

APPENDIX K FLYOVER SHORT LIST DESCRIPTION

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ROLLESTON ACCESS IMPROVEMENTS

TECHNICAL NOTE

FLYOVER OPTIONS GENERAL DESCRIPTION REPORT

WAKA KOTAHI NZ TRANSPORT AGENCY

28 April 2022

QUALITY ASSURANCE

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1 OPTIONS DESCRIPTION OVERVIEW

The purpose of this note is to provide a description of the three connectivity short list options for the Rolleston Access Improvements Detail Business Case, so that the general configurations, operations, risks and benefits can be shared widely.

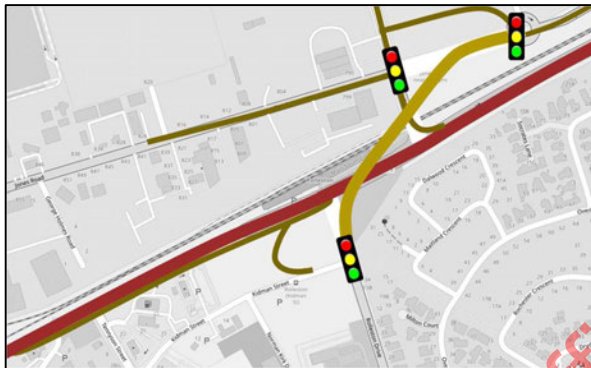
The three shortlist connectivity options were developed from a longer list of options. Each configuration on the long list was intended to address the access and safety concerns of the Waka Kotahi's NZUP programme, and were developed in response to both:

- A high level of community concern about the impacts and effects of the skewed flyover option; and
- Community uncertainty about what other options had been considered, and how thoroughly.

The long list options proceeded through a multi-criteria assessment process (which has been reported in previous technical notes), which identified the three options described here, as the best options to proceed for further assessment.

The three options considered are shown schematically in the following images. They are known as:

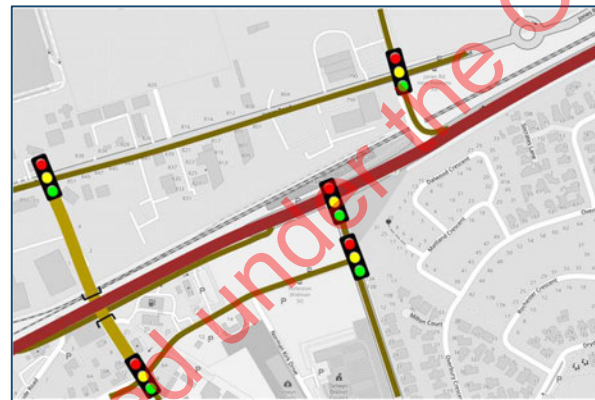
- Skewed Flyover
- Straight Flyover
- Tennyson-George Holmes connection (considered both as flyover or underpass)



Option 4
Skewed Flyover (Refined Consulted Option)



Option 7
Straight flyover



Option 13
Tennyson - George Holmes (flyover/ underpass + signals at Rolleston Drive North)

2 OPTION 4: SKEWED ALIGNMENT

2.1 Brief Description

The Skewed Alignment option consists of the elements described in the following bullets, with the design image shown in Figure 1 and Figure 2:

- A flyover over SH1 directly connecting Rolleston Drive North to the position of the roundabout on Jones Road, west of the iPort Drive/Jones Road roundabout.
- Replacement of the roundabout at the flyover connection with traffic signals**
- A linking/access road from the flyover signals through the iPort site and connecting back to Hoskyns Road - the flyover to Hoskyns link is intended to provide for east-west movements along Jones Road, which is otherwise severed by where the flyover connects to Jones Road**.
- A left-out only from Hoskyns Road to State Highway 1 allowing free-flow onto the highway (lane gain/uncontrolled intersection)**. The left-turn in from the highway is removed.
- Both sets of traffic signals on the highway are removed (Hoskyns Road and Rolleston Drive North). Free-flow single lanes operate in both directions
- The Rolleston Drive north connection with the highway is eliminated.
- A southbound service lane is formed on the highway from a point north of where the current Hoskyns Road signals are. The service lane allows vehicles to decelerate from the highway and access a slip-lane to Kidman Street, or the BP, McDonalds and other services currently accessible from the highway.
- The slip lane also provides left-turn in/left-turn out access only to Tennyson Street and Brookside Drive.
- A slip lane loops back from the service lane to Kidman Street** - the connection to Kidman Street will be signalised.
- Kidman Street intersection with Rolleston Drive is signalised

**indicates elements that have been added to the option since the consultation process during 2021.

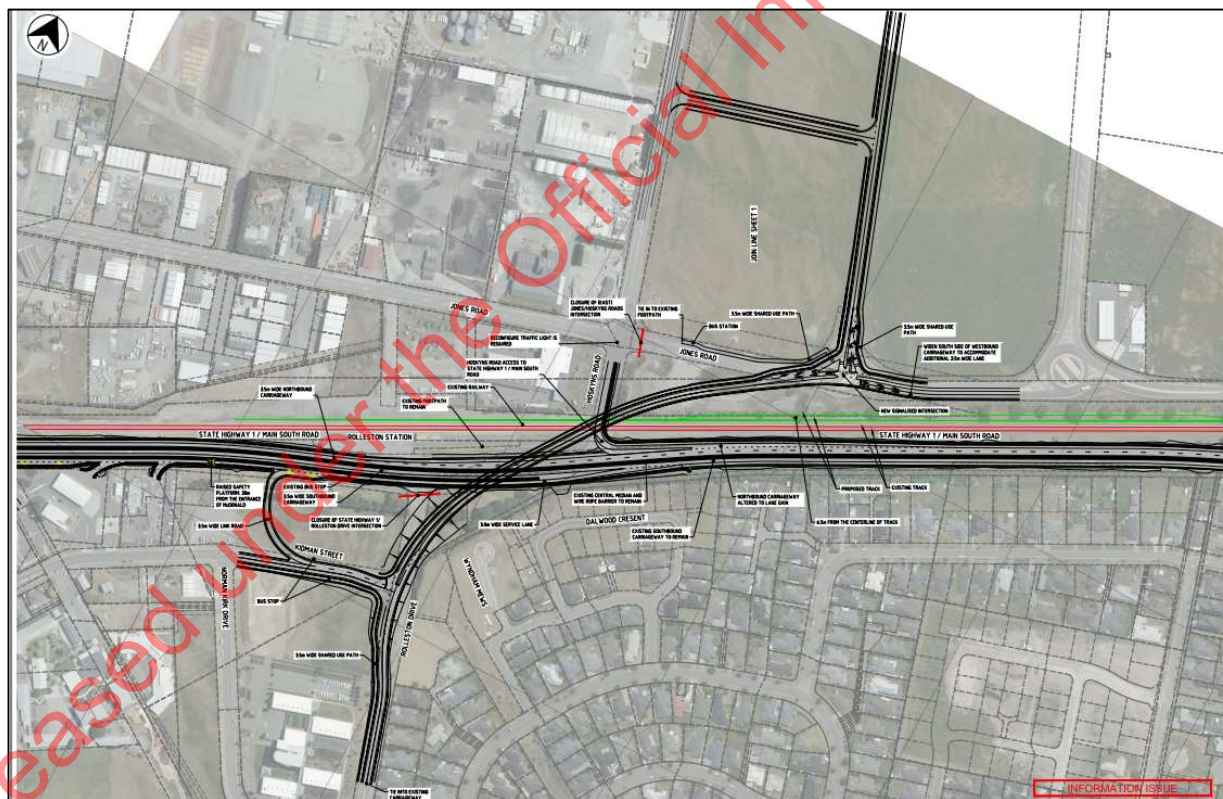


Figure 1: Skewed Flyover Configuration – initial concept

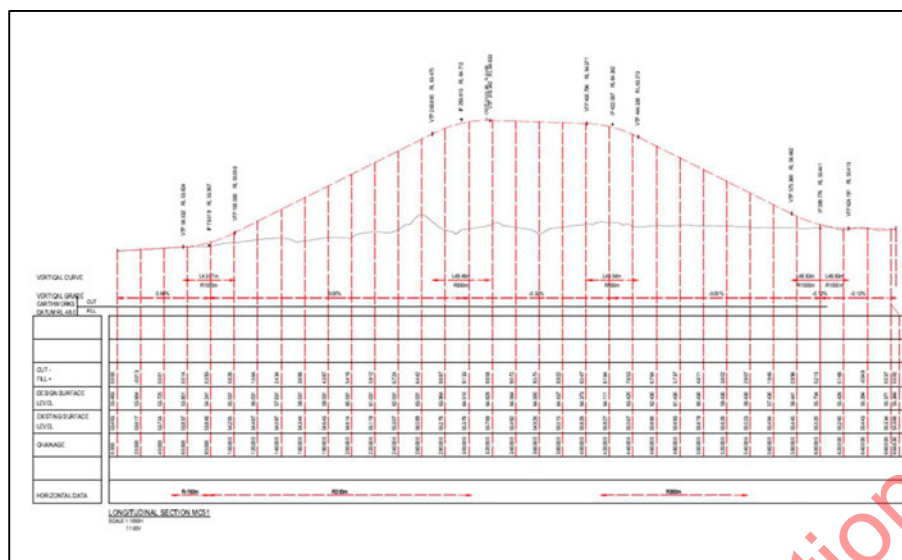


Figure 2: Skewed Flyover Configuration - initial concept long section

2.2 Multi-modal operation

The skewed option offers the following:

Pedestrians and Cyclists

In general, the configuration offers benefits to pedestrians and cyclists in removing the risk of collisions at the signals on the highway. However, others may perceive the existing signalised movements at ground level, to be more convenient. Cycle and pedestrian connections and crossings are to be provided on all legs of the flyover signalised intersections

- Shared use pathways (SUP) provided on both sides of the flyover. The flyover grades are typically less than 5%, which is considered an acceptable gradient for most types of cyclists.
- At the Jones Road intersection, the flyover SUP connects to a path on the old Jones Road alignment to tie-in with the existing arrangement at the Jones/Hoskyns intersection. The intention is to develop connections to the cycle facilities network, as it expands in Rolleston
- Pedestrian access from Hoskyns Road to the railway station will remain, but its continuation to the crossing point on the highway (where the Rolleston Drive signals were) will be removed.
- Cycle and pedestrian access to the flyover from Rolleston Drive or Kidman Street will require use of the crossing function of the traffic signals.
- The median barrier between the highway north-south lanes and between the south bound lane and service lane will preclude pedestrian and/or cyclist crossing of the highway.

Public Transport

Bus routing will be affected by the removal of signals and turns from the highway. In the images shown in Figure 3 below, the existing routes and alternative routes are shown.

The bus routes are affected by the removal of the right-turn capability onto and off the highway, and the changes to some of the left-turn provisions.

- Primarily Route 85 (red) will need the most re-routing consideration. Northbound operations can continue from Kidman Street, flyover, linking roads and Hoskyns Drive to the highway. Southbound operations will require either:
 - Exit from the Highway at Weedons, to use Jones Road and flyover; or
 - Exit via the slip lane to Kidman Street and Rolleston Drive north and internal routing within Rolleston; or
 - Exit via the slip lane to Tennyson Street.

All routing options will require some separation of northbound and southbound bus-stops.

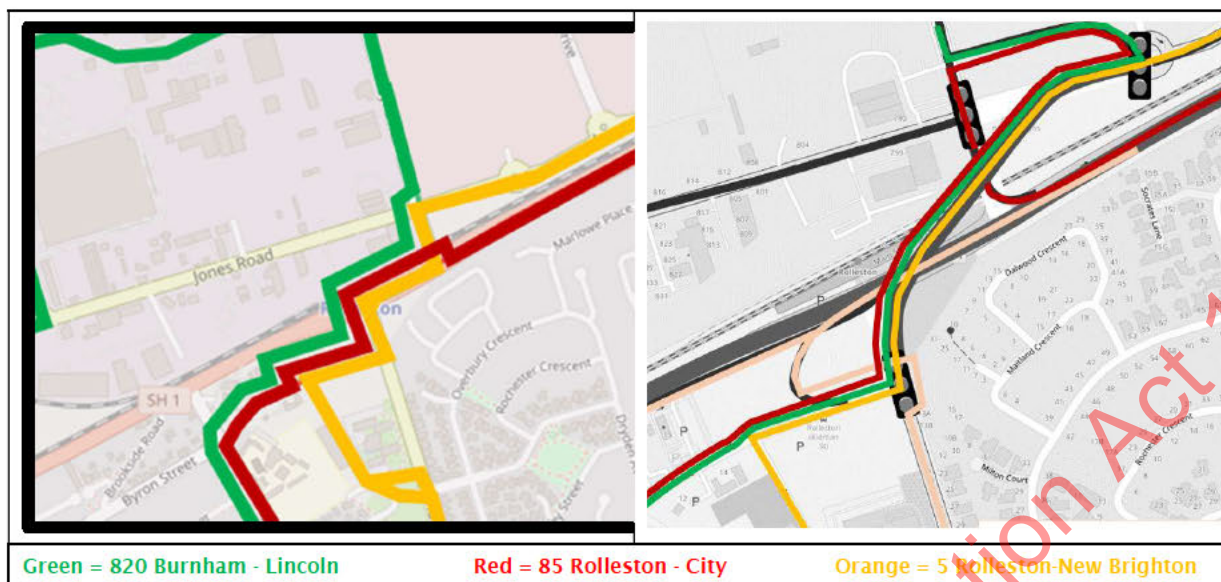


Figure 3: Bus Routing Impacts - Skewed Flyover

There is currently a (multi) bus-stop on Kidman Street, between Norman Kirk Drive and Rolleston Drive North. The intention is to continue with the stops on Kidman Street, with the stops on the north side being moved further to the west, to accommodate the slip-lane link onto Kidman Street.

2.3 Tie-ins, Property and Network Implications

Property

With the exception of iPort land, the skewed flyover option does not require any private property. All of the land required for the footprint of the flyover and its ramps is owned by either Waka Kotahi or the Selwyn District Council. Only the connecting roads through iPort are owned by others. The intention would be to develop the connecting roads to accommodate the expected development to minimise the deviation when travelling along Jones Road, but this will be determined by the development within the zone.

The properties on Rolleston Drive north, just south of the new signalised intersection with Kidman, will have specifically designed access (probably their own service lane). Otherwise, no property accesses are directly affected by this option.

Tie-Ins

The tie-in points for this project – that is where the new infrastructure joins up with the existing are:

- Rolleston Drive North – between Kidman Street and Norman Kirk Drive intersection
- Kidman Street – east of Norman Kirk Drive intersection
- Jones Road – just west of iPort Drive roundabout
- Hoskyns Road – north of Jones Road

Network Implications

Key traffic movements and journeys in the Rolleston area will be modified by the Skewed Flyover option;

- **Travel along State Highway 1 (SH1) through Rolleston:** The traffic signals at Rolleston Drive and Hoskyns Road are removed and movements along SH1 through Rolleston no longer need to stop, they flow freely.
 - Congestion and delays for travel along SH1 are significantly reduced.
- **A Rolleston township resident travelling towards Christchurch:** The main route that is taken to directly access SH1 is over the Skewed Flyover, through the Big Box Retail area, turning left onto Hoskyns Road and then using the free left slip lane from Hoskyns Road to SH1 to travel towards Christchurch. Alternative routes are either travelling over the Skewed Flyover, along Jones Road and accessing SH1 via the Weedons Interchange or by travelling out of Rolleston along Levi Road and accessing Weedons Interchange from the south.

- The route via the Flyover, through the Bulk Retail area, and onto SH1 via Hoskyns Road will take longer than the current direct right turns onto SH1. However the Flyover route eliminates the crash risk from the traffic signals on SH1 which is increasing over time, both for right turns at these signals, and at the rail crossing.
 - The route along Levi Road is becoming more congested over time. With the Skewed Flyover in place, more traffic uses this route during peak times and congestion is likely to increase.
 - The route via Jones Road to the Weedons Interchange is a longer distance to travel, but no significant congestion or delay is anticipated on this route.
- **A Rolleston township resident returning to Rolleston from Christchurch:** The main access is provided by the service lane which runs westbound alongside SH1, access to Kidman Street is provided from this service lane, and movement south on Rolleston Drive is provided from the Kidman/Rolleston intersection. From the service lane, the resident could also access Tennyson Street instead.
 - The route via the service slip lane into the Rolleston township area is relatively direct and the removal of the signals on SH1 will reduce congestion and delays for travel from the Christchurch area into Rolleston.
 - There is a risk that the high volume of traffic anticipated to use the service slip lane to access Kidman Street and Rolleston Drive North could result in a queue back onto SH1 in peak times. It is intended to install traffic signals on the slip lane at Kidman Street, so the traffic signal timings can be operated to control any queuing back into the slip lane and onto the highway.
- **A Rolleston Resident who works in the Industrial Area:** Access to and from Rolleston and the Industrial area is provided via the Skewed Flyover and the link through the Bulk Retail area.
 - Although this route is a longer distance than the current route across SH1 via the traffic signals, over time congestion at these signals is predicted to increase and delays and queues will become much longer. In the future, the Skewed Flyover route will provide a reasonable and consistent travel times between Rolleston and the Industrial area.
- **Trucks travelling to/from Christchurch to the Industrial Area:** Travelling to and from Christchurch, trucks are directed to access the Industrial Area via the Weedons Interchange and Jones Road.
 - Due to the increased traffic volumes at the Weedons Interchange with the Skewed Flyover, delays are anticipated to increase for certain movements through the interchange. Delays from the SH1 westbound off-ramp to the Interchange are likely to be greater, effecting trucks making this movement in peak times.
 - To reduce the level of delays anticipated at the Weedons Interchange, a roundabout meter is proposed on Weedons Road (south) to create gaps in the traffic on Weedons Road for vehicles using the SH1 westbound off-ramp.
- **Trucks travelling to/from SH1 South to the Industrial Area:** From the south, the route for trucks into the Industrial area is to turn left at the Dunns Crossing Road roundabout and use Two Chain Road onto Jones Road. SDC have plans to upgrade Two Chain Road and the rail crossing onto Jones Road.
 - No significant delay or congestion is anticipated at the Dunns Crossing Road roundabout or along Two Chain Road.
- **People travelling to/from businesses and properties on the section of Jones Road west of Hoskyns:** Access to SH1 towards Christchurch is direct, vehicles can turn right onto Hoskyns Road and access SH1 via the free moving left slip lane. Access to Rolleston will be provided by travelling along Hoskyns Road, through the Bulk Retail Area, and onto the Skewed Flyover towards Rolleston. Heading to SH1 to the south two routes can be used, either via Two Chain Road and the Dunns Crossing Roundabout or through the Bulk Retail Area, over the Skewed Flyover, turning right onto Kidman Street and then using the service lane to access SH1 through Tennyson Street.
 - No significant delay or congestion on the route to SH1 towards Christchurch is expected, this is likely to be a direct and reasonably free-flowing movement.
 - Heading to Rolleston, the route through the Bulk Retail area and onto the Skewed Flyover will take longer than the current more direct movements via the traffic signals on SH1 in the short term. Congestion at the State Highway traffic signals is forecast to increase as Rolleston grows, resulting in deteriorating travel times. Furthermore, the flyover eliminates the crash risk with the traffic signals which is also forecast to increase over time.
 - Although a longer route, no significant delay or congestion is expected along Two Chain Road and at the Dunns Crossing Roundabout.
- **People travelling from SH1 south to the Rolleston town and residential areas:** Access into Rolleston from SH1 south is provided via the roundabout at Dunns Crossing Road / SH1. Traffic can use the roads through Rolleston to get to certain locations, for example Brookside Road or Lowes Road

to reach the Town Centre and residential areas. If the occasional driver does not turn off at Dunns Crossing Road, the Weedons Interchange can be used to access the Rolleston Area.

- Although the routes into Rolleston town from SH1 south are longer, no significant congestion or delay is expected on these movements and the right turn crash risk turning off SH1 at the signals is eliminated (this crash risk is increasing over time).

The movements described above largely result in traffic volumes aligning with the desired Rolleston network framework. Jones Road, Weedons Road, and Levi Road are within desired traffic volume ranges and the Town Centre traffic flows fluctuate, but remain at levels which are around the desired future levels.

The Skewed Flyover encourages trucks to move away from the Town Centre and residential areas towards SH1 and the industrial area.

2.4 Engineering Details

The basic engineering details of the bridge structure, and its construction, are outlined here:

Bridge Structure

- Three spans of 48/58/66m length from South-West to North-East.
- Two bridge abutments (note northern abutment will be hard against rail boundary).
- Two piers will be located in SH1 median and road reserve between SH1 & Rail Corridor.
- Material to be used will be steel trough girder composite with precast/cast in-situ concrete deck. Continuous girders/deck with steel pot bearings at piers & abutments. Piers and abutments will consist of reinforced concrete crosshead, columns and bored piles.
- Vertical grades are 5% in both directions. Clearance is achieved over SH1 for Over Dimension (OD) vehicles and required clearance is achieved over Kiwirail line.
- Bridge typical section is two x 3.5m lanes, 2 x 1.5m shoulders and two x 3.0m shared path. Total width is 16m.
- Three x 2600mm deep steel trough girders with 250mm deck slab (made up of precast planks and insitu concrete). Total structural depth of 2850mm.

Construction Approach

Construction process is as per the general approach to steel-composite bridges in NZ. Complications lie in the size of the girders and length of bridge. Girder depth when placed on transport is unlikely to trigger overheight dimensional constraints – but may necessitate planning of transport route. Assuming girders are fabricated in the North Island or overseas and delivered to Lyttelton Port, transport route along SH74, 76 and 1 is 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.

Segmentation of girders & cross-bracing between girders means that multiple girders segments could be 'pre-spliced' in a yard adjacent to the bridge before being lifted as one – however this may result in a very heavy lift.

A more approachable solution is to lift individual beam segments into place before using a smaller crane and a mobile work platform to install cross bracing and splice connections.

The approach also necessitates the use of at least 1 temporary tower (placed 10-15m south of the pier between SH1 & the rail corridor. A possible erection sequence is shown below (Segment 1 at South end, Segment 5 at North end). Temporary restraints would be needed on the pot bearings to prevent girder movement during the erection process.

Segment 1 ~ 30m	Segment 2 ~ 30m	Segment 4 ~ 30m	Segment 3 ~ 40m	Segment 5 ~ 40m
<i>Segment 1 & 2 spliced together on the ground before being lifted in place.</i>		<i>Segment 3 lifted onto temporary (tension) tower.</i>		<i>Segment 4 lifted and splice to Segments 2 & 3. Segment 5 lifted in last (note that Segments 4 & 5 can be alternated).</i>

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.

2.5 Key Risks and Issues

There are two key risks impacting on the skewed flyover option:

- The skew means that the bridge spans between piers and embankments are long and are approaching the limits of conventional bridge construction. This issue is caused/exacerbated by the skew on the piers by comparison to the bridge alignment. Worst case scenario is that this bridge cannot be constructed in the proposed materials/cross-sections.
- This option is the most expensive of the flyovers, and by itself is expected to consume the allocated NZUP funding. The worst case scenario is that infrastructure choices need to be made which will mean the full objectives of the NZUP programme cannot be achieved

The skewed flyover is the only flyover option which has been discussed in public forum. General feedback was extremely critical of the disconnect caused with Jones Road, and the lack of connections to/from the highway. While all the points have been addressed to some extent by the updated configuration, the deviation in the Jones Road travel is likely to still be a significant issue.

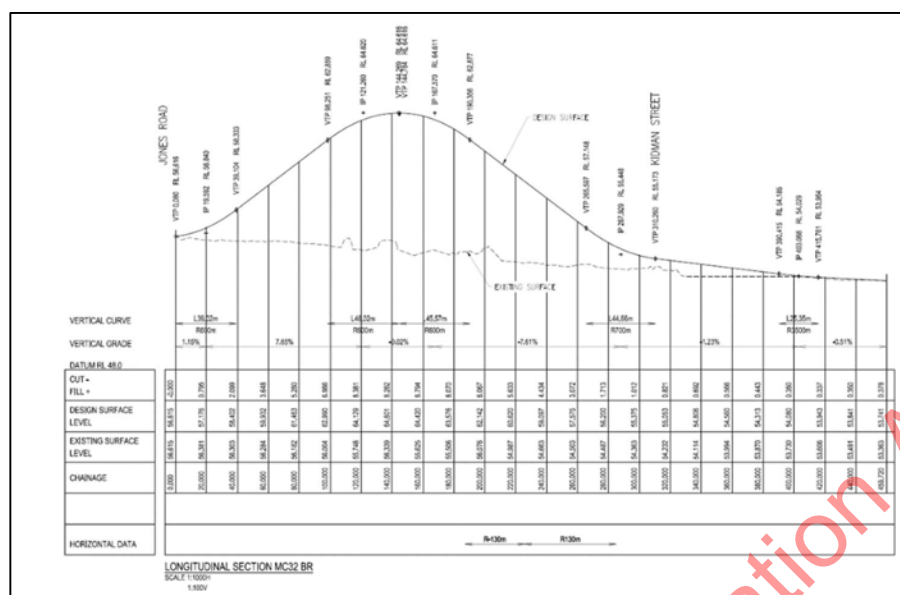


Figure 5: Straight Alignment – initial concept long section

3.2 Multi-modal operation

The straight option offers the following:

Pedestrians and Cyclists

In general, the configuration offers benefits to pedestrians and cyclists in removing the risk of collisions at the signals on the highway. However, others may perceive the existing signalised movements at ground level, to be more convenient. Cycle and pedestrian connections and crossings are to be provided on all legs of the flyover signalised intersections

- Pedestrian pathways provided on both sides of the flyover. The flyover grades on the Jones Road side are approaching 8% which is at the top end of acceptable grades. The slope is however short.
- The paths on the flyover connect the shared use paths which are being developed under Selwyn District Councils SUP plans.
- Pedestrian access from Hoskyns Road to the railway station will remain, but its continuation to the crossing point on the highway (where the Rolleston Drive signals were) will be removed.
- Cycle and pedestrian access to the flyover from Rolleston Drive or Kidman Street will require use of the crossing function of the traffic signals.
- The median barrier between the highway north-south lanes and between the south bound lane and service lane will preclude pedestrian and/or cyclist crossing of the highway.

Public Transport

Bus routing will be affected by the removal of signals and turns from the highway. In the images in Figure 6 below, are the existing routes and alternative routes.

The bus routes are affected by the removal of the right-turn capability onto and off the highway, and the changes to some of the left-turn provisions.

- Primarily Route 85 (red) will need the most re-routing consideration. Northbound operations can continue from Kidman Street, flyover, linking roads and Hoskyns Drive to the highway. Southbound operations will require either:
 - Exit from the Highway at Weedons, to use Jones Road and flyover; or
 - Exit via the slip lane to Kidman Street and Rolleston Drive north and internal routing within Rolleston; or
 - Exit via the slip lane to Tennyson Street.

All routing options will require some separation of northbound and southbound bus-stops.

There is currently a (multi) bus-stop on Kidman Street, between Norman Kirk Drive and Rolleston Drive North. The intention is to continue with the stops on Kidman Street, with the stops on the north side being moved further to the west, to accommodate the slip-lane link onto Kidman Street.

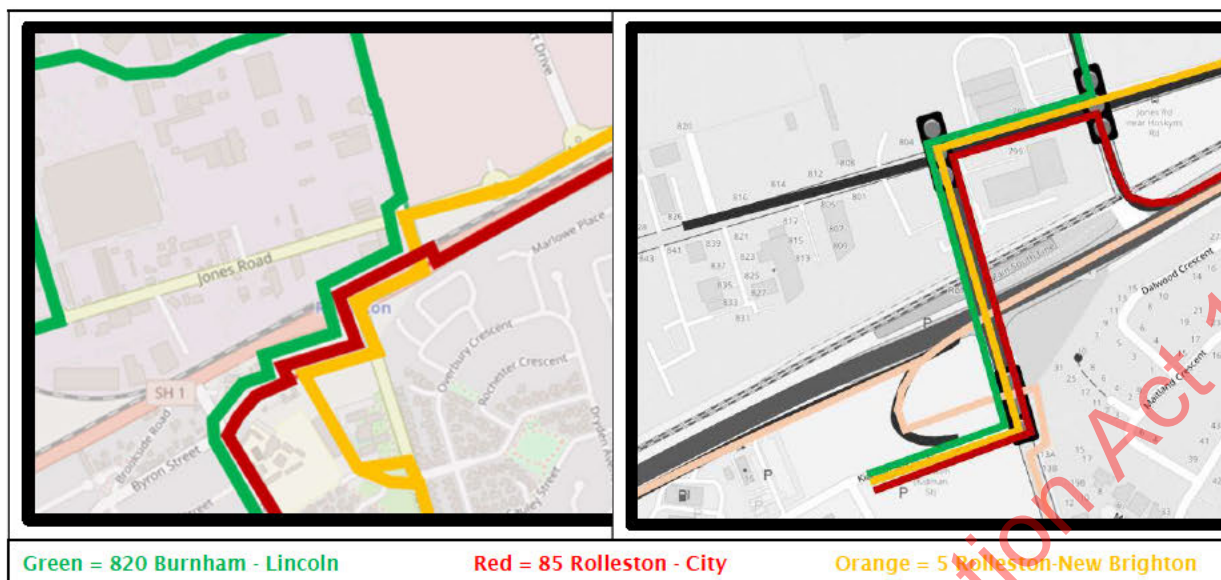


Figure 6: Bus Routing for Straight Flyover

3.3 Tie-ins, Property and Network Implications

Property

The Straight flyover option has a requirement for property primarily from the Drummond and Ethridge site, as the flyover and its northern intersection will require land from the D&E's western and northern boundaries. Accesses to the RV centre and Tailored Energy (including public weigh bridge) will be affected.

All of the remaining land required for the footprint of the flyover and its ramps is owned by either Waka Kotahi or the Selwyn District Council.

The residential properties on Rolleston Drive north, just south of the new signalised intersection with Kidman, will have specifically designed access (probably their own service lane). Otherwise, no other property accesses are directly affected by this option.

Tie-Ins

The tie-in points for this project – that is where the new infrastructure joins up with the existing are:

- Rolleston Drive North – between Kidman Street and Norman Kirk Drive intersection
- Kidman Street – east of Norman Kirk Drive intersection
- Jones Road – west of the RV Centre site, and east of Hoskyns Road
- Hoskyns Road – north of Jones Road

Network Implications

Key traffic movements in the Rolleston area are effected by the Straight Flyover option as follows;

- **Travel along State Highway 1 (SH1) through Rolleston:** The traffic signals at Rolleston Drive and Hoskyns Road are removed and movements along SH1 through Rolleston no longer need to stop, they flow freely.
 - Congestion and delays for travel along SH1 are significantly reduced.
- **A Rolleston township resident travelling towards Christchurch:** The main route that is taken to access SH1 is over the Straight Flyover, turning right onto Jones Road, turning right on Hoskyns Road and then using the free left slip lane from Hoskyns Road to SH1 to travel towards Christchurch. The main alternative route out of Rolleston continues to be along Levi Road and accessing Weedons Interchange from the south.
 - The route via the Flyover and onto SH1 via Hoskyns Road will take a little longer than the current direct right turns onto SH1. But the Flyover route eliminates the crash risk from the traffic signals on SH1 which is increasing over time, e.g. for right turn movements at these signals.

- The route along Levi Road is becoming more congested over time. With the Straight Flyover in place, a similar level of traffic will continue to use this route during peak times and congestion will remain.
- **A Rolleston township resident returning to Rolleston from Christchurch:** The main access is provided by the service lane which runs westbound alongside SH1, access to Kidman Street from this service lane, and the existing left turn movement onto Rolleston Drive.
 - The route via the service slip lane into the Rolleston township area is relatively direct and the removal of the signals on SH1 will reduce congestion and delays for travel from the Christchurch area into Rolleston. From the service lane traffic can access Tennyson Street and Rolleston Drive North (via Kidman Street).
 - There is a risk that the high volume of traffic anticipated to use the service slip lane to access Kidman Street and Rolleston Drive North could result in a queue back onto SH1 in peak times. To mitigate this risk, traffic signals will be installed on Kidman Street and the capacity at these signals and at the Kidman Street / Rolleston Drive North intersection will be designed to accommodate anticipated future traffic volumes. Additionally, the traffic signal timings can be operated so that the queue back on SH1 is controlled.
- **A Rolleston Resident who works in the Industrial Area:** Access to and from Rolleston and the Industrial area is provided via the Straight Flyover.
 - The Straight Flyover provides a direct route between Rolleston and the Industrial area and will provide a reliable travel times for these traffic movements.
- **Trucks travelling to/from Christchurch to the Industrial Area:** Travelling to and from Christchurch, trucks are directed to access the Industrial Area via the Weedons Interchange and Jones Road.
 - There is a risk that the increased traffic volumes at the Weedons Interchange with the Straight Flyover that delays may increase delays for certain movements through the interchange. Delays from the SH1 westbound off-ramp to the Interchange in particular could be greater, effecting trucks making this movement in peak times.
 - To reduce the level of delays anticipated at the Weedons Interchange, a roundabout meter may be required on Levi Road to create gaps in the traffic on Levi Road for vehicles using the SH1 westbound off-ramp.
- **Trucks travelling to/from SH1 South to the Industrial Area:** From the south, the route for trucks into the Industrial area is to turn left at the Dunns Crossing Road roundabout and use Two Chain Road.
 - No significant delay or congestion is anticipated at the Dunns Crossing Road roundabout or along Town Chain Road.
- **People travelling to/from businesses and properties on the section of Jones Road west of Hoskyns:** Access to SH1 towards Christchurch is direct, vehicles can turn right onto Hoskyns Road and access SH1 via the free moving left slip lane. Access to Rolleston will be provided by travelling over the Straight Flyover towards Rolleston. Heading to SH1 to the south two routes can be used, either via Two Chain Road and the Dunns Crossing Roundabout or over the Straight Flyover, turning right onto Kidman Street, and then using the service lane to access SH1.
 - No significant delay or congestion on the route to SH1 towards Christchurch is expected, this is likely to be a direct and reasonably free-flowing movement.
 - Heading to Rolleston, the route over the Straight Flyover will be quicker than the current route through the SH1 signals where congestion and queues are anticipated the grow significantly over time. Additionally, the Straight Flyover route eliminates the crash risk with the traffic signals which is increasing over time.
 - Although a longer route, no significant delay or congestion is expected along Two Chain Road and at the Dunns Crossing Roundabout.
- **People travelling from SH1 south to the Rolleston town and residential areas:** Access into Rolleston from SH1 south is provided via the roundabout at Dunns Crossing Road / SH1. Traffic can use the roads through Rolleston to get to certain locations, for example Brookside Road or Lowes Road to reach the Town Centre and residential areas. If the occasional driver does not turn off at Dunns Crossing Road, the Weedons Interchange can be used to access the Rolleston Area.
 - Although the routes into Rolleston town from SH1 south are longer, no significant congestion or delay is expected on these movements and the right turn crash risk turning off SH1 is significantly reduced.

The movements described above largely result in traffic volumes aligning with the desired Rolleston network framework. Jones Road, Weedons Road, and Levi Road are within desired traffic volume ranges and the Town Centre traffic flows fluctuate, but remain at levels which are around the desired future levels.

3.4 Engineering Details

The basic engineering details of the bridge structure, and its construction, are outlined here:

Bridge Structure

- Four spans of 25/25/35/25m length from South to North.
- Two bridge abutments. Three piers, located in SH1 median, road reserve between SH1 & Rail Corridor, and adjacent to rail corridor.
- Precast prestressed concrete 1525mm deep Super-T girders. Monolithic with piers/abutments.
- Piers/abutments consist of reinforced concrete crosshead, columns and bored piles.
- 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 x 1.5m shoulders, one x 3.0m shared path and one 2.0m footpath. Total width is 18.5m.
- Eight, precast, prestressed concrete 1525mm deep Super-T girders with 200mm insitu deck slab. Total structural depth of 1725mm

Construction Approach

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.

3.5 Key Risks and Issues

The key risks impacting on the skewed flyover option:

- The flyover landing on the northern side makes use of a site currently used for access to KiwiRail corridor and adjoining properties. The flyover footprint will require this property and will expand into the Drummond and Etheridge site. Further design updates may also impact the D&E site on its Jones Road and Rail corridor boundaries. The tolerance of the property owner to the acquisition process is unknown.
- There may also be property implications for the Tailored Coal property and RV centre on Jones Road (being investigated).
- While this option is not the most expensive of the flyover options, its basic cost, plus the additional elements required to make it work are pushing this option toward the limit of the NZUP funding.

The straight flyover option has not yet been considered in the public forum.

4 OPTION 13: TENNYSON STREET CONNECTION (FLYOVER OR UNDERPASS)

4.1 Brief Description

The Tennyson Street to George Holmes Drive connection Straight Alignment option consists of the elements described in the following bullets, with the design images shown in Figure 7, Figure 8, Figure 9 and Figure 10.

- A flyover over SH1 directly connecting George Holmes Drive to Tennyson Street.
- Flyover will require signalised intersections at George Holmes/Jones and Tennyson/Kidman
- Significant reworking of the accesses to the businesses on Tennyson Street, on its northern end, will be required.
- The signalised intersection of Rolleston Drive North / SH1 is maintained.
- The signalised intersection of Hoskyns Road / SH1 is removed and replaced with a left-out only from Hoskyns Road.
- The southbound service lane is part of this option, providing access to the businesses north of Tennyson Street. Service lane will not accommodate access to Tennyson Street. Left-out from Tennyson Street to SH1 is the only movement at the intersection
- It will allow left-in/left-out to Brookside.
- Signalised intersection at George Holmes / Jones.

The possibility of an underpass instead of a flyover is a possible option – it will have the same access provisions as the flyover version, however the information below typically relates to the flyover version.



Figure 7: Tennyson to George Holmes Flyover



Figure 8: George Holmes / Jones intersection

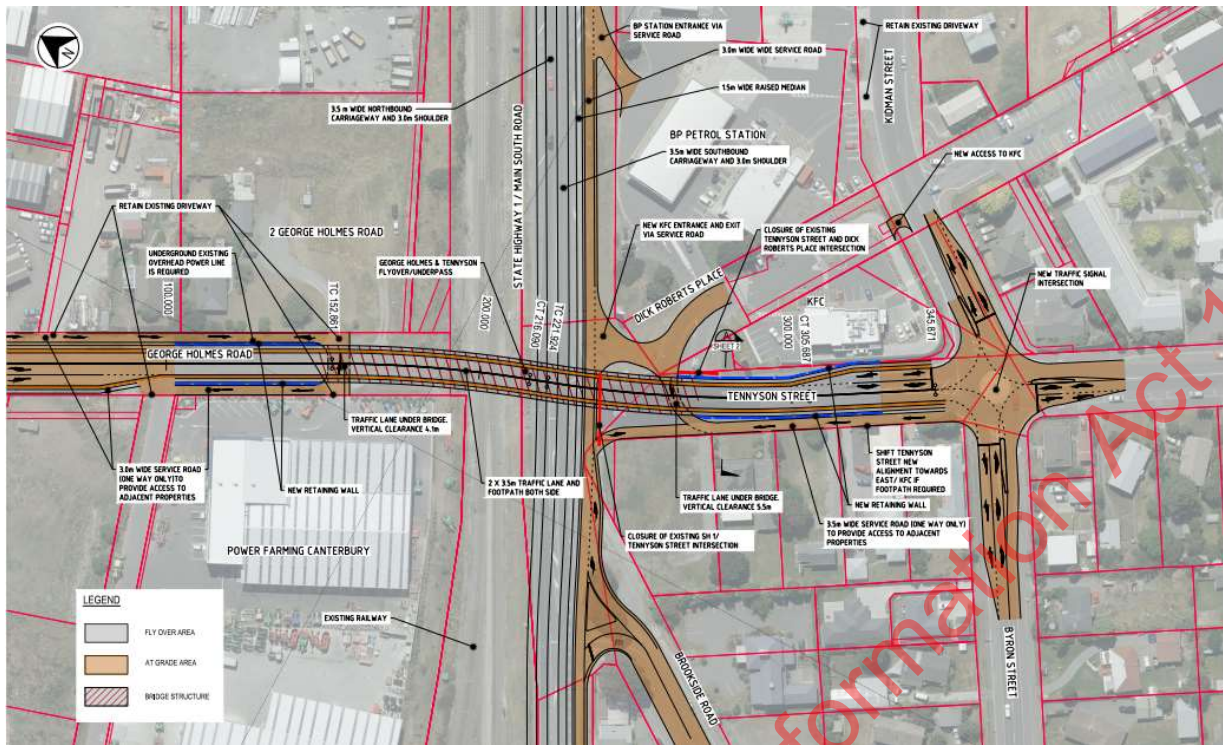
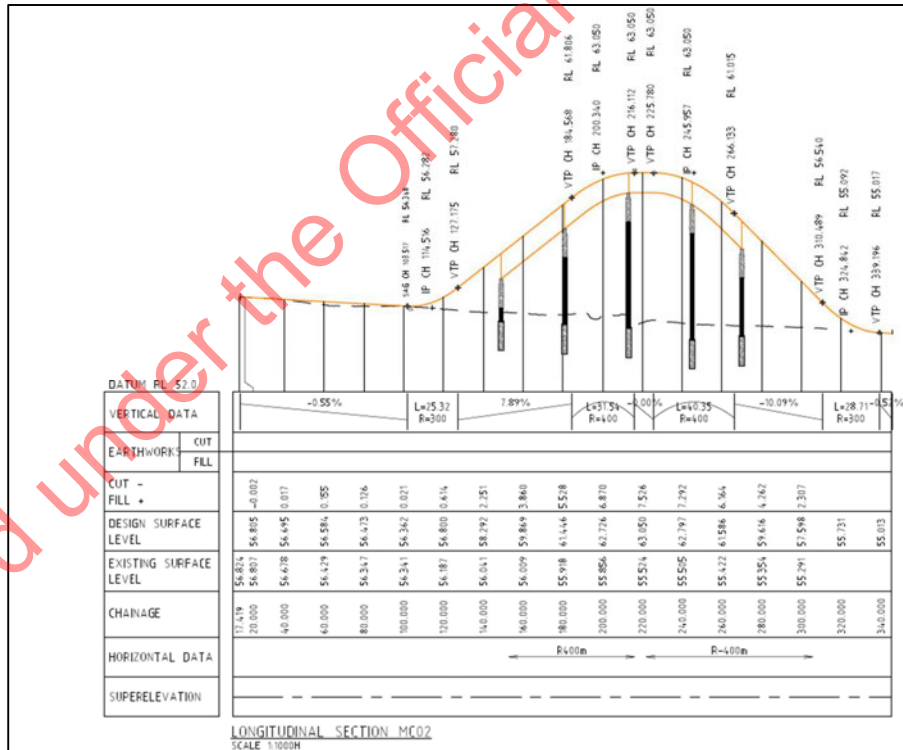


Figure 9: Tennyson Flyover or Underpass – initial concept



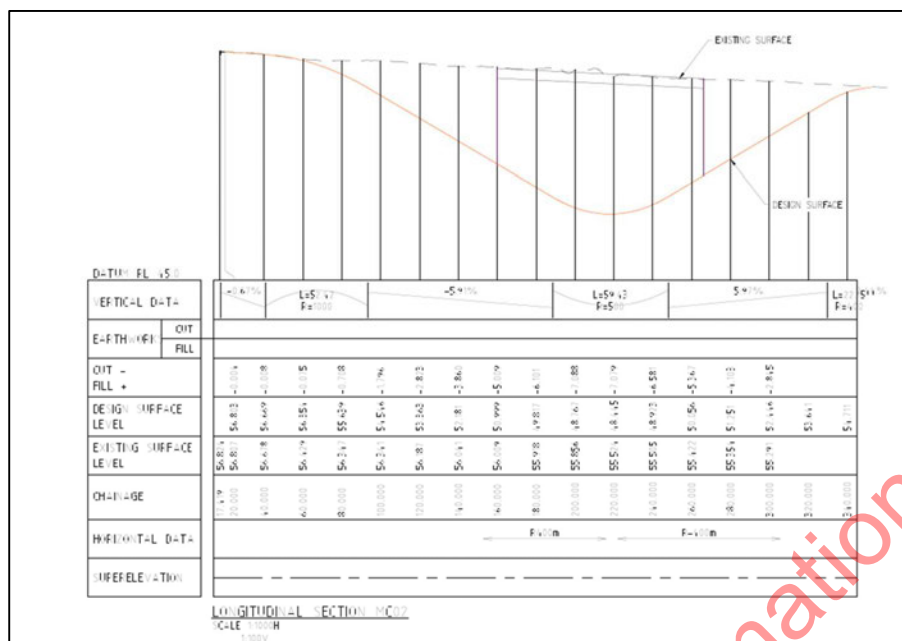


Figure 10: Tennyson Flyover and Underpass – initial concept long section

4.2 Multi-modal operation

The Tennyson-George Holmes option offers the following:

Pedestrians and Cyclists

In general, this configuration is considered to offer benefits to pedestrians and cyclists, in that the need to use highway traffic signals is removed, although one signal set remains which cyclists might choose to use. This option also connects cyclists and pedestrians to the town centre, which is a low speed environment (with inherently lower safety risk), but this may be countered, to some extent, by the increase in vehicle volumes using Tennyson Street and the flyover.

Cycle and pedestrian connections and crossings are to be provided on all legs of the flyover signalised intersections

- Pedestrian pathways provided on both sides of the flyover. The flyover grades on the Tennyson Street are approaching 10% which is high for a cycle facility (necessary to cater for the required movements under the flyover).
- Jones Road side is approaching 8% which is at the top end of acceptable grades. The slope is however short.
- The paths on the flyover connect the shared use paths on the north side which are being developed under Selwyn District Councils SUP plans, and into the slow town centre on the south side.
- Pedestrian access from Rolleston Drive, across the highway to the railway station and the path to Hoskyns Road will remain.
- The median barrier between the highway north-south lanes and between the south bound lane and service lane will preclude pedestrian and/or cyclist crossing of the highway.

Pedestrian access to the businesses on Tennyson Street north of Kidman/Byron is yet to be determined. This area has space constraints at the moment, which push the flyover to the property boundaries, however with property development on the south side, there may be an opportunity to better accommodate pedestrian space.

Public Transport

Bus routing will be affected by the removal of the Hoskyns Road signals primarily. In the images in Figure 11 below, are the existing routes and alternative routes:

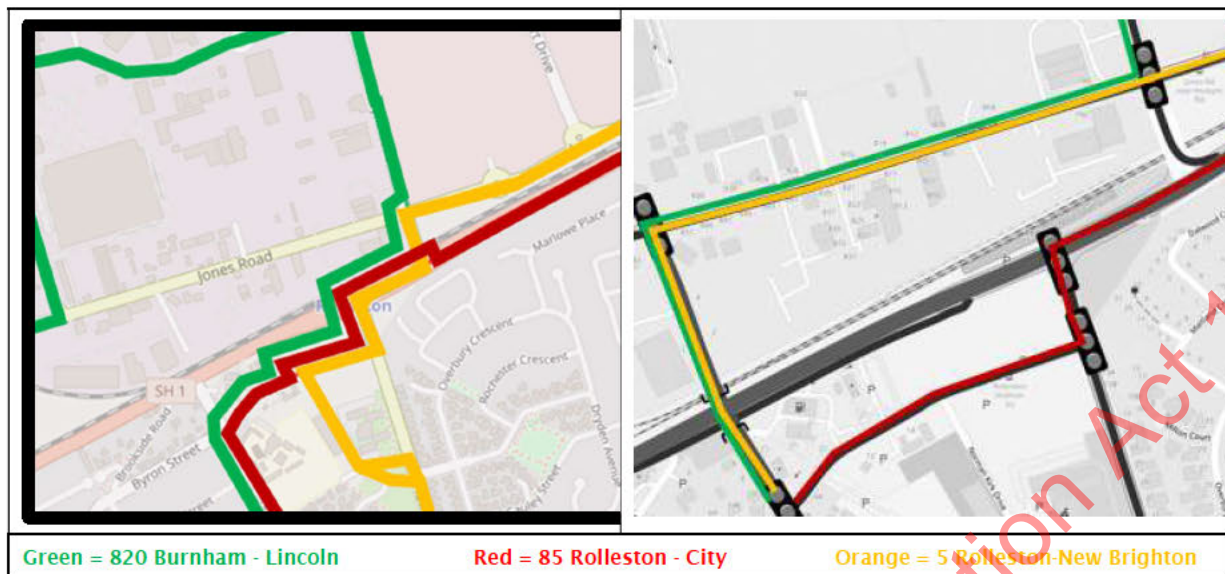


Figure 11: Bus Routing for Tennyson-George Holmes Flyover/Underpass

The bus routes are affected by the removal of the right-turn capability onto and off the highway at Hoskyns Road.

- Route 85 (red) will need no re-routing consideration.
- Routes 820 (green) and Route 5 (orange) will need to travel along Jones Road to George Holmes Road and travel into Tennyson. The orange route could then use Kidman Street to Norman Kirk Drive to resume normal routing.

There is currently a (multi) bus-stop on Kidman Street, between Norman Kirk Drive and Rolleston Drive North. The intention is to continue with the stops on Kidman Street.

4.3 Tie-ins, Property and Network Implications

Property

The Tennyson – George Holmes option, at this stage of development, does not require the acquisition of any additional property. The concept plans have been drawn such that all of the land required for the footprint of the flyover and its ramps is owned by either Waka Kotahi or the Selwyn District Council. Given the tightly constrained space there is a risk that some land may be required for the construction envelope to build the structures.

It should also be noted that this option impacts on the accesses to properties and businesses on George Holmes Road and Tennyson Street north of Kidman Street which may impact on how the properties and businesses will have to manage their layouts and operations.

Tie-Ins

The tie-in points for this project – that is where the new infrastructure joins up with the existing are:

- Rolleston Drive North – new intersection on SH1. Ties in north of current Hoskyns / SH1 intersection/
- Kidman Street – east of Tennyson Street
- Tennyson Street – south of Kidman Street
- Byron Street – west of Tennyson Street
- Jones Road – east and west of the George Holmes intersection
- Hoskyns Road – north of Jones Road

Network Implications

Key traffic movements in the Rolleston area are affected by the Tennyson Drive Flyover option as follows;

- **Travel along State Highway 1 (SH1) through Rolleston:** The traffic signal at Rolleston Drive / SH1 is maintained and the volume of traffic passing through this intersection reduces. The traffic signal at Hoskyns Road / SH1 is removed and traffic through this location flows freely.
 - Congestion and delays for travel along SH1 are reduced, but some minor-to-moderate level of delay remains at peak time at the Rolleston Drive North / SH1 signal into the future.
- **A Rolleston township resident travelling towards Christchurch:** Direct access to SH1 is retained by the Rolleston Drive North / SH1 signals.
 - The crash risk, e.g. for right turns, with the traffic signals on SH1 remains and is increasing over time.
 - The route along Levi Road is becoming more congested over time. With the Tennyson Drive Flyover in-place, traffic volumes on this route will mildly reduce which helps manage congestion levels in this area.
- **A Rolleston township resident returning to Rolleston from Christchurch:** The main access is provided by the existing left-turn slip lane at the Rolleston Drive North / SH1 signals, the service lane which runs westbound alongside SH1, and the existing left turn movement at Rolleston Drive South.
 - The route via the left turn into Rolleston Drive North towards the Rolleston township area is relatively direct, and traffic can access Tennyson Street via Kidman Street and in the future the Moore Street extension. From the service lane traffic can access the businesses currently located on the south side of SH1.
- **A Rolleston Resident who works in the Industrial Area:** Access to and from Rolleston and the Industrial area is provided via the Tennyson Drive Flyover.
 - The Tennyson Drive Flyover provides a direct route between Rolleston and the Industrial area and will provide reliable travel times for these traffic movements, albeit that everything must pass through the Kidman/Tennyson traffic signals that may periodically experience delays.
 - The Tennyson Drive Flyover removes traffic travelling between Rolleston and the Industrial area from the signals at SH1 / Rolleston Drive North, reducing the overall volume of traffic at this intersection and reducing delays and congestion.
 - A proportion of traffic using the Tennyson Drive Flyover is predicted to use Tennyson Street, through the town centre, to travel to/from the Flyover. E.g. 35% of traffic travelling northbound on the Tennyson Flyover towards the industrial area in the morning peak is estimated to have travelled through the Town Centre.
- **Trucks travelling to/from Christchurch to the Industrial Area:** Travelling to and from Christchurch, trucks are directed to access the Industrial Area via the Weedons Interchange and Jones Road.
 - The Weedons Interchange is predicted to operate without significant delays, queueing or congestion because of the direct access provided to/from SH1 at Rolleston Drive North and the reduced delay and congestion at this location. In this scenario, traffic volumes through Weedons Interchange do not significantly increase.
- **Trucks travelling to/from SH1 South to the Industrial Area:** From the south, the route for trucks into the Industrial area is to turn left at the Dunns Crossing Road roundabout and use Two Chain Road.
 - No significant delay or congestion is anticipated at the Dunns Crossing Road roundabout or along Two Chain Road.
- **People travelling to/from businesses and properties on the section of Jones Road west of Hoskyns:** Access to SH1 towards Christchurch is direct, vehicles can turn right onto Hoskyns Road and access SH1 via the free moving left slip lane. Access to Rolleston will be provided by travelling onto the Tennyson Drive Flyover towards Rolleston. Heading to SH1 to the south two routes can be used, either via Two Chain Road and the Dunns Crossing Roundabout or over the Tennyson Drive Flyover, turning left onto Kidman Street and then using Rolleston Drive North to access SH1.
 - No significant delay or congestion on the route to SH1 towards Christchurch is expected, this is likely to be a direct and reasonably free-flowing movement.
 - Heading to Rolleston, the route over the Tennyson Drive Flyover will be quicker than the current route through the SH1 signals where congestion and queues are anticipated the grow significantly over time. Additionally, the Tennyson Drive Flyover route eliminates the crash risk with the traffic signals at Hoskyns Road / SH1 which is increasing over time.
 - Although a longer route, no significant delay or congestion is expected along Two Chain Road and at the Dunns Crossing Roundabout.
- **People travelling from SH1 south to the Rolleston town and residential areas:** Access into Rolleston from SH1 south is provided via the roundabout at Dunns Crossing Road / SH1. Traffic can use the roads through Rolleston to get to certain locations, for example Brookside Road or Lowes Road

to reach the Town Centre and residential areas. If the occasional driver does not turn off at Dunns Crossing Road, the Weedons Interchange can be used to access the Rolleston Area.

- Although the routes into Rolleston town from SH1 south are longer, no significant congestion or delay is expected on these movements and the right turn crash risk turning off SH1 is significantly reduced. This crash risk is currently increasing over time.

The Tennyson Drive Flyover has a significant adverse effect; it is expected to increase traffic volumes on Tennyson Street in the Town Centre to undesirably high levels, diminishing the “liveable community”. Kidman Street traffic volumes are also anticipated to increase. Traffic volumes in other locations remain within desired ranges.

4.4 Engineering Details

The basic engineering details of the bridge structure, and its construction, are outlined here.

Bridge Structure

- Four spans of 25m length each from South to North.
- Two bridge abutments. Three piers, located in SH1 median, road reserve between SH1 & Rail Corridor, and adjacent to rail corridor.
- Precast prestressed concrete 1225mm deep Super-T girders. Monolithic with piers/abutments.
- Piers/abutments consist of reinforced concrete crosshead, columns and bored piles.
- Vertical grades is 7.89% approaching Jones Road and 10.0% approaching Kidman Street. Clearance is achieved over SH1 for Over Dimension (OD) vehicles and required clearance is achieved over Kiwirail line.
- Bridge typical section is two x 3.5m lanes, 2 x 1.5m shoulders and two x 3.0m shared path. Total width is 16m.
- Seven, precast, prestressed concrete 1225mm deep Super-T girders with 200mm insitu deck slab. Total structural depth of 1425mm

Construction Approach

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.

Underpass Structure

While considered as an option for assessment purposes, the Tennyson – George Holmes underpass has not had a construction approach investigated. At a high-level, it is understood that the process to create an underpass of this size and at the shallow depth envisaged would need to be a cut-and-cover approach. This would shut both the highway and the rail line for unacceptable periods of time, with no capability for bypass.

4.5 Key Risks and Issues

The key risks impacting on the Tennyson George Holmes flyover option:

- This option retains the traffic signals on SH1 at Rolleston Drive North. As such this project does not offer the full suite of safety improvements originally envisioned.
- The construction of the flyover presents considerable challenges. While the bridge itself is a standard process, generating space on either side, particularly at the Tennyson Street end, to enable construction and allow equipment to work will have significant impacts on the adjacent properties and business. The lack of space available is a very imposing constraint on this option.
- The straight flyover between Tennyson and George Holmes will generate higher traffic volumes on Kidman Street and Tennyson Street – which is intended as a low volume – slow speed town centre environment.
- The vehicle movements around the businesses at the northern end of Tennyson Street are not intuitive

The Tennyson – George Holmes option has not been considered in the public forum.

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