		Criteria/KPI		Factors to consider
Investment Objectives	**Safety** • Working towards zero injuries and deaths	1.1	DSIs (including vulnerable users)	• Right turn conflicts, merges, out of context, vulnerable driveway risks
		1.2	Reduced road/rail incidents	• Short stacking at Hoskyns and other level crossing risks
	Connectivity • Support a more connected community, resulting in liveability benefits	2.1	Pedestrian travel times across SH and rail	• Directness, gradient, environment
		2.2	Social connectedness - people within 15/30 minutes	• Vehicle connectivity to a range of key destinations
		2.3	Travel time between Rolleston township and industrial area	• Sector to sector times from traffic model
		2.4	Freight productivity	• SH delays and access to industrial area
	Resilience / sustainability • Provide a more sustainable and resilient network	3.1	People throughput (non-car)	• Number of pedestrians, cyclists and public transport users crossing the State Highway and Rail corridors
		3.2	Rail movements	• Proxy for freight on rail
		3.3	Resilience to unplanned events	• Risk of crashes and traffic obstructions, provision of alternative routes
		3.4	Reduce CO2 emissions associated with land transport	• Does traffic have to deviate from the main road network
		3.5	Flexible – ability to adapt to future changes	• Especially areas at Jones/Hoskyns for rail connectivity • Service lane/RDN residual land opportunity • Tennyson development potential
Other	**Planning effects**	P1	Consentability	• Visual, noise and environmental impacts
		P2	Property	• Impacts on adjacent property access, business impacts and acquisition risks – number and scale
	Technical effects	T1	Engineering Difficulty	• Including Structures, Geotech and stormwater
		T2	Constructability	• Impact of construction (timeframes and temporary traffic management)
	Wider network effects	W1	Wider network effects	• Rerouting traffic impacts on network performance, other users and adjacent communities
		W2	Rail network effects	• Impact on operations and rerouted traffic at other level crossings
		W3	Interdependencies	• Triggers other network improvements – scale and timing
		W4	Amenity/visual impacts	• Traffic impacts in sensitive environments • Fit with network plan and liveable communities

Impacts on Te Ao Maori are being assessed through the Waka Kotahi partnership with Te Taumutu and Tuahurri Runanga cultural advisory group, covering the entire NZUP programme.

2 PREVIOUS ANALYSIS

2.1 Consultation Option Development

A key feature of the NZUP programme is a multi-modal flyover connecting the northern and southern sides of Rolleston. The originally identified alignment, which was presented as part of public consultation, was between Rolleston Drive North and Jones Road (at the Bulk Retail roundabout). This option, referred to as the ***Rolleston Drive to Jones Road skewed flyover***, includes the full closure of both Rolleston Drive North and Hoskyns Road signalised intersections with SH1.

As outlined in the draft Alternatives and Options assessment report, a multi criteria assessment was undertaken on a range of flyover options in August 2021. This considered the wider network effects of this option using traffic modelling along with several other alternative alignments, in August 2021. The various alignments are presented in Figure 2.

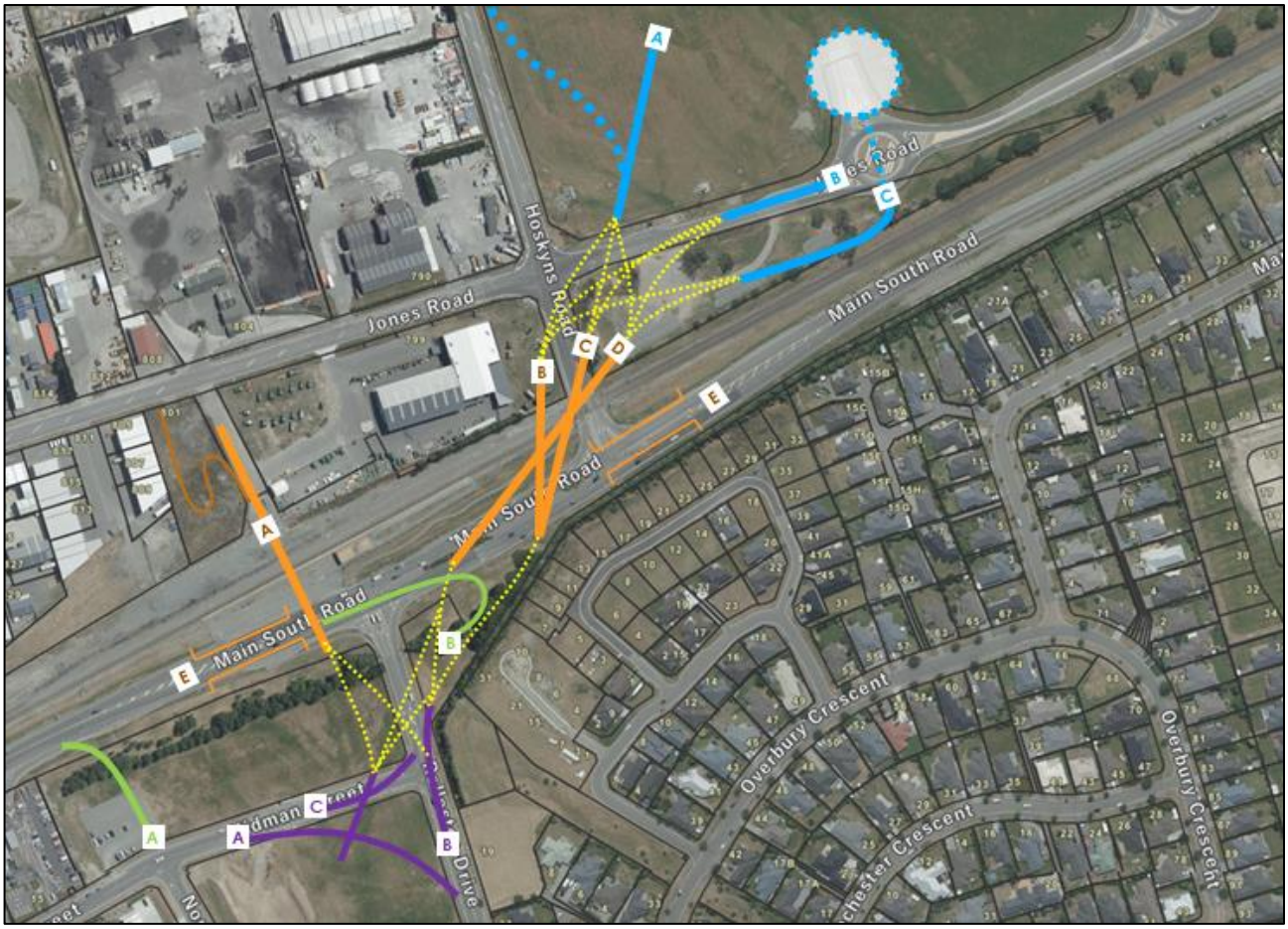


Figure 2: Rolleston North to Jones Road - Flyover options

Following the MCA process, the project team agreed to progress **bridge alignment D** as emerging technically preferred option, which would then tie-in with **Option B** on the northern side and **Option B** on the southern side to align with Rolleston Drive North, the main collector road. The flyover would extend over the existing SH1 and the Main South Line and allow for the addition of a third rail for rail operation improvements at Rolleston. This was chosen on the basis that it offers a gentle gradient (less than 6%), has minimal property access disruption, and delivers on the safety objective of having zero harm at the Hoskyns Road level crossing.

The option also supports the road hierarchy and network plan to keep traffic on main roads and also presents a safe option that provides multi-modal connectivity. The other options did not perform quite so well because of property impacts or gradient (alignment option A or B), or issues of geometry or constructability (alignment options C and E).

The option was presented to the community in late 2021 in the context of the wider package of improvements and a significant amount of feedback was received. The purpose of the consultation was to ask people what they thought about the options and what was important to them. In parallel, further technical analysis was undertaken to fully understand the effects of the proposal. Through both processes several issues were raised in relation to the flyover concept:

- Feedback outlined concern about the closure of a section of Jones Road (east-west movement) meaning that traffic would need to divert around the Bulk Retail development via iPort Drive and Link Drive to

Hoskyns Road, taking longer and therefore not providing good connectivity to the western end of the industrial area.

- Concerns from emergency services that the longer route would impact their response times.
- Concerns that the reduced state highway access (closure of Hoskyns level crossing) meant people had to drive through too many roundabouts from Weedons interchange along Jones Road, IPort and Link Drive, raising safety concerns with this increased traffic.
- Concerns that rerouting of traffic (caused by closures of movements onto SH1), would put significant pressure on the Weedons Ross Road interchange. This was also identified through ongoing transport model analysis that identified high peak delays, and potential queues back onto SH1.
- Technical constructability review identified that the bridge alignment is the longest of the alternatives that were considered requiring structural steel girders spanning up to 65m. The longer the structure, the more the associated level of embodied carbon. This would have knock-on impacts on Climate Change goals.
- The length and skew of the proposed flyover structure presents engineering complexity issues, which raises buildability risks. These had not been investigated in detail prior to consultation and have subsequently been investigated further.

2.2 Refinement of Consultation Option

In response to the feedback received from consultation and subsequent more detailed design development, analysis and modelling, a number of changes were made to the design of the concept. These are outlined in section 5.2 below, and in summary included improved access to/from SH1 and improved east-west connectivity along Jones Road. These changes introduced additional complexity and cost to the concept and therefore it was agreed that a more targeted evaluation exercise be undertaken to consider a broader suite of options to address connectivity between the Rolleston town centre and the industrial zone. This cast the “long list” net wider, before proceeding to a medium list and a short list.

3 LONG LIST TO MEDIUM LIST

A long-list of alternatives and options for providing connectivity across the State Highway and railway line was developed based on feedback received from the consultation process, along with some of the options that were previously considered and discarded[1] and some new options identified as part of a project team workshop. The long list was subject to a high level evaluation against the investment objectives using input from the subject matter experts. This was moderated using independent specialists from Waka Kotahi to produce a medium list of viable options.

The long list is outlined in Table **2**. The table identifies which of the alternatives have been brought through to the medium list, and the key rationale for this.

Table 2: Long List Alternatives

ID	Category	Option	Short List	Rationale for discounting or notes
DM	At grade	**Do Minimum** • Assumes the other elements of the package are included • Signals are retained at RDN and Hoskyns Road	Yes	Progress as it is the Do Minimum (acknowledging that modelling indicates that this is not a sustainable option beyond 2028)
1		**Signal optimisation** • Refine current signals to increase capacity • Adding second right turn into Hoskyns from highway (full connectivity).	No	• Optimisation likely to have minimal improvement • Signals are out of context coming off CSM2. • Potential queuing back from Hoskyns/SH1 signals worsening level crossing risk. • Limited improvement for connectivity and does not support future growth
2		**At grade (safety)** • Retain RDN signals • Hoskyns LILO	No	• Addresses most of the level crossing risk, but retaining the left in movement at Hoskyns Road has risks and may trigger rail re-signalling. • Does not provide full connectivity (i.e. IZone to Rolleston town) or fully support the Investment Objectives. • Signals are out of context coming off CSM2.
3	RDN to Jones skewed options	**Skewed flyover -consulted** • Development of the previously (2013) developed option • Skewed connection between RDN and Jones Road/bulk retail roundabout • No Hoskyns or RDN Connection to SH1	No	• Option has already been thoroughly assessed, summarised in options and alternatives report • Following consultation and further analysis there is a technically improved alternative that has been identified for a RDN to Jones Road skewed alignment (see option 4)
4		**RDN to Jones Road Skewed Flyover** **(Refined consultation option)** • Left-out from Hoskyns Road • Slip lane to Kidman Street from the service lane • New road through the Bulk Retail development, connecting Jones Road (East) to Hoskyns Road. • Signals at either ends of the flyover	Yes	• Maintains easy gradients and improves access and local connectivity • Need to assess buildability, traffic flows and performance and costs

[1] Not all options that were discarded previously were carried forward into the long list – those that were fatally flawed at the previous stage were reassessed and if new information was available that justified re-evaluation, they were reconsidered.

ID	Category	Option	Short List	Rationale for discounting or notes
5		**Skewed Flyover + LO @ GH** • Left-out from George Holmes Road (grade-separated to avoid additional rail level crossing) • Slip lane to Kidman Street from the service lane • Signals at either ends of the flyover • Closes Hoskyns level crossing	No	• Additional structure, Incrementally higher cost • Removes Hoskyns left out residual risk, but this is minor improvement over refined skew consultation option, • KiwiRail will not accept a new at-grade level crossing for the left-out from George Holmes Road, hence additional structure
6		**Flyover Hoskyns North (S-Bend underpass or overbridge)** • Left-out from Hoskyns Road • Slip lane to Kidman Street from the service lane	No	• Technical difficulty • Clears Jones Road, needs link back through IPort • High additional cost with low (if any) additional benefit • Local property access disbenefits
7	RDN to Jones direct options	**Direct Flyover (or underpass) Straight (RDN to Jones Road)** • Original 'Alignment A' • Left-out from Hoskyns Road • Slip lane to Kidman Street from the service lane. controlled as separate leg to the Kidman signals • Signals at either ends of the flyover	Yes	• Further work required to assess property impacts • Further work required to assess traffic operations
8		**Direct Flyover Straight (RDN to Jones Road) Half Interchange** • Original 'Alignment A' • Left-out from Hoskyns Road (for heavy vehicles) • Slip lane to Kidman Street from the service lane (or offramp four leg intersection) • Northbound onramp from the bridge to SH1 north • Signals at either ends of the flyover.	Yes	• Further work required to assess property impacts • Further work required to assess traffic operations • Additional structures required
9	Roundabouts	**Rolleston Dr N roundabout (priority)** • George Holmes LO grade separated • Hoskyns LILO Note: Need George Holmes for Industrial to township connectivity	No	• Permits SH U-turn and left into Hoskyns (to replace the right turn into Hoskyns) • Priority controlled roundabout has high traffic delays due to unbalanced flows, performs worse than Do Min in all periods and particularly poor in AM peak. • U-turn movement puts a lot of pressure on the roundabout
10		**RDN roundabout (signalised)** • George Holmes LO grade separated • Hoskyns LILO • Pedestrian/cycle overbridge to Tennyson Street	Yes	-Signalised roundabout needed to address imbalanced flows, and works reasonably well
11		**RDN roundabout + Hoskyns Road roundabout**	No	• Larger property take (from new residential areas) • New associated safety risks • Do not resolve level-crossing issues • May worsen SH through movement reliability

ID	Category	Option	Short List	Rationale for discounting or notes
12		**RDN / Hoskyns Road – combined roundabout**	No	• Larger property take (from new residential areas) • New associated safety risks • Do not resolve level-crossing issues • May worsen SH through movement reliability
13	Tennyson Drive to George Holmes Road under/overpass	**Tennyson Under (or over) pass + RDN signals** • Hoskyns LILO	Yes	-The connection is for light/medium vehicles only Heavies use Hoskyns or Weedons interchange
14		**Tennyson Under (or over) pass + RDN roundabout** • Hoskyns LILO	Yes	-
15	SH1 tunnel	SH1 Trench + RDN signals and Hoskyns all-movements with signals	No	• Complexity – Scale and cost • High construction impact for the community (i.e. long period of TMP and disruption) • Doesn't address safety issues at Hoskyns Road level crossing
16		SH1 Trench + Rolleston-Hoskyns Realignment (one signalised intersection)	No	
17		More Capacity (than option 16) RDN / Hoskyns	No	
18	SH1 (E-W) overbridge	SH1 Flyover, Tennyson Underpass, Hoskyns LILO	No	• Cost • High construction impact for the community (i.e. long period of TMP and disruption) • Hoskyns left in options rejected due to residual level crossing risk • Don't provide industrial to township connectivity (hence needed GH left out and roundabout OR Tennyson/GH connection
19		SH1 Flyover + RDN signals and Hoskyns all-movements with signals	No	
20		SH1 Flyover + RDN signals and Hoskyns LILO	No	
21		RDN realigned to Hoskyns underneath	No	
22		Rolleston Dr N realigned to Hoskyns underneath, no connections South	No	
23		Rolleston Dr N realigned to Hoskyns & LILO	No	
24	Two flyovers	**Tennyson Drive to George Holmes under (or over) pass AND** **SH1 (east-west) flyover + Hoskyns LO**	Yes	-

4 MEDIUM LIST TO SHORT LIST

4.1 Medium List

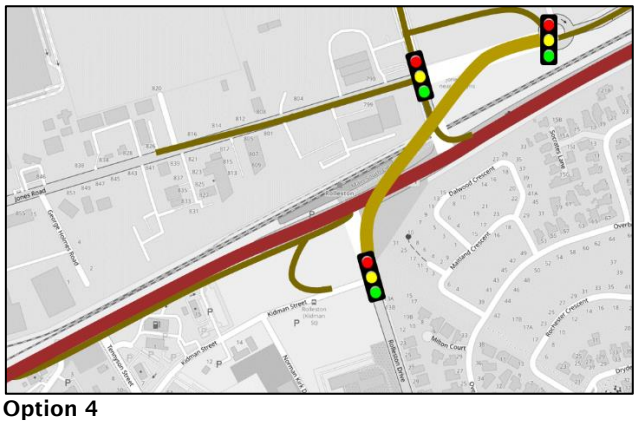
A concise overview of the medium-list of connection alternatives is provided within Table 3.

Table 3: Medium-list Details

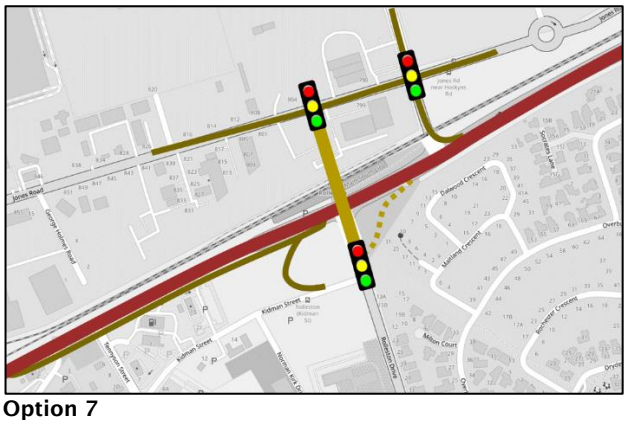
ID	Option	Grade Separation	
		George Holmes to Tennyson Street	Rolleston Drive North to Jones Road
DM	Do Minimum	-	-
4	RDN (RDN) to Jones Road - Skewed Flyover (Refined from Consulted Option)	-	• Two lanes on the bridge • Left-out from Hoskyns Road • Slip lane to Kidman Street from the service lane
7	RDN to Jones Road – Straight Flyover	-	• Alignment A • Four lanes on the bridge
8	RDN to Jones Road – Straight Flyover + **Northbound on-ramp**	-	• Alignment A • Four lanes on the bridge • Additional slip lane from the top of the bridge to SH1 NB (replaces Hoskyns Road left out)
10	Rolleston Dr N roundabout (signalised)	George Holmes LO onto SH1	-
13	Tennyson Underpass + RDN signals	Underpass	-
14	Tennyson overpass + RDN roundabout	Overpass	-
24	Tennyson Drive to George Holmes underpass **AND** SH1 (east-west) flyover + Hoskyns LO	Underpass	• SH1 overpass • Two lanes on the bridge • Left-out from Hoskyns Road

The diagrams on the next page provide simple representations of each option and identify the corresponding local intersection treatments which accompany each flyover option.

Appendix B provides the latest concept sketches for each of the medium list options.

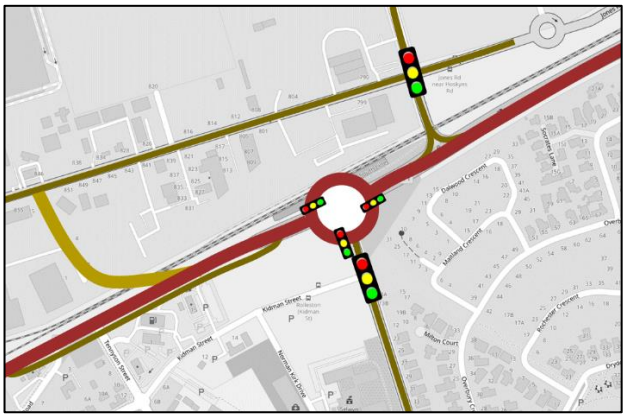


Option 4
Skewed Flyover (Refined Consulted Option)

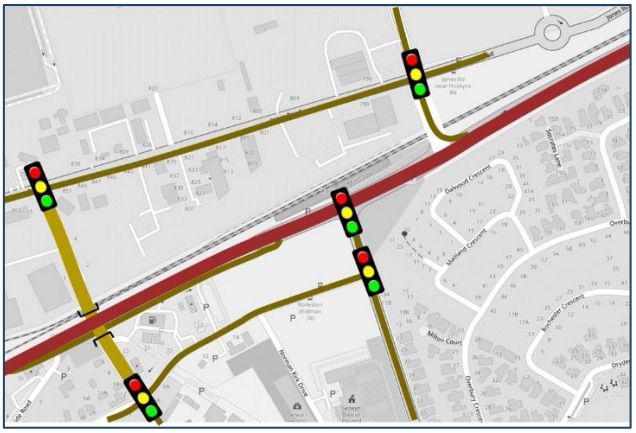


Option 7
Straight flyover

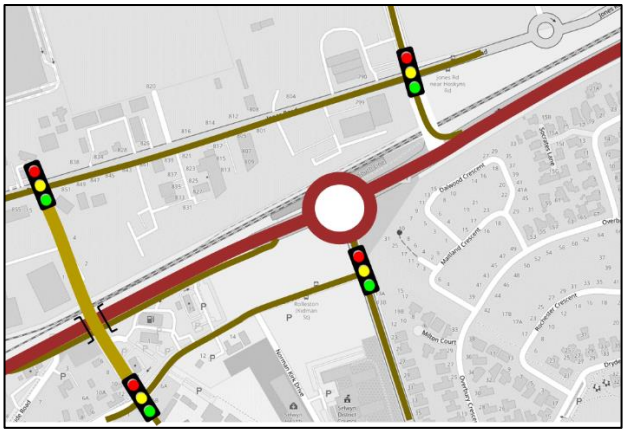
Option 8
Straight flyover (plus NB on-ramp)



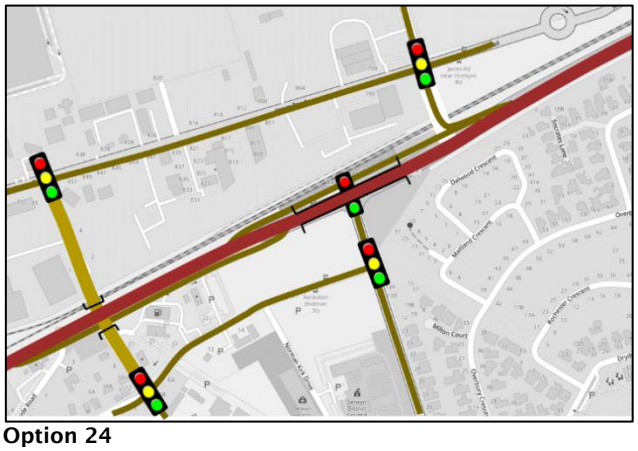
Option 10
RDN roundabout (signalised) + grade-separated left out @ George Holmes Road



Option 13
Tennyson Drive overpass + RDN signal



Option 14
Tennyson Drive overpass + RDN roundabout



Option 24
Tennyson Drive to George Holmes underpass + SH1 (east-west) flyover + Hoskyns LO

4.2 Review of the Medium List

The medium-list to short-list process took the form of a challenge review from Project Partners and key stakeholders, undertaken across the following sessions:

- 19th January 2022 – challenge session from senior members of the Waka Kotahi team
- 1st February 2022 – challenge session from SDC and Kiwirail

The key feedback from these challenge sessions, and the rationale behind discounting options is outlined within Table 4.

Table 4: Medium List Assessment

ID	Option	Key feedback/risks	Progress to short list	
DM	Do Minimum	• DM doesn't address the safety or connectivity issues • Additional congestion on the network will result in deteriorating conditions for all modes	Yes	Business case requirement to progress the Do Minimum
4	RDN to Jones Road - Skewed Flyover	• Refined version of option presented as part of the public consultation exercise • Refinements provide improved access to SH1 and reduce pressure on Jones Road/Weedons interchange • Delivers on investment objectives • High cost and complex structure	Yes	
7	RDN to Jones Road – Straight Flyover	• Straight alignment is a more straightforward alignment on the desire line between RDN and industrial zone • Has shorter, steeper ramps to flyover • Provides same access to SH1 as skewed option • Delivers on investment objectives • Risk around property impacts	Yes	Has re-emerged from pre-consultation assessment
8	RDN to Jones Road – Straight Flyover (NB on-ramp to SH)	• Same as option 7 but with on ramp provided to reduce pressure on Jones Road and Hoskyns Road intersections • Complex to provide on ramp without increasing gradients on either side of flyover	Yes	Sub-option of Option 7, but not favoured due to need for controlled intersection at top of flyover with poor sight lines
10	RDN roundabout (signalised)	• Signalised roundabout has a large footprint • Although a roundabout is a safe system, the provision of signal metering does not address key safety risk on SH1 • Doesn't provide for north -south connectivity without additional access ramp from George Holmes Drive	No	
13	Tennyson Underpass + RDN signals	• Decoupled highway access from local connectivity • Underpass takes local traffic and active travel under Highway/railway • Results in increased traffic on Kidman and Tennyson Street through town centre • Significant property effects to be considered	Yes	Could also be an overpass option with RDN signals
14	Tennyson overpass + RDN roundabout	• Delivers similar connectivity and safety benefits to option 13, but has similar property and wider network effects. • Overpass takes local traffic and active travel over Highway/railway	No	Option 13 provides similar functionality
24	Tennyson Drive to George Holmes underpass **AND** SH1 (east-west) flyover + Hoskyns LO	• Two significant structures delivering grade separation in two locations (decoupling highway access from local connectivity) • Very complex to construct around a live highway and railway	No	

The medium list was subject to a multi criteria assessment using the criteria outlined above. The scores were drafted by the project team and were then workshopped in the various challenge sessions.

The final short-list therefore consists of:

- Do Minimum
- **Option 4:** Rolleston Drive North to Jones Road – Skewed Flyover (Refined from Consulted Option)
- **Option 7:** Rolleston Drive North to Jones Road – Straight Flyover
    - Retaining the flexibility to consider Option 8 if constructable
- **Option 13:** Tennyson Drive underpass plus retaining signals at Rolleston Drive North / SH1

Despite some concerns regarding the constructability of a northbound on-ramp from the top of a straight flyover, the option remained in contention post the challenge sessions pending further constructability analysis. Essentially this would be a sub-option to Option 7, and should that be the confirmed preferred option, then the feasibility of the on-ramp would be explored further.

The evidence for discounting Options 10, 14 and 24 is presented below.

4.3 Evidence for Discounting Medium List Options

4.3.1 Option 10: Rolleston Drive North – signalised roundabout

A large signalised roundabout at Rolleston Drive North caters for turning movements into and out of Rolleston town centre and provides a left in/left out connection to Hoskyns Road for traffic from Rolleston and Christchurch (via a U-turn at the roundabout). Due to the volumes of traffic on all approaches, modelling indicates that the roundabout will need to be signalised to prevent excessive queuing from developing. Although a roundabout on a busy State Highway is compliant with the Safe Systems approach, the implementation of signals is not. Similarly, the left turn into Hoskyns Road retains a higher rail level crossing risk and may trigger the need for rail signal improvements. Therefore, this option fails to address one of the key safety issues.

Furthermore, the roundabout does not cater for north-south movements from the industrial area to the town centre (it does, however, provide for south-north movements). It therefore fails to address one of the key connectivity objectives of the project. This could be remedied by the provision of an on-ramp facility from George Holmes Drive to the State Highway to the south of the roundabout, but this has safety issues with merging and weaving over a short distance.

A roundabout of this scale would have a large footprint and not cater for active travel users (without additional infrastructure).

The MCA assessment indicated a modest negative score against the safety investment objective. Without the George Holmes Drive connection, this option would also score poorly against the connectivity investment objective. With the George Holmes Drive connection, the option scored poorly in terms of property, visual effects, engineering difficulty, planning consent and constructability.

4.3.2 Option 14: Tennyson Drive overpass + Rolleston Drive North roundabout

In order to mitigate some of the problems identified for option 10, option 14 was developed. This combined the Rolleston Drive North roundabout with an overpass connecting Tennyson Drive with George Holmes Road. The overpass caters for active travel as well as local traffic movements between the town centre and the industrial zone and the roundabout caters for access between the town centre and the State Highway.

Decoupling of local trips from State Highway trips was thought to take pressure off the roundabout and therefore it was tested as a conventional roundabout (unsignalised). However, the performance was shown to deteriorate over time, particularly in the morning peak where northbound traffic from the south must give way to turning traffic leaving Rolleston. Signalising the roundabout addresses this issue but doesn't address the desire to remove signals from the highway. Overall this option was considered to be less desirable than option 13. Although neither option allows for the removal of the traffic signals, the intersection footprint in option 13 is significantly smaller and modelling indicates a higher level of performance.

This option received a slight negative score against the safety investment objective and high negative scores for property (two locations impacted at Tennyson Street and Rolleston Drive North) and constructability.

4.3.3 Option 24: Tennyson Drive to George Holmes underpass AND SH1 (east-west) flyover

Option 24 provides grade separation in two locations – an east-west flyover of SH1 over the local road network and a north-south underpass connecting Tennyson Drive to George Holmes Road. This separates local traffic from traffic accessing the State Highway. Putting the highway on an elevated structure, however, is likely to be expensive and disruptive to construct.

This option scored relatively well against the investment objectives (it achieved the highest score of the discounted options and the fourth highest score overall), however it received a high negative score against the effects criteria – particularly consentability, engineering difficulty, constructability and visual effects.

5 OVERVIEW OF THE SHORT LIST

This section summarises the details around each of the short-listed options.

Technical Note No.13: Options Description Reports provide further details regarding the three short listed options for the Rolleston Access Improvements Detail Business Case, so that the general configurations, operations, risks and benefits can be shared widely. It also includes see the physical specifications, long sections (gradient) and cross sections.

5.1 Do Minimum

The Do Minimum, for the purpose of the flyover assessment, assumes the inclusion of all other preferred options for other elements of the NZUP programme; namely:

- A dual lane roundabout at SH1 / Dunns Crossing Road / Walkers Road intersection.
  - The centre of the roundabout will be offset south of the current intersection.
- Left-in / Left-out at the SH1 / Rolleston Drive South intersection.
- Service lane on the eastern side of SH1 between Rolleston Drive North and Brookside Drive.
- Rail improvements:
  - Improvements at Rolleston Station adding a third line past the LPC siding. Yard Option 2 is located north of the LPC siding.

In respect to the connection between Rolleston Town Centre and the Industrial Area, the Do Minimum assumes the retention of the SH1 traffic signals at Hoskyns Road and Rolleston Drive North in their current state.

5.2 Option 4: Rolleston Drive North to Jones Road – Revised Skewed Flyover

As outlined above, several issues with the skewed flyover concept were identified as part of the public engagement process and further analysis.

As a result of this, the project team looked to identify mitigation measures that could be adopted as part of the design in order to reduce any negative impacts (especially on the Weedons Ross Road interchange and access to the western end of Jones Road). Following liaison with Waka Kotahi technical specialists and KiwiRail, the following features were added to the option:

- Left-out from Hoskyns Road onto SH1. This would be a free-flow movement (meaning that it is very unlikely any blocking back to the railway line will occur), with an auxiliary lane added onto SH1.
  - Provides a more direct access point to SH1 from the industrial area (northbound to Christchurch)
  - Enables the right turn out of Rolleston movement onto SH1 via a slightly convoluted route over the flyover, through the Bulk Retail area and then through the Hoskyns Road/Jones Road signal.
- Slip-lane from the southbound service lane to connect onto Kidman Street. This provides a direct access to Rolleston Drive North (rather than using Tennyson Street) and an alternative route (from the Weedons Ross Road interchange) from SH1 to the industrial area (via the flyover).

Changes to the option since the original MCA

The key changes to the skewed flyover option since the original MCA are:

- Connection road through Big Box development
- Left out from Hoskyns Road
- Off ramp "Loop road" from SH1 service lane onto Rolleston Drive North or the flyover.
- Roundabout at Jones Road intersection replaced by signals

The option is therefore a refinement to that presented as part of the public consultation. Furthermore, since the first MCA more information has come to light which established a higher impact to property and utilities than previously thought.

The amended option is presented in Figure 3.

Note that all plans are provided at concept level and will be subject to further review as the project progresses.

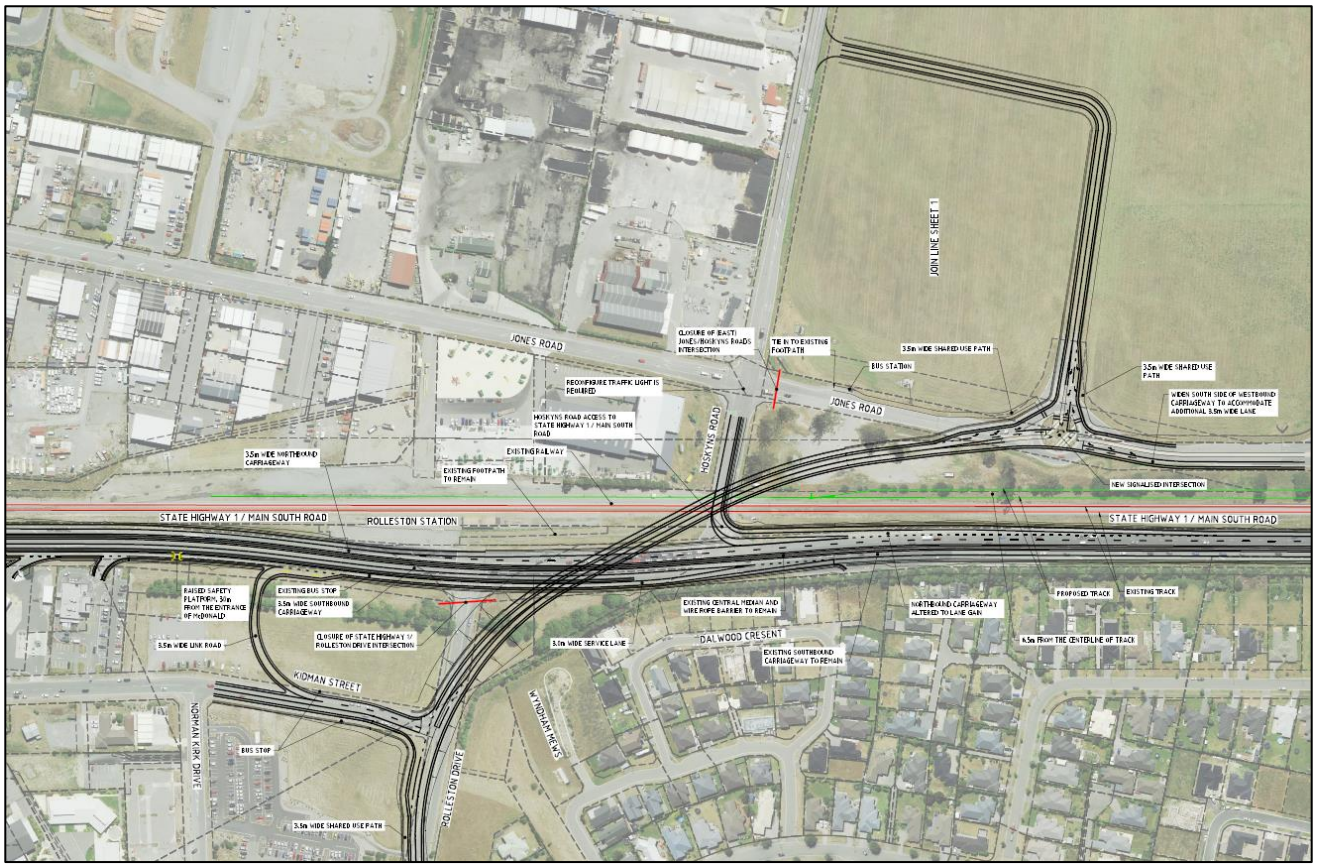


Figure 3: RDN to Jones Road – Skewed Flyover concept

5.3 Option 7: RDN to Jones Road – Straight Flyover

This option was considered in the earlier option assessment and was not chosen because the shorter, steeper ramps were not ideal for active users. The option would essentially see the extension of Rolleston Drive North through to a new T-intersection at Jones Road.

Of all the options, it would present the shortest bridge structure, but it is also the only option that would require more than two general traffic lanes (and so is the widest bridge).

The key features of this option are:

- A three-lane overbridge
- Four spans of 25/25/35/25m length from South to North.
- New signalised intersection for the flyover/Jones Road
- Signal at Kidman Street / Rolleston Drive North
- Footpath on one side, shared path on the other side
- Vertical grade 7.65% approaching Jones Road and 7.61% approaching Kidman Street. Clearance is achieved over SH1 for Over Dimension (OD) vehicles and is achieved over KiwiRail line.
- Bridge typical section is three x 3.5m lanes (two lanes from RDN to Jones Rd), 2 x1.5m shoulders, one x 3.0m shared path and one 2.0m footpath. Total width is 18.5m.
- Site distance achieved on the bridge for 60km/h design speed (posted speed limit 50 km/hr)
- Accesses to properties on RDN side (Ch 350-450) will access via separated service lane
- "Loop" provided from SH1 southbound, from the service lane around to a new signal on RDN.
- Land is required on the Jones Road side
- Access issues to integrate the busy weighbridge on Jones Road (immediately opposite the flyover landing) into the design.
- Includes a left-out from Hoskyns Road onto SH1.

The previous work identified that the key issue for this option related to the steep grades, especially on the Jones Road side. This was seen as a particular issue for cyclists, and if a 5% grade (typically seen as the maximum desirable grade) were to be achieved then the Jones Road/flyover intersection would need to be raised. This would then add significant cost and complexity to the option.

However, as part of this revised assessment further technical input has been sought from Waka Kotahi's cycle design experts. The advice was that "short and sharp" grades are generally acceptable, particularly if direct connections are being provided. What was once seen as a critical flaw in the option, is no longer the case.

This option will put a lot of traffic through three sets of traffic signals for access to Christchurch, so it will require effective signal coordination to maintain reliable traffic flow. During the morning peak, there is a high demand for travel between Rolleston and Christchurch, which means that volumes for the Rolleston Drive North – Flyover – Jones Road – Hoskyns Road – SH1 movement will be very high. Coordination of three sets of signals will be required to ensure that queues do not extend back to downstream intersections.

The concept layout for Option 7 is provided as Figure 4.

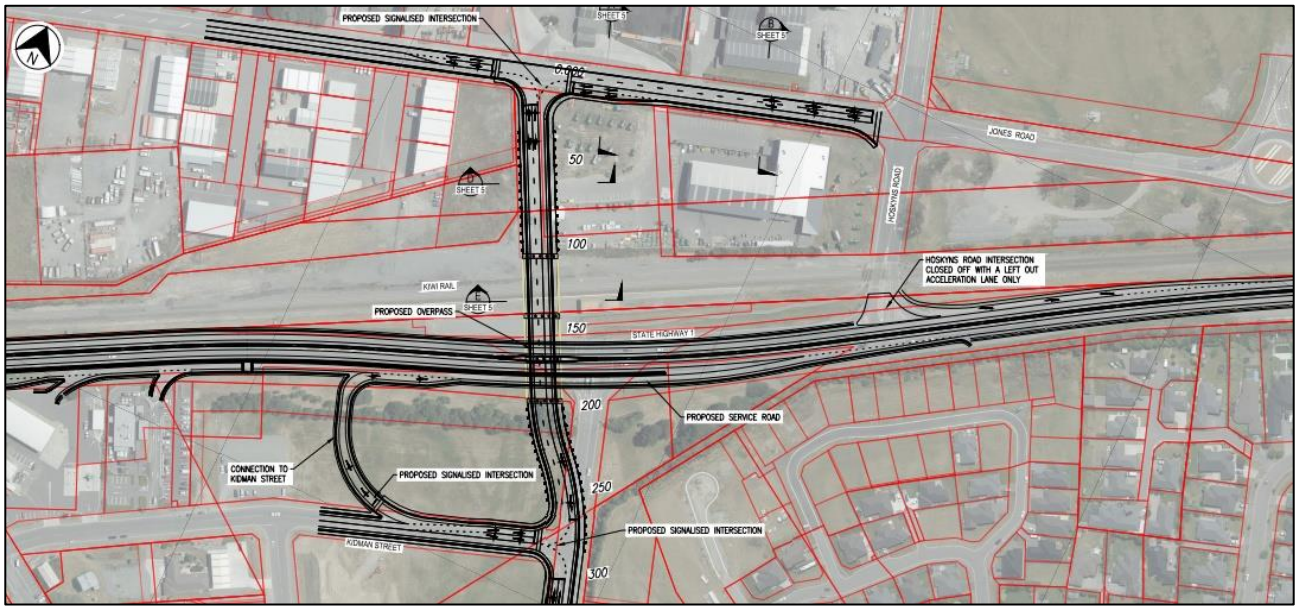


Figure 4: RDN to Jones Road – Straight Flyover initial concept

5.4 Option 13: Tennyson Drive Underpass

This option is somewhat of a departure from other alternatives, in that the primary connection on the Rolleston township side is from Tennyson Drive rather than Rolleston Drive North that is the main traffic route. This deviates from anything that has previous been considered, going as far back as the original CRETS[2] report in 2007.

The option focuses on grade-separation between Tennyson Street and George Holmes Road, with the local road being an underpass and the state highway remaining at-grade. However, the option for the local road connection being an overpass has not been ruled out. The other key feature of this option is the retention and modification of the traffic signals at the Rolleston Drive North / SH1 intersection.

The key features of this option are:

- Two-lane underpass
- Retention and modification of the signals at Rolleston Drive North / SH1
- Signalisation of the Tennyson Street / Kidman Street intersection
- New signals at Kidman Street / Rolleston Drive North.
- Accesses issues for properties on both sides
- Service lane bypasses Tennyson Street - i.e. underpass also goes under the service lane, note SH access to town centre will be via Rolleston Drive North and Kidman Street.
- Site distance achieved for 60km/h design speed.

Figure 5 provides the concept for the Tennyson Drive underpass option.

[2] Christchurch, Rolleston and Environs Transportation Study

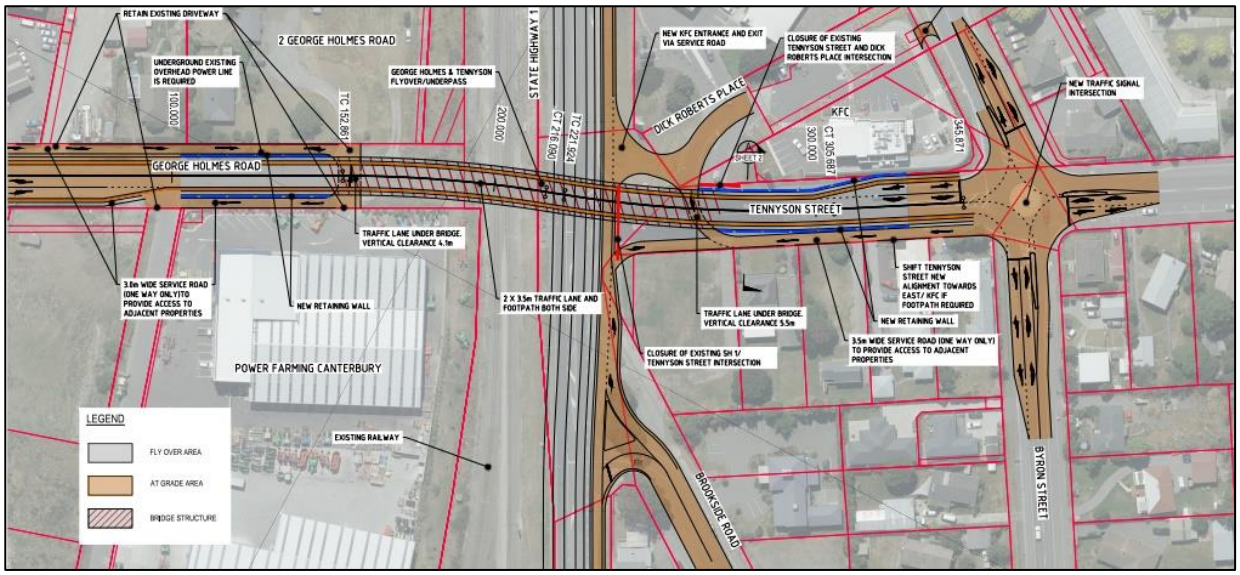


Figure 5: Tennyson Street to Jones Road – Underpass initial concept

5.5 Bridge Structure

For context, Table 5 provides an overview of the bridge design parameters that have informed the concept design for each of the short-listed options. This information has informed the MCA, and in particular the constructability and technical difficulty evaluations.

Table 5: Bridge design assumptions

	Skewed Bridge	Straight flyover	Tennyson (underpass)
Bridge length and width	170m long by 16m wide (2 traffic lanes, 1 SUP)	90m long by 18m wide (3 traffic lanes, 2 SUP)	100m by 16m wide (2 traffic lanes, footpaths)
Span length, depth and material	Four@48-66m, 2.6m deep, steel girder	4*20m span, 1.2m deep, concrete	20m wide
Bridge height / underpass depth	9m	8.8m	-7m
Number of columns	4	5	Vertical retaining walls and bridge support
Ramp length + gradient	• 240m@5% Jones • 200m@5% RDN	• 120m@7.7% Jones • 200m@7.6% RDN	• 150m @ 6% Jones • 90m @ 6% Tennyson
Connection road length	• Hoskyns LO 100m, RDN off ramp 200m, Jones connection 800m, service lane on RDN 200m	• Hoskyns LO 100m, RDN off ramp 200m, Jones connection 800m, • Service lane on RDN 200m, alt accessway 250m	• Access lanes 200m, RDN/SH lane reconfiguration
Traffic signals	3 new signals, plus 1 upgrade	2 new signals, plus 1 upgrade	3 new signals, plus SH1 upgrade
Property acquisition	Major property - Big box and SDC land	Moderate property – Jones Road and SDC land	Minor property - construction space and access requirements

The general design parameters that have been applied are:

- OD envelope: 6m high by 10m wide
- Rail clearance 5.5m
- Local road under 5.5m clearance
- Design speed 60 km/hr, posted speed limit 50 km/hr
- Accessible gradient < 1 in 12 (8%)

6 LOCAL ROAD MODIFICATIONS

6.1 Additional Infrastructure Requirements

As described above, the options do not simply relate to the flyover structure itself. Changes to access will require people to use alternative routes in the future and the effects of this re-routing has been considered as part of the multi criteria assessment. For each option there are some supporting road changes that would be required to enable and deliver all the intended benefits.

This section provides a simple representation of each option and describes:

- How each of the options work in terms of the wider transport plan and network system
- How public transport (and bus stops) will be impacted
- Implications to connectivity – getting to and from the key places

Table 6 provides an overview of the supporting network changes.

Table 6: Supporting local network modifications

	Skewed Bridge	Straight flyover	Tennyson (underpass)
Additional intersection upgrades	• Conversion of the 'Bulk Retail' / Jones Road roundabout to a signal • Signals at Kidman St / RDN • Off ramp "Loop" from the service lane to Kidman Street/RDN intersection. Will require another set of signals at this junction to act as one integrated intersection	• Upgrade of Jones Road / Hoskyns intersection. • Signals at Kidman St / RDN • Off ramp "Loop" from the service lane to Kidman Street/RDN intersection. Will require another set of signals at this junction to act as one integrated intersection.	• Upgrade of the Jones Road / George Holmes Road intersection • Signals at Kidman St / RDN • Upgrade of the Kidman St / Tennyson Drive intersection
Access to SH1 from Rolleston	Over the flyover and then either: • Along Jones Road and via the Weedons Ross Road interchange, or • Loop back around via the Bulk Retail area (new road) and Hoskyns Road. • OR via Levi Road to the Weedons Interchange	Over the flyover and then either: • Along Jones Road and via the Hoskyns Road slip lane • OR via Levi Road to the Weedons Interchange	Through under-pass and then: • Along Jones Road and via the Hoskyns Road slip lane • OR via Levi Road to the Weedons Interchange
Access to Rolleston from SH1	Either: • Via Jones Road and then over the flyover • Via the service road and 'loop' into the Kidman/RDN signals	Either: • Via Jones Road and then over the flyover • Via the service road and 'loop' into the Kidman/RDN signals	Either: Via Jones Road and then over the flyover • Via the service road and 'loop' into the Kidman/RDN signals
Access to the iZone	Over the flyover and then accessing Hoskyns Road via a new bulk retail area distributor road	Over the flyover and then accessing Jones Road or Hoskyns Road	Through underpass and via Jones Road
Public transport	Services to use flyover via: • Service 5 uses Jones Road. Bus stops relocated east of new Jones Road signals to retain use • Service 85 (direct route) accesses SH1 via Hoskyns Road and new bulk retail area connector road to CHC and service lane Rolleston-bound Service 820 heads to / from Burnham and IZone via Hoskyns Road and new bulk retail area distributor road. Adds approx. 150m to route	Services to use flyover via: • Service 5 uses Jones Road. Existing stops on Jones Road can be retained • Service 85 (direct route) accesses SH1 via Hoskyns Road Service 820 heads to / from Burnham and IZone via Hoskyns Road. Adds approx. 1000m to existing route	Services to use underpass via: • Service 5 extends use of Jones Road. Route diversion and bus stop relocation may be required to retain access to P&R site and neighbouring land uses. • Service 85 (direct route) accesses SH1 via Hoskins Road slip road to CHC and service lane Rolleston-bound • Service 820 heads to / from Burnham and IZone via Hoskins Road and new bulk retail area distributor road. Route will bypass P&R site unless diverted
Walking and cycling	• Flyover provides non-conflicting crossing of SH1 for active mobility modes.	• Flyover provides non-conflicting crossing of SH1 for active mobility modes.	• Underpass provides non-conflicting crossing of SH1 for active mobility modes.

	Skewed Bridge	Straight flyover	Tennyson (underpass)
	• Additional paths needed to connect to wider pedestrian network on Jones Road • At grade connection to Rolleston Rail Station for active modes is removed. Extensive route detour required via flyover to connect rail station to Rolleston centre. • Kidman Street – Rolleston Drive intersection does not provide improved connectivity for active modes over existing arrangement	• New signalised intersections at each end provide protected crossing opportunities and connect bridge to the existing wider pedestrian network. • At grade connection to Rolleston Rail Station for active modes is removed. Extensive route detour required via flyover to connect rail station to Rolleston centre.	• Separated cycle facilities not provided – they will mix with road traffic

Figure 6 to Figure 8 provide a representation of the supporting network changes for each option.

All options have the following consistencies:

- SH service lane with left in left out
- Signals for the Kidman Street / Rolleston Drive North intersection

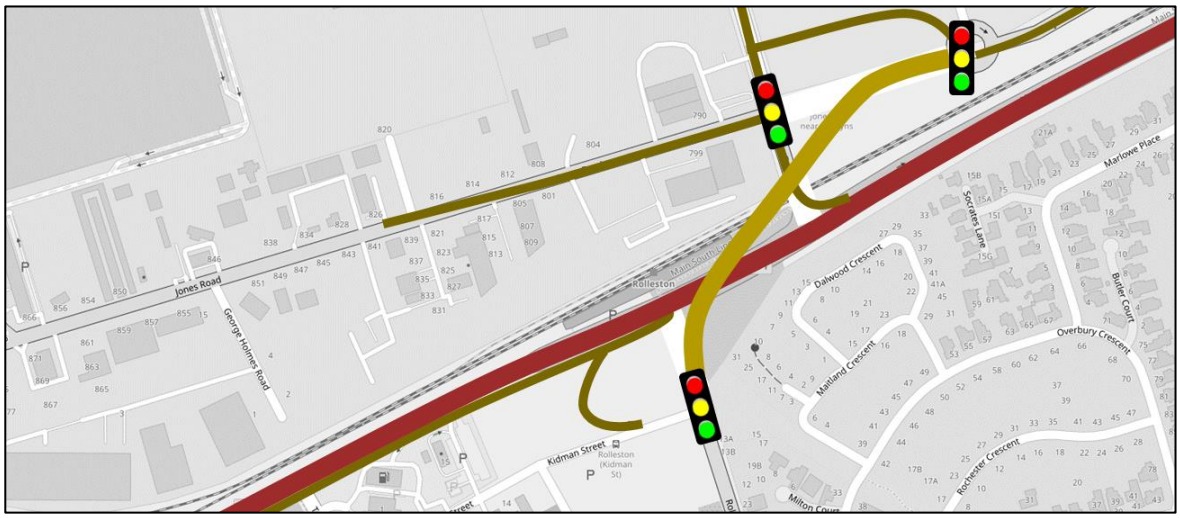


Figure 6: Option 4 – Refined Skewed Flyover

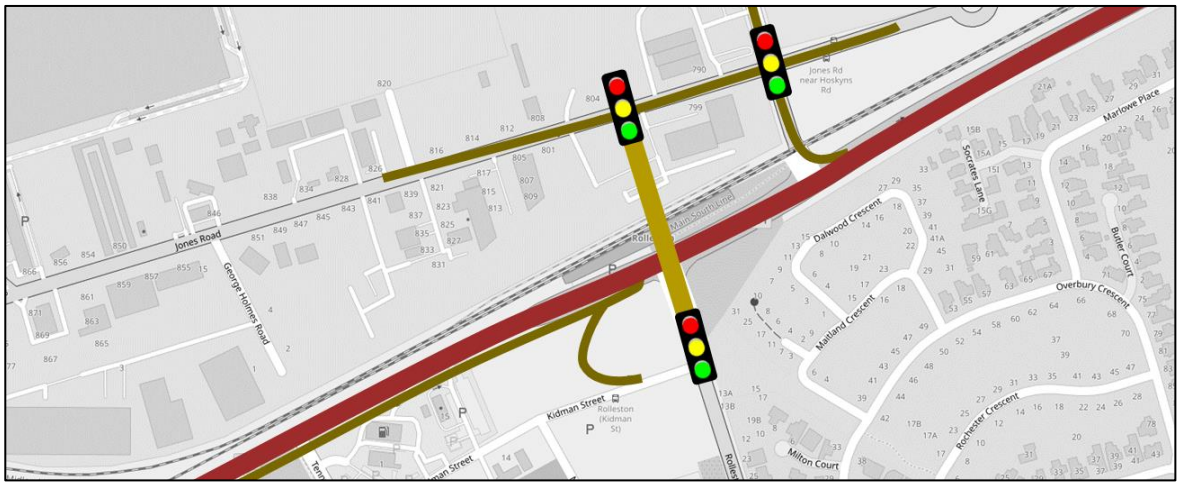


Figure 7: Option 7 – Straight Flyover

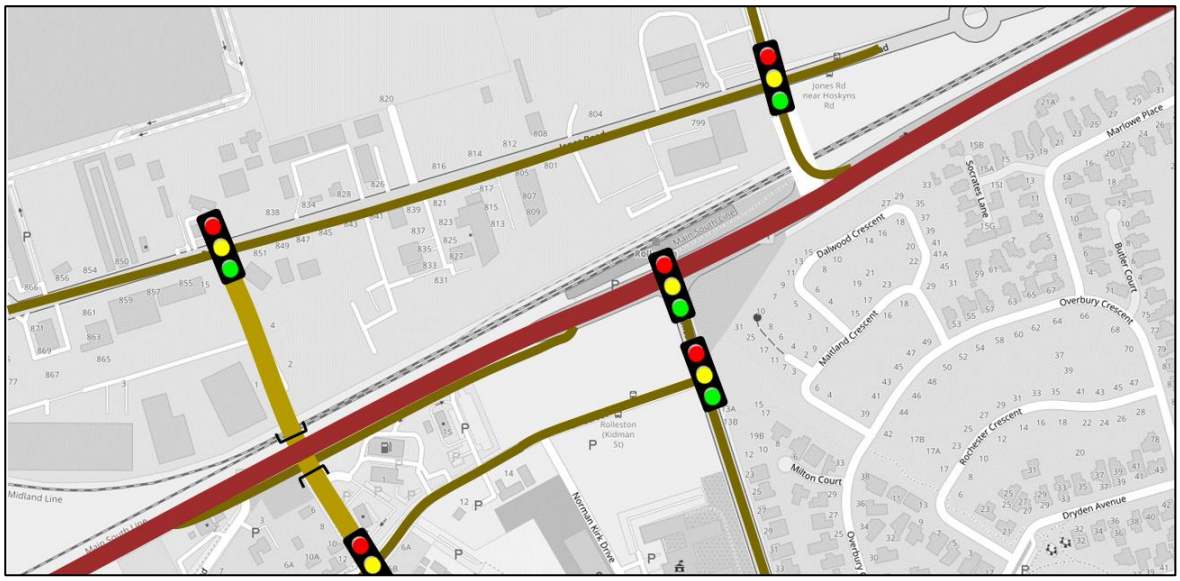


Figure 8: Tennyson Street to Jones Road – Underpass (or flyover)

6.2 How do the Options 'Fit' Into the Desired Transport Network?

There is no current all-inclusive Network Operating Framework (NOF) for Rolleston. Rather, there are several local strategies which describe the primary freight, traffic, cycling, walking and public transport routes. To gain an appreciation of what the desired transport network for Rolleston is, and the potential points of conflict for various modes, a NOF style map has been sketched for each of the short-listed flyover alternatives.

It is most important to recognise that:

- Tennyson Street between Kidman Street and Rolleston Drive is seen as a primary walking and cycling link, with high amenity access for active modes, with reduced emphasis on vehicle movement
- Norman Kirk Drive is a public transport route, providing amenity access, but again not a key traffic route.
- Rolleston Drive North is earmarked as the main traffic route, shown secondary below the State highway and arterial roads of Jones Road, Levi Road and Weedons Road, but is also used as walking/cycling route.
- Routes shown as heavy vehicle routes are typically "arterial roads" in the SDC road hierarchy, and hence are also important traffic routes.
- Heavy vehicles are expected to use Weedons interchange and Jones Road
- The southern access to industrial zones moves from the SH1/Hoskyns Road intersection to Walkers Road/Two Chain Road/Jones Road
- People looking to access Rolleston have the option to use Levi Road via the Weedons Ross Road interchange.

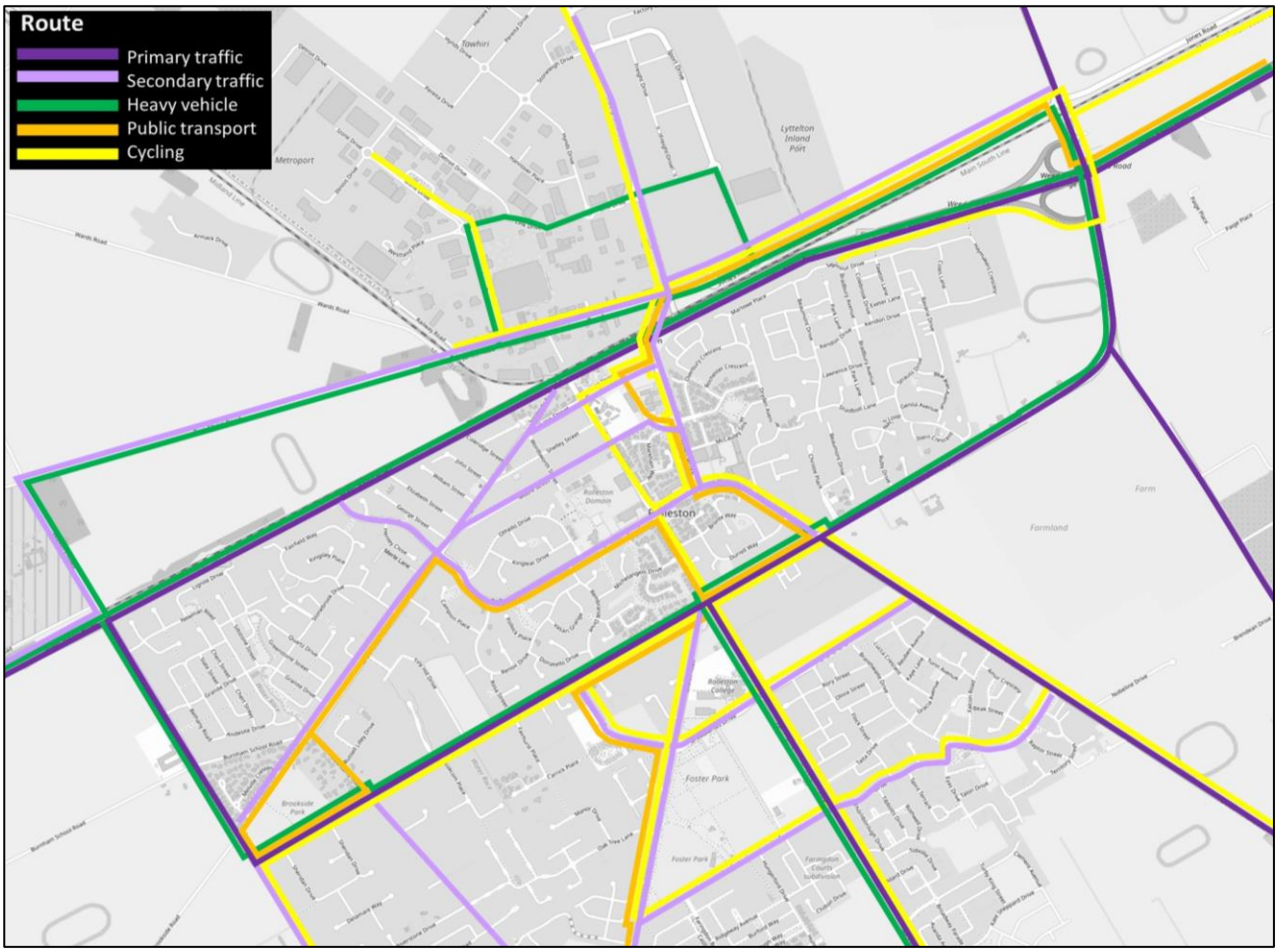


Figure 9: Network Operating Plan – indicative

The intent of the maps on the next page is to show how the transport network will work and how the flyover may (or may not) help deliver the overall transport vision for Rolleston.

Figure 10: Network Operating Plan – Skewed Flyover

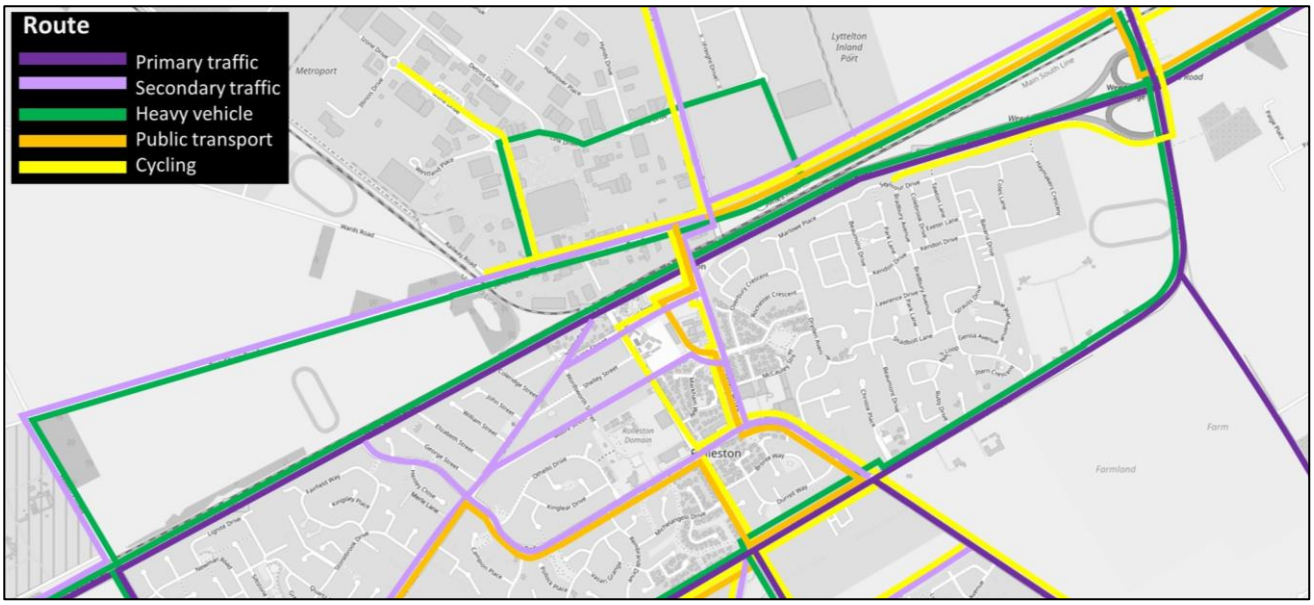


Figure 11: Network Operating Plan – Straight Flyover

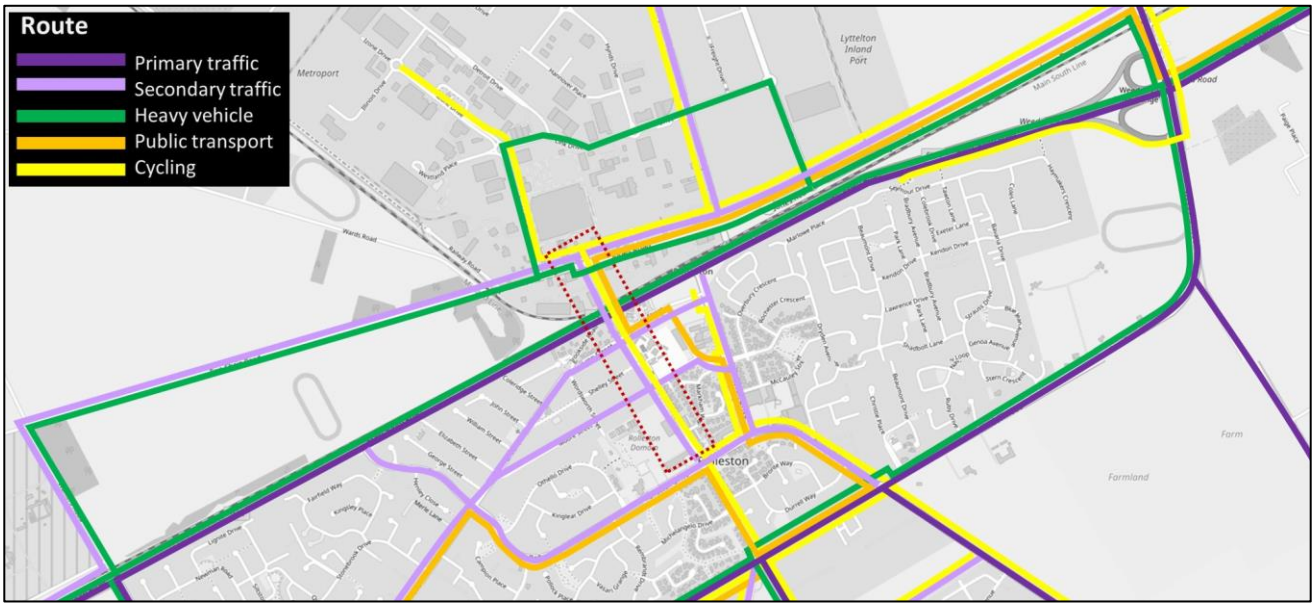


Figure 12: Network Operating Plan – Tennyson-George Holmes

From the maps it is evident that:

- The **straight flyover** is the alternative that would best deliver the network operating plan for Rolleston, reinforcing Rolleston Drive North as the main traffic route and enabling the desired modes to be kept on the streets that they have been planned for.
- The **skewed flyover** will also largely deliver the network operating plan but requires a new secondary traffic route around Jones Road where the flyover lands and through the Bulk Retail area. The option will partly sever Jones Road, the main heavy vehicle route, and connectivity is reduced by the need for freight and traffic to divert via a new internal road through the Bulk Retail area.
- The **Tennyson-George Holmes underpass/flyover** would have several implications:
    - Traffic volumes through the town centre would increase, and without physically restricting access, Tennyson Street is likely to function as a secondary traffic route. This goes directly against the intent of the Rolleston Town Centre for a "liveable community", the network operating plan and overall transport strategy.
    - It would however provide a more direct walking/cycling connection between the town centre and IZone but does require people to traverse the length of Jones Road with multiple driveways to get to the Bulk Retail area.
    - Bus routing would need to change to divert via Tennyson Street rather than Rolleston Drive North.

7 TRAFFIC EFFECTS

Traffic modelling for each of the short-listed options was undertaken using the Paramics micro-simulation model for the AM, inter and PM peak periods for future years 2028 and 2038. The base year, do minimum, and forecasting microsimulation modelling aspects have been Peer Reviewed and signed off as appropriate.

This section provides relevant statistics from the model which have helped inform the MCA and identification of an emerging preferred flyover alignment. For each option, the following elements were consistent:

- Dunns Crossing Road / Walkers Road / SH1 2-lane roundabout.
- Left-In / Left-Out (LILO) at Rolleston Drive South / SH1.
- Service lane on the south side of SH1, with LILO access to Brookside Road.
- Bulk retail link road connecting between Jones Road (east of Hoskyns Road) and Hoskyns Road (north of Jones Road).
- Weedons Interchange delay mitigation, a single-lane signal meter on the south approach to the southern interchange roundabout.

The detailed outputs of the traffic modelling are presented within **Technical Note No.11 – Short List Modelling Assessment**.

7.1 Network statistics

Total vehicle kilometres travelled (VKT) and vehicle hours travelled (VHT) for the modelled road network are outputs that will be used to inform the economic appraisal for the programme. The change in VKT and vht for an option when compared to the Do Minimum can be used as a general proxy for the relative scale of the travel time benefit that an option could be expected to deliver.

Table 7 provides the network statistics for each option for the 2038 future year. The advantage of assessing benefits at this broader network level is that the wider effects of options can be understood. The results for each option have been colour coded against the Do Minimum results (red = worse, green = better).

Table 7: Network statistics - 2038

	AM peak			PM peak		
	Average Travel Time (mins)	Average Distance (km)	Average Speed (kph)	Average Travel Time (mins)	Average Distance (km)	Average Speed (kph)
Do Minimum	10.2	9.8	58	10.5	9.3	53
Skewed flyover	10.6	9.9	56	9.4	9.3	60
Straight flyover	10.2	9.9	58	9.5	9.3	58
Tennyson-George Holmes	9.5	9.9	57	9.4	9.3	60

The modelling shows that, when considering the network as a whole, the **'Tennyson-George Holmes'** option would be expected to deliver the highest travel time saving in the morning peak. This is primarily due to the separation of traffic connecting between Rolleston and the industrial area using the Tennyson link from traffic using the signals at Rolleston Drive North to access Christchurch. As traffic flows increase this benefit reduces and safety issues increase on the state highway.

For all options most benefits would be generated for the PM peak (and similar for all options), and these benefits would increase for latter years (reflecting higher growth and higher congestion in a Do Minimum scenario).

7.2 Where is Traffic That is Using the Flyover Coming From?

Figure 13 to Figure 15 provides 'Select Link Analysis' plots for each short-listed option for the 2028 AM peak (northbound/Christchurch bound movements). The purpose of these plots is to highlight where traffic that is using the flyover would be expected to be coming from, and by nature allows for an assessment of whether the flyover is encouraging 'the right traffic on the right roads. Similar plots for the 2028 PM peak and for the southbound direction are provided within **Technical Note No.13**.

Figure 13: AM 2028 Skewed Flyover - Northbound

Figure 14: AM 2028 Straight Flyover - Northbound

Figure 15: AM 2028 Tennyson Underpass - Northbound

7.3 Traffic Volumes on Key Roads

All options include changes to access onto the state highway which will have wider implications to traffic volumes across the local road network. The desire is to help deliver SDC's aspirational road hierarchy, 'keep the right traffic on the right roads' and ensure efficient travel beyond just the state highway corridor.

Table 8 provides a summary of the traffic volumes along key roads and highlights the wider implications to some of key outcomes that are being sought through the Detailed Business Case (DBC). A full table of results for the 2028 and 2028 future years is provided within **Technical Note No.11**.

Table 8: Traffic volumes on key local roads (2038 – two way hourly)

Road	Key implications	AM peak				PM peak			
		Do Minimum	Skewed flyover	Straight flyover	Tennyson -George Holmes	Do Minimum	Skewed flyover	Straight flyover	Tennyson-George Holmes
Tennyson Street (north of Moore Street)	Liveability	512	396	362	734	558	506	516	884
Hoskyns Road Level Crossing (north of SH1)	Rail / road safety	1,506	564	1,056	445	1,626	726	978	633
Levi Road (west of Weedons Road)	Safety and efficiency on the local roads	1,391	1,336	1,391	1,239	1,560	1,529	1,504	1,394
Weedons Road (south of interchange)	State highway access	1,783	1,504	1,567	1,569	1,934	1,826	1,833	1,750
Weedons Road (south of interchange)		1,212	1,075	1,047	1,257	1,390	1,091	1,066	1,212
Jones Road (west of Hoskyns)	Industrial zone access / level crossing on Jones Road	793	564	1,976	1,172	480	560	1,767	1,278
Jones Road (east of IPort Drive)		621	854	626	613	658	615	390	463
Selwyn Road (West of Weedons Ross Road)	Travel to/from Christchurch	1,290	1,507	1,445	1,298	1,253	1,187	1,155	1,126

The key results are:

- The **Tennyson-George Holmes** option will increase traffic through the Rolleston Town Centre. **This goes against the Town Centre vision that SDC have been striving towards.**
- Jones Road east of the Industrial area increases most significantly in the Skewed Flyover option, to around 850 vehicles per hour (vph) by 2038.
- Volumes on Kidman Street increase in all options. Volumes are highest in the Tennyson Street over/underpass options, reaching 900-1070 vph in 2028/2038.
- In 2028 in all options the volumes on Selwyn Road (the alternative route from Rolleston towards Christchurch) increase and the corresponding section of SH1 decreases. This is because of the reduced access from Rolleston to SH1 towards Christchurch which is a particular factor in the AM peak.

7.4 Travel Times

The travel times on five key routes through the study area have been examined to determine how different areas of the network perform and operate under the Do Minimum and various short-list option scenarios. The routes are listed below and shown in Figure 16

- SH1: From Dunns Crossing Road to/from the SH76 Y-Interchange.
- Rolleston Drive North and Jones Road: From Masefield Drive to/from Weedons Road.
- Tennyson Street: From Lowes Road to/from SH1
- Levi Road and Weedons Road: From Tennyson Street to/from McClelland Road
- Jones Road, Hoskyns Road and IPort Drive: From Two Chain Road to/from Jones Road

Figure 16: Routes Analysed for Travel Times

Table 9 presents the travel times for 2038 for each of the key routes.

Table 9: Travel times on key routes (2038)

Road	Direction	AM peak				PM peak			
		Do Minimum	Skewed flyover	Straight flyover	Tennyson-George Holmes	Do Minimum	Skewed flyover	Straight flyover	Tennyson-George Holmes
SH1	Eastbound	6.8	6.3	6.1	6.6	7.4	6.3	6.1	7.1
	Westbound	9.3	6.5	8.1	7.1	15.4	7.7	8.5	8.4
Town Centre to Industrial (RDN to Jones Road east end)	Northbound	10.9	8.5	5.5	6.1	12.8	4.2	4.4	4.5
	Southbound	6.9	3.5	4.5	4.1	7.8	3.4	4.9	3.8
Tennyson Street	Northbound	6.9	2.0	2.1	3.1	4.4	2.4	2.3	2.3
	Southbound	2.0	2.2	2.0	2.2	2.3	2.2	2.2	3.3
Outer suburbs to Weedons Interchange (Lowes-Levi-Weedons)	Eastbound	5.3	12.5	8.2	5.9	4.0	5.7	5.3	4.4
	Westbound	4.6	4.6	4.5	4.4	7.9	5.1	5.3	5.7
Within the Industrial Area	Eastbound	4.6	2.8	3.4	2.9	42.4	4.3	3.3	3.4
	Westbound	3.5	2.8	4	3.4	5.6	2.8	3.6	3.7

By the 2038 AM peak, a Do Minimum network would become very congested, particularly along SH1 through the Rolleston Drive North and Hoskyns Road signals. The short-listed options resolve these issues, with resultant travel time improvements of 2-3 minutes along SH1.

The main negative impacts of the options are to travel times along the Lowes-Levi-Weedons route, because of additional demand (and subsequent delays) at the Weedons Ross Road interchange. The increase in travel time along Levi Road from a Do Minimum of 5.3 minutes to 12.5 minutes with a 'Skewed flyover' represents **a significant degradation** compared to current travel times

The Tennyson Street underpass show improvements on most routes by 2038. The exception is a small increase on Lowes Road / Levi Road / Weedons Road (0.5 minutes) and on Tennyson Street southbound (0.1 to 0.2 minutes). The main negative impact for the straight flyover option is again on the Levi Road route, but the added increase in travel time is not as significant (additional 3 minutes) as what would be expected for the skewed flyover.

7.5 Queuing Back Across the Hoskyns Level Crossing

There are a number of rail level crossings in the study area where there is risk that queues back from the crossings could interact with the upstream intersection. The DBC options change the traffic volumes through the study area and the intersection forms and operation and as a result of this may affect the risk of queueing back from the rail crossings. The three key locations identified with more significant risks are;

- Walkers Road, north of the Dunns Crossing Road / SH1 intersection
- Hoskyns Road, south of the Jones Road / Hoskyns Road intersection
- Weedons Road, south of the Jones Road / Weedons Ross Road intersection and north of the Weedons Interchange northern roundabout

These locations are shown in the figure below.

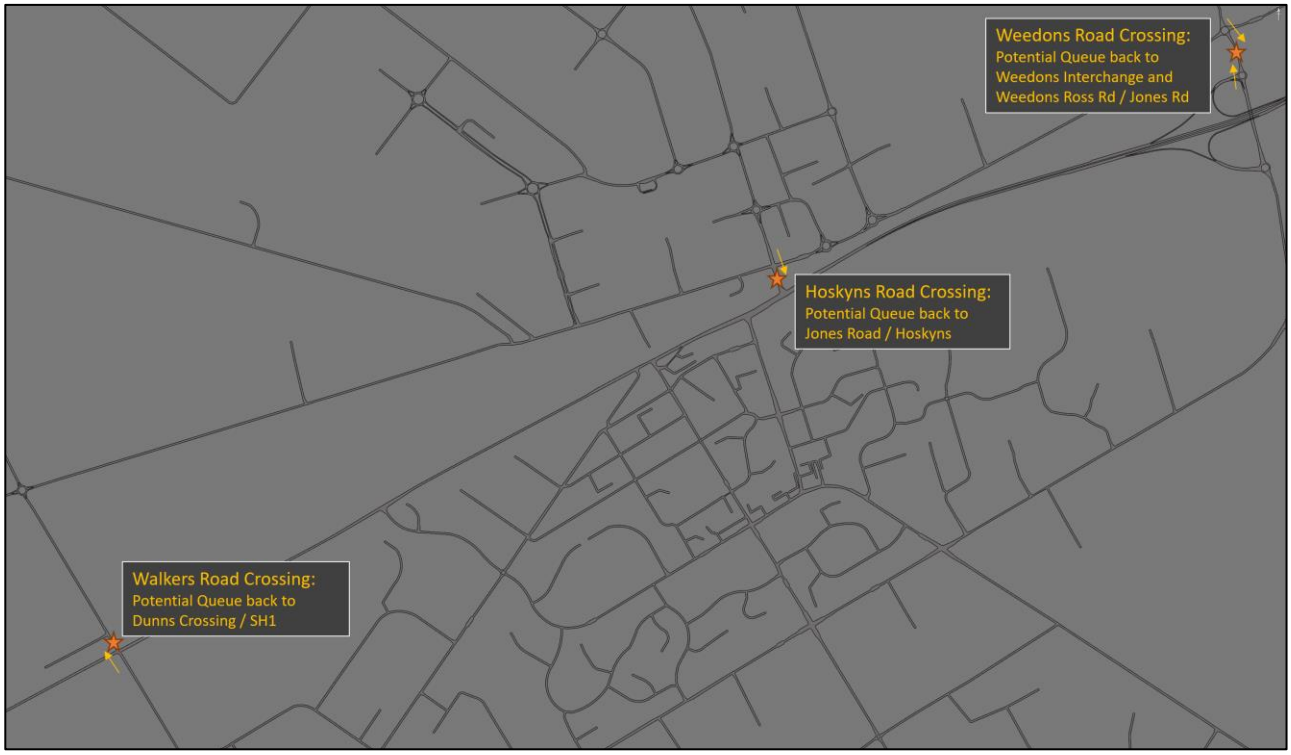


Figure 17: Rail Level Crossings and Key Queue Locations

The traffic modelling of the short-listed options has identified:

- There are no significant issues at either the Walkers Road or Hoskyns Road crossings (aside from the Do Minimum where there is a queue back from Hoskyns Road).
- The skewed and straight flyover options tend to produce slightly longer queues at the on the north approach to the Weedons Road crossing. The Weedons Ross Road / Jones Road roundabout is only around 40-60m from this crossing, therefore queues back into this roundabout from the rail crossing are likely in all scenarios and may be mildly exacerbated in the Flyover options.
- The Tennyson Street over/underpass options tend to produce mildly longer queues on the south approach to the Weedons Road crossing. The northern Weedons interchange roundabout is around 100-120m from the rail crossing, so this does not appear to be a significant issue.

8 SHORT LIST ASSESSMENT

8.1 Overview of MCA

A more detailed assessment has been undertaken of the short-listed options using the multi criteria assessment framework developed in earlier stages of the project. Although the same framework was used, more specialist analysis was undertaken. A nominated specialist for each of the KPIs or effects was asked to develop and implement a methodology. These methodologies and the resulting outputs were peer reviewed by Waka Kotahi, Selwyn District Council and Kiwirail specialists and documented in a series of specialist reports (included in **Appendix D**). The specialist reports were used to score the options using a seven-point scale (from -3 to +3) relative to the existing situation.

The final MCA scores we also informed from insights through the following engagement:

- 9th December 2021 – Waka Kotahi challenge session No.1 (medium to short list)
- 19th January 2022 – Waka Kotahi challenge session No.2 (short-list review)
- 1st February 2022 – KiwiRail and SDC review
- 22nd February 2022 – workshop with Fire and Emergency Services
- 16th March 2022 – Workshop with ECan (relating to public transport impacts)

This section of the report presents the key points of difference between each of the short-listed options for each of the key criteria, along with supporting evidence.

8.2 Safety

As a summary, the two 'safety' key performance indicators (KPIs) are:

- **KPI 1.1: DSIs**. Impact to DSIs, not just along the state highway but considering the wider implications of any options to the wider local network (due to traffic diversion effects).
- **KPI 1.2: Reduced road / rail incidents.** The extent to which proposed interventions contribute to a reduction in the number of incidents or near misses at the existing level crossings.

The key points of differentiation between the options for each 'safety' KPI, as identified by the SME and tested by the wider project team, are outlined below. Generally, the skewed alignment was seen as presenting the fewest safety risks followed by the straight alignment. However, for both options there are likely to be some relatively simple mitigation measures that could be introduced to further reduce the safety risk. The interactions between a Tennyson-George Holmes flyover and service lane are far more numerous, and it might not be possible to fully mitigate all identified issues.

8.2.1 DSIs

All options score better than the Do Minimum. Growth on the network will exacerbate existing safety issues and therefore the do minimum was scored -3. Overall, the straight alignment rated best (score = +1) when compared to the skewed (0) and Tennyson-George Holmes (-2) options. The key reasons are

- The **straight alignment** generally provides a safe and legible option. One of the safety issues raised by the safety SME related the visibility of the traffic signals at either end of the structure (due in part to the steep grades). There are also potential safety issues which relate to enabling movements into accesses that are close to the bridge structure (on either side) and risk of queuing back onto the state highway along the loop road.
- For the **skewed alignment**, there is a higher exposure to crashes with an alignment connecting to the Bulk Retail Area and the closure of Jones Road at Hoskyns Road. This is because motorists must navigate more intersections to access the iZone from the town centre. There is also potential for vehicles to back up onto SH1 from the loop road. However, new traffic signals help to offset safety issues, hence the neutral overall score.
- The **Tennyson-George Holmes** alignment presents the highest risk to DSIs of any option. This is because this option would see the retention of the signals at the SH1/Rolleston Drive North signals. These are already out of context and would become more so with the removal of the SH1/Hoskyns Road signals, because would function as the first major intersection coming off the high speed Christchurch Southern Motorway. Other safety risks relate to potential merging crashes between Tennyson Street and Brookside Road, and potentially confusing access arrangements to BP and KPC etc.

8.2.2 Reduced road/rail incidents

All options were identified as providing benefits for reducing the conflict between road and rail. This is because all options, in some form or another, reduce the number of potential interactions compared to the do minimum (which was scored -3). However, all options would still see the Hoskyns Road level-crossing retained, but with Hoskyns Road/SH1 intersection operating as a left-out only – hence why a consistent score of -1 was scored. This score was agreed by both the 'Safety' and 'Rail' SME's.

Currently the main safety risk relates to vehicles queuing back from the signals across the railway line. However, this risk is essentially removed with all options because the 'left-out' will be designed with a lane gain ("merge like a zip") onto the state highway.

Although all options score positively relative to the do minimum, the straight alignment is the only option that received a positive score relative to the existing situation.

8.3 Connectivity

The scoring for connectivity captured an assessment against the following KPIs:

1. Pedestrian travel time
2. Social connectedness
3. Traffic travel times
4. Freight productivity
5. Travel choice and liveable community
6. Resilience
7. CO2 emissions
8. Flexibility

Table 10 provides the scores and key points of differentiation between the options for each of the various 'connectivity' criteria.

Table 10: Connectivity – points of differentiation

Criteria	Skewed flyover	Straight flyover	Tennyson-George Holmes	Points of differentiation
Pedestrian travel time	1	2	2	• The refined skewed flyover reduces travel time between the industrial area and town centre, but the alternatives provide a more direct and quicker connection (and shorter journey up and over the bridge)
Social connectedness	3	2	2	• The skewed flyover most directly links the two major commercial areas (i.e. Town Centre and Bulk Retail area). Hence a higher score than the alternatives.
Traffic travel times	1	2	2	• Result informed by the traffic modelling, including the overall network statistics (described in **Section 7**). The 'skewed flyover' puts more pressure on the Weedons Ross Road interchange and results in a longer route to get to SH1 (due to the need to loop back around via the Bulk Retail area).
Freight productivity	1	3	0	• SH1 freight movement is improved for options where the signals are being removed from the state highway. Hence why the Tennyson-George Holmes option scores lower. • The 'skewed flyover' severs Jones Road, and hence impacts some freight movement to the industrial area. • The 'straight flyover' benefits both state highway and local freight movements noting that large trucks are expected to use Weedons interchange and Jones Road.
Travel choice and liveable community	1	2	-2	• Tennyson-George Holmes scored poorly as the option would increase traffic volumes through the town centre and Kidman Street. • The 'straight flyover' scored higher than the 'skewed flyover' as it provides that more direct connection between Rolleston's and all of the industrial employment area.
Resilience	1	2	2	• Whilst the skewed flyover would deliver good travel time reliability for movement across the state highway, it would create a slightly convoluted route to access the state highway heading northbound. • Other alternatives score better due to better SH access that reduces the traffic impacts at the Weedons Ross Road interchange. • All options assume good traffic signal optimisation is provided.
CO2 emissions	-2	-1	-1	• The scores are generally a reflection of the embodied carbon emissions associated with the length of the bridge structure and the need for the skewed option to be made of stee girders.

Criteria	Skewed flyover	Straight flyover	Tennyson-George Holmes	Points of differentiation
				• The 'straight flyover' and 'Tennyson-George Holmes' alternatives also result in overall lower network vehicle kms.
Flexibility	2	2	-1	• The straight flyover option makes land available (off Kidman Street and Jones Road) that has been historically earmarked for the flyover landing. Straight alignment also enables better shaped land parcels to be retained and sold on for other purposes. • The Tennyson-George Holmes option potentially causes issues to access for existing businesses. Little flexibility to change land use types or accesses once the under/overpass goes in.
RANK	Second	First	Third	

Overall, all shortlisted options scored positively in terms of connectivity. The straight flyover alignment received higher scores overall than the other two options.

8.4 Rail Operations and Rail Network Effects

KiwiRail, a project partner, provided the scoring for the following criteria:

- Safety – rail/road incidents.
- **Rail operations**. This is a proxy for benefits to rail freight and reflects potential improvements to rail network travel times
- **Rail network effects.** Impact on operations and rerouted traffic at other level crossings

The key points identified by the SME were:

Rail operations	• For all options the line speed could be reinstated, but there would be limited ability to increase number of tracks over crossing. • For the straight across flyover access to Rolleston Yard would need to be relocated. This is the only key point of differentiation, resulting in a score of '0' for this option, compared to +1 for the alternatives.
Rail network effects	• For all options, there would be limited ability to separate shunting and main line activities. • The key point of differentiation related to the need to relocate access to the Rolleston Yard for the 'straight flyover' option, resulting in a slightly lower score (but not negative).

8.5 Engineering Difficulty

'Engineering difficulty' considers difficulty and design challenges of 'high ticket' items such as structures and potential stormwater treatments. This is not directly related to cost, as some options that are simple design tasks may be costly to construct. Although constructability is not considered directly, engineering difficulty is considered in deciding how to resolve any potential constructability issues and/or impact on/integration with other infrastructure.

The key points of differentiation between the options are:

- **Skewed flyover** - very long span and high skew result in design complexity for both sub and super structure. The length of the span is at the high end of design standards. Designing piers to minimise impacts on road and rail corridors will provide some challenge.
- **Straight flyover** - Simple technology, short span and perpendicular angle result in simple engineering and design processes. The short length of the flyover and clearance height required over SH1 means design grades and site distance achieved are at design limitations. This leaves little room for innovation. Minimising impacts on businesses will be the main driver for design challenges.
- **Tennyson-George Holmes** - simple technology, short span and perpendicular angle result in simple engineering and design processes. The short length of the underpass or flyover and clearance height required over SH1 means design grades and site distance achieved are at design limitations. This leaves little room for innovation. Space for construction is severely limited and will be a big challenge to minimise disruption to businesses. Minimising impacts on businesses will be the main driver for design challenges. This especially the case on the Tennyson Street end with access issues for businesses like KFC. Existing stormwater pump station on George Holmes Road will add some design complexity to relocate.

The scores for engineering difficulty were:

- **Skewed flyover**: -3
- **Straight flyover:** -1
- **Tennyson-George Holmes:** -2

Generally, the skewed flyover was seen as the most technically challenging to implement, in large part due to the length of its span.

Notwithstanding, these 'simpler' alternatives would still be subject to notable challenges:

Straight flyover	• Treatment of stormwater at Jones Rd end may be challenging due to existing flat grades and requirement to capture the runoff from the flyover. • Integrating the busy weigh-station, immediately opposite the flyover landing on Jones Road, into the design.
Tennyson-George Holmes	• Treatment of stormwater at Jones Rd end may be challenging due to existing flat grades and requirement to capture the runoff from the flyover. The stormwater pump station at Jones Road will require a major modification/relocation. • High degree of difficulty to construct within a confined space along Tennyson Street. Finding an appropriate construction staging area will be difficult. • Difficulty in ensuring access to properties throughout the entire construction period.

8.6 Constructability

The total constructability score considered the following sub-assessments (and scoring):

- Specialist construction techniques
- Temporary works complexity
- Disruption to State Highway traffic
- Disruption to local traffic
- Disruption to rail

The scores for the various constructability assessments are provided within Table 11.

Table 11: Constructability – points of differentiation

	Specialist construction techniques	Temporary works complexity	Disruption to State Highway traffic	Disruption to local traffic	Disruption to rail	Total	MCA Score
Skewed flyover	-3	-3	-2	-2	-2	**-12**	**-3**
Straight flyover	-2	-2	-2	-1	-2	**-9**	**-2**
Tennyson-George Holmes	-2	-2	-2	-1	-2	**-9**	**-2**

The key points of differentiation, which have informed the scores, are outlined below.

Skewed flyover

- Large span and skew of bridge will involve complex construction and temporary works.
- Disruption to local traffic considered greater than the alternatives due to need for modifications at tie-in points.
- Girder depth when placed on transport unlikely to trigger overheight dimensional constraints.
- Approach necessitates the use of at least one temporary tower (placed 10-15m south of the pier between SH1 & the rail corridor).

Straight flyover

- Typical construction process expected for a structure of this form – common within NZ industry
- Girders are a typical size for casting beds in South Island and can be transported using standard methods.
- Disruption to local traffic scored lower than the 'skewed flyover' as Rolleston Drive North will need to be closed to traffic during construction, and alternatives routes via more local streets will be required.

Tennyson-George Holmes

- Typical construction process expected for a structure of this form – common within NZ industry
- Girders are a typical size for casting beds in South Island and can be transported using standard methods.
- Duration of disruption likely to be less than the 'straight flyover' but still considered to be moderate.

All options will result in speed restriction and traffic management controls during construction. The duration of disruption to State Highway Traffic would likely to be shorter for the 'straight flyover' and 'Tennyson-George Holmes' alternatives but would still create local road disruption.

8.7 Consenting and Property

For assessing consents, the information identified through the Environmental and Social Responsibility (ESR) screens (August 202)1 for various flyover options were used. This provided a baseline understanding of the sensitivity of the receiving environment to noise and the susceptibility to visual change (e.g. a resident of a nearby property or an industrial activity).

To assess 'consentability', a judgement was made based on the following measures:

- Scale of road noise effects - in particular, the potential increase in noise received by nearby persons, because of changed carriageway alignments and/or change in vehicle speeds. Scoring was based on the anticipated duration of the noise effects (short, medium or long term) and the extent to which mitigation including existing noise bunds or fences (or the ability to replicate that mitigation) would be effective.
- Scale of visual effects on nearby persons and the wider public.
- Complexity of the consent/approval process including whether there is the potential for notification.

To assess 'property' the following metrics were used:

- The number of properties that would require acquisition
- The number of properties where mitigation against negative effects (such as noise) would be required
- The type of properties that are impacted.

8.7.1 Consentability

The key points of differentiation between the options for 'consentability' were:

- The **skewed alignment** will be subject to a complicated consenting process (NoR for new designation or 'full' alteration). Noise and visual effects for residential properties would be key issues.
- Whilst also likely to be complex, there would be limited amenity effects associated with a **straight alignment** due to the further distance for sensitive receivers (i.e. residential properties).
- For the **Tennyson-George Holmes** alignment the amenity effects are relatively low, but mitigation to resolve access issues for existing properties may be significant.

Overall, the straight alignment scored 1 point better (-1 rather than -2) than the alternatives.

8.7.2 Property

The key points of differentiation between the options for 'property' were:

- The **skewed alignment** does not involve acquisition of any residential properties, but still requires link roads through the Bulk Retail Area (which would require a relatively large amount of lane) plus SDC owned property.
- The **straight alignment** is mostly within the road reserve or SDC owned land that has been earmarked for the flyover purpose. The main issue relates to the property requirements on the Jones Road side that will require strips of land to achieve the flyover width and cross section along Jones Road.
- The **Tennyson-George Holmes alignment** has the smallest property impact in terms of acquisition requirements, but potentially the highest in terms of retaining effective and safe access to existing properties (on both sides of SH1). Further requirements for construction space have not been assessed at this stage, but are likely to be required

All options retain a Left Out function at Hoskyns Road so were all awarded a slight negative score by the specialist rail assessor

Option 4 achieved the highest score for social connectedness as it provides direct connectivity between the specialist retail area in the town centre and the bulk retail area to the north. It also has a gentler gradient

Option 7 scores highest for freight productivity as it allows for the removal of the RDN and Hoskyns Road signals without needing to sever Jones Road

Options 4 and 13 were considered more challenging from a consentability perspective. Option 4 is larger with more visual effects and option 13 has effects on a larger number of sensitive businesses

Option 4 scores poorly for engineering difficulty and constructability due to the scale of structure required for the skewed flyover

Table 12: Short list MCA

		DSIs	Road/rail incidents	Ped travel times	Social connectedness	Traffic travel times	Freight productivity	People throughput (travel choice and liveable community)	Rail operations	Resilience (reliability)	CO2 emissions	Flexibility	Consentability	Property	Engineering difficulty	Constructability	Wider traffic effects	Rail network effects	Interdependencies	Amenity/visual effects
DM	No Flyover all other programme elements included	-3	-3	-1	-3	-2	-2	-1	-2	-1	0	0	0	0	0	0	-1	-2	0	0
4	RDN to Jones Road - **Skewed Flyover**, Hoskyns LO	0	-1	1	3	1	1	1	1	1	-2	2	-2	-2	-3	-3	1	1	-1	-2
7	RDN to Jones Road – Straight Flyover, Hoskyns LO	1	-1	2	2	2	3	2	0	2	-1	2	-1	-1	-1	-2	1	0	0	-1
13	Tennyson Underpass + RDN signals, Hoskyns LO	-2	-1	2	2	2	0	-2	1	2	-1	-1	-2	-1	-2	-2	0	1	-2	-1

Option 13 scores poorly for safety as it retains the traffic signals on the State Highway which is not a safe system approach

Both of the straight alignments provide more direct connectivity between the town centre and the industrial area than the skewed alignment. Modelling indicates slightly faster travel times as a result

Option 13 scores poorly for the liveable community aspect of this score as it encourages increased traffic on Tennyson Street – a corridor with higher "place" value where reduced traffic volumes would be desirable

Option 4 has the highest negative score for CO2 emissions due to the scale of the structure involved and associated higher levels of embodied carbon

Option 13 scores relatively poorly for interdependencies as it is likely to trigger a number of local road improvements to prevent traffic from rat running through undesirable parts of the network

9 MCA RESULTS AND SENSITIVITY

Table 13 provides the total scores for each option and relative rankings. For completeness the Do Minimum has also been included within the final set of results.

The table also provides rankings based on the following sensitivity tests which are intended to capture the key identified risks:

- **Investment Objectives** = 60% of the total score
- **Liveability** = 40%
- **Traffic operations** = 30%
- **Safety** = 30%

For each sensitivity test the weightings for all other criteria have been distributed proportionally with the original baseline weightings.

Table 13: MCA scores and sensitivity testing

	Baseline			Sensitivity Analysis (Ranking)			
	Unweighted score	Weighted score	Rank	Investment Objectives	Liveability	Traffic Operations	Safety
Do Minimum	-21	-1.2	4	4	4	4	4
Skewed flyover	-3	-0.4	2	2	2	2	2
Straight flyover	9	0.3	1	1	1	1	1
Tennyson-George Holmes	-7	-0.6	3	3	3	3	3

The results of the MCA present a clear front-runner in terms of the highest scoring option – namely the 'Straight flyover' option. Not only is it the only option that has an overall positive weighted score, it also ranked highest using the baseline weightings and for all sensitivity tests.

It provides a clear indication that the **straight flyover is the emerging preferred option**. The next highest scoring alternative is the skewed flyover.

10 COST AND PROPERTY

10.1 Cost Estimates

The MCA process itself excluded consideration of cost to ensure that fundamentally that options were being judged on the outcomes that would be delivered, and wider associated implementation risks.

Indicative costs have however been developed for each option which includes a high level of contingency given the early stage on concept development. The latest indicative cost estimates for each option are provided below, noting that these are all subject to change as the design process continues:

- Option 4 – Skewed flyover: $104m
- Option 7 – Straight flyover: $83m
- Option 13 – Tennyson-George Holmes overpass plus signals at RDN: $67m

The cost estimates are subject to the following limitations:

- The estimates have been developed on the conservative (lower side), but they are suitable for the purpose of comparison at this short-list assessment stage.
- Property acquisition costs have been considered, as per Table 14. A higher contingency for 'property' has also been applied to capture potential non-direct impacts on adjacent businesses.
- The estimates do not include the service lane costs (that is a separate component for the overall package).
- MSQA, consultant costs etc. are included as percentage.

10.2 Property

Table 14 provides an overview of the property acquisition costs for each of the options.

Table 14: Property implications

Option	Sub-option	Property Cost[3]
Skewed flyover (refined)	T-road through the IPort	$11,200,000
	Hook turn through the iPort	$10,800,000
Tennyson/George Holmes		$1,900,000
Straight flyover		$10,500,000

The table highlights that the greatest property acquisition costs relate to either the straight ($10.5m) or skewed flyover options ($10.9m - $11.2m). However, the **highest property risks relate to the Tennyson Street / George Holmes Road flyover option**. This is because:

- The skewed flyover is the 'historic' option that was originally identified as part of the 2007 CRETS, further consulted during the SDC LTP process and is the option that was presented during public consultation for these Rolleston Transport Improvements. There has been dialogue between SDC and the landowners of the Bulk Retail Area, who are willing sellers but at commercial market rates. The landowners also acknowledge that the flyover would benefit potential future commercial enterprises by providing that direct connection to the Rolleston Town Centre.
- Waka Kotahi has held early engagement with potentially affected owners of the land where a proposed straight flyover would land on the Jones Road side. They have raised concerns about impacts on access to their businesses that would need to be resolved as part of any final designs.
- An underpass (or overpass) between Tennyson Street and George Holmes Road, whilst requiring the smallest amount of land, would potentially have the highest impacts to property access of all the options. The key challenges are:
    - Access to Power Farming Canterbury and other recent businesses on George Holmes Drive.
    - Integrating the KFC access (and drive-through) into the design.
    - Enabling access to businesses, including the proposed Burger King, along Tennyson Street and the loss of access from the new service road to Tennyson Street.
    - Ensuring there is sufficient space for construction.
    - Disruption impacts to business during construction.

[3] inc. Acquisition Fees

11 EMERGING PREFERRED OPTION

As outlined through the MCA process, the clear front runner is the straight alignment. This option provides an extension of Rolleston Drive North through to a new T-intersection at Jones Road.

As outlined above, the key features of this option are:

- A three lane overbridge
- New signalised intersection for the flyover/Jones Road
- Signal at Kidman Street / Rolleston Drive North
- Footpath on one side, shared path on the other side
- Vertical grade 7.65% approaching Jones Road and 7.61% approaching Kidman Street. Clearance is achieved over SH1 for Over Dimension (OD) vehicles and is achieved over KiwiRail line.
- Site distance achieved on the bridge for 60km/h design speed
- Accesses to properties on RDN side (Ch 350-450) can be graded but may be a safety issue
- "Loop" provided from SH1 southbound, from the service lane around to a new signal.
- Land is required at the "RV centre", but initial discussions have indicated that this is possible.
- Challenge to integrate the busy weighbridge on Jones Road (immediately opposite the flyover landing) into the design.
- Includes a left-out from Hoskyns Road onto SH1.

This option scores best against the investment objectives. It is also the option that has the lowest level of negative effects. Overall, it is the only option that achieves a weighted positive score against the MCA criteria.

11.1 Why not the Skewed Flyover?

The skewed flyover was the original preferred alignment on the basis that it offered a gentle gradient, had minimal property access disruption, and delivered on the safety objective of having zero harm at the Hoskyns Road level crossing. Following public consultation, and subsequent technical analysis, the design was refined to improve access to the highway and improve east-west connectivity along Jones Road albeit in a rather convoluted manner. The option did not perform as well as the straight flyover option as it resulted in more convoluted routing for all modes travelling between the Rolleston Town Centre and the industrial zone.

The structure is more complex to construct and will result in higher embodied carbon emissions. It also doesn't perform as well from an economic perspective (higher cost for lower benefit).

11.2 Why not the Tennyson-George Holmes Underpass?

The Tennyson-George Holmes connection offers some advantages. It separates out local north-south movements from State Highway access and provides a legible connection between the Town Centre and industrial zone. However, it results in increased traffic along Tennyson Street and Kidman Street, and therefore detracts from the liveable community aspirations of this part of the network. It also requires signals to be retained on the State Highway at Rolleston Drive North – this is not a safe system approach and does not deliver on the safety investment objective and reduced freight productivity along the state highway.

APPENDIX A MINUTES OF MEETINGS

NZUP Rolleston DBC Challenge Review

Minutes and Actions

Time:	13:00 – 17:00	
Date:	Thursday 9 December, 2021	
Venue:	Waka Kotahi Meeting Room PR1.01	
In attendance	Richard Osborne Fiona McLeod Leanne Scott Geoff Griffiths Colin MacKay Michael Blyleven Colin Knaggs Denny Sahng	Waka Kotahi
	Alan Kerr	Stantec (Project Team)
	Vince Pace	Jacobs (Project Team)
	James Harrison	Fulton Hogan (Independent Reviewer)
	Mark Beijeman	Aurecon (Independent Reviewer)
Apologies	N/A	

1. Meeting Summary

1.1 Meeting Objectives

- Provide NZUP and project context to the challenge team
- Go through the options list for connectivity across the SH currently being assessed by the project team
- Identify any fatal flaws to rule out any options
- Identify a shortlist for further investigation works

1.2 Key Project Objectives

- Address safety issues along SH1 and at Hoskyns level crossing
- Provide connectivity between industrial and residential sides of Rolleston
- Support more inclusive access within Rolleston via modal choice and a resilient transport network in the face of growth

1.3 Identified Shortlist

No.	Option	Features
1	2	At-grade dual roundabout @ Rolleston Dr North LILO @ Hoskyns George Holmes/SH1 LO overpass
2	2	Replace "George Holmes/SH1 LO overpass" in Option 2 with "George Holmes/Tennyson St connection (over/underpass)" LO at Hoskyns
3	6.1	East-West SH1 flyover (LI)LO @ Hoskyns Tennyson/George Holmes St connection (over/underpass)
4	8	Skewed Flyover LO @ Hoskyns Slip lane off service lane into Kidman St Signals at either ends of the flyover
5	11	Local road straight over/underpass (LI)LO @ Hoskyns Slip lane off service lane into Kidman St Signals at either ends of the flyover

1.4 Meeting Actions:

ID	Action required	Owner	Due
1	Liaise with Simon Kennett, seek his involvement & guidance on underpass/overpass	Michael Blyleven	Jan 2022
2	Design details to be further developed for shortlist	Project Team	17/01/2022
3	Modelling refinements		
4	Indicative MCA Assessment results on the shortlist		
5	Arrange next Challenge Review in 3rd week of Jan 2022	Richard Osborne	17/12/2021
6	Identify local cycle group to engage with	Fiona McLeod /Denny Sahng	Jan 2022

2. Project Context

This challenge session focuses on the options to provide connectivity between the residential and industrial sides of Rolleston

2.1 NZUP Rolleston Scope outside of connectivity options

- Dual lane roundabout @ Dunns Crossing/Walkers Rd
- Left In Left Out (LILO) @ Rolleston Dr South
- Southbound service lane from about Rolleston Dr North to Brookside Rd
- Rail corridor/operational improvements – 3rd track on Main South Line (MSL) inc. run-around track
- Any optimisation works required at Weedons Interchange (signal metering)

2.2 Investment Objectives

- Address safety issues along SH corridor (right turning conflicts, adjacent rail level crossing) (40%)
- Connectivity across SH between the residential and industrial sides of Rolleston (40%)
- Resilient transport network in the face of growth & responding to emergency events, support sustainable travel options (active modes & public transport), support liveability and self-sustaining township outcomes (20%)

2.3 Rail corridor improvement

- Originally envisioned as a 500m track to connect the MSL to the Midland Line to "complete the triangle".
- Discussions with KiwiRail highlighted significant signalling upgrade costs, circa $11M. This was not envisioned at inception of the NZUP project.
- Consideration of alternative rail options has led to a preferred option that introduces a 3rd rail line on the MSL with a run-around track, circa $7.5M.
- Rail signalling upgrade may be required anyway depending on the roading configuration at Hoskyns Rd because the current antiquated rail system is linked to the traffic signals on the SH1/Hoskyns Rd intersection.
- Rail station: there's currently no known plans for the future of the rail station. There is a concept plan for a Park & Ride site by Hoskyns Rd in the IPort developer's area, but sits where the proposed skewed flyover lands.
- PT Futures: looking to kick off again next year. Three options are on the table at the moment, will hopefully know more about which option(s) are coming out ahead by the middle of next year.

2.4 Hoskyns Level Crossing

- Biggest rail level crossing safety risk in the South Island given the number of traffic and rail movements
- SH1/Hoskyns signals were originally put in as a temporary measure until more significant investment is made to provide better connectivity
- One of the key safety issues to be addressed on this project, next to Dunns Crossing/Walkers Rd intersection
- Initial design philosophy was to close the SH intersection to eliminate the safety risk altogether
- Modelling showed removal of this access would severely congest the Weedons Interchange (inc. RT restrictions at Tennyson/Brookside & Rolleston Dr South), which would raise further congestion and safety issues around the Interchange
- Right turning movements on the SH1 do not align with the Road to Zero strategy, undesirable
    - Right Turn (RT) in from Christchurch is a safety risk and will trigger rail signal upgrade

    - RT out is a no-go from both Waka Kotahi and KiwiRail's perspective re: safety
- Left turning access of some form is likely required to ensure Weedons Interchange doesn't fall over
    - Left Out (LO) is fine and won't require rail re-signalling as long as the lane is free-flowing into its own lane heading towards Christchurch
    - Left In (LI) may trigger rail re-signalling as there will be periodic queues at the Jones Rd signals. KiwiRail is investigating this further and will advise if this is acceptable without requiring a re-signal upgrade

DECISION: LO @ Hoskyns Rd is required

2.5 Cost Estimates

- Project is expected to be delivered within the baseline P50 ($90M)
- Other project scope elements are estimated to cost ~$30M, i.e. there is approximately $60M to deliver the connectivity option (less considering admin fees and sunk costs incurred to date)
- Current estimates on options are indicative only for comparative purposes
- Current level of cost estimates is not sufficient, need to price risks
- Constructability is a major cost element that needs to be better understood on all the shortlisted options

3. Options Review

3.1 Do Minimum

Pros	Cons	Comments (neutral)
	• LOS at existing accesses onto SH1 will be E or F, creating further safety risk • Signals on SH1 become increasingly challenged	• Removing RT accesses along SH1 helps improve operations at intersections, but focuses traffic at key nodes • Even with no changes to the network Levi Rd/Weedons Interchange is going to experience congestion from all the residential growth

3.2 At grade options (Options 2/3/4)

Pros	Cons	Comments (neutral)

• Options are likely within the affordable range	• Lose ability to control the intersections unless it's signalised
	• Safety issues
	  ○ Hoskyns level crossing remains
	  ○ Merging & weaving issues between George Holmes access
		• LO at George Holmes required to provide connectivity from industrial to residential - has to be grade separated to not create another level crossing risk
		• Need more work done to refine an at-grade option and rule it out objectively

	and the roundabout, would need to operate SH at slower speed • Options 3 & 4 have major property impacts • Likely will not be an enduring solution, even if it works up to 2038 • Don't meet reliable connectivity requirements & leaves residual safety issues, hence don't meet our investment objectives	• Modelling showed there is a need to provide Tennyson/George Holmes connection to make the network work • Elliptical roundabout at Memorial Ave worked well despite what the modelling showed • Take an at-grade option through to showcase what can be delivered at grade with lower project cost • Do we need to consider some form of grade-separated roundabout solution? E.g. SH over, roundabout under

DECISION: Take Option 2 to shortlist, including a sub-option (Option 2a) with Tennyson/George Holmes connection

3.3 East-West Tunnel (Options 5a/5b)

Pros	Cons	Comments (neutral)
	• Major constructability issues, would take longest to build (~3yrs), traffic management issues, unclear methodology • Doesn't address all objectives: safety issues at Hoskyns remain • Significant cost. Could optimise design to save costs, e.g. open trench configuration like Intercity Bypass, but still would be excessive • Health and safety issues for trench • Significant concrete material required: environmental impacts, carbon footprint	• Ground conditions understood to be very good (gravel) • Water table ~14m deep • May still require a tank for drainage, closer to the water table

DECISION: Excluded from shortlist

3.4 East-West Flyover (Options 6.1/6.2/6.3)

Pros	Cons	Comments (neutral)
• Cost-wise may be cheaper than skewed flyover – needs to be looked at in more detail particularly around constructability • Can provide for all connectivity movements, particularly if combined with George Holmes/Tennyson connection • Keeps access to Rolleston station platform	• Safety issues at Hoskyns remain if retaining full access and would be unacceptable for KiwiRail ○ Keep LILO at Hoskyns, combine with Tennyson/George Holmes connection • Major constructability issues similar to E-W Tunnel, maybe to a slightly lesser scale • Property impacts • Significant cost • Retaining SH1/Hoskyns signals may not be a long-lasting solution (resilience) • Consentability – visual impacts, large earthworks and MSE walls	• Option 6.3 provides slightly longer stacking distance, marginal benefits • Moving signals to the other side of the rail line would still not be accepted by KiwiRail, too much traffic volume • Potential optimisation via sinking Rolleston Dr North approach under the overpass structure to not have the structure climb as high (e.g. Robinsons Rd) • Opportunity to shorten the structure by taking out the structure by Hoksyns Rd, keep LILO @ SH1/Hoskyns • More room for construction away from the residential area

DECISION: Take Option 6.1 to shortlist with LILO @ Hoskyns, combined with George Holmes over/underpass

3.5 Local road underpass (Rolleston Drive North to Hoskyns/Jones Rd) (Options 7a/7b)

Pros	Cons	Comments (neutral)
	• Longer than 80m length, i.e. tunnel • Major constructability issues • No LO at Hoskyns – fatal flaw • Uncharacteristic of the surrounding environment	• Potential optimisation for Option 7a to turn it into more of a "trench" than tunnel by "bridging" the SH and rail • Comparison: underpass in Lloyd St, Midland, WA ~$50M AUD in 2013

DECISION: Excluded from shortlist

3.6 Tennyson/George Holmes over/underpass (Option 9/10)

Pros	Cons	Comments (neutral)

• Ideal pedestrian/cyclist desire line
• Provides connectivity from industrial to the residential side
	• Allowing for all modes incurs additional traffic through Tennyson St: compromises liveability outcomes	• Adjacent business accesses would need to be rationalised or businesses relocated (e.g. KFC, BK)
		• Needs to be packaged with other options further north around Rolleston Dr North/Hoskyns Rd
		• Preference to go under than over
		  ○ Shorter length required than overpass
		  ○ Good ground conditions: experience from CSM2
		  ○ Water table ~14m deep
		• May require turning Tennyson/Kidman/Byron into a T-junction to prevent through movements
		• Need to test signals performance at Tennyson

DECISION: Not an option by itself, part of other options taken to shortlist

3.7 Local straight under/overpass (Option 11)

Pros	Cons	Comments (neutral)

• Better desire line on the industrial side, in current absence of iPort development
• Constructability-wise, would be one of the simplest out of all the options looked at to date
  ○ Perpendicular
  ○ Got more room to work with
• Better for pedestrian/cyclists than skewed option because it has a better desire line, even if it is on steeper gradients people would prefer to go up/under for a shorter length than travel out further and having to backtrack
•
	• Shorter length means steeper gradients (7-8%) especially on Jones Rd side
	• Property purchase required (Drummond & Etheridge)
		• Is there opportunity to put pedestrian/cyclists on a separate structure that is on a gentler slope
		• Modelling work required
		  ○ How resilient is this network configuration
		  ○ Is Tennyson/George Holmes connection required
		• Would need 2 right turn lanes at Jones Rd landing
		• Overpass/underpass may need to be 4-laned
		• MCA-wise, scored similarly to the skewed flyover
		•

DECISION: Included in shortlist, both overpass and underpass

3.8 Skewed Flyover, as consulted (Option 8)

Wasn't discussed during the meeting, but still in the shortlist.

3.9 Overpass vs. Underpass

Criteria	**Overpass**	**Underpass**
Structure length	Slightly longer	Slightly shorter
Ped/Cycle	Slightly steeper grades	Easier grades CPTED issues Noisier
Sightlines		Potential sightline issues given the relatively short length, especially for buses
Cost	Similar costs for <80m structures	>80m becomes a tunnel and becomes much more expensive, requiring fire suppression, ventilation etc.
Consentability		Preferred in urban environment, less visual impact

ACTION: Talk to cycling multi-modal specialist (Simon Kennett) and get their input on whether underpass or overpass is favourable, seek involvement in MCA scoring around multi-modal criteria

ACTION: Project team consider engaging with local cycling group for their feedback

4. Meeting Close Out

More detailed investigation works required on the shortlist options, key areas include:

- Refined designs
- Network performance (modelling)
- Social & environmental outcomes
- Cost estimates

Next Challenge Session

Objective: present the shortlist options in more detail, ratify MCA scoring ranking without cost considerations

- Week of 17th Jan 2022, 3hrs
- Include Andrew Mazey & David Jackways

Another meeting/discussion likely to follow this once cost estimate information becomes available.

James can help pull together costs around constructability, e.g.

- Quantities
- Approximate construction programming
- Preliminary & general

NZUP Rolleston DBC Challenge Review

Minutes and Actions

Time:	09:30AM – 12:30PM	
Date:	Wednesday 19 January, 2022	
Venue:	Waka Kotahi Meeting Room PR1.01	
In attendance	Richard Osborne Fiona McLeod Geoff Griffiths Colin MacKay Michael Blyleven Colin Knaggs Denny Sahng	Waka Kotahi
	Alix Newman Matt Soper	Stantec (Project Team)
	Vince Pace	Jacobs (Project Team)
	James Harrison	Fulton Hogan (Independent Reviewer)
	Mark Beijeman	Aurecon (Independent Reviewer)
Apologies	N/A	

1. Meeting Summary

1.1 Meeting Objectives

- Recap the shorter options list (7) for connectivity being assessed by the project team since the last Challenge Session
- Identify any fatal flaws to rule out any options
- Identify a shortlist for further investigation works

1.2 Key Project Objectives

- Address safety issues along SH1 and at Hoskyns level crossing
- Provide connectivity between industrial and residential sides of Rolleston
- Support more inclusive access within Rolleston via modal choice and a resilient transport network in the face of growth

1.3 Identified Shortlist

No.	Option	Features
1	4	Skewed flyover from Rolleston Drive North to Jones Road Signals at the current Jones Rd roundabout location Link road through IPort development site Potentially another set of signals at IPort link road/Hoskyns Road Southbound service lane offramp to Kidman Street Left Out only at Hoksyns Rd/SH1
2	7	Straight flyover from Rolleston Drive North to Jones Road Signals at industrial end of flyover/Jones Road Southbound service lane offramp to Kidman Street Left Out only at Hoksyns Rd/SH1
2.5	8	As per Option 7 and includes: Northbound offramp onto SH from top of the straight flyover **Only to be explored after confirming vertical geometry would work
3	13	Tennyson/George Holmes underpass/overpass Signals at industrial end of underpass/overpass on Jones Road Signals at Rolleston Drive North/SH1 retained Left Out only at Hoksyns Rd/SH1

1.4 Meeting Actions:

ID	Action required	Owner	Due
1	Design details to be further developed for shortlist	Project Team	17/01/2022
2	Modelling checks		
3	Bring Andrew M. and David J. up to speed on outcomes of challenge session, particularly around Option 13/14/24		
4	Risk workshop	Project Team	25/02/2022
5	Identify local cycle group to engage with	Fiona McLeod /Denny Sahng	Jan 2022

2. General Discussions

Grade for active modes

Waka Kotahi multi-modal team provided the following input before Christmas:

- 6-8% grade for pedestrians and cyclists is acceptable and having a more direct route may be more beneficial than a longer and less direct connection at ~5% grade.

- Overpasses seen to be better than underpasses, no explicit explanation has been provided
- Speed on the downhill seen as a bigger concern

Active mode structures with grade of 6-8% have been built in other parts of the country and shouldn't pose significant consenting risk.

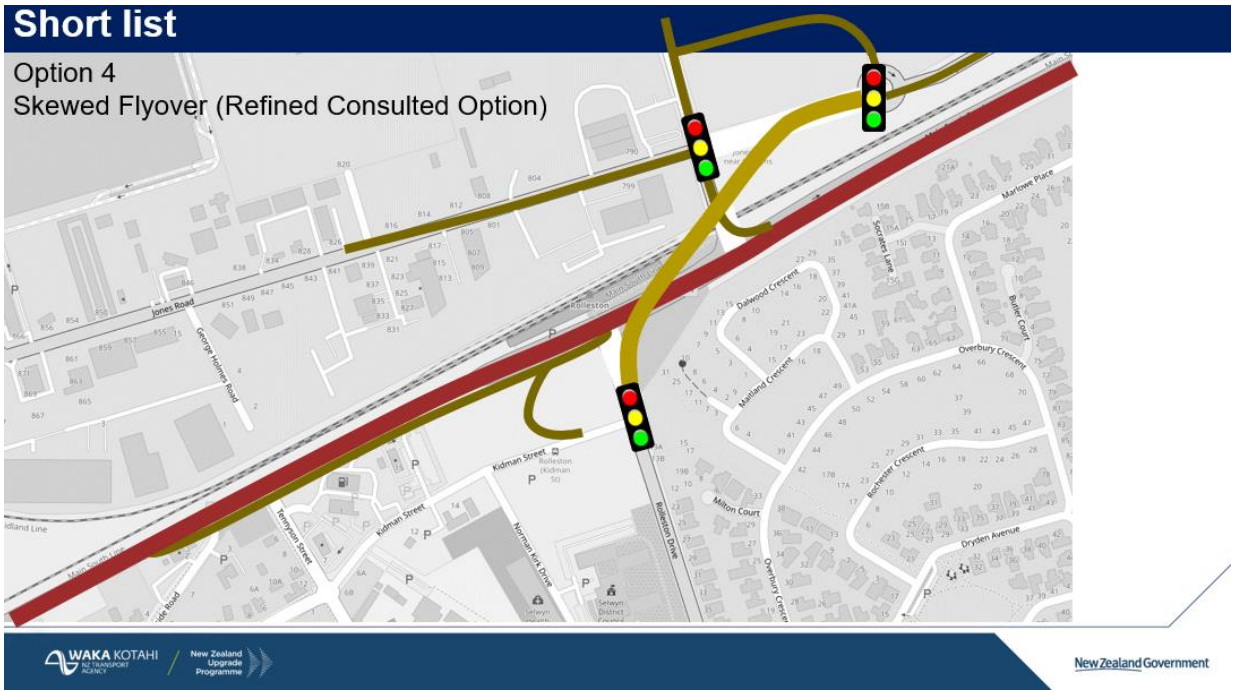
What is the origin-destination the connection is intended to cater for and how would it link with the local road network?

- SDC is looking to put cycle path along the length of Jones Rd that this connection would tie in with, as well as their plans for a cycle link up Hoskyns Rd and West Melton Rd
- The required connection is mainly for vehicles – we're not expecting big number of cyclists/pedestrians, but it's about doing the right thing.
- A connection across Tennyson/George Holmes likely provides a better desire line for the current state of play, but may change once IPort is fully developed on the other side

Options Assessment

Technical analysis to date demonstrated the need for some form of grade-separation

Option 4: Refined skewed flyover



Refined option includes the following post-consultation feedback:

- Link road from base of the flyover to Hoskyns Rd through IPort development (shortened travel distance back to Jones Rd from about 1.6km to about 600m). This would be a proper road similar

to that in Tower Junction (Troupe Dr), no stopping lines, ~10m wide. Would need to be a public road and has cost implications on the project.

- Offramp from the SH1 service lane for southbound traffic onto Kidman St: provides another connection from Chch to industrial area
- Left out only from Hoskyns Rd to SH1 – with the removal of the signals this essentially becomes a free lane gain onto SH1

Pros	Cons	Comments (neutral)
• Delivers on the project objectives	• Still severs Jones Rd – link road helps • Likely to be cost prohibitive • Technically challenging – buildability issues with the span lengths and skew • Wider network effects - rerouting	• Signals at either ends of the flyover: traffic modelling has shown this is required with the anticipated volumes of traffic • IPort link road/Hoskyns Rd intersection will also likely require signals

Current base estimate is ~$85M excluding risk adjustment.

Rest of the project scope is ~$30M so need to compare these options cost against $60M available to the P50 of $90M.

DECISION: KEEP

Option 7: Straight flyover

Pros	Cons	Comments (neutral)
• Delivers on the project objectives	• 6-8% grade for active modes	• 3 lanes on the flyover (2 towards Jones Rd, 1 towards

• Continuous connectivity on the industrial side • Relatively cheaper structure than skewed option • Easier constructability • "Neat" solution, not a lot of tack-ons to make it work	• Property acquisition required • Access issues to resolve for businesses adjacent to the flyover	Rolleston Dr North) – to be optimised vs. cost in later design refinements • Could explore stairs to drop down to Rolleston station

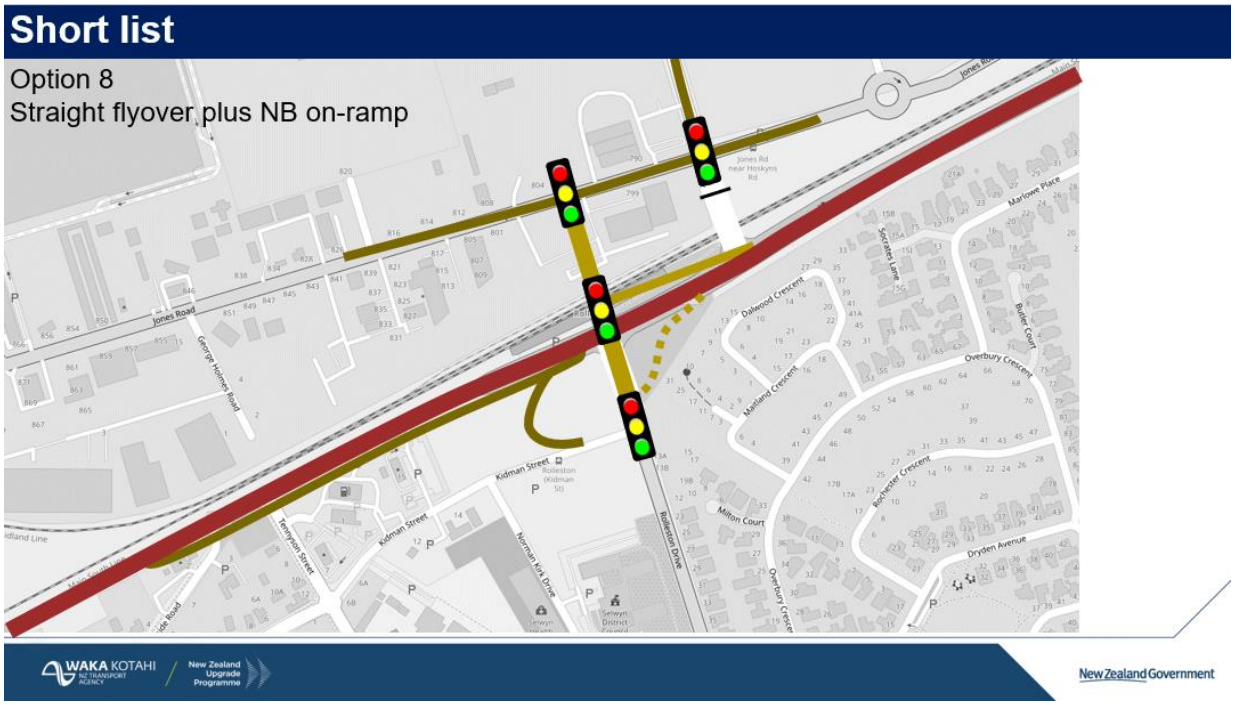
DECISION: KEEP

Community may still want Left In @ Hoskyns from SH1 - what's our response?

- Level crossing activations may cause queuing on the SH1
- Jones/Hoskyns signals will get busier in the future and traffic may back up towards the level crossing – safety risk
- Increase in safety risk at the level crossing may require rail signalling upgrade, costing ~$11M
- Current plans for the rail improvement is a 3rd track alongside the Main South Line and would cross Hoskyns Rd
- Left Out of Hoskyns Rd can be provided as it forms into a lane gain onto SH1 and won't cause short stacking issues

More design work to be progressed on the overpass to ensure it works particularly around the vertical sight distance. Option 8 to be explored further only if there is surplus sight distance available as the disbenefits seem to outweigh the benefits.

Option 8: Straight flyover with northbound onramp

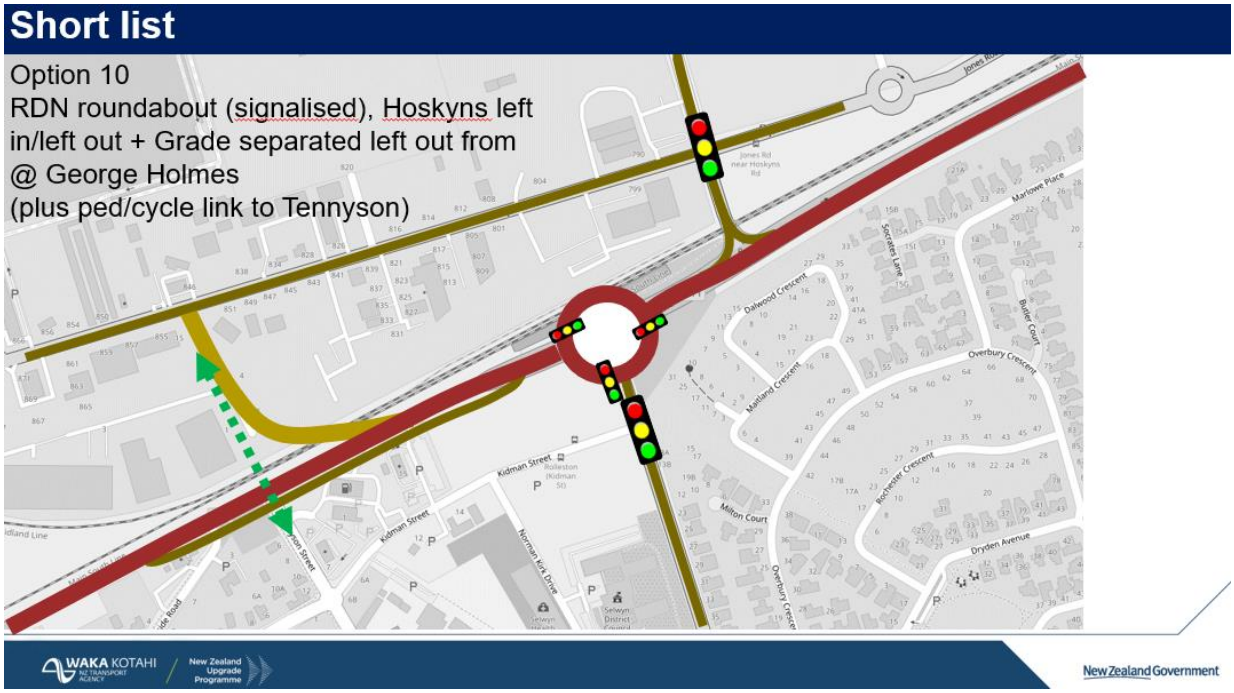


Pros	Cons	Comments (neutral)
• Provides better access from Rolleston Dr North to SH1 towards chch (less traffic signals)	• Safety issue – vehicles queuing on an uphill grade, especially for larger vehicles such as buses • RT on flyover would impede industrial to residential connection • Merge from onramp to SH1 traffic – potential safety risk • Onramp within KiwiRail corridor – may not be accepted • Onramp would require retaining walls, "ugly" • More costly than Option 7 • 3 sets of signals in close proximity (one on either ends of flyover + another for onramp access in between)	• Hoksyns Rd intersection closed • Would not be designed for large trucks – should use Weedons Interchange • Sight distance will govern vertical curves – may require steeper grades or longer spans and be more difficult for ped/cyclists • Unorthodox to have set of signals at the crest of a bridge – any examples?

DECISION: DROP

May be reconsidered if there is residual vertical sight distance to flatten the crest of the flyover

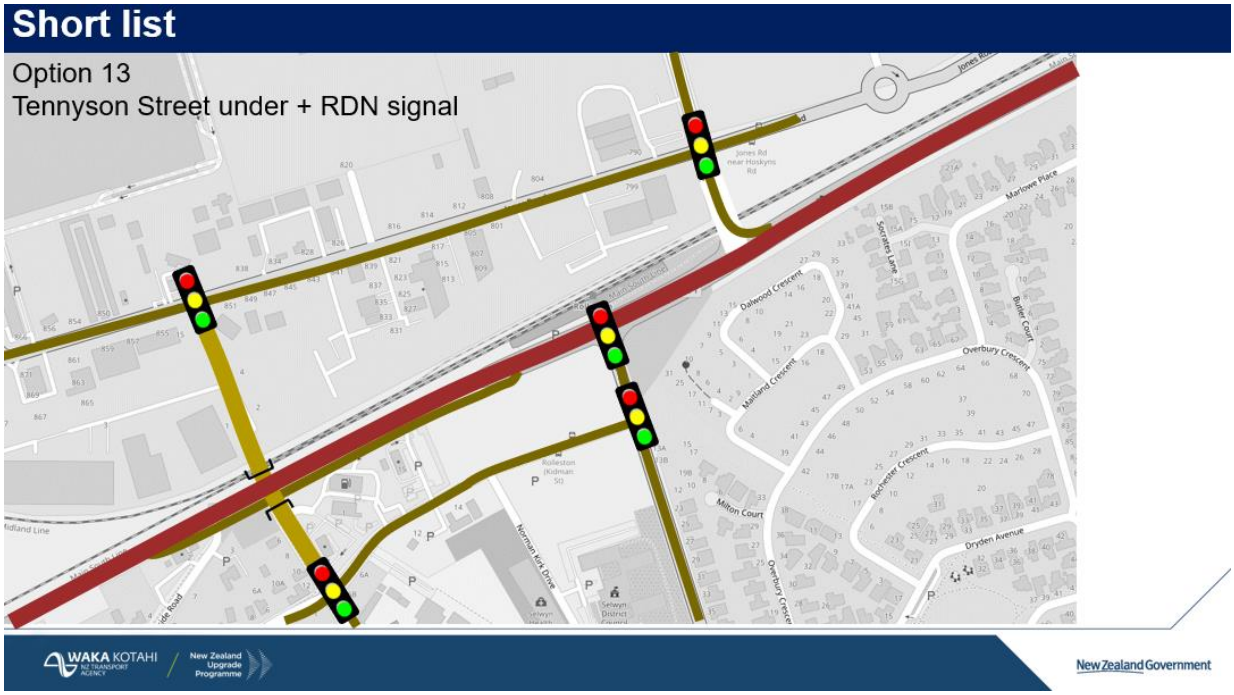
Option 10: Roundabout at SH1/Rolleston Dr North



Pros	Cons	Comments (neutral)
	• Retains Left In at Hoskyns Rd – safety issue, requires rail signalling upgrade • Rail proximity to SH1 • George Holmes onramp would be steep to come back down to grade onto SH1 • SH1 speed limit may need to be reduced to 60km/h, George Holmes onramp 40km/h for safety reasons • SH1 congestion issues • Land acquisition required for roundabout	• Signalised roundabout – traffic modelling highlighted issues with a priority roundabout

DECISION: DROP

Option 13: Tennyson/George Holmes Rd underpass + Rolleston Dr North signals

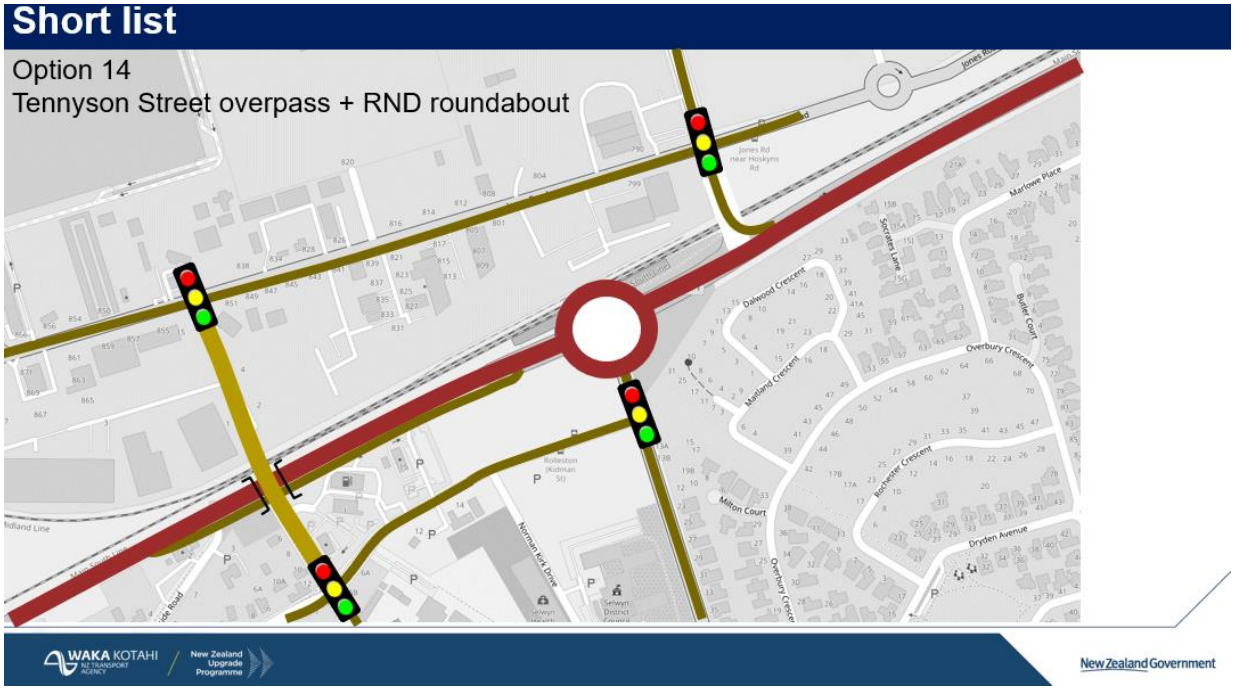


Pros	Cons	Comments (neutral)
• Retains connectivity via signals at Rolleston Dr North • Relatively cheaper to construct	• Signals retained on SH1 - Speed limit would need to be reduced to 60km/h between Hoskyns and Tennyson • Significant change to transport network - contrary to SDC's plans for Tennyson St • Access issues for businesses next to proposed structure, particularly on Tennyson side	• Assuming ped/cycle connection would be retained at SH1 signals and towards Hoskyns Rd • Could be either overpass or underpass

SDC viewpoint is critical for Options 13, 14, 24 going forward before undertaking more design work

DECISION: KEEP

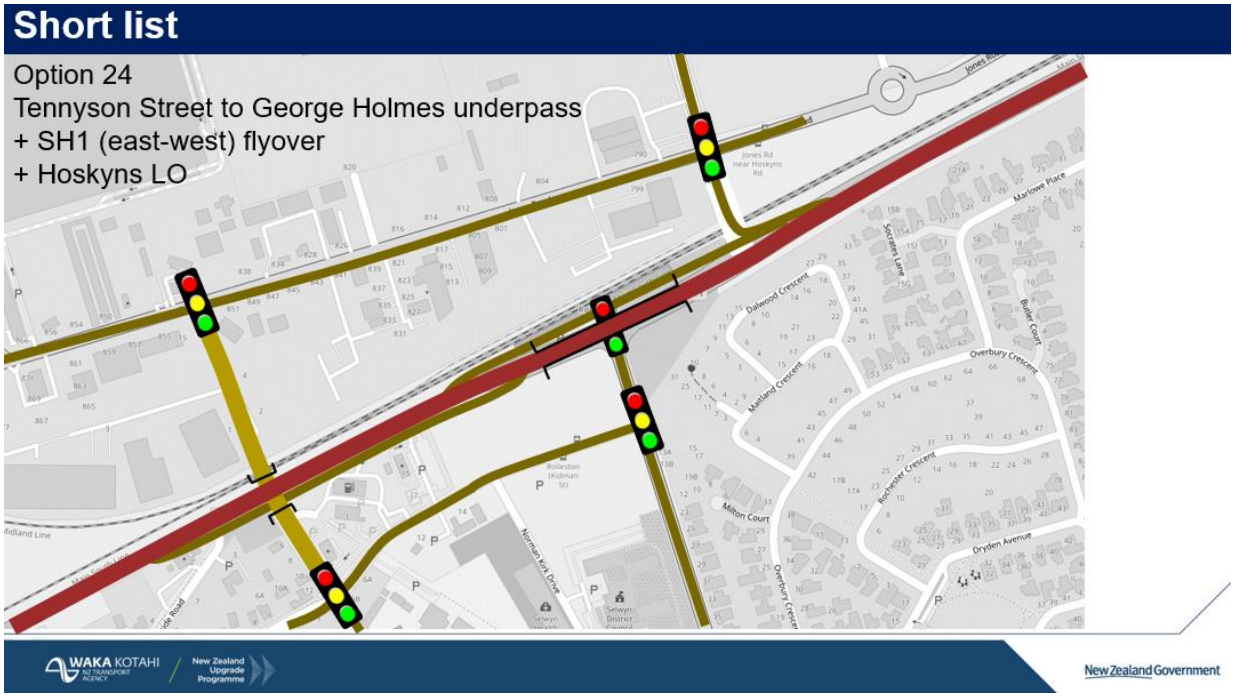
Option 14: Tennyson/George Holmes Rd underpass + Rolleston Dr North roundabout



Pros	Cons	Comments (neutral)
• Better aligns with safe system approach on SH1 - roundabout doesn't need to be signalised	• Land acquisition required for roundabout • Roundabout proximity to Kidman St signals • Backwards step going from signals to roundabout – chance that it will need to be re-signalised in the near future • Less safe for active mode users • Minimal benefit over the existing signals • Contrary to SDC's network plan • Access issues for businesses next to proposed structure	• Could be either overpass or underpass • Dual lane roundabout assumed • 2 lanes southbound into roundabout: 1 for SH traffic, one for Rolleston service lane traffic

DECISION: DROP

Option 24: Tennyson/George Homes underpass + SH1 flyover



Pros	Cons	Comments (neutral)
• Addresses safety concerns at SH1 Rolleston Dr North signals	• Two structures – cost implications • Conflict between right turning vehicles from Rolleston Dr North with Left Out of Hoskyns Rd • Space constraints, implications on the existing rail station	• Could be underpass or overpass at Tennyson/George Holmes • Southbound slip lane starts before Rolleston Dr North, parallel to SH1 structure • Left In to Hoskyns – could be explored • Seems to be a lot of effort just to eliminate RT conflicts, minimal incremental benefit for the additional cost compared to Option 13

DECISION: DROP

General Discussion

SIP speed limit project through Rolleston – on hold, infrastructure changes through SIP and NZUP projects will govern future speed limit

Speed consideration on SH1 needs to be factored in each of the options taken forward for further analysis

Need to take underpass/overpass designs far enough to ensure vertical sight distances can work in at least 50km/h speed environment

No option is going to have no issues – it will be a matter of which option has fewer issues.

George Holmes/Tennyson underpass vs. overpass - factors

- Cost – underpass is likely cheaper than an overpass
- CPTED – overpass preferred for active modes
- Business Access – overpass would be easier to resolve access issues to adjacent businesses
- Stormwater – overpass would have less drainage issues than an underpass

Risk needs to be priced for next round of cost estimates

Constructability – Much more room to play with at Rolleston Dr North end, constrained at Tennyson/George Holmes.

ACTION: Project team consider engaging with local cycling group for their feedback

3. Meeting Close Out

Progress more design work on the three shortlisted options, enough to produce schedule of quantities that can be tested with James for feedback

Undertake a risk workshop that can then be fed into next level of cost estimation

Aim for a SDC council briefing in March

Meeting Notes

Rolleston Access Improvements - Fire and Emergency Discussion	
Date/Time:	February 22, 2022 / 09:00 – 10:00
Place:	TEAMS Online
Attendees	**Facilitation / Moderator** Alix Newman **Participants** **Waka Kotahi NZ Transport Agency**: Denny Sahng, Colin Knaggs, Fiona McLeod **Stantec:** Vanessa Wong, Alan Kerr, Matt Soper, Alix Newman **Fire and Emergency:** David Barry, Rachel Butler, Bailey Wells, Karl Patterson

Summary

The main purpose of this workshop was to discuss the short listed three overpass / underpass options with Fire and Emergency.

Question to discuss are:

What are the implications to emergency services?

- Response times?
- Access to SH1
- Access to Industrial Zone
- Other?

The short listed options are:

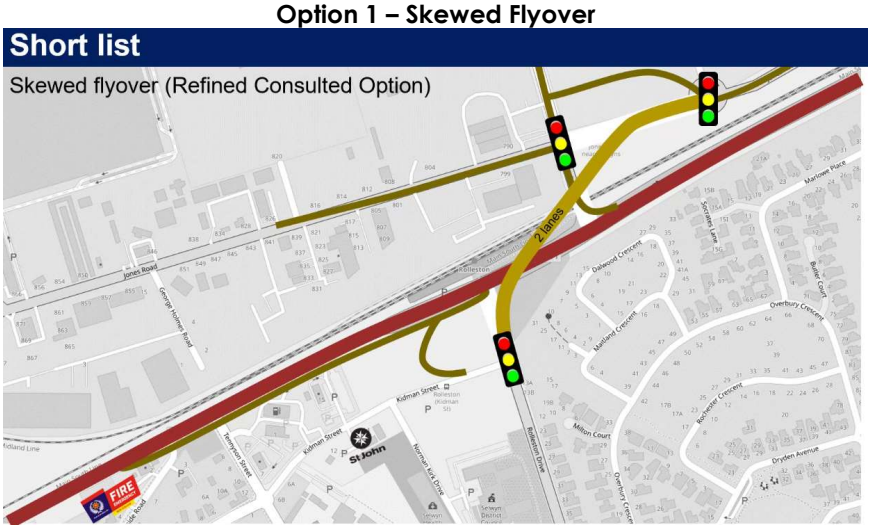
- Skewed Flyover
- Straight Flyover
- Tennyson Street Underpass

Item
General • Around the room introductions • NZUP – Flyover Alternatives: includes a range of interventions of intersection upgrades, upgrades to the rail network to allow more efficiency movement of trains. This is all to address safety and efficiency issues. • The purpose of discussion today is to talk about the multi-modal flyover options and be on the same page as to what are the key concerns in regards to Fire & Emergency (how can each of these options be designed / developed to best suit Fire & Emergency).
Outline where we are at & Short list options • Short list of flyover alternatives (narrowed down to 3 options) • Feedback from the community have expressed their concerns on arrangements discussed in regards to the buildability of the flyover, costs and structure involved with the construction, and impacts on Jones Road. • Concerns / issues / risks include: - Skew of the angle of flyover (will this really be suitable for the community of Rolleston? → this led on to thinking about other options) - People needing to access Jones Road if they need to head south (southern side / Jones Rd cut off with some of these options)

Meeting Notes

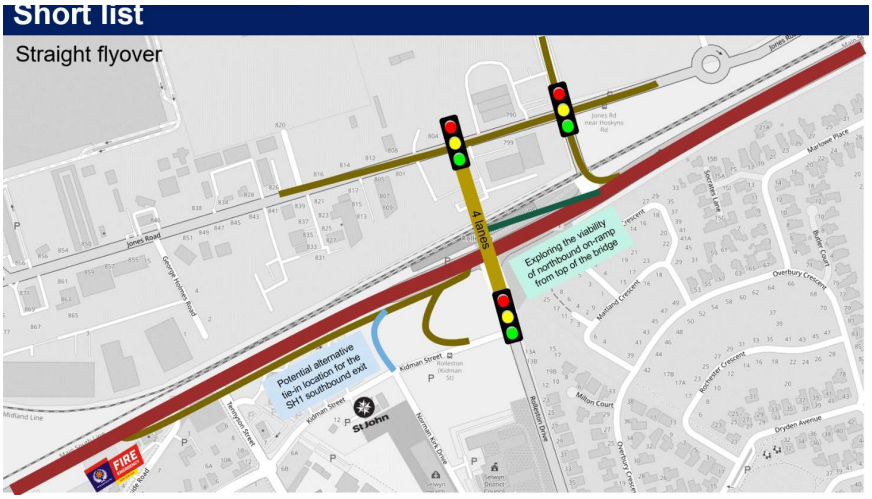
Item

Option 1 – Skewed Flyover



- **Skewed flyover (2lanes)**
  - The service lane will run parallel to the southbound SH lane
  - The implications to Fire & Emergency will be able to turn on to service lane onto the highway going southbound but will no longer have direct access onto the SH heading northbound. Fire & Emergency will have to travel down Brookside and onto Kidman St and then onto flyover → continue onto Jones Rd.
  - This option has increased in scope and cost than originally anticpated due to having to add all of the connections (Hoskyns Left, Izone connections, Kidman link).

Option 2 – Straight Overpass

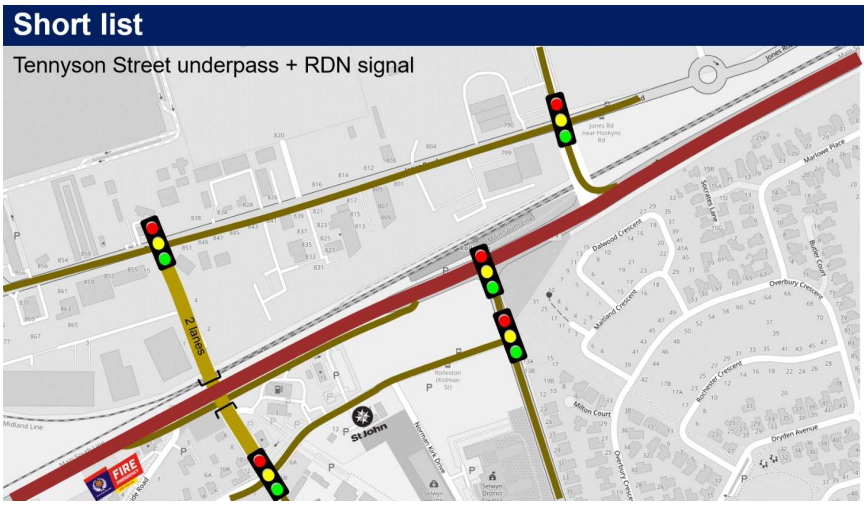


- **Straight flyover (3 or 4lanes)**
  - This option will roughly connect at the same place on Rolleston Dr (compared to option 1)
  - Implications for Fire & Emergency is mostly the same as option 1 re routes
  - Possible link off slip lane to Kidman Street or option to intersection with Kidman/Norman Kirk. Selwyn District is nervous about latter option because Norman Kirk Drive has not been engineered for this kind of high traffic flow
  - Kidman / Norman Kirk will need traffic lights
  - Issues with heavy vehicles coming from industrial area being able to get onto SH1 from Jones Rd → overpass → local roads to SH1. This maneuver tracking will need to be checked
  - Gradients / Vertical sightline = difficult to achieve safety standards

Meeting Notes

Item
On ramp to northbound on highway – still being looked at, but known to have some issues related to intersection required on flyover, lanes required and queuing, plus likely sightline concerns.

Option 3 – Tennyson Street Underpass + RDN Signal



- **Tennyson Street Underpass + RDN Signal**
  - Implications for RDN signal is not great for safety (which was purposely taken out for previous options). This option doesn't achieve the safety objective of removing these signals at RDN.
  - This option may not be well-received by council as it will bring a lot of traffic onto Tennyson which is used by a lot of different modes of transport (walking, cycling precinct).
  - Otherwise, modelling indicates functions reasonably well.

Travel Time Outputs

- SH1 will have faster travel time / perform better with fewer/no signals

ACTIONS

- Undertake travel time analysis on what it would to be to get around Brookside, around Dunns Crossing and back up – (ie how to access northbound lane of highway from current station location) Modelling team to extract this

Discussions by Fire & Emergency

- IZone industrial employment zone
  - Can be serviced by Rolleston, Burham, Wigram
- Hoskyns Road being a separate 'road segment zone' (emergency service zone / deployment zone is broken up into separate zones for NZ). Each zone's geospatial data talks to the dispatch system → this enables the correct area to respond to the correct incident type.
- PRT (rescue cutting gear) coming in from each direction on the SH.

- Karl Patterson will take this flyover information and put it through their own modelling system and come back with further discussions.
- Fire & Emergency looking at new locations around Rolleston for new station, and looking at best travel times etc. (predominantly volunteers live south of SH)
  - Levi / Lowes may become central spine of Rolleston due to the massive growth of residential houses etc. (this should be taken into consideration when deciding on new station location)
- Data issues received from Waka Kotahi previously – data needs to have no breaks in it
- Road to Zero – how will these options impact this?

Meeting Notes

Item
• **Preferences on options** – Alan prefers straight flyover. Provides all the connectivity components, de-risks some property stuff, tighter corridor to construct – likely to be easier and quicker option. Was a clear favourite from Workshop last week. – The project team is working through the key risks on all options (Denny). – Dave prefers the straight flyover, however concerned about where they could gain access to get onto overpass (most direct would be via Kidman). Alan- we are potentially looking at a slip lane that will allow access onto flyover from the highway. **ACTIONS** • Stantec to send Fire & Emergency more detailed design of these options *CONFIDENTIAL – NOT FOR PUBLIC • Fire & Emergency (Rachel) to send Stantec / Waka Kotahi what they need from the data / what data they need specifically • Feedback from Fire & Emergency by **middle of March** • Aim is to get to a point where we have preferred option for reporting by **end of March** • Public Forum is set to be **end of April**

If you wish to submit any feedback in relation to the problems or options discussed during the workshop, please feel free to contact us via the project manager email address: alix.newman@stantec.com

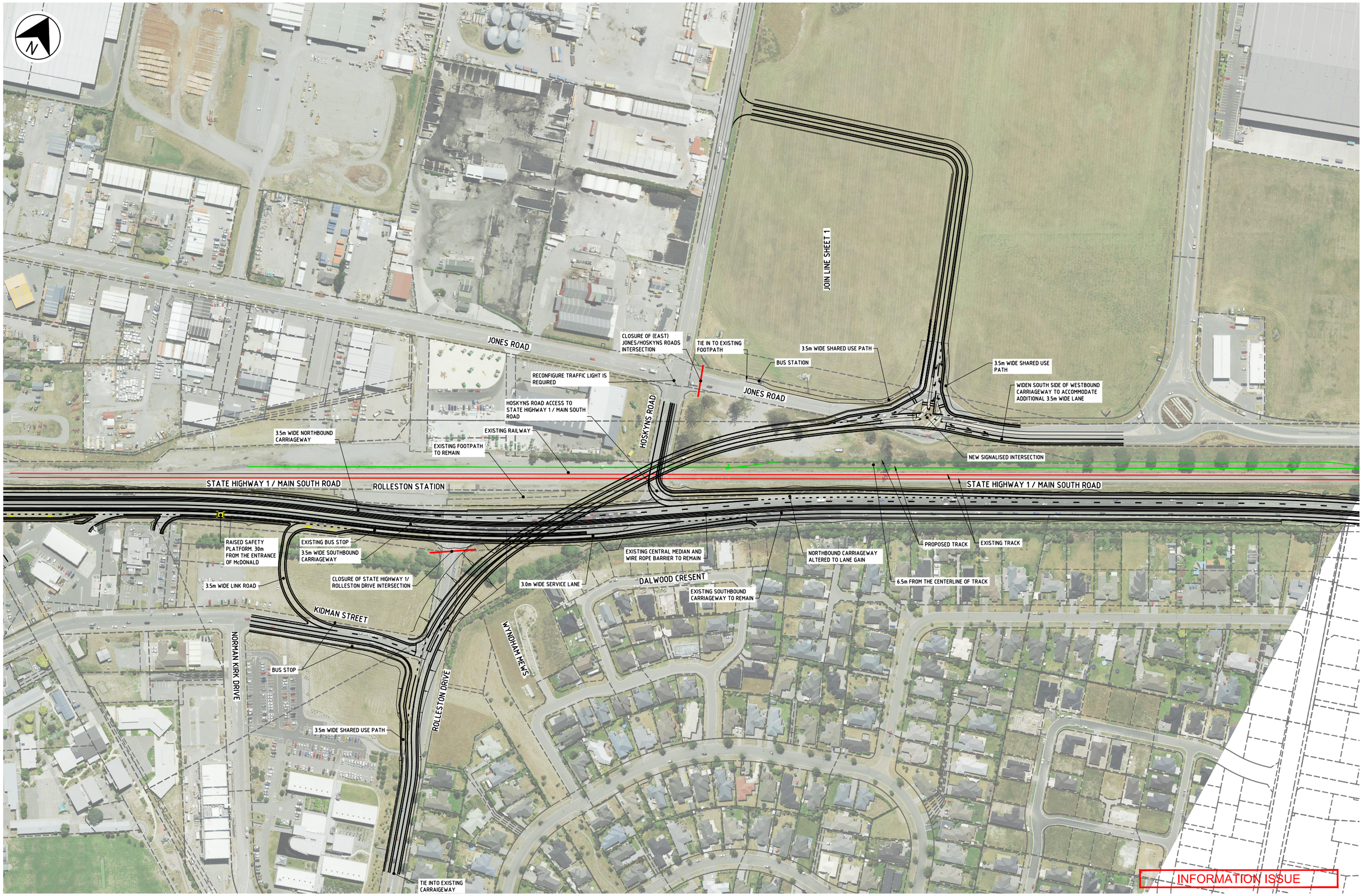
The meeting adjourned at 10:00.

Drafted by: Vanessa Wong

Checked & Edited by: Alix Newman

APPENDIX B CONCEPT DESIGNS

DATE: 6/04/2022 11:06:01 AM NAME: RAKE, BRENTON
LOCATION: C:\users\rakeb\appdata\local\projectwise\jacobs_anz_ie\d0498126\IA259900-0000-CR-SKT-0086.dwg



REV	DATE	DRAWN	REV'D	APP'D	REVISION	DRAWING NUMBER	REFERENCE DRAWING TITLE
A	27/10/21	ML			ISSUE FOR INFORMATION		

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CLIENT	WAKA KOTAHI NZ TRANSPORT AGENCY		
PROJECT	ROLLESTON ACCESS IMPROVEMENTS DETAILED BUSINESS CASE		
DRAWN M. Lai	DRAWING CHECK	REVIEWED DATE	APPROVED DATE
DESIGNED M. Lai	DESIGN REVIEW		

TITLE: SERVICE ROAD, FLYOVER AND SIGNALISED INTERSECTION

SCALE	DRAWING No	REV
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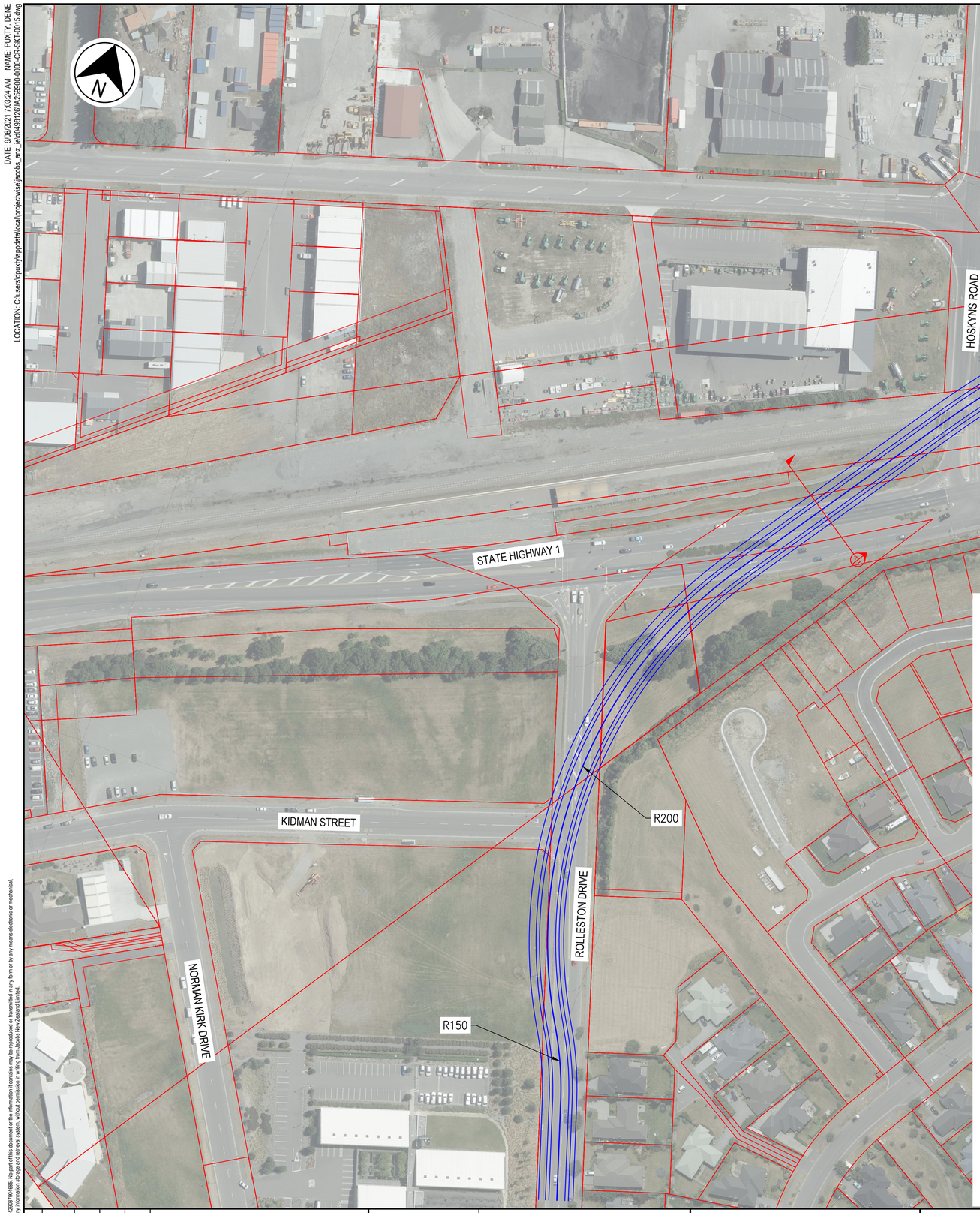

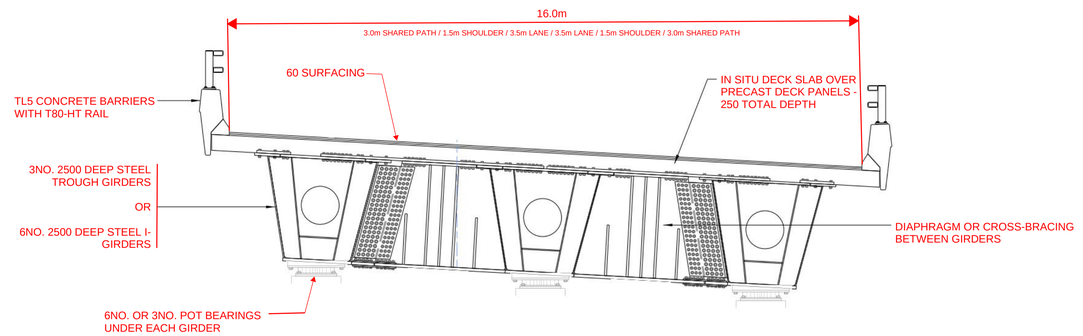

SECTION A
NTS

REV	DATE	DRAWN	REV'D	APP'D	REVISION	DRAWING NUMBER	REFERENCE DRAWING TITLE

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CLIENT: SELWYN DISTRICT COUNCIL
PROJECT:

DRAWN	DRAWING CHECK	REVIEWED	APPROVED
DESIGNED	DESIGN REVIEW	DATE	DATE

TITLE: ROLLESTON FLYOVER OPTION 5

SCALE	DRAWING No	REV
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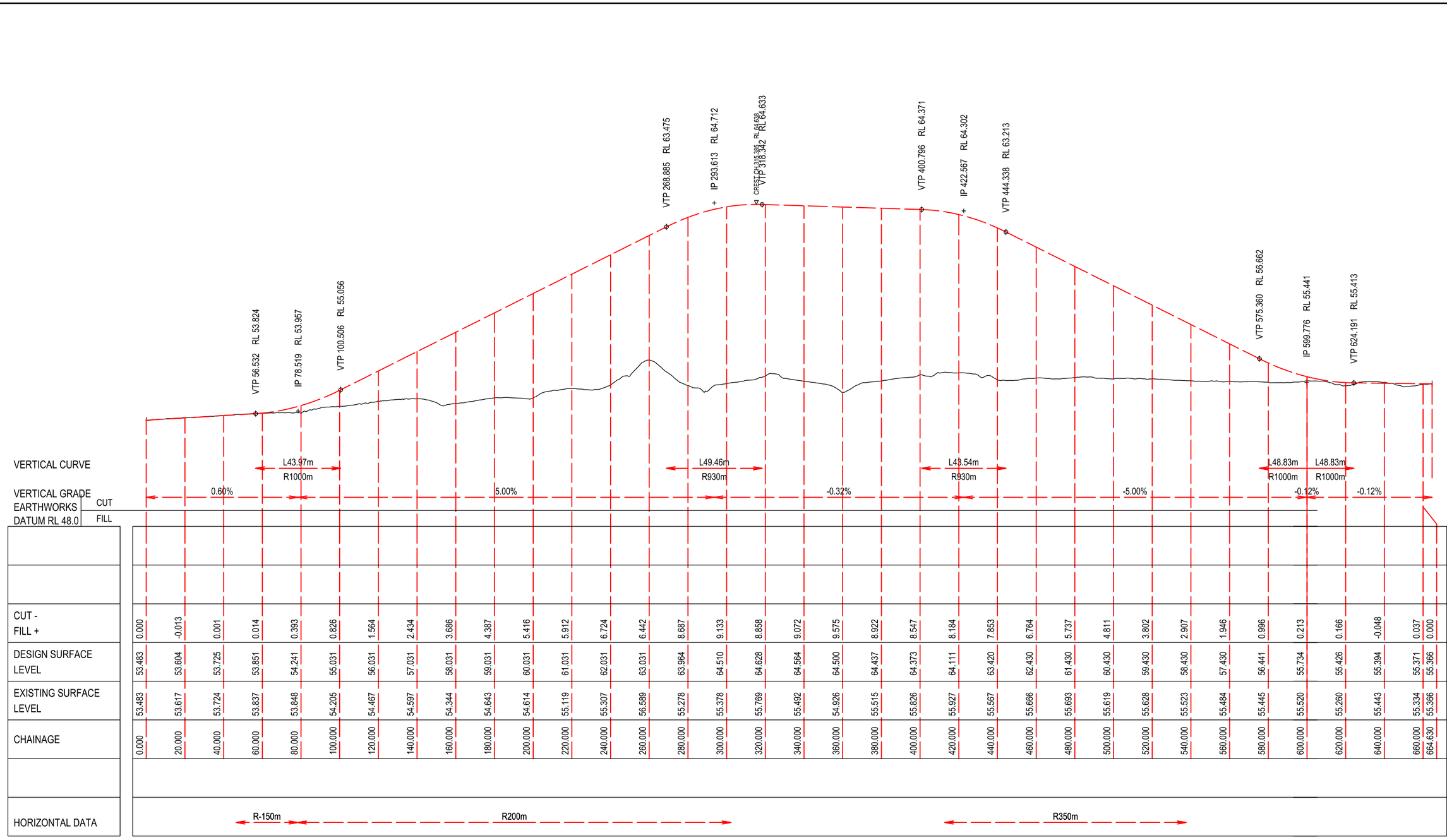

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60.000	0.014	53.851	53.837
80.000	0.393	54.241	53.848
100.000	0.826	55.031	54.205
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180.000	4.387	59.031	54.643
200.000	5.416	60.031	54.614
220.000	5.912	61.031	55.119
240.000	6.724	62.031	55.307
260.000	6.442	63.031	56.589
280.000	8.687	63.964	55.278
300.000	9.133	64.510	55.378
320.000	8.858	64.628	55.769
340.000	9.072	64.564	55.492
360.000	9.575	64.500	54.926
380.000	8.922	64.437	55.515
400.000	8.547	64.373	55.826
420.000	8.184	64.111	55.927
440.000	7.853	63.420	55.567
460.000	6.764	62.430	55.666
480.000	5.737	61.430	55.693
500.000	4.811	60.430	55.619
520.000	3.802	59.430	55.628
540.000	2.907	58.430	55.523
560.000	1.946	57.430	55.484
580.000	0.996	56.441	55.445
600.000	0.213	55.734	55.520
620.000	0.166	55.426	55.260
640.000	-0.048	55.394	55.443
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LONGITUDINAL SECTION MC51

SCALE 1:1000H
1:100V

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PRELIMINARY ISSUE

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CLIENT SELWYN DISTRICT COUNCIL
PROJECT
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DESIGNED | DESIGN REVIEW | DATE | DATE

TITLE
ROLLESTON FLYOVER
OPTION 5 LONG SECTION

SCALE 1:1000 (A1) | DRAWING No SKT-019 | REV P1

A1

KIDMAN STREET

NORMAN KIRK DRIVE

ROLLESTON DRIVE

DRYDEN AVENUE

250

300

350

400

450

456.283

ENTRY FROM KIDMAN / ROLLESTON INTERSECTION

PROPOSED ONE-WAY SERVICE ROAD TO ACCESS PROPERTIES

JOIN LINE

JOIN INTO NEW SIGNALISED INTERSECTION

EXIT OUT VIA DRYDEN AVENUE / NEW INTERSECTION

JOIN LINE

SCALE 1:500 (A1)

0 10 20 30 40 50m

108 6 4 2

PRELIMINARY ISSUE

REV	DATE	DRAWN	REV'D	APP'D	REVISION	DRAWING NUMBER	REFERENCE DRAWING TITLE

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CLIENT: SELWYN DISTRICT COUNCIL

PROJECT:

DRAWN	DRAWING CHECK	REVIEWED	APPROVED
DESIGNED	DESIGN REVIEW	DATE	DATE

TITLE: ROLLESTON OVERPASS LAYOUT
SHEET 4

SCALE: 1:500 (A1)

DRAWING No: SKT-0100

REV: P1

A1

PRELIMINARY ISSUE

REV	DATE	DRAWN	REV'D	APP'D	REVISION	DRAWING NUMBER	REFERENCE DRAWING TITLE

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CLIENT: SELWYN DISTRICT COUNCIL

PROJECT:

DRAWN	DRAWING CHECK	REVIEWED	APPROVED
DESIGNED	DESIGN REVIEW	DATE	DATE

TITLE: ROLLESTON OVERPASS LAYOUT SHEET 4

SCALE	DRAWING No	REV
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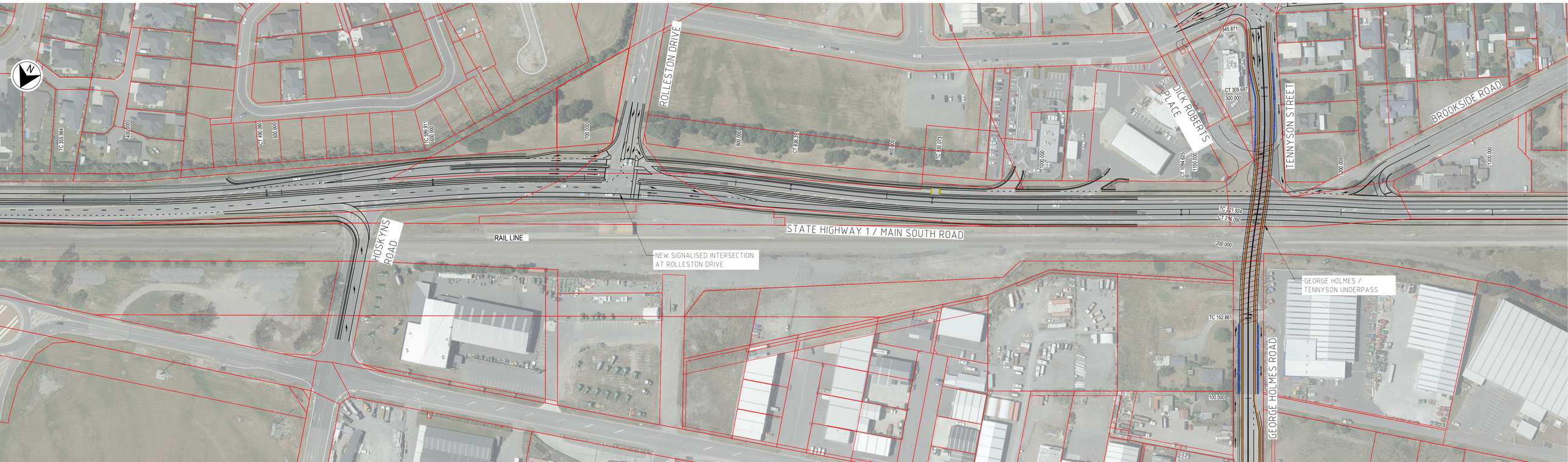

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INFORMATION ISSUE

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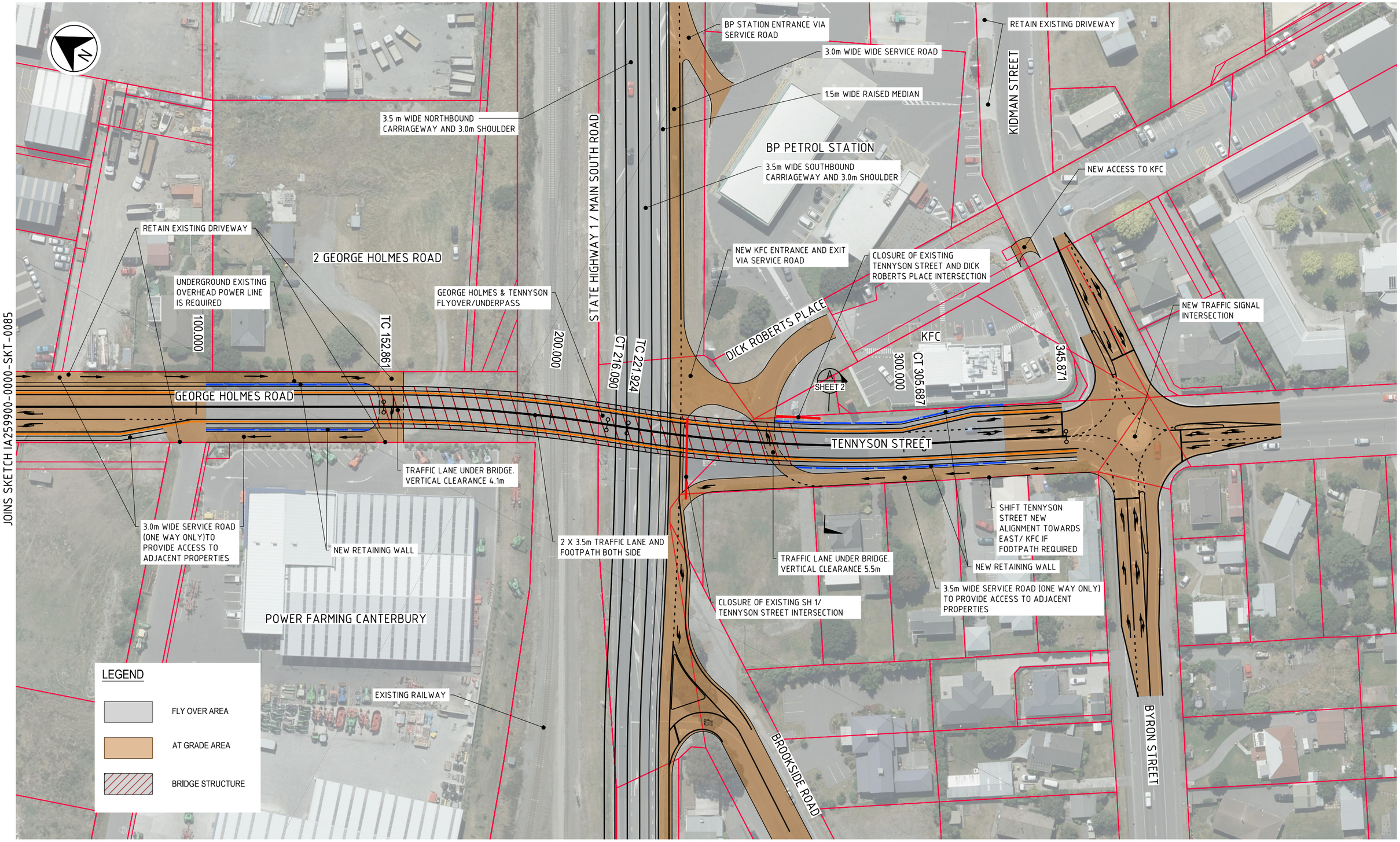

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A	30/11/21	ML			ISSUE FOR INFORMATION		

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Fax: +64 3 940 4901
Web: www.jacobs.com

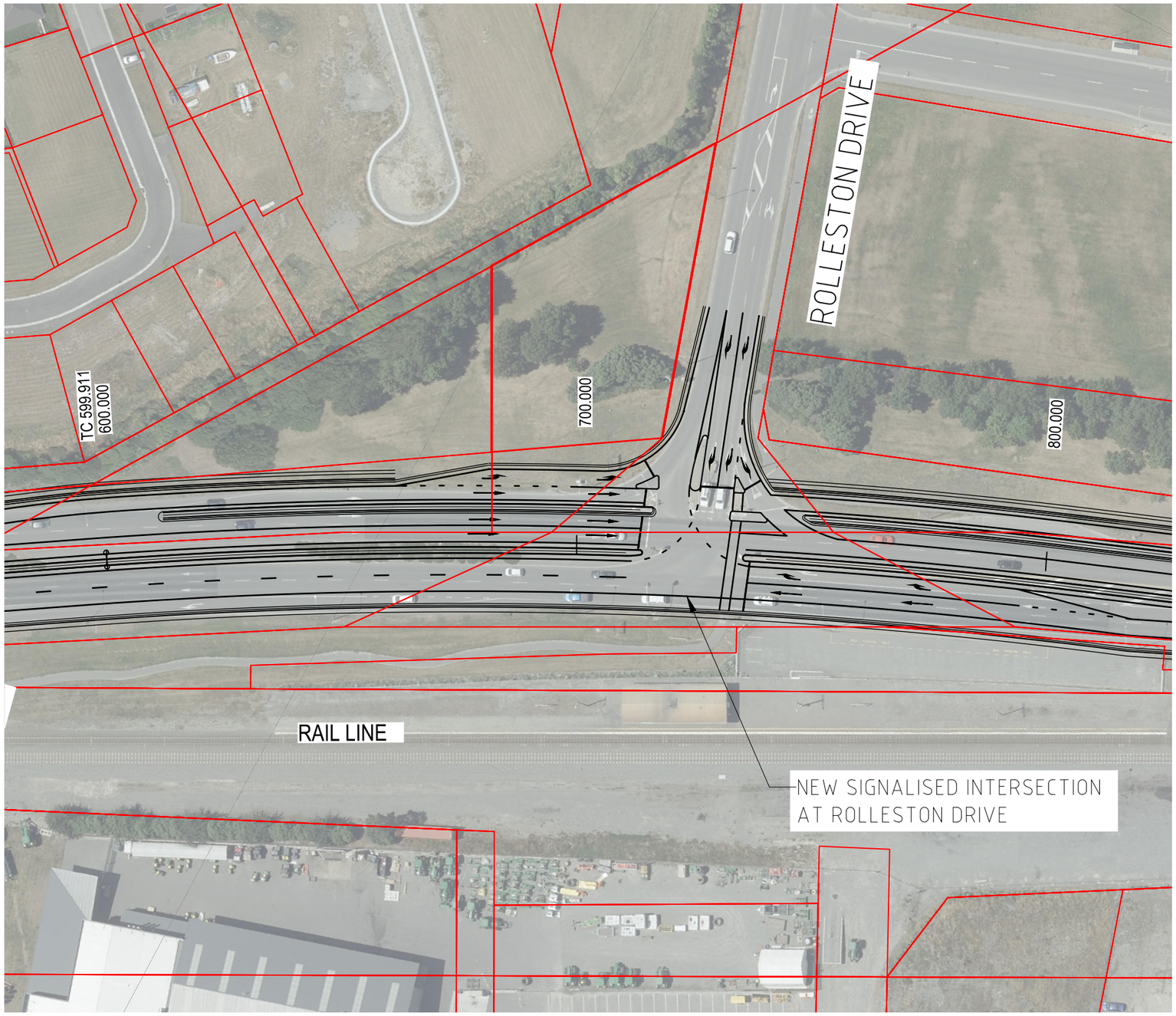
CLIENT: WAKA KOTAHI NZ TRANSPORT AGENCY
PROJECT: ROLLESTON ACCESS IMPROVEMENTS DETAILED BUSINESS CASE

DRAWN	DRAWING CHECK	REVIEWED	APPROVED
M. Lai			
DESIGNED	DESIGN REVIEW	DATE	DATE
M. Lai			

TITLE: GEORGE HOLMES ROAD AND TENNYSON STREET

SCALE: 1:500(A1)
DRAWING No: IA259900-0000-CR-SKT-0083
REV: A

A1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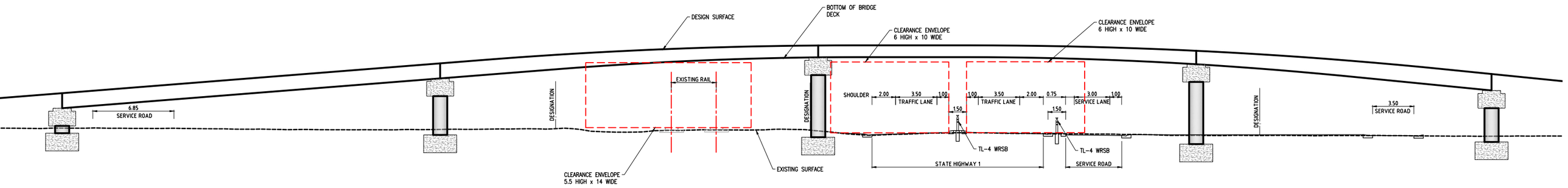
600.000
700.000
800.000
RAIL LINE
NEW SIGNALISED INTERSECTION
AT ROLLESTON DRIVE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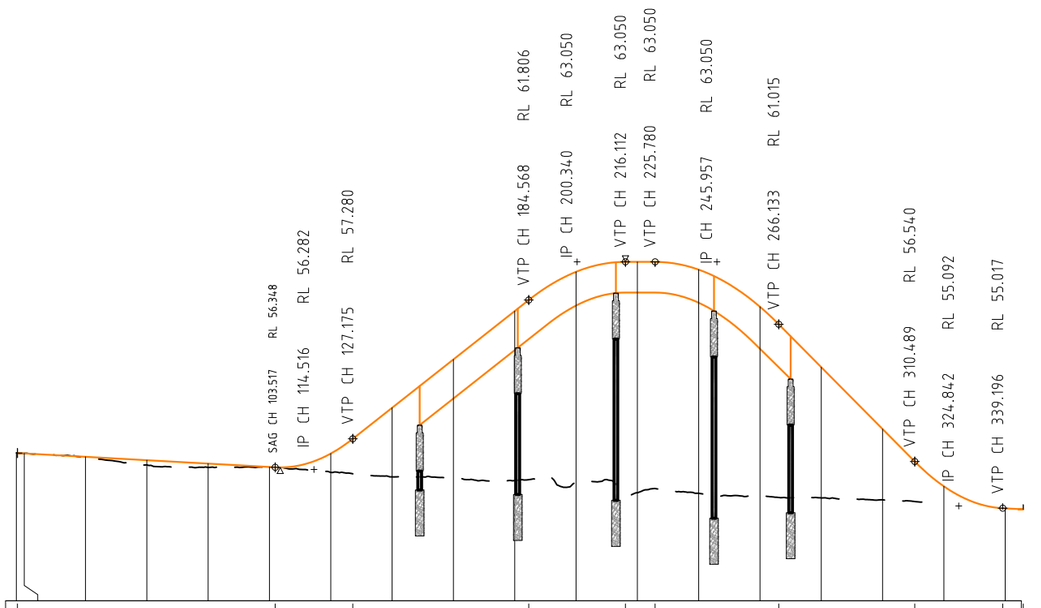
BOTTOM OF BRIDGE DECK
CLEARANCE ENVELOPE 6 HIGH x 10 WIDE
CLEARANCE ENVELOPE 6 HIGH x 10 WIDE
6.85
SERVICE ROAD
DESIGNATION
EXISTING RAIL
DESIGNATION
SHOULDER
2.00
3.50
TRAFFIC LANE
1.00
1.50
1.00
3.50
TRAFFIC LANE
2.00
0.75
1.50
3.00
SERVICE LANE
1.00
TL-4 WRSB
TL-4 WRSB
STATE HIGHWAY 1
SERVICE ROAD
DESIGNATION
3.50
SERVICE ROAD
CLEARANCE ENVELOPE 5.5 HIGH x 14 WIDE
EXISTING SURFACE



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EARTHWORKS CUT																			
EARTHWORKS FILL																			
CUT - FILL +	-0.002	0.017	0.155	0.126	0.021	0.614	2.251	3.860	5.528	6.870	7.526	7.292	6.164	4.262	2.307				
DESIGN SURFACE LEVEL	56.805	56.695	56.584	56.473	56.362	56.800	58.292	59.869	61.446	62.726	63.050	62.797	61.586	59.616	57.598	55.731	55.013		
EXISTING SURFACE LEVEL	56.824	56.807	56.678	56.429	56.347	56.341	56.187	56.041	56.009	55.918	55.856	55.524	55.505	55.422	55.354	55.291			
CHAINAGE	17.419	20.000	40.000	60.000	80.000	100.000	120.000	140.000	160.000	180.000	200.000	220.000	240.000	260.000	280.000	300.000	320.000	340.000	
HORIZONTAL DATA									R400m			R-400m							
SUPERELEVATION																			

LONGITUDINAL SECTION MC02

SCALE 1:1000H
1:100V

SCALE 1:1000 (A1) 0 20 40 60 80 100m
20 10

INFORMATION ISSUE

REV	DATE	DRAWN	REVD	APP'D	REVISION	DRAWING NUMBER	REFERENCE DRAWING TITLE
A		BR			ISSUE FOR INFORMATION		

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CLIENT: WAKA KOTAHI NZ TRANSPORT AGENCY
PROJECT: ROLLESTON ACCESS IMPROVEMENTS DETAILED BUSINESS CASE

DRAWN	DRAWING CHECK	REVIEWED	APPROVED
B. Rake			
DESIGNED	DESIGN REVIEW	DATE	DATE
B. Rake			

TITLE: GEORGE HOLMES ROAD AND TENNYSON FLYOVER
LONG SECTION - OVERPASS

SCALE	DRAWING No	REV
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A1

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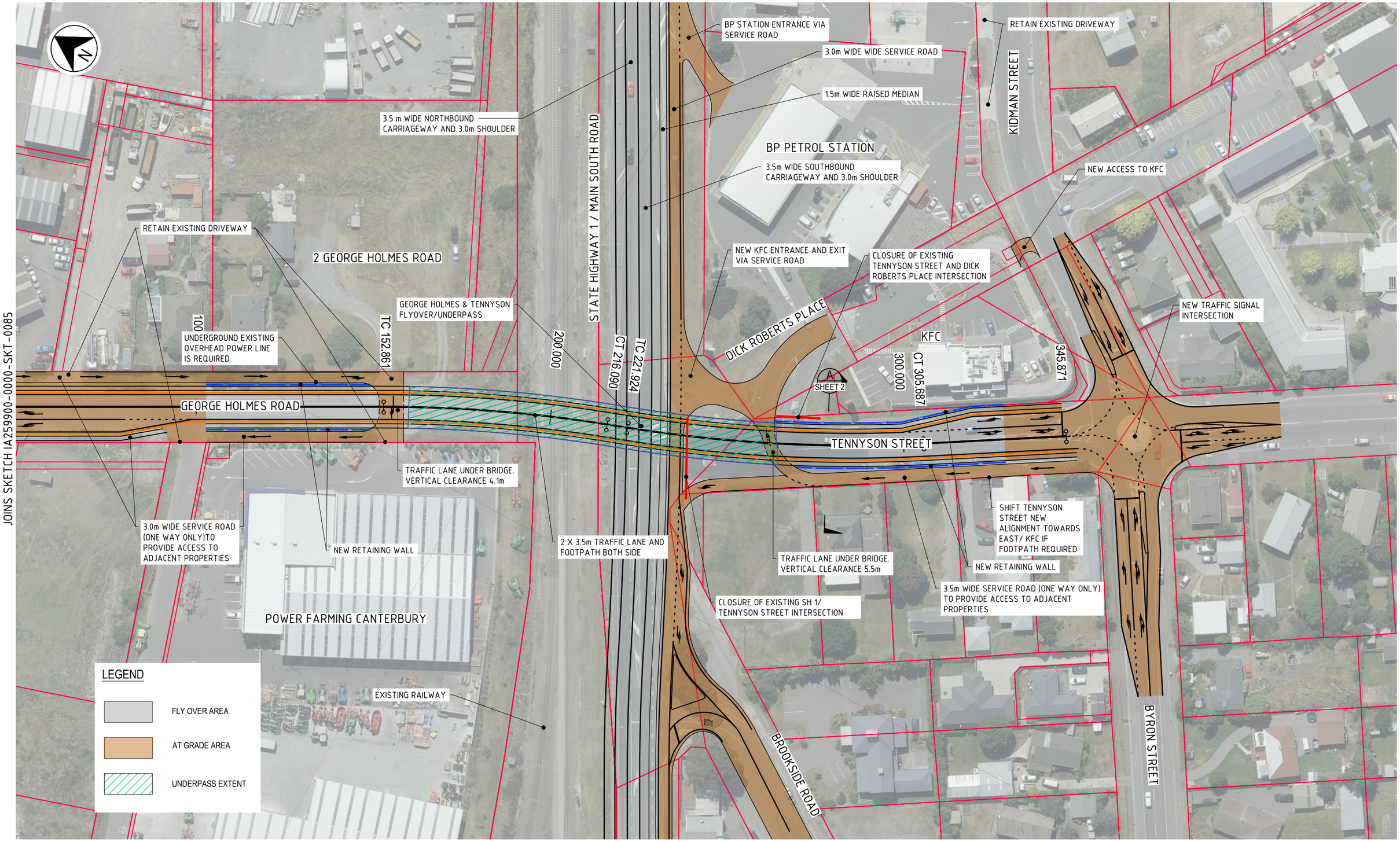
JOINS SKETCH IA259900-0000-SKT-0085



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A	30/11/21	ML			ISSUE FOR INFORMATION		

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DRAWN	DRAWING CHECK	REVIEWED	APPROVED
M. Lai			
DESIGNED	DESIGN REVIEW	DATE	DATE
M. Lai			

TITLE: GEORGE HOLMES ROAD AND TENNYSON STREET UNDERPASS

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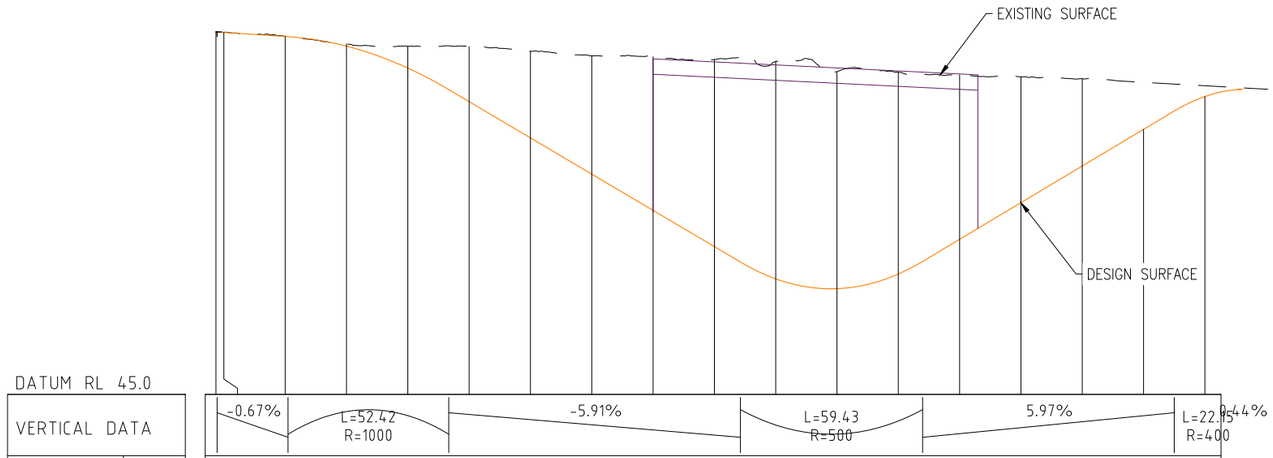

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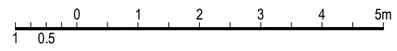
EARTHWORKS	CUT																			
	FILL																			
CUT - FILL +		-0.004	-0.008	-0.075	-0.708	-1.796	-2.823	-3.860	-5.009	-6.101	-7.088	-7.079	-6.581	-5.367	-4.103	-2.845				
DESIGN SURFACE LEVEL		56.803	56.669	56.354	55.639	54.546	53.363	52.181	50.999	49.817	48.767	48.445	48.923	50.056	51.251	52.446	53.641	54.711		
EXISTING SURFACE LEVEL		56.824	56.807	56.678	56.429	56.347	56.341	56.187	56.041	56.009	55.918	55.856	55.524	55.505	55.422	55.354	55.291			
CHAINAGE		17.419	20.000	40.000	60.000	80.000	100.000	120.000	140.000	160.000	180.000	200.000	220.000	240.000	260.000	280.000	300.000	320.000	340.000	
HORIZONTAL DATA										R400m				R-400m						
SUPERELEVATION																				

LONGITUDINAL SECTION MC02
SCALE 1:1000H
1:100V

SCALE 1:50 (A1)



PRELIMINARY ISSUE

REV	DATE	DRAWN	REV'D	APP'D	REVISION	DRAWING NUMBER	REFERENCE DRAWING TITLE
A	30/11/21	ML			ISSUE FOR INFORMATION		

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PROJECT	ROLLESTON ACCESS IMPROVEMENTS DETAILED BUSINESS CASE		
DRAWN M. Lai	DRAWING CHECK	REVIEWED DATE	APPROVED DATE
DESIGNED M. Lai	DESIGN REVIEW		

TITLE: GEORGE HOLMES ROAD AND TENNYSON STREET

SCALE	DRAWING No	REV
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A1

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180.000

200.000

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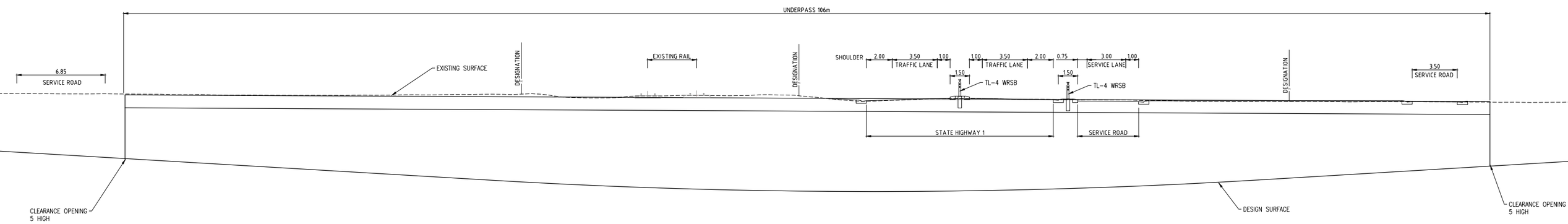


APPENDIX C SME REPORTS

Flyover Alternatives – SME Report

Connectivity

1 Connectedness

		Ped travel times	Social connectedness	Traffic travel times	Freight productivity
4	Rolleston Drive North to Jones Road - Skewed Flyover, Hoskyns LO (Refined Consulted)	1 Reduces travel time between the Bulk Retail area and town centre but could be argued that this does not meet the desire line - as taking people in the opposite direction to the Jones Road businesses. Straight across is a shorter journey.	3 Most directly connects the two retail areas - town centre and the Bulk Retail Area	1 Provides good benefits for SH1 southbound. For SH1 northbound the modelling shows that puts pressure on Weedons Interchange more than the alternatives. And requires longer route to get onto SH1 through Bulk Retail area and then through Hoskyns signals and left out.	1 SH1 (through traffic) freight benefits as removing two signals. Not that great for freight using Jones Road, as that direct connection is removed.
7	Rolleston Drive North to Jones Road – Straight Flyover, Hoskyns LO	2 Provides a relatively central connection on Jones Road that makes existing businesses and the Bulk Retail Centre relatively accessible.	2 Good benefits, but doesn't directly link to key employment catchments - still need to travel along Jones Road or Kidman to get to the Town Centre / Bulk Retail	2 Modelling shows some good benefits of this option	3 Pretty good for freight, both on SH1 and Jones Road. Also provides between "across SH1" connection, for smaller service vehicles/trucks
13	Tennyson Underpass + Rolleston Drive North signals, Hoskyns LO	2 Provides the most direct connection from the Town Centre to the Industrial Area. Potentially a more significant desire line to Rolleston Drive North	2 Links the Town Centre to key employment zones	2 Modelling shows roughly equiviant benefits with Option 7 and Option 13. Benefit in separating north south local movement from highway access	0 As above, again pretty good for freight using SH1, however signals at Rolleston Drive north are retained (i.e. some delay for through movements). Rolleston Drive North is more of a freight route than Tennyson however.

Reference: 310205403

2 Resilience / Sustainability

		Travel choice and liveable community	Resilience (reliability)	CO2 emissions	Flexibility
4	Rolleston Drive North to Jones Road - Skewed Flyover, Hoskyns LO (Refined Consulted)	1	1	-2	2
		Will support a better walking/cycling network with shared path on the bridge, and avoiding having to use traffic signals	Provides good travel time reliability, unless trying to get on the Weedons Interchange. Slightly convoluted route to access the state highway NB	Flyover options add right turn bans and would add extra travel distance via Levi Road. The structure itself is longer, so more embedded carbon.	Option makes available land (off Kidman Street) that has been historically earmarked for the flyover landing.
7	Rolleston Drive North to Jones Road – Straight Flyover, Hoskyns LO	2	2	-1	2
		Similar benefits to Option 7. Both link to cycle network on the Industrial side	Generally better than the skewed flyover, as the effects on Weedons are dampened. Would improve resilience for emergency vehicles getting across SH1.	Slightly better in terms of network effects (VKT/VHT), and structure is as short as it can be.	Option makes available land (off Kidman Street) that has been historically earmarked for the flyover landing. RV centre can still function well, so property impacts are relatively minimal. Straight alignment enables better shaped land parcels to be retained and on sold for other purposes
13	Tennyson Underpass + Rolleston Drive North signals, Hoskyns LO	-2	2	-1	-1
		Encouraging more through traffic into the town centre	As above	Similar to Option 7.	Potentially causes issues to access for existing businesses (off George Holmes, KFC, new petrol station). Little flexibility to change land use types or accesses once the under/overpass goes in

Stantec

Memo

Flyover Alternatives – SME Report

Consentability and Property

1 Introduction

An MCA process was undertaken in February 2022 to assess three additional flyover options for the Rolleston Access Improvements Detailed Business Case, further to the options that were considered back in August 2021.

This memorandum provides an explanation of the scoring made for the consentability and property KPIs for the February 2022 MCA. It sets out the methodology for scoring, the assumptions made, the evidence used to support the scoring, and the gaps in the evidence base. The scores and rationale are then repeated.

2 Methodology and Assumptions

From the outset, it is important to note that the MCA scoring process for the consentability and property KPIs was a brief and high-level exercise only. Furthermore, consentability and property matters have many considerations/implications that are interrelated. However, for the purpose of this exercise, an attempt was made to separate the two. The methodology was based off that undertaken for the MCA process in August 2021, which is explained as follows.

2.1 Consentability

To assess 'consentability', a judgement was made based on the following measures:

- Scale of road noise effects - in particular, the potential increase in noise received by nearby persons, as a result of changed carriageway alignments and/or change in vehicle speeds. This did not include an assessment of noise generated in the construction stage.

  In the absence of noise modelling at this stage in the process, the scale of potential noise effects was scored based on proximity of realigned carriageways to receivers and spatial extent of works.

  Scoring was then based on the anticipated duration of the noise effects (short, medium or long term) and the extent to which mitigation including existing noise bunds or fences (or the ability to replicate that mitigation) would be effective.

- Scale of visual effects on nearby persons and the wider public. For the purpose of this exercise, this encompassed:

- Likely appearance of works and integration with the area, as viewed from nearby persons as well as the general public
- Potential for shadowing on nearby persons from structures
- Potential for visual dominance on property occupiers from height, bulk and proximity of structures
- Potential for glare or light spill on property occupiers

Professional judgement was used when considering the likely visual appearance and the change to the existing environment, including the spatial extent of work, where scoring the nature and scale of visual effect.

- Complexity of the consent/approval process including whether there is the potential for notification.

  Professional judgement was used when considering the complexity of the RMA approval process. Where works are located within the designation and are very minor, an Outline Plan Waiver is likely all that is required and this is given a score of 0. Other types of approvals for more substantial works within the designation (Outline Plan of Works) or outside the designation (requiring alterations to designation boundaries, or notice of requirements for altered or new designations and/or resource consents) are given progressively negative scores.

An overall score was then given to each option based on a judgement of 'consentability'.

2.2 Property

The following were measured to assess the impact on properties:

- The number of properties that would require acquisition
- The number of properties where mitigation against negative effects (such as noise) would be required
- The type of properties that are impacted.

Where no properties are affected, this would be given a 0 (neutral) score.

Where 1-3 properties are affected, this would be given a -1 score as this impact is confined to a small area/a small number of property owners.

Where 4-9 properties are affected, this would be given a -2 score as this is moderate but could be managed.

Where 10 or more properties are affected, this would be given a -3 score as this would require dealing with a large number of property owners where there is a higher risk of unwillingness.

There was then some flexibility with the above scores depending on the type of land use. The area of land that would require acquisition is difficult to calculate at this stage of conceptual designs, so was not measured.

3 Evidence Used and Gaps

3.1 Consentability

Environmental and Social Responsibility (ESR) screens are an exercise to identify potential planning and environmental constraints and opportunities for a defined area. For assessing consentability, the information identified through the ESR screens in August 2021 for various flyover options and other proposed interventions in Rolleston, such as the service lane and railway improvements, provided a baseline understanding of the sensitivity of the receiving environment to noise and the susceptibility to visual change (e.g. a resident of a nearby property or an industrial activity).

An ESR screen for Option 13 (flyover from Tennyson to George Holmes) has not been undertaken. Furthermore, acoustic and visual assessments by suitably qualified professionals in those matters would provide more assurance of the scale of potential noise and visual effects.

3.2 Property

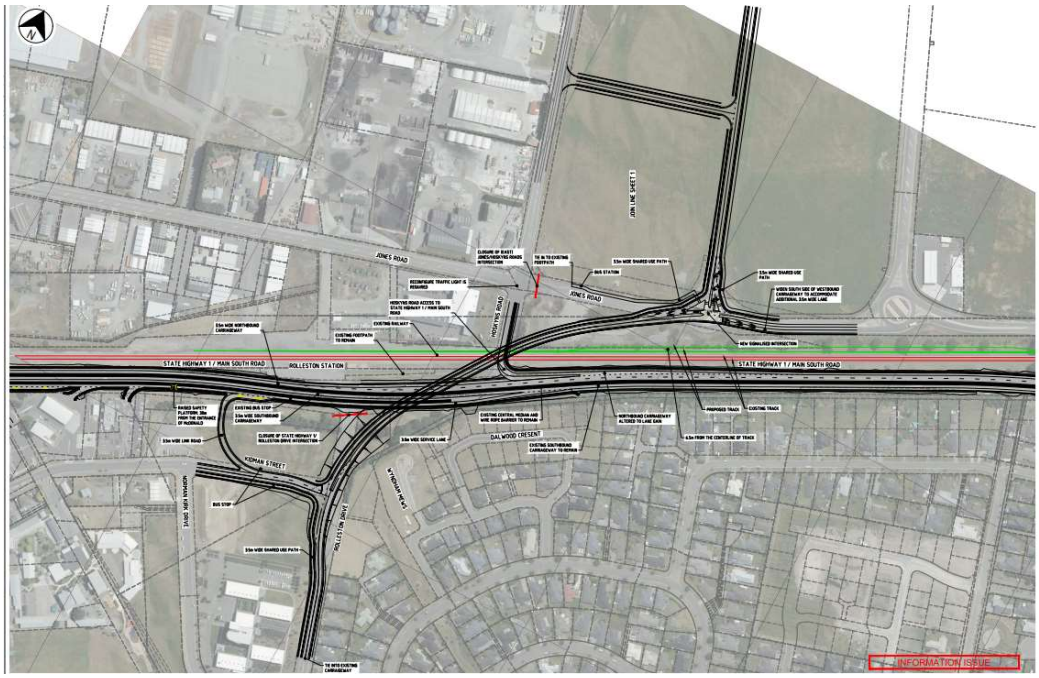
A judgement of property impacts was made based on the physical extent of works shown on the plans. This did not take into account land outside these extents that may be required in the construction period e.g. test pits, stockpiling materials, traffic management. It also did not take into account how individual property accesses could be affected, nor any implications for resource consents held by landowners to undertake activities on their properties.

4 Scores and Rationale for the Additional Options

The three options that were assessed in the February 2022 MCA, and the scores and rationale given are as follows:

Option 4: Skewed Alignment

Reference: 310204503

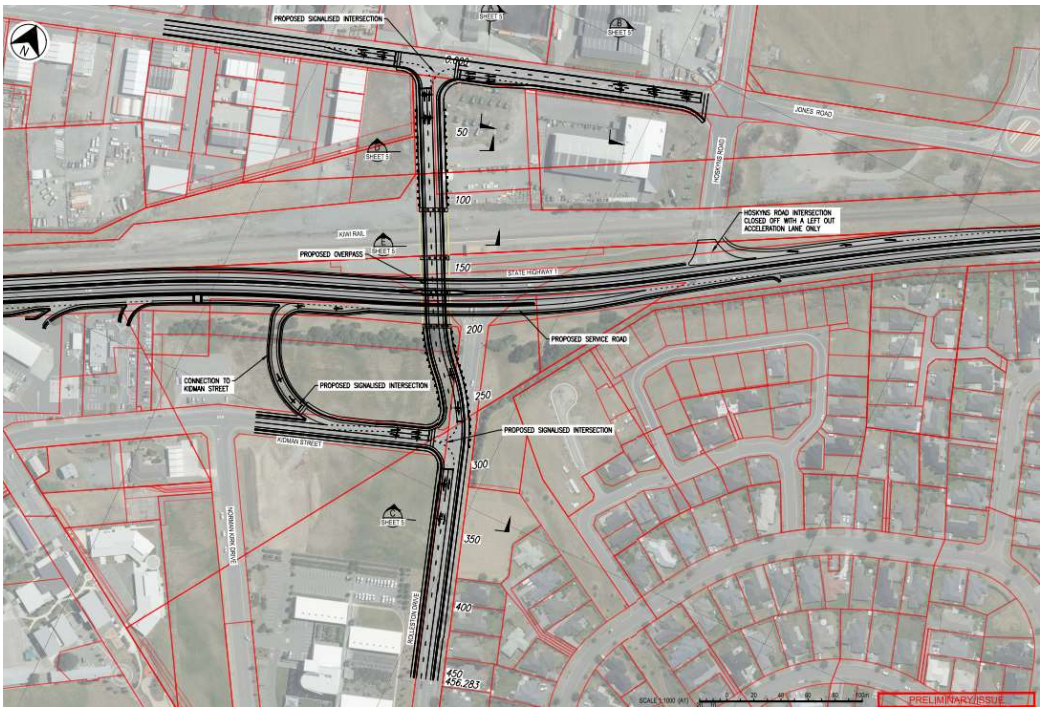


Consenting: -2. Fairly complex/comprehensive consenting process (NoR for new designation or 'full' alteration). Noise and visual effects for residential properties but not as significant as alignments that were closer to residential boundaries.

Property: -2. Does not involve acquisition of any residential properties, but still requires link roads through Carter property (where a fair amount of land would be required) and Council-owned property.

Option 7: Straight across flyover from RDN to Jones Rd:

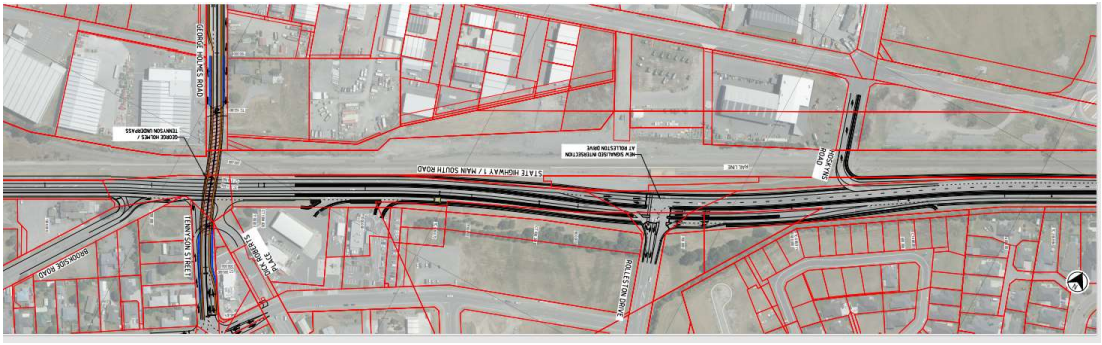
Reference: 310204503



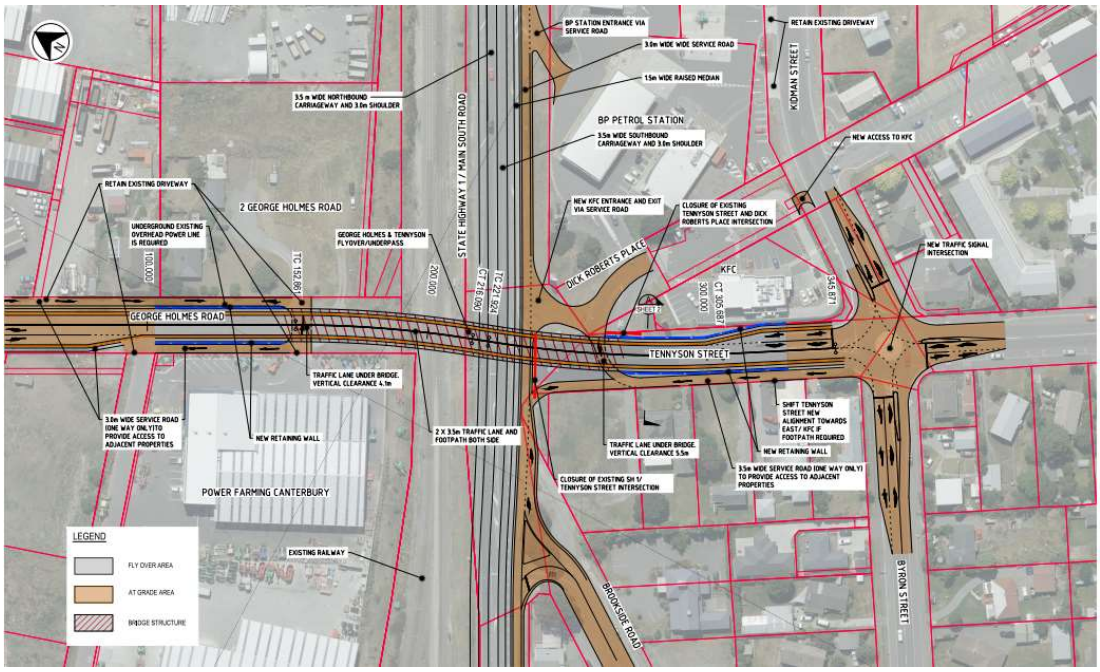
Consenting: -1. Fairly complex/comprehensive consenting process (NoR for new designation or 'full' alteration). Limited amenity effects due to distance from sensitive receivers (e.g. residential properties)

Property: -1. Mostly within road reserve, and Council-owned land earmarked for this purpose. Some acquisition of commercial property required (although no major buildings) and unclear property status of 'Crown'-owned land.

Option 13: Straight across flyover from Tennyson to George Holmes plus signals at RDN:



Reference: 310204503



Consenting: -2. Less complicated consenting process (maybe ‘minor’ alteration as is all within legal road, SH1 and railway land). Limited amenity effects due to distance from sensitive receivers (e.g. residential properties). However, note that properties on western side of Tennyson St, which will be adjacent to the beginning of the over/underpass are zoned residential, just not used for residential purposes right now.

Property: -1. All within local road reserve, SH1 and Kiwirail with the authorities responsible for that land being partners in the project. At the workshop, this was suggested to be a -1 score due to potential access implications, which had not been previously considered.

Flyover Alternatives – SME Report

Constructability

1. Approach to assessment

The evaluation tables for each intervention have only been assessed against the do nothing.

Baseline Performance has not been considered given the temporary nature of the issued assessed.

Do Nothing relates to how this location/situation would perform against the existing situation. i.e. what is the extent of traffic disruption for different options compared to the do nothing (existing situation).

The Sub-Category Assessments are based on the following criteria:

Specialist Construction Techniques		Criteria Considered
0	Neutral	
-1	Slight Negative	Could be undertaken by small to medium Contractors with everyday plant and equipment. Low risk work.
-2	Moderate Negative	Restricted to competent and experienced contractors (Tier 1). Involves detailed programming and planning. Generally medium risk work that may include some high-risk components.
-3	Large Negative	Specialist contractors required – Complex planning required, unique or innovative construction methods required not frequently carried out in the country. Limited skills available or one-off plant and equipment required Very high risk.

Temporary Works Complexity		Criteria Considered
0	Neutral	
-1	Slight Negative	Category 0 works – standard solutions to ensure the site conditions do not conflict with the scope or limitations of the chosen solution
-2	Moderate Negative	Categories 1 and 2 work – Required simple or complex designs for propping, excavations, foundations, structural steelwork, or reinforced concrete.
-3	Large Negative	Category 3 work – Complex or innovative designs required. Complex work sequences involving construction of temporary/permanent works interfaces.

Disruption to State Highway Traffic		Criteria Considered
0	Neutral	
-1	Slight Negative	Minor short term. little inconvenience to travel, may include speed restrictions.
-2	Moderate Negative	Regular changes to traffic layouts, temporary diversion, speed reductions, some very short, planned road closures may be required.
-3	Large Negative	Long duration road closures resulting in long diversion routes impacting significantly on journey time

Reference: 310204503

Disruption to Local Traffic		Criteria Considered
0	Neutral	
-1	Slight Negative	Minor short term. little inconvenience to travel, may include speed restrictions.
-2	Moderate Negative	Regular changes to traffic layouts, temporary diversion, speed reductions, some very short, planned road closures may be required.
-3	Large Negative	Long duration road closures resulting in long diversion routes impacting significantly on journey time

Disruption to Rail		Criteria Considered
0	Neutral	
-1	Slight Negative	Minor short term. Little inconvenience to travel, may include speed restrictions.
-2	Moderate Negative	Local speed reductions, some very short, planned rail closures may be required.
-3	Large Negative	Long duration rail closures

2. Scoring

Option								Commentary
		TOTAL	Construction Techniques	Temporary Works Complexity	Disruption to SH Traffic	Disruption to Local Traffic	Disruption to Rail	
0	Do nothing	0	0	0	0	0	0	Neutral score as no change
4	Rolleston Drive North to Jones Road – Skewed Flyover	-12 (-3)	-3	-3	-2	-2	-2	Large span and skew of bridge will involve complex construction and temporary works Disruption to local traffic considered greater than Options 7 and 13 due to need for modifications at tie-in points Girder depth when placed on transport unlikely to trigger overheight dimensional constraints – but may necessitate planning of transport route. Assuming girders are fabricated in North Island or overseas and delivered to Lyttelton Port, transport route along SH74, 76 and 1 likely to be clear of any significant overhead obstacles (other than traffic lights). Girders may be segmented into 5 segments of length ~30-40m lengths to facilitate design approach, fabrication, transport, and erection. Erection of segments will necessitate a dual mobile crane lift. Approach also necessitates the use of at least 1 temporary tower (placed 10-15m south of the pier between SH1 & the rail

Reference: 310204503

Option								Commentary
								corridor. Temporary restraints would be needed on the pot bearings to prevent girder movement during the erection process. Lifting in could be completed with mobile cranes available in the region (note that all spans are long enough to justify a dual lift). Spans over SH1 will require lane closures at night. Span over rail will require Kiwirail supervision and a Block of Line (BoL). Precast deck segments would need to be lifted into place under lane closure/BoL, and remaining insitu deck & barrier construction would be as per typical approach for industry
7	Rolleston Drive North to Jones Road – Straight Flyover	-9 (-2)	-2	-2	-2	-1	-2	Typical construction process expected for a structure of this form – common within NZ industry. Piles, columns, and crossheads constructed using typical bored pile techniques and methods for forming up circular columns and rectangular crossheads. Girders are a typical size for casting beds in South Island and can be transported using standard methods. Lifting in could be completed with mobile cranes available in the region (note the span over rail is long enough to justify a dual lift). Spans over SH1 will require lane closures at night. Span over rail will require Kiwirail supervision and a Block of Line (BoL). Deck & barrier construction would be as per typical approach for industry. Duration of disruption to State Highway Traffic likely to be shorter than Option 4 but still considered moderate Disruption to local traffic scored lower than Option 4 as RDN Steet closed to traffic during construction and alternatives routes available.
13	Tennyson Underpass – Rolleston Drive North Signals	-9 (-2)	-2	-2	-2	-1	-2	Typical construction process expected for a structure of this form – common within NZ industry. Piles, columns, and crossheads constructed using typical bored pile techniques and methods for forming up circular columns and rectangular crossheads. Girders are a typical size for casting beds in South Island and can be transported using standard methods. Lifting in could be completed with mobile cranes available in the region (note the span over rail is long enough to justify a dual lift). Spans over SH1 will require lane closures at night. Span over rail will require Kiwirail supervision and a Block of Line (BoL). Deck & barrier construction would be as per typical approach for industry. Duration of disruption likely to be less than Option 4 but still considered moderate Disruption to local traffic scored lower than Option 1 as Tennyson Steet closed to traffic during construction and alternatives routes available.

3. Additional Comments

Construction Techniques – All options will require detailed programming and phasing of work, but Option 4 is more complex due to span and skew of the bridge*Temporary Works Complexity – Standard solutions i.e., trench excavations, can be adopted for all options but Option 4 is more complex due to

span and skew of bridge Disruption to State Highway Traffic – All options will result in speed restriction and traffic management controls during construction. Duration of disruption to State Highway Traffic likely to be shorter for Options 7 and 13 but still considered moderate disruption to Local Traffic – Option 4 has greater impacts at tie-in points with local roads. Option 4 will impact significantly on traffic in Carter's development. Option 7 and 13 will impact business on Jones Rd significantly. Disruption to Rail – All option equally scored as speed restrictions and closures required to install bridge beams

Sub Attribute Weightings

All sub-attributes have been equally weighted. Disruption to State Highway Traffic could be given a slightly higher weighting over disruption to local traffic due to the traffic volumes impacted. If underpass options are adopted for Options 7 and 13, the Construction Techniques would increase to 3, the Temporary Works Complexity would increase to 3, the State Highway Disruption would increase 3. Local Road Option would remain at -1.

Flyover Alternatives – SME Report

Engineering Difficulty

1 Introduction

Engineering Difficulty considers difficulty and design challenges of 'high ticket' items such as structures and potential stormwater treatments. This is not directly related to cost, as some options that are simple design tasks may be costly to construct. Although constructability is not considered directly, engineering difficulty is considered in deciding how to resolve any potential constructability issues and/or impact on/integration with other infrastructure.

The purpose of this KPI is to develop differentiation between options based on delivery to known and understood standards, complexity in design and the technical performance. The assessment is a qualitative assessment based on engineering judgement as to the design complexity of each option. The purpose of this KPI is to develop differentiation between options based on delivery to known and understood standards, complexity in design and the technical performance. The assessment is a qualitative assessment based on engineering judgement as to the design complexity of each option.

2 Approach to scoring

Scoring against this KPI assumes that the "Baseline" option will be Neutral and score 0. As all other options will involve some form of engineering complexity, they will all score a negative. In most cases the "Do minimum" will also score 0 except in cases where this may lead to engineering difficulty in requirement for more maintenance or repairs to aging and/or inadequate infrastructure.

Any option that is considered standard "design by the book" complexity is scored -1. Any option that may require a number of iterations or reviews to resolve issues with integration, constructability score -2. It is not expected any option will score -3 as no "long-term" or "irreversible" engineering complexity issues are expected.

Reference: 310204503

Flyover				
Option		Assessment	Score	Commentary
4	Rolleston Drive North to Jones Road - Skewed Flyover, Hoskyns LO (Refined Consulted)	Very long span and high skew result in design complexity for both sub and super structure. Th length of the span is at the high end of design standards. Designing piers to minimise impact son road and rail corridors will provide some challenge.	-3	Getting skews to work and longitudinal stresses, steel might get crowded. Treatment of ground conditions and stormwater runoff expected to be standard practice.
7	Rolleston Drive North to Jones Road – Straight Flyover, Hoskyns LO	Simple technology, short span and perpendicular angle result in simple engineering and design processes. The short length of the flyover and clearance height required over SH1 means design grades and site distance achieved are at design limitations. This leaves little room for innovation. Minimising impacts on businesses will be the main driver for design challenges.	-1	Treatment of ground conditions expected to be standard practice. Treatment of stormwater at Jones Rd end may be challenging due to existing flat grades and requirement to capture the runoff from the flyover.
13	Tennyson Underpass + Rolleston Drive North signals, Hoskyns LO	Simple technology, short span and perpendicular angle result in simple engineering and design processes. The short length of the flyover and clearance height required over SH1 means design grades and site distance achieved are at design limitations. This leaves little room for innovation. Minimising impacts on businesses will be the main driver for design challenges. This especially the case on the Tennyson Street end with access issues for businesses like KFC. Existing stormwater pump station on George Holmes Road will add some design complexity to relocate.	-2	Treatment of ground conditions expected to be standard practice. Treatment of stormwater at Jones Rd end may be challenging due to existing flat grades and requirement to capture the runoff from the flyover.

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Flyover Alternatives – SME Report

Safety

1 Introduction

An MCA process was undertaken in February 2022 to assess three additional flyover options for the Rolleston Access Improvements Detailed Business Case, further to the options that were considered back in August 2021.

This memorandum provides an explanation of the scoring made for the Safety KPIs for the February 2022 MCA. It sets out the methodology for scoring, the assumptions made, the evidence used to support the scoring, and the gaps in the evidence base. The scores and rationale are then repeated.

2 Methodology and Assumptions

The MCA scoring process for both the DSI and the Reduced road/rail incidents KPIs was a brief and high-level exercise only. The scoring used the same methodology used in the earlier MCA to provide consistency between the alternative options

As a summary, the two Safety KPIs are as follows:

- **KPI 1.1: DSIs – Existing DSIs** within the study area will be documented and analysis will be undertaken to determine the extent to which proposed interventions contribute towards improved safety outcomes and addressing predicted crash risks.
- **KPI 1.2: Reduced road/rail incidents** – The number of incidents or near misses at the existing level crossings will be documented and analysis will be undertaken to determine the extent to which proposed interventions contribute towards safety outcomes. The measure to be used in this assessment will be DSIs for both the existing and predicted future years. DSIs will be determined for each of the options including the Do Nothing and the various options being considered.

The Safety Assessment considers the following sub-criteria:

- General safety performance
- Impact for cyclists, pedestrians and other vulnerable road users
- Impact of Heavy Commercial Vehicles

The Do Nothing and each of the options were considered with reference to the existing crash data, the predicted future crash risk and the configuration of the individual intersection layouts and proposed mid-block cross sections within the wider project area. The sub-criteria were taken into account for each of these elements to provide a relative score that is rolled up into one score per element being

3 Scores and Rationale for the Additional Options

The three options that were assessed in the February 2022 MCA, and the scores and rationale given are as follows:

Option 4: Skewed Alignment from Rolleston Drive North to Jones Road

DSIs: 0

- The skewed overbridge alignment allows for more gradual approaches to structure, making it easier for pedestrians and cyclists with a 3.5 metre wide shared path to be provided on the western side of the structure and a standard footpath on the eastern side.
- There is lack of detail of how vulnerable road users will access the shared path and footpath on both sides of the bridge with no connections shown.
- It has been assumed Kidman/Rolleston Drove North intersection is priority controlled, no detail on how pedestrians and cyclists cross at this intersection to use the shared path has been provided.
- Signals are proposed at Jones Road with the existing roundabout being removed – a signalised intersection is not a safe system solution.
- There is a higher exposure to crashes with alignment connecting to the Carters Development and closure of Jones Road at Hskyns Road. This results in motorists having to navigate more intersections to access iZone from the town centre.
- There is potential for vehicles to back up onto SH1 from the loop road.

Reduced road/rail incidents: -1

- Level crossing at Hoskyns Road remains open for left out northbound movements only.
- Left out will have their own slip lane onto SH1 so vehicles will not have to queue across the tracks.
- Despite being an improved configuration when compared to the current layout, there is still a risk of vehicles queueing across tracks should there be a crash in the merge lane or another incident that prevents free flow movements.

Option 7: Straight across flyover from Rolleston Drive North to Jones Road:

DSIs: 1

- This option provides a more direct alignment over SH1 linking Rolleston Drive North directly to Jones Road with signals at both intersections.
- The overbridge has steeper grades (8.5% on the Jones Road side and 6% on the Rolleston Drive North side), with a 2 metre wide footpath on western side and a 3 metre wide shared path on eastern side.
- There are two new signalised intersections at either end of the overbridge structure which will not be visible until drivers reach the crest of the vertical alignment. This may increase the potential for rear end crashes to occur with hidden queues due to the vertical geometry.

- There are more access movements close to the structure at the Kidman Street and Jones Road intersections which can create conflicts.
- There is a lack of detail provided to demonstrate how vulnerable road users, including cyclists, get on to shared path on the eastern side at the Kidman Street intersection.
- There is potential for vehicles to back up onto SH1 from the loop road and there are concerns over the property access on Rolleston Drive North at Ch. 350-450 due to potential grade from embankment.

Reduced road/rail incidents: -1

- Level crossing at Hoskyns Road remains open for left out northbound movements only.
- Left out will have their own slip lane onto SH1 so vehicles will not have to queue across the tracks.
- Despite being an improved configuration when compared to the current layout, there is still a risk of vehicles queueing across tracks should there be a crash in the merge lane or another incident that prevents free flow movements.

Option 13: Straight across flyover from Tennyson Street to George Holmes Road plus signals at Rolleston Drive North:

DSIs: -2

- In this option, the signals are to remain at Rolleston Drive North on SH1 which is not a safe system solution that has inherent risks within the high speed environment.
- The flyover is too steep (8% on the Jones Road side and 10% on the Tennyson Street side) for active modes with a signalised intersection at Tennyson Street / Bryon Street that will be obscured by the vertical alignment. This increases the potential for rear end crashes to occur with hidden queues due to the vertical geometry.
- The layouts are confusing on both sides of the structure, with the proposal to retain access to BP, KFC etc plus property accesses off George Holmes Road.
- The height restrictions for the underpasses under the structure to the commercial activities on the eastern side will not be heeded resulting in vehicles colliding with the structure.
- Merging crashes will occur between Tennyson Street and Brookside Road on the service lane with the left out and left in movements in the service lane crossing over.
- There is also potential for vehicles to attempt to access Tennyson Street from the service road, putting them in conflict with other vehicles.
- No indication has been provided as to what intersection controls are proposed at Jones Road / George Holmes Road intersection.
- This option could be either an overbridge or an underpass however given the location and the need to provide access to the adjacent activities and properties creates complex interfaces. An underpass does not deliver a safe environment for vulnerable users when applying CPTED principles.

Reference: 310204503

Reduced road/rail: -1

- Level crossing at Hoskyns Road remains open for left out northbound movements only.
- Left out will have their own slip lane onto SH1 so vehicles will not have to queue across the tracks.
- Despite being an improved configuration when compared to the current layout, there is still a risk of vehicles queueing across tracks should there be a crash in the merge lane or another incident that prevents free flow movements.

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Flyover Alternatives – SME Report

Wider Network Impacts

1 Approach

Study area:	Rolleston: Weedons Ross Road interchange to Dunns Crossing/Walkers Road intersection
KPI definition:	To understand the extent to which the improvements deliver on the aspirational road network hierarchy (traffic on strategic roads) and Network Operating Plan and to assess how this may minimise traffic impacts (potential modal conflicts) on other areas.
Measure:	This KPI is informed by transport modelling and particularly the following outputs; • Network wide distances. Light and Heavy vehicles - AM period, inter-peak period, PM period. • Network wide travel times. Light and Heavy vehicles - AM period, inter-peak period, PM period. • Key route travel times. All vehicles - AM period, inter-peak period, PM period • Traffic volumes on key routes and others. Light and Heavy - AM peak hour, Inter-peak hour, PM peak hour. • Intersection performance within the area of influence of the Rolleston Improvements. Peak hour delay / Level of Service – AM, Inter-peak, PM
Rationale:	The purpose of this KPI is to compare the traffic outcomes in the study area to be consistent with the strategic intent of the network plan. Regarding traffic volumes and the operation of key routes, the following are key aspects; • Encouraging a degree of increased use of Jones Road and Levi Road to access the Weedons Interchange as the northern entrance to Rolleston. • Embedding Dunns Crossing Road / Walkers Road roundabout as the southern entrance to Rolleston. • Supporting Rolleston Drive North as the main route to/from State Highway 1 (SH1) through the Rolleston town/residential area. • Maintaining a sustainable level of traffic in the Rolleston Town Centre (Tennyson Street, between Lowes Road and Kidman Street). • Maintaining a sustainable level of traffic on Kidman Street. • Limiting, or not promoting, 'rat-running' through other, lower tier, routes in the study area. This philosophy expects more traffic to use connecting arterials of Weedons Road, Jones Road, Two Chain Road and Levi Road / Lowes Road. These routes are programmed within the Selwyn District Council Long Term Plan for future upgrades. Two Chain Road has been identified as a critically inter-dependent work to be delivered at the same time as the NZUP Dunns Crossing Road / SH1 intersection and rail improvements.

2 Evaluation Notes

The evaluation is based upon the transport analysis findings. These are reported in one substantial technote which is currently in draft status; TN#11 Short List Modelling Assessment.
Technote #11 was completed at the stage where there were 7 potential options. This was refined to three short-listed option, as scored in this MCA. The results from these three Short List options are readily identified in TN#11.

The evaluation is based on five sub-category assessments with the following weightings;

- Network wide distances. 15%
- Network wide and key movement travel times. 20%
- Achieving aspiration road hierarchy. 30%
- Freight on appropriate route 20%
- Intersection performance within area of influence. 15%

How these sub-categories have been assessed is described in the tables below.

Network distance		Criteria Considered
3	Large Positive	Significantly shorter network and key movement distance travelled
2	Moderate Positive	Shorter network and key movement distance travelled
1	Slight Positive	Marginally shorter network and key movement distance travelled
0	Neutral	No significant increase from baseline (existing situation, 2021-2028 average travel distances)
-1	Slight Negative	Longer network and key movement distance travelled
-2	Moderate Negative	Significantly longer network and key movement distance travelled
-3	Large Negative	Significantly longer network and key movement distance travelled and indirect and undesirable route volumes increase

Network & key movement travel times		Criteria Considered
3	Large Positive	Significantly reduced network and key route travel times
2	Moderate Positive	Reduced network and key route travel times
1	Slight Positive	Marginally reduced network and key route travel times
0	Neutral	No change baseline (existing situation, 2021 and estimated 2028 / 2038 average travel times)
-1	Slight Negative	Marginally increased network and key route travel times
-2	Moderate Negative	Increased network and key route travel times
-3	Large Negative	Significantly increased network and key route travel times

Achieving Aspirational Road Hierarchy		Criteria Considered
3	Large Positive	Listed key route volumes are in-line with anticipated hierarchy volume range. Other routes, notably the town centre, maintain volumes at the ideal sustainable levels in all time periods. High traffic volumes are not present on undesirable routes.
2	Moderate Positive	Listed key route volumes are within tolerable thresholds of anticipated hierarchy volume range. Other routes, notably the town centre, have volumes within sustainable levels during

		certain time periods. Moderate traffic volumes are not present on undesirable routes.
1	Slight Positive	Some listed key route volumes are outside of anticipated hierarchy volume range, and some routes volumes are within tolerable thresholds. Other routes, notably the town centre, are close to sustainable levels and within in sustainable levels in some time periods. Lower-to-moderate traffic volumes are not present on undesirable routes.
0	Neutral	Listed key route volumes are somewhat aligned (some routes within tolerable ranges, others outside). Other routes, notably the town centre, are close to sustainable levels. Other key arterials (e.g. SH1) carry higher traffic volumes.
-1	Slight Negative	Listed key route volumes are close to, but remain outside of, anticipated hierarchy volume range. Other routes, notably the town centre, are outside of sustainable levels in some periods. Lower-to-moderate traffic volumes are present on undesirable routes.
-2	Moderate Negative	Listed key route volumes are outside of tolerable anticipated hierarchy volume range. Other routes, notably the town centre, are outside of sustainable volumes in most/many time periods. Moderate traffic volumes are present on undesirable routes.
-3	Large Negative	Listed key route volumes are significantly outside of anticipated hierarchy volume range. Other routes, notably the town centre, are outside of sustainable levels in all time periods (high or low). High traffic volumes are present on undesirable routes.

Freight on appropriate route		**Criteria Considered**
3	Large Positive	Freight movements and volumes reduce significantly in the town centre and residential areas. Freight volumes and movements largely contained to industrial area and SH1.
2	Moderate Positive	Freight movements and volumes reduce in the town centre and residential areas. Freight volumes and movements focussed towards industrial area and SH1.
1	Slight Positive	Freight movements and volumes reduce mildly in the town centre and residential areas. Freight volumes and movements remain at similar levels in industrial area and SH1.
0	Neutral	No significant change to freight volumes and the locations of freight movements.
-1	Slight Negative	Freight movements and volumes increase mildly in the town centre and residential areas. Freight volumes and movements remain at similar levels, or reduce, in industrial area and SH1
-2	Moderate Negative	Freight movements and volumes increase in the town centre and residential areas. Freight volumes and movements are less focussed towards industrial area and SH1.
-3	Large Negative	Freight movements and volumes increase significantly in the town centre and residential areas. Freight volumes and movements not contained to industrial area and SH1.

Intersection Performance		**Criteria Considered**
3	Large Positive	All significant intersections through the wider network and localised intersections within the immediate vicinity of the Improvements perform at LOS E or better in future years.

2	Moderate Positive	The majority of significant intersections through the wider network and localised intersections within the immediate vicinity of the Improvements perform at LOS E or better in future years.
1	Slight Positive	Most significant intersections through the wider network and localised intersections within the immediate vicinity of the Improvements perform at LOS E or better in future years.
0	Neutral	One significant intersection through the wider network or localised intersection within the immediate vicinity of the Improvements performs at LOS F in future years.
-1	Slight Negative	One or Two significant intersections through the wider network and localised intersections within the immediate vicinity of the Improvements perform at LOS F.
-2	Moderate Negative	Two-to-Four significant intersections through the wider network and localised intersections within the immediate vicinity of the Improvements perform at LOS F.
-3	Large Negative	Four or more significant intersections through the wider network and localised intersections within the immediate vicinity of the Improvements perform at LOS F.

The evaluation tables for each intervention have been assessed using the same approach for each intervention. The Do-Nothing relates to how this location/situation would perform against those criteria in the future as projected traffic volumes increase, with no change in the infrastructure around the NZUP Improvement area. The project options are then assessed in the same manner using the same criteria, i.e. how the location/situation performs against the criteria into the future as projected traffic volumes increase.

3 Wider Components Assumed to be Consistent

The MCA for the Dunns Crossing Road / Walkers Road intersection and the Rolleston Drive South intersection have been completed in an earlier phase of the project. These NZUP improvement components are assumed to included alongside the Flyover in each of the three short-list options above.

In addition to the Dunns Crossing Road / Walkers Road roundabout, LILO at Brookside Road / SH1, and LILO at Rolleston Drive South / SH1, the following components in the area of influence around the Flyover were held consistent between the three options in the modelling assessment that this MCA is based on report (as reported in TN#11);

- **Bulk Retail connection road**: Provides relatively direct and higher quality route between Hoskyns Road (north of Jones Road) and Jones Road / Bulk Retail intersection.
- **Bulk Retail / Hoskyns Road roundabout**: 2-Lane roundabout of similar size / form to Jones Road / Link Drive roundabout, located approximately 200-250m north of Jones Road.
- **Kidman Road / Rolleston Drive North signals:** Signalised in all options.
- **SH1 westbound service lane:** Branching off just west of Rolleston Drive North and continuing through to west off of Brookside Road.
- **Hoskyns Road is Left-Out Only at SH1:** Forms a lane-gain with SH1 which leads into the 2-lane Christchurch Southern Motorway Stage 2 (CSM2).

4 Assessment

Option			Sore						Commentary
		Network / key mvt distance	Network / key mvt travel time	Achieving aspirational road hierarchy	Freight on appropriate route	Intersection performance changes	OVERALL	ROUNDED OVERALL	
	Do nothing	0	-1	-1	1	-2	-0.60	-1	There is no significant deterioration of network-wide and/or key movement distances. By 2038 travel times along Jones Road and in/out Industrial area are problematic. Volumes on Jones Road, Levi Road, and Weedons Road are outside of aspirational road hierarchy ranges. SH1 volumes remain high, there are no significant traffic volumes on undesirable routes. Three significant / local intersections perform with LOS F in AM and PM 2028.
4	Skewed Flyover to Jones / Bulk Retail, Left-Out Hoskyns Rd / SH1, Service-lane slip to Kidman Rd	-1	1	1	2	-1	0.60	1	Minor increases in travel distance. Minor reductions in travel times for key movements which become more significant in 2038. Jones Road, Weedons Road, and Levi Road are within desired traffic volume range as per aspirational road hierarchy, Town Centre traffic flows fluctuate by time period & forecast year - overall neutral. Encourages freight away from Town Centre and residential areas towards SH1 and industrial areas. Two intersections perform with LOS F in the AM 2028, and 2 with LOS E in the PM 2028
7	Straight Flyover to Jones, Hoskyns Road Left Out	0	2	1	1	0	0.90	1	No change in travel distance.

Reference: 310204503

									Improvements in travel time more evident in 2028 and become more significant in 2038. Volumes and travel patterns are similar to the Skewed Flyover. Two intersections perform with LOS F in the AM 2028, in PM 2028 all intersections are LOS D or better
13	Tennyson St under or over-pass, signals at SH1 / Rolleston Drive North, Hoskyns Left-Out	0	2	-3	-2	3	-0.45	0	No change in travel distance. Improvements in travel time more evident in 2028 and become more significant in 2038. Without treatment, has significant detrimental effect on Tennyson St with high volume increase - other wider network volumes (Jones, Weedons, Levi) are at similar levels to other options. Kidman carries 100 HV vph, two-way. All intersections are LOS E or better in AM 2028, in PM 2028 all intersections are LOS C or better

ROLLESTON ACCESS IMPROVEMENTS

TECHNICAL NOTE
APPROACH TO MULTI-CRITERIA ASSESSMENT

WAKA KOTAHI NZ TRANSPORT AGENCY
7 July 2021

QUALITY ASSURANCE

Rev.	Date	Description	Signature or Typed Name (documentation on file)			
			Prepared by	Checked by	Reviewed by	Approved by
1	8 June 21	Version 1	MS	MM	AK	AN
2	23 June 21	Version 2 – updated following WK comments	MS	AK	AK	AN
3	7 July 21	Version 3 – added some option information	AN	MS	AK	AN

1 INTRODUCTION

This memo summarises the approach to multi-criteria assessments (MCAs) that are being undertaken as part of the Rolleston Improvements Detailed Business Case (DBC). The MCAs will be one of the tools being used to help the project team establish emerging preferred options for each of the following elements of the NZ Upgrade Programme (NZUP):

- **Flyover** – establishing the preferred alignment for a new flyover connection between Rolleston Drive and Hoskyns Road. The MCA will also help identify the preferred intersection arrangements at either end of the flyover.
- **Rolleston Drive South**. Improving safety outcomes while retaining some network connectivity is the key outcome desired for upgrading this intersection.
- **Dunns Crossing Road/Walkers Road Intersection**. A significant reduction in the risk of death and serious injuries (DSIs) is the key outcome required from upgrading the intersection. There is also a desire that this intersection will act as a gateway to Rolleston and the primary access to the industrial area for freight traveling from the south.
- **Service Lane** – the new service lane will deliver safe and efficient access to the Rolleston town centre (via Tennyson Street and Brookside Road) and some of the service businesses along the state highway corridor. **Waka Kotahi have confirmed that there is no need for the project team to assess alternative options**; but do need to ensure that the service lane design integrates safely with SH1.
- **Rail Network Improvements** – One of the outcomes required from the NZUP investment is improved connectivity between the Midland Line and the Main South Line in Rolleston.

These locations are shown in Figure 1.

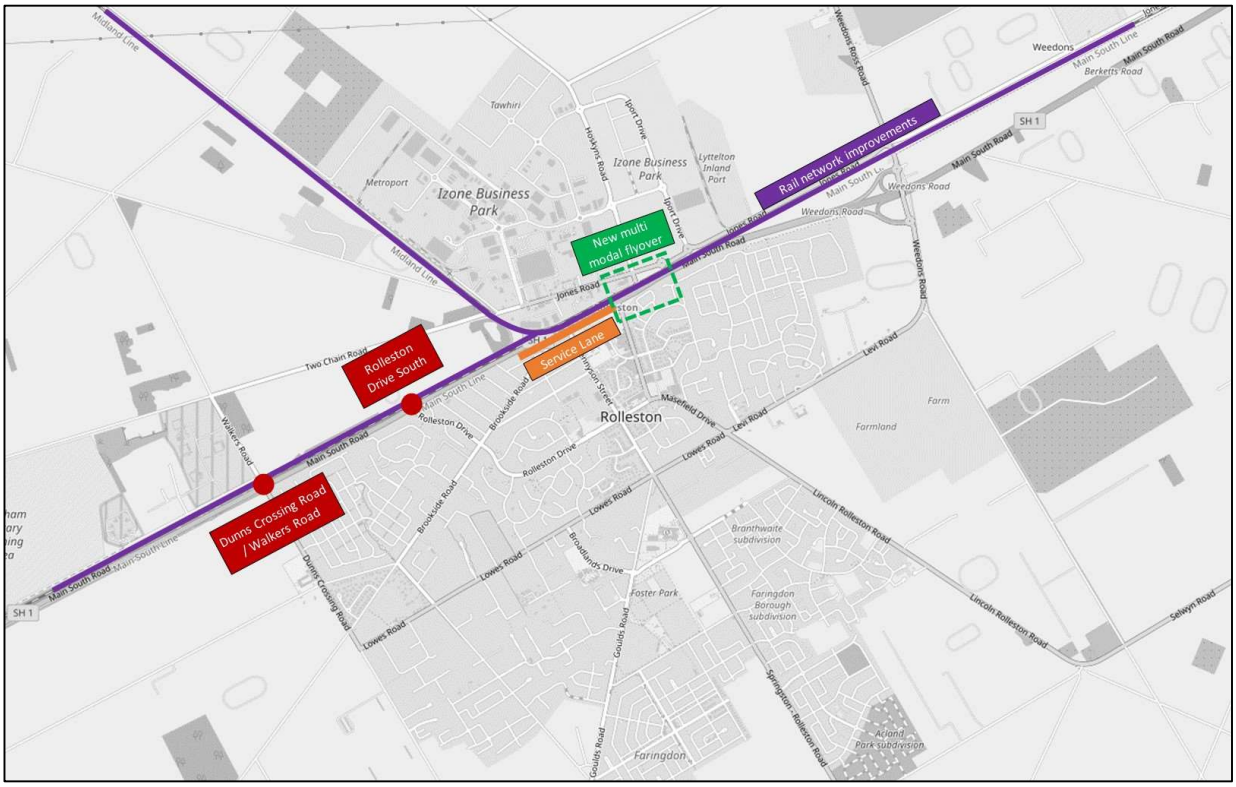


Figure 1: Location of interventions

Other tools that will be used to help establish emerging preferred options are:

- Indicative cost estimates
- Traffic modelling (particularly for the flyover options)

The following sections outline the criteria that will be used in assessments as well as a summary of the methodology that will be employed.

2 APPROACH TO THE MCA

The MCA processes have looked to align as closely as possible with Waka Kotahi's MCA Template and User Guidance (March 2020), and where possible, a consistent set of criteria will be used for all assessments. Alternative weightings may end up being used for different MCAs as the relative risks (e.g. property) may be different

The NZUP scope is clearly defined, and as such we are at the point where we are refining options rather than considering fundamentally different alternatives.

We would therefore expect that most options being considered should inherently strongly support the delivery of the project Investment Objectives (IOs) and desired NZUP outcomes. A two-phase approach to the MCA has therefore been undertaken:

- **Phase 1:** A pass/fail of each alternative against the investment objectives and NZUP outcomes. Any alternatives which do not support the investment objectives or NZUP outcomes will be dropped at the end of this phase.
- **Phase 2:** MCA of remaining alternatives, focusing on criteria that correspond to the key project risks.

2.1 Phase 1: Pass/Fail vs IO's and NZUP Outcomes

2.1.1 Criteria

The themes of the investment objectives are:

1. Work towards zero injuries and deaths by reducing intersection conflicts.
2. Support a more connected community, resulting in liveability benefits.
3. Provide a more sustainable and resilient network.

The NZUP outcomes that the project must deliver are:

1. Improve safety for all road users by reducing the number of deaths and serious injuries (DSIs).
2. More inclusive access to economic and social opportunities in Rolleston by improving mode choice.
3. Enhance Rolleston's competitive advantage and business productivity by improving connectivity between the town centre and the industrial zone.
4. Reduce CO2 emissions associated with land transport.

2.1.2 KPIs

To help with the evaluation against the Investment Objectives, a series of KPIs have been identified.

IO 1: Work towards zero injuries and deaths

This investment objective will have two KPIs associated with it:

- DSIs – existing DSIs within the study area will be documented and analysis will be undertaken to determine the extent to which proposed interventions contribute towards improved safety outcomes.
- Reduced road/rail incidents – the number of incidents or near misses at existing level crossings will be documented and analysis will be undertaken to determine the extent to which proposed interventions contribute towards improved safety outcomes.

IO 2: Support a more connected community, resulting in liveability benefits

This investment objective will have four KPIs associated with it:

- Pedestrian travel times – considering the directness of connection between key areas and delays encountered crossing busy roads.
- Social connectedness – a qualitative KPI based on access to employment and recreational opportunities from residential areas (based on quantitative analysis of population within 15/30 minutes walking/cycling/PT/driving time of employment opportunities in iZone).
- Travel time between key locations – traffic modelling will be used to quantify changes in AM and PM peak travel time for the following key journeys (consistent start and end points will be determined by the modelling team):
    - Regional trip – Burnham (or southern extent of project area) to iZone and vice versa.
    - Regional trip – Rolleston town to Christchurch (or northern extent of project area) and vice versa.
    - Local trip – Rolleston town centre to iZone and vice versa.
- Freight connectivity – two aspects of freight connectivity will be determined. Rail connectivity improvements will be assessed by quantifying train movement time between the Midland Line and the Main South Line to the South of Rolleston. Road connectivity improvements will be assessed by

determining travel time changes for routes between iZone and Burnham, the Weedons Ross Interchange and Rolleston Town Centre.

It should be noted that, although the NZUP package will contribute to liveability benefits, other investment may be required to realise these benefits (for example, through the Rolleston Town Centre masterplan process). Therefore, no specific liveability KPIs have been defined, with the focus being on connectivity as a way of quantifying this particular investment objective.

IO 3: Provide a more resilient and sustainable network

This investment objective will have three KPIs associated with it:

- People throughput – quantified as the number of pedestrians, cyclists and public transport users crossing the State Highway and Rail corridors.
- Rail movements (proxy for freight on rail) – existing rail movements will be quantified along with the number of potential additional rail movements that could be unlocked by the intervention options.
- Resilience to unplanned events – qualitative assessment of changes to network resilience. This would in large part relate to reductions in the likeliness of crash related road closures.

2.2 Phase 2: MCA against key risks

2.2.1 Criteria

The proposed MCA criteria are provided within Table 1.

Table 1: MCA criteria

Theme	Definition
Investment Objectives	• Work towards zero injuries and deaths • Support a more connected community, resulting in liveability benefits • Provide a more sustainable and resilient network

Effects	• Engineering difficulty (inc. structures and stormwater)
	• Impact of construction (timeframes and temporary traffic management)
	• Property.
	• Consentability
	  ○ Noise and emissions
	  ○ Visual effects
	• Wider traffic impact, capturing impact to other road users
	• Rail impact
	• Interdependencies

Mitigation	• Impacts on Te Ao Maori • Additional works required to mitigate negative environmental and social effects

Excluded criteria

The following criteria, some of which are included within the Waka Kotahi's MCA User Guidance, have been excluded from this initial MCA.

- Wider economic benefits (included as a benefit on the Investment Logic Map).
- Safety in Design
- Climate change mitigation and adaptation
- Urban design
- Geotechnical
- Alignment with strategies.

The key rationale at this stage for excluding criteria is where there is unlikely to be notable differentiation between options. By limiting the number of criteria being assessed, a clear picture of the relative benefits/disbenefits of alternatives can be established. This removes a risk of weighting of key criteria being 'watered down' to make room for other criteria which are likely to have a low bearing on the final result.

2.2.2 KPIs

Each of the critical success factors identified above will be assessed using a standalone qualitative KPI:

Critical Success Factors

- **Engineering difficulty** – to consider difficulty of 'high ticket' items such as structures and potential stormwater treatments. The scale of engineering difficultly has a direct bearing on cost. In the case of the flyover options, consideration to be given to the ability to achieve the necessary grades to appropriately accommodate active modes.
- **Impact of construction** – considering potential impact of traffic management, covering duration (implicitly cost) and impact to the state highway/local road network. Also considering the impacts on direct neighbours (e.g. noise).
- **Property** – the number of properties that require acquisition, and number of properties where mitigation against negative effects (such as noise) would be required.
    - The primary focus is on the number of different properties that would need to be required, with a secondary focus on the sqm of land take required.
- **Consentability** – key consenting challenges will be highlighted for each intervention and these will be used to determine a consentability score. Key considerations are noise, vibration and visual impact.
- **Wider traffic impact** – the modelling will be used to understand the extent to which the improvements deliver on the aspirational road network hierarchy (NOF) and contribute to improved conditions for traffic across the wider network.
- **Rail impact** – the extent to which the proposed interventions deliver wider operational benefits to the rail network will be considered.
- **Interdependencies** – the viability of some options may be dependent on other infrastructure or availability of land. For example, the Moore Street extension.

Environmental, Social and Cultural Factors

Each of the environmental, social and cultural factors identified below will be assessed using a standalone qualitative KPI that will draw on quantitative analysis where appropriate:

- **Impacts on Te Ao Maori** – to be assessed in consultation with relevant Runanga.
- **Additional works required to mitigate negative effects** – this factor acknowledges that it may be possible to mitigate some of the negative effects of significant construction projects. It will therefore consider the extent to which mitigation is possible for the intervention options. The impact of some options, such as banning turns, may also have wider traffic and network efficiency implications.

3 EVALUATION APPROACH

In keeping with Waka Kotahi guidance, each of the criteria will be assigned to a particular subject matter expert (SME) from within the project team who will be responsible for undertaking the analysis. Each SME will be responsible for their own evaluation methodology and will be expected to present methodology, analysis and scoring in a workshop context. Where multiple quantitative KPIs are used to inform the evaluation of particular criteria, the approach to discerning the overall score will be clearly documented.

3.1 Scoring

In accordance with Waka Kotahi guidance, a -3 to +3 scoring scale was adopted.

Scoring will be undertaken relative to the do minimum. Generally, a score of zero will be taken as being 'as per the status quo', but with consideration that the network is experiencing rapid growth and other network changes are currently progressing. Table 2 provides the scoring scale.

Table 2: Scoring Scale – Network Options

Magnitude	Definition	Score
Large Positive	Major positive impacts resulting in substantial and long-term improvements or enhancements of the existing environment.	+3
Moderate Positive	Moderate positive impact, possibly of short-, medium- or long term duration. Positive outcome may be in terms of new opportunities and outcomes of enhancement or improvement.	+2
Slight Positive	Minimal positive impact, possibly only lasting over the short term. May be confined to a limited area.	+1
Neutral	Neutral – no discernible or predicted positive or negative impact.	0
Slight Negative	Minimal negative impact, possibly only lasting over the short term, and definitely able to be managed or mitigated. May be confined to a small area.	-1
Moderate Negative	Moderate negative impact. Impacts may be short, medium or long term and are highly likely to respond to management actions.	-2
Large Negative	Impacts with serious, long-term and possibly irreversible effect leading to serious damage, degradation or deterioration of the physical, economic, cultural or social environment. Required major rescope of concept, design, location and justification, or requires major commitment to extensive management strategies to mitigate the effect.	-3

3.2 Weightings

The following baseline weightings have been identified as a starting point for discussion:

Table 3: Weightings – Proposed Sensitivity Test

Categories	Criteria	
Effects	Engineering difficulty (inc. structures and stormwater)	20%
	Impact of construction	20%
	Property (no. impacted owners)	20%
	Consentability (inc. noise, CO2 and visual effects)	10%
	Wider transport impact	10%
	Rail Impact	5%
	Interdependencies	5%
Mitigation	Impacts on Te Ao Maori	5%
	Additional works required to mitigate negative environmental and social effects	5%

Sensitivity tests will be undertaken on the evaluation to determine whether applying different weights to the criteria results in different outcomes. The following weighting tests will be undertaken:

- Equal weighting – all criteria will be weighted equally.
- Agreed weightings (see Table 3) with stakeholders.

Further sensitivity tests can be run based upon feedback from stakeholders.

4 OPTIONS TO BE EVALUATED

This section outlines the long-list of options that will be tested through the proposed MCA framework.

4.1 Flyover

The assessment of the flyover options has been broken down into three areas:

- Tie-in on the southern side (**purple**)
- Bridge alignment (**orange**)
- Tie-in on the northern side (**blue**)

A list of the options being considered for each of these areas are provided on the next page and shown diagrammatically on Figure 2. Waka Kotahi have confirmed that a connection from the flyover into the service road is no longer part of the NZUP scope of works (**green**).

Note that the extension of Moore Street (**red**) is not yet committed, with land from the Ministry of Education school site yet to be obtained.

Figure 2: Flyover options

It has been assumed that an active mode only bridge (i.e. no vehicle connectivity) is outside of the NZUP scope. However, we will seek confirmation from Waka Kotahi that this is the case prior to proceeding with the MCA.

Tie-in on the southern side

A. Connection between Kidman Street and Rolleston Drive north (PBC identified option).
B. Continuation of Kidman Street.
C. Continuation of Rolleston Drive.

Bridge Alignment

A. Straight alignment across to Jones Road.
B. 60 degree bridge alignment.
C. 45 degree bridge alignment.
D. 30 degree bridge alignment.
E. Local road underpass (under SH and railway line).

Tie-in on the northern side

A. Connection into the development land
B. Connection into the south-west approach to the Jones Road/Carters development roundabout
C. Connection into a new south-eastern approach to the Jones Road/Carters development roundabout

4.2 Rolleston Drive South

The following options have been considered for Rolleston Drive South:

- Do nothing.
- Signals.
- Roundabout (assumed to be two lane).
- Right turn-out movement banned.

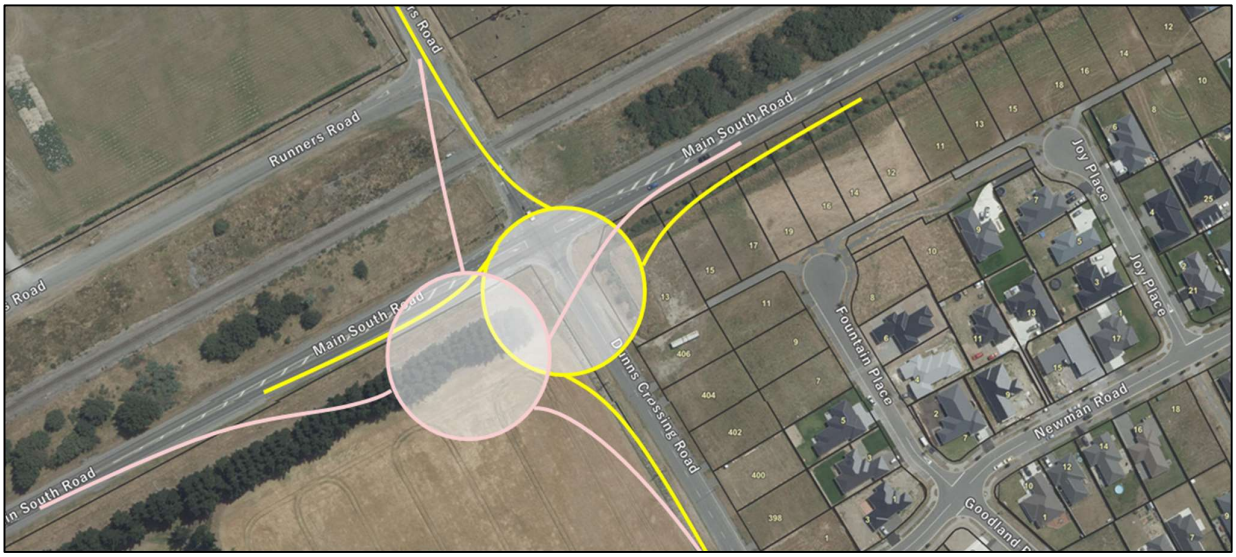
Figure 3: Rolleston Drive South options

4.3 Dunns Crossing Road / Walkers Road

The following options have been considered for Dunns Crossing Road / Walkers Road:

- Do nothing.
- Roundabout on top of the current intersection (yellow).
- Roundabout offset to the south-west of the current intersection, requiring the realignment of all approach roads (pink).
- Roundabout to the south of existing intersection, left-in/left-out only for Dunns Crossing Road and new road though the Plan Change 73 area (blue).
- Signal.

- Left-in/Left-out for both Walkers Road and Dunns Crossing Road. U-turns and access to Rolleston provided at a new roundabout at Rolleston Drive south.
- Oval (or lozenge) roundabout. Potential RIAWS on approaches to stop all traffic when a train is passing.
- Grade separated intersection.



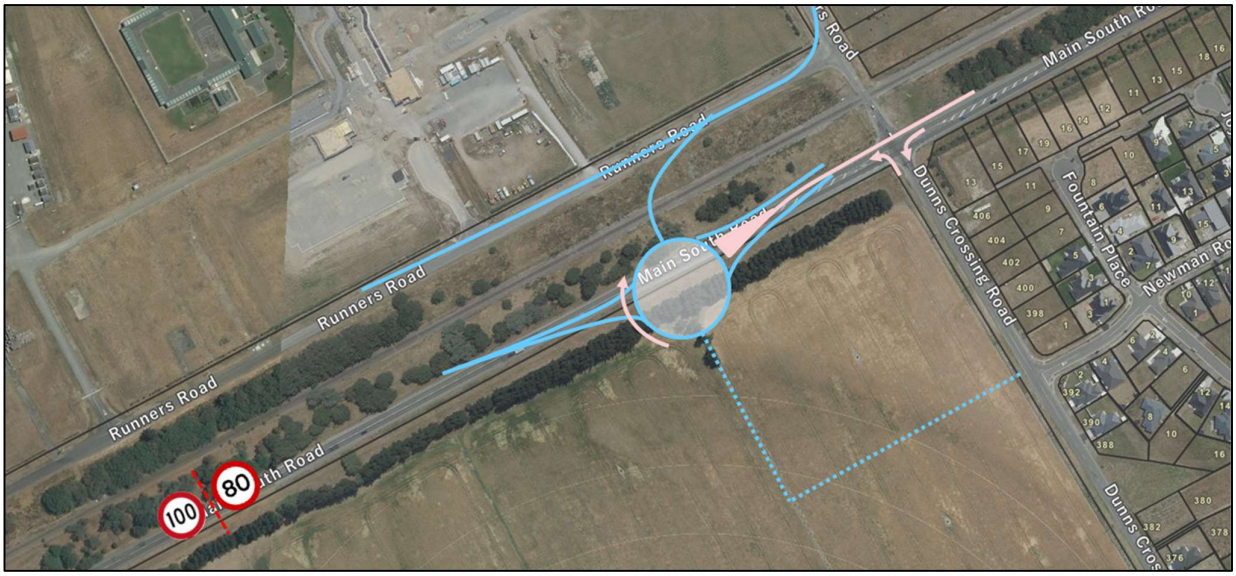


Figure 4: Dunns Crossing Road / Walkers Road options

4.4 Rail Improvements

The following options have been considered for rail improvements:

- Rail Option 1: Completion of triangle junction south of Rolleston station.
- Rail Option 2: Called Yard Option 1 :Additional shunting capacity in Rolleston station.
- Rail Option 3: Called Yard Option 2: Additional shunting capacity further north of LPC connection
- Rail Option 4: Signalling changes to improve connectivity between Midland Line and Main South Line (not illustrated – no infrastructure change)
- Rail Option 5: Completion of triangle junction with LPC siding

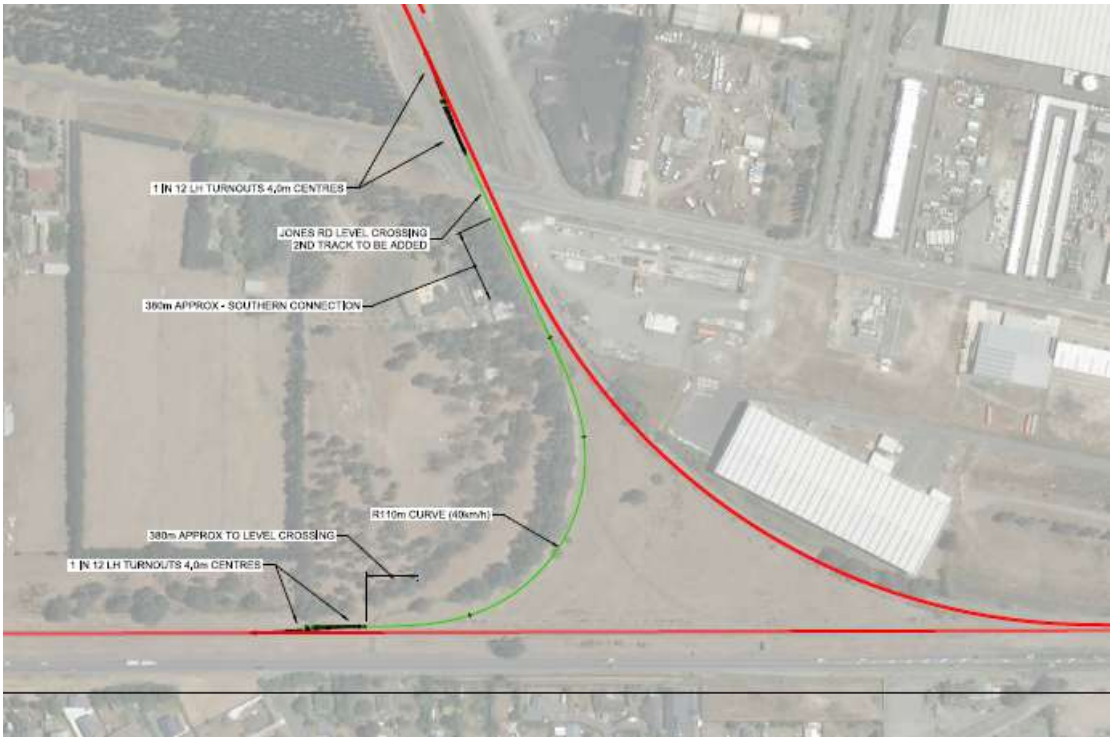


Figure 5: Rail Option1:

Figure 6: Rail Option 2: Yard Option 1

Figure 7: Rail Option 3: Yard Option 2

Figure 8: Rail Option 5: Completion of Triangle to LPC line