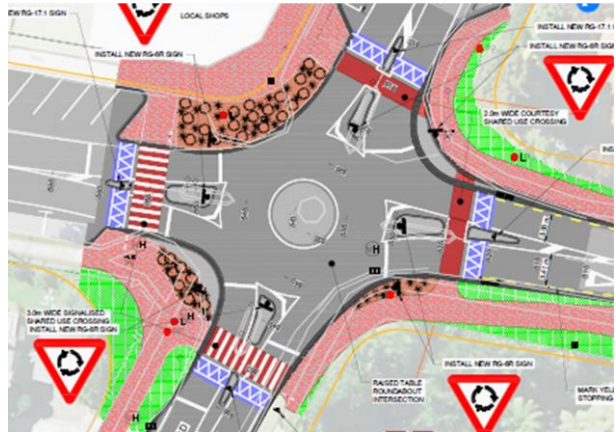


Springfield & Otonga Road Roundabout




Detail design road safety audit



Report prepared for
Rotorua District Council
July 2017



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1 Introduction

1.1. Context

ViaStrada has been commissioned by Rotorua Lakes Council (RLC) to undertake a desktop safety audit of the detail design stage drawings of the proposed upgrade of the existing roundabout at the intersection of Springfield Road and Otonga Road. The proposed upgrade essentially enlarges the existing roundabout and provides facilities for active road users.

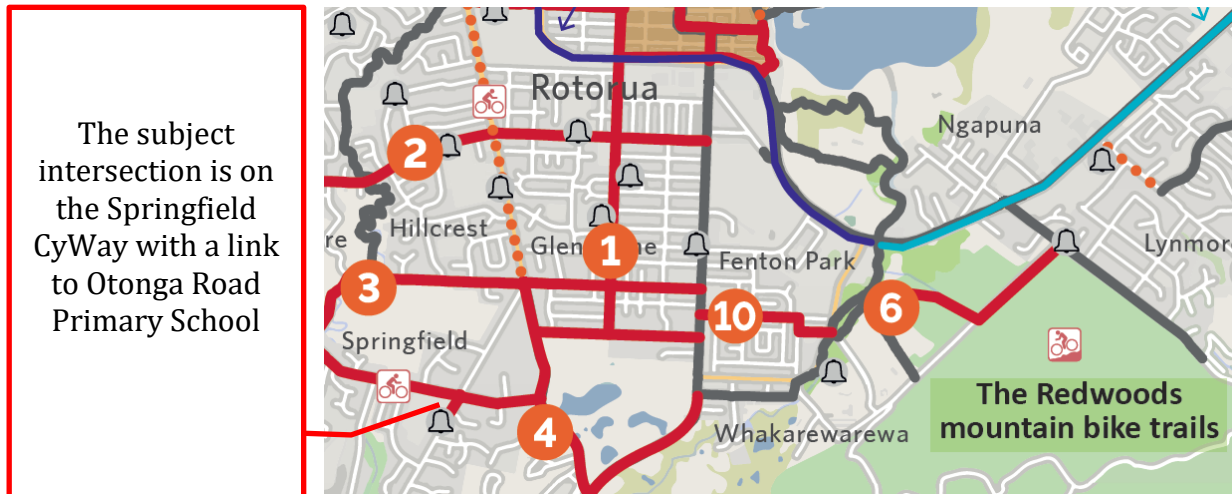


Figure 1-1: Roundabout location

1.2. CAS

A search of the NZTA Crash Analysis System (CAS) database for all crashes within a 100 m radius of the roundabout in the preceding 5 year period found 5 recorded crashes.

There has been no fatal or serious injury crashes and one minor injury crash, which involved a circulating cyclist hit by a vehicle that failed to give way entering the roundabout.

A copy of the CAS report is attached in Appendix B.

1.3. The safety audit team

The safety audit team (SAT) consisted of:

- Warren Lloyd SAT leader
- Jon Ashford SAT member

1.4. Site visit

No site visit has been undertaken as part of this audit, but the SAT leader has visited and is familiar with the intersection.

1.5. Previous audits

We have been advised by Opus Consultancy that no previous audits have been undertaken.

1.6. Audit procedure

The audit follows the NZ Transport Agency Road Safety Audit procedures for projects. The expected crash frequency is qualitatively assessed on the basis of expected exposure (how many road users will be exposed to a safety issue) and the likelihood of a crash resulting from the presence of the issue. The severity of a crash outcome is qualitatively assessed on the basis of factors such as expected speeds, type of collision, and type of vehicle/object involved.

Table 1: NZTA Safety audit concern categories

Concern	Suggested action
Serious	A major safety concern that must be addressed and requires changes to avoid serious safety consequences.
Significant	Significant concern that should be addressed and requires changes to avoid serious safety consequences.
Moderate	Moderate concern that should be addressed to improve safety
Minor	Minor concern that should be addressed where practical to improve safety.

The guideline also categorises safety concerns by probability of the problem leading to a crash and the severity of any crash that may occur (refer **Table 2**).

Table 2: Crash risk matrix

Severity (likelihood of death or serious injury)	Frequency (probability of a crash)			
	Frequent	Common	Occasional	Infrequent
Very likely	Serious	Serious	Significant	Moderate
Likely	Serious	Significant	Moderate	Moderate
Unlikely	Significant	Moderate	Minor	Minor
Very unlikely	Moderate	Minor	Minor	Minor

The ranking system takes into account the risk of a crash occurring and the severity of the outcome. The concern categories and risk matrix helps the auditor and client to

assign priority to addressing the issues raised which can be used inform programming of safety projects.

When considering the severity of a particular issue, it is important to note that the audited facility caters for pedestrians and cyclists who are “vulnerable” road users. Naturally, a conflict between these users and a motor vehicle is more likely to result in death or serious injury than a conflict between two motor vehicles. This likelihood increases with the speed of impact: it is assumed that a collision between a vulnerable road user and a vehicle travelling above 30 km/h is likely to result in death or serious injury. However, note that the lowest concern rating for an issue that involves a likely chance of death or serious injury is moderate. A low impact speed of 10 km/h or lower is unlikely to result in death or serious injury and therefore can contribute to a concern being rated as simply minor.

The ranking of the frequency of expected crashes has been assessed by the SAT in accordance with **Table 3**.

Table 3: Indicative crash frequency

Crash Frequency	Indicative description
Frequent	Multiple crashes (more than 1 per year)
Common	1 every 1 – 5 years
Occasional	1 every 5 – 10 years
Infrequent	Less than 1 every 10 years

1.7. Items not covered

This scheme safety audit does not cover the aspects of:

- Intersection capacity
- Street lighting levels

1.8. Disclaimer

The findings and recommendations in this report are based on an examination of available relevant plans, the specified road and environs, and the SAT’s professional knowledge and experience. However, it must be recognised that no audit can guarantee the elimination of all possible safety concerns as all traffic environments consist of a multitude of elements that are never completely within the control of engineering design.

Safety audits, by nature, focus on aspects relating to safety and therefore do not constitute a complete review of design or assessment of standards with respect to engineering or planning documents. This audit applies to the stated project. Whilst some issues covered are general and might be applicable to other locations, the SAT does not take any responsibility for transferral of concepts to other projects or locations.

2. Safety audit findings

2.1. General issues

2.1.1. Signalised zebra crossing note		Comment
<ul style="list-style-type: none"> <i>Risk ranking:</i> Comment 		
<p>Drawing sheet C013 notes that the zebra crossings are signalised. We have been advised by the Opus designer that this no longer the case. The SAT have undertaken this audit on the understanding that the zebra crossings are not signalised.</p>		
Recommendations:		
2.1.1.1.	That drawing C013 is amended.	
<p><i>Designer Response:</i> Reference to signalised crossings is inaccurate (a remnant of previous design) and will be removed from drawings.</p>		
<p>Safety Engineer: <i>Accept Designers response</i></p>		
<p>Client Decision: <i>Accept Designers response</i></p>		
<p>Action Taken: Click here to enter text.</p>		

2.1.2. Stormwater sump in traffic lane		Moderate
<ul style="list-style-type: none"> Crashes are likely to be: Occasional Death or serious injury: Likely <i>Risk ranking:</i> Moderate 		
<p>Drawing sheet C013 shows an existing kerbside storm water sump in the south-east quadrant of the roundabout. In the proposed design, the sump is located within the carriageway, on the likely tracking path of vehicle wheels and cyclists.</p> <p>Drivers and cyclists may swerve to avoid it or cyclists may lose control if they hit it unexpectedly.</p>		
Recommendations:		
2.1.2.1.	That the storm water sump is relocated clear of the wheel track within the carriageway.	
<p><i>Designer Response:</i> Sheet C14 shows that this existing cesspit is to be removed and a new double cesspit to be installed at the base of the ramp (along the kerblines) on the Eastern arm of Otonga Rd. The existing cesspit will be removed from Sheets C13 and C15.</p>		



Safety Engineer:	Accept Designers response
Client Decision:	Accept Designers response
Action Taken:	Click here to enter text.

2.1.3. Manhole lid in traffic lane	Comment
<ul style="list-style-type: none"> <i>Risk ranking:</i> Comment 	
<p>Drawing sheet C013 shows an existing median side stormwater manhole (MH) lid, also in the south-east quadrant of the roundabout. In the proposed design, the MH lid is located on the likely tracking path of circulating vehicles and vehicles entering from Springfield Road east approach. This can result in the lids being lifted off their frames and becoming on-road hazards.</p>	
Recommendations:	
2.1.3.1.	Ensure that this MH lid and all other service covers are securely seated or fixed in their frames.
<i>Designer Response: Comment noted, will pass this onto the Contract Manager</i>	
Safety Engineer:	Accept Designers response
Client Decision:	Accept Designers response
Action Taken:	Click here to enter text.

2.1.4. No kerb beside rain garden	Minor
<ul style="list-style-type: none"> <i>Crashes are likely to be:</i> Infrequent <i>Death or serious injury:</i> Unlikely <i>Risk ranking:</i> Minor 	
<p>Section B on Sheet C014 and Section E on Sheet C016 both show the rain garden in the south-west quadrant. The detail show there is no kerb proposed between the edge of the carriageway and the rain garden on this acute corner. The other rain gardens are protected by a raised kerb.</p> <p>An errant vehicle or vehicle miss-judging the corner can drop off the edge of the road and at best, damage the rain garden and landscape planting or at worst, over react with steering (similar to an edge of seal crash) resulting in veering back across the road, possibly into the zebra crossing.</p>	
Recommendations:	



2.1.4.1.	That a kerb upstand is provided on the south-west quadrant, consistent with the other rain gardens.
<i>Designer Response: Designer agrees with SAT, kerb upstand will be provided along the edge of the garden and the concrete apron</i>	
Safety Engineer: Accept Designers response	
Client Decision: Accept Designers response	
Action Taken: Click here to enter text.	

2.1.5. Skid resistance	Minor
<ul style="list-style-type: none"> • Crashes are likely to be: Infrequent • Death or serious injury: Unlikely • Risk ranking: Minor 	
<p>All approaches to the roundabout are long and straight which accommodates higher speed. This may result in vehicles braking sharply as they approach the crossing or limit line. Rear end collisions in braking zones can increase with differential surface friction on the approach and within the intersection.</p> <p>Sheet C015 indicates that could be up to four different pavements types on the intersection approaches.</p>	
Recommendations:	
2.1.5.1.	Check skid resistance of the different approach surfaces as necessary to minimise differential surface friction.
2.1.5.2.	The AC surface could be grooved on the roundabout approaches to improve skid resistance if required.
<p><i>Designer Response: No change to design. This is an existing intersection that has been a mini-roundabout for many years, local drivers are well aware of this intersection and their approach speeds should be appropriate to stop/pause at the limit line. For visiting drivers the long straight approaches will give them sufficient view to the advanced warning signage, gated give way signs, line marking on ramps, central mountable island and raised profile of the intersection. Also, street lighting is being improved and LED luminaries are to be installed, enhancing the visibility of this intersection in the hours of darkness. Therefore, there should be sufficient visual cues to approaching drivers to lower their approach speeds well in advance of the intersection. In addition, Springfield Rd (Otonga Rd to MacDowell St) is on RLC's pavement rehabilitation projects this year. The other approaches are not proposed to be resurfaced or rehabilitated in the next 12 months.</i></p>	



Safety Engineer:	<i>Accept Designers response</i>
Client Decision:	<i>Accept Designers response</i>
Action Taken:	Click here to enter text.

2.2. Alignment & design

<p>2.2.1. Courtesy & zebra crossing markings</p>	<p>Moderate</p>
<ul style="list-style-type: none"> • Crashes are likely to be: Occasional • Death or serious injury: Likely • Risk ranking: Moderate 	
<p><u>Courtesy crossings</u></p> <p>The plans indicate that the two shared use courtesy road crossings (not on the CyWay route) are to be coloured red. We accept that this is a shared facility but note that green, as specified by MOTSAM for <u>cycle facilities</u>, is used throughout NZ to highlight road crossings and conflict points. The use of green colouring alerts motorists to expect cyclists on what may otherwise appear to be a pedestrian only crossing facility.</p> <p><u>Zebra crossings</u></p> <p>The plans indicate that the two zebra crossings (on the CyWay route) are to be marked with red and white bands. The zebra crossing is also intended for shared use, although under current NZ legislation, cyclists must dismount and walk their bikes across the crossing to achieve the ‘right of way’ of a pedestrian.</p> <p>As noted above, green is specified by MOTSAM to highlight road crossings and conflict points for cycle facilities and for national consistency, the crossing should be marked with green and white bands. The use of green colouring alerts motorists to expect cyclists on what may otherwise appear to be a pedestrian only crossing facility.</p> <p><u>Key considerations</u></p> <p>The SAT suggest that <u>all shared</u> road crossings should have the same ‘treatment’ (colour, texture, markings, signs) throughout the city, and we understand that RLC have adopted red as the preferred colour treatment. The SAT is concerned that drivers and crossing users may not be able to differentiate between the two types of shared use crossings as they are currently proposed for this roundabout. This is exacerbated at this location as there are four crossings at the intersection and most drivers and some crossing users are likely to encounter one of each crossing type on their journey through the intersection.</p> <p>Confusion over crossing types could also result in pedestrians or cyclists mistakenly entering the crossing thinking the driver is slowing down to allow them to cross, when the driver is only slowing down for the ramp and not intending to stop or allow people to cross. The possible outcome of a misunderstanding or error of judgement at a crossing is a collision between a crossing user and a vehicle which is not considered a safe system.</p> <p>The SAT add that the red surface colouring (as used in Christchurch prior to the switch to green) can be difficult to see at night.</p>	

Recommendations:	
2.2.1.1.	That consideration is given to adopting green as specified by MOTSAM to highlight road crossings and conflict points for facilities that will be used by cyclists.
2.2.1.2.	That consideration is given to having a city wide standard for shared use crossings.
Designer Response: <i>Designer agrees with SAT.</i>	
Safety Engineer: <i>Agrees there should be consistency and standardisation to the treatment of shared used crossings.</i>	
Client Decision: <i>RLC uses red at the colour to highlight crossing locations and will update Cycling Framework document to standardise the crossing treatments.</i>	
Action Taken:	Click here to enter text.

2.2.2. Crossing locations	Moderate
<ul style="list-style-type: none"> • Crashes are likely to be: Occasional • Death or serious injury: Likely • Risk ranking: Moderate 	
<p><u>Otonga Road</u></p> <p>Because the CyWay route connects to the school, consideration could be given to removing the Otonga Road zebra crossing at the roundabout and relocating it closer to the school. This would not disadvantage school riders and the increased safety of the crossing being further from the roundabout should make this CyWay a more desirable route for interested but concerned cyclists.</p> <p>The SAT note that there are ‘no stopping’ lines marked on the west side of Otonga Road and there is a very narrow edge line on the east side of Otonga Road that we assume people will park along when dropping off or collecting school children. There may be an opportunity to provide kerb buildouts and a raised platform crossing here or alternately a staged crossing with a median island.</p> <p><u>Springfield Road</u></p> <p>The issues discussed in 2.2.3 are exacerbated as a consequence of the CyWay crossing Springfield Road at the roundabout. This crossing location places unrealistic demand on pedestrians, cyclists and drivers as discussed in 2.2.9, and consideration should be given to utilising the existing zebra crossing location at Springfield Road Chainage 615, further from the roundabout.</p>	

Recommendations:	
2.2.2.1.	Designer to consider providing a shared CyWay crossing on Otonga Road at Chainage 870 to 875. This may include kerb build outs on a raised platform crossing or a staged crossing with a median island and the carriageway remaining flush. The roundabout crossings could all revert to courtesy crossings.
2.2.2.2.	If Council is comfortable with CyWay cyclists using the existing zebra crossing, then the crossing at Springfield Road Chainage 615 is considered a better location. This is because the decision demands on all road users are reduced in this location, compared to the roundabout location. Further, the CyWay path users are no longer required to share the narrow footpath between angle parked cars and the shop fronts. The roundabout crossings could all revert to courtesy crossings.
<p>Designer Response: <i>OTONGA RD: A crossing point closer to the School was considered, however the existing Springfield Rd shared path is heavily used by riders other than those on the school commute (e.g. recreational riders traveling to/from Whakarewarewa Forest) and a crossing point away from the desire line would not accommodate these users. Traffic modelling was done at this site (to investigate the viability of a signalisation) as part of the modelling pedestrian movement monitoring was undertaken and showed approximately of those pedestrians crossing the southern approach of Otonga Rd, 60% were crossing 30m south of the intersection. However, this may have also been due to the substandard crossing facilities currently at the intersection. After much deliberation with the Client it was decided the crossing location had to suit all users of the path, hence its placement on the desire line at the intersection.</i></p> <p><i>SPRINGFIELD RD: The existing zebra crossing is greatly underutilised, likely due to it not being in close proximity to either the local shops or the access to the Kindergarten or rear access to the Primary School. It is also dangerous to use in the winter months due to sun strike for drivers travelling East in the mornings. As part of the traffic modelling, pedestrian movements were monitored on the Western approach (from the zebra crossing to the intersection) and this was had the highest demand. Nearly half of the pedestrians crossing this approach in the morning peak were unaccompanied children. The local shops are a large pedestrian and cyclist “generator” and having a crossing facility close to these shops will meet demand. Designer was instructed to not compromise parking, and although changes to position of parking bays was accepted the Client declined any recommendation’s to remove parking bays to provide a crossing facility further away from the intersection. Designer agrees this crossing location could be placed further away from the intersection.</i></p>	
Safety Engineer: <i>Installed at the most appropriate location for all users</i>	

Client Decision:	No change to design, accept design as is.
Action Taken:	Click here to enter text.

2.2.3. CyWay route in front of shops		Moderate
<ul style="list-style-type: none"> Crashes are likely to be: Common Death or serious injury: Unlikely Risk ranking: Moderate 		
<p>The proposal, although not shown on the plan, suggests that the CyWay will continue along the north side of Springfield Road between the angle parking and shops. The residual space between the overhanging parked cars and the shop fronts, with the usual clutter of advertising and street furniture, plus some poorly parked bikes, will be an undesirable space for a shared CyWay path, particularly if the predicted CyWay volumes are realised. There is also little or no intervisibility between customers exiting the shops and (possibly fast moving) cyclists.</p> <p>Although this area in front of the shops could be deemed to be outside the project audit scope, the SAT are concerned for the safety and convenience all path users in this location.</p>		
Recommendations:		
2.2.3.1.	The designer consider relocating the CyWay zebra crossing over Springfield Road further from the roundabout so path users are not required to share the narrow path between angle parked cars and the shop fronts (refer Item 2.2.2).	
<p>Designer Response: <i>The CyWay route doesn't continue along the frontage of the shops as the Designer and Client share the same concerns as the SAT. However, we do agree the shops will be a destination for cyclists. The Designer has recommended to the Client that cycle parking (cycle racks) be provided outside the shops however the Dairy owner has advised they are proposing to relocate the entrance to their shop – RLC have decided to wait until they have confirmation of these proposed changes before installing any cycle racks. Designer recommends a "shared path ends" sign is provided on the northern side of crossing.</i></p>		
Safety Engineer:		Accepts Designers response
Client Decision:		Accepts Designers response
Action Taken:		Click here to enter text.



2.2.4. Horizontal deflection		Moderate
<ul style="list-style-type: none"> Crashes are likely to be: Occasional Death or serious injury: Likely Risk ranking: Moderate 		
<p>By inspection, (using the Austroads Part 6 1993: deflection guidance¹) there is insufficient deflection provided on any approach except for the Otonga Road south approach. The SAT accept that this may be mitigated by the vertical deflection which will reduce approach speed, see 2.2.5. The safety concern is that a lack of horizontal deflection will enable drivers to enter and travel through the roundabout without any geometric demand to moderate their speed. This means crashes that do occur, can be at a higher speed which increases crash severity.</p> <p>We note that 51% of injury crashes at urban roundabouts involve entering versus circulating vehicles².</p> <p>Crash modelling research³ has found that: <i>“the models indicate that reduction of mean circulating free speeds of 26km/hr by 20% would result in a 38% accident reduction in entering versus circulating accidents. The models also predict that the ‘entering versus circulating’ accident rate is 10 times worse at a circulating speed of 60km/h, compared with a circulating speed of 20km/h.”</i></p>		
Recommendations:		
2.2.4.1.	<p>That the designer reconsider the horizontal geometry through the roundabout and ensure that minimum deflection is provided on all approaches. The SAT suggest the designer should aim to balance the speed through the roundabout which results in a safer environment for all road users.</p>	
<p><i>Designer Response: Horizontal deflection has been greatly improved from existing, which was one of the key objectives of this project. However due to existing physical constraints (primarily existing road reserve available and overhead power network) and the requirement to provide a shared path on the southern side as well as ensuring sufficient corner radius be provided for large vehicles to negotiate the intersection the deflection improvements are limited. The raised profile of the intersection has been recommended to help off-set the limited horizontal deflection that can be provided to reduce vehicle speeds through this intersection.</i></p>		
Safety Engineer: Accepts Designers response		
Client Decision: Accepts Designers response		

¹ This has been superseded by the more complex deflection criteria in Austroads 4B 2015 guidance, however the 1993 version gives a quick check (see Figure 4.7 in Austroads Part 6) to ensure that minimum deflections are provided.

² Turner, S., & Roozenburg, A. (2006). Roundabout Crash Prediction Models.

³ Turner, S., & Roozenburg, A. (2006). Roundabout Safety–Influence of Speed, Visibility and Design.

Action Taken: [Click here to enter text.](#)

2.2.5. Vertical deflections	Moderate
<ul style="list-style-type: none"> • <i>Crashes are likely to be:</i> Occasional • <i>Death or serious injury:</i> Likely • <i>Risk ranking:</i> Moderate 	
<p>The limited horizontal deflection (issue 2.2.4) is supplemented at the roundabout by the inclusion of the ramp and raised platform which provides vertical deflection. The Opus designer has confirmed that the ramps and raised table is generally approximately 90mm higher than the existing road surface. However there are some safety concerns with the ramps and platforms as proposed.</p> <p>The vertical deflection is a ramp on the entry to the roundabout and the raised platform that extends through and around the roundabout to the departure ramp. It is not known to SAT how effective this design is for reducing traffic entry or circulating speed, particularly with the limited horizontal deflection.</p> <p>From speed survey research undertaken by the SAT for a separate project, it is evident that some drivers do not slow down for vertical deflection, relying on their vehicle suspension to smooth out the hump. And it was observed that it is common for slower drivers to slow down more at humps than drivers who are in a hurry.</p> <p>As previously discussed (issue 2.2.1.), a driver slowing down for the speed humps could result in waiting pedestrians or cyclists mistakenly entering the crossing when it is not safe to do so.</p>	
Recommendations:	
2.2.5.1.	<p>Due to the uncertainty that the ramps and raised platform will slow drivers down and the risk that pedestrians and cyclists may enter the crossing when it is not safe to do so, the designer should reconsider the provision for active users at the roundabout to provide safer crossing options.</p> <p>This could include replacement of the raised table through the intersection with individual raised platforms at each crossing.</p>
<p>Designer Response: <i>Designer agrees that raised pedestrian ramps would have a similar/more effective traffic calming effect than the current design of a raised platform. The Client preferred the raised platform.</i></p>	
<p>Safety Engineer: <i>Believe the proposed treatment will improve safety</i></p>	
<p>Client Decision: <i>Accept current design</i></p>	

Action Taken: [Click here to enter text.](#)

2.2.6. Conspicuity of the central island	Minor
<ul style="list-style-type: none"> • Crashes are likely to be: Occasional • Death or serious injury: Unlikely • Risk ranking: Minor 	
<p>The existing small roundabout central island has a raised profile with yellow surface colouring. The proposed central island has a very low profile with a grey concrete surface and no other features such as kerbing or signs to raise driver awareness to it. As the island is mountable and the adjacent pavement is asphaltic concrete, in time the central island may be difficult to distinguish from the surrounding carriageway.</p> <p>As noted in 2.2.4, the proposed deflections are minor and create little geometric demand to moderate speed. Without a strong visual presence, the islands' purpose to reduce speed and act as a traffic control will be limited.</p>	
Recommendations:	
2.2.6.1.	That the roundabout central island should have a well-defined edge and surface treatment that will provide a strong visual presence to approaching traffic, particularly at night.
<p><i>Designer Response: The roundabout central island needs to be mountable for large vehicles negotiating the roundabout (turning right in particular), hence the low profile edge. However the Designer agrees that it could be painted (white or yellow) to make it more visible. The existing street lighting is being improved, with LED luminaires replacing the existing – the visibility of this intersection at night will be greatly improved.</i></p>	
<p>Safety Engineer: <i>Accepts Designers response</i></p>	
<p>Client Decision: <i>Accepts Designers response – white paint on central roundabout island</i></p>	
<p>Action Taken: Click here to enter text.</p>	

2.2.7. Edge of central island	Moderate
<ul style="list-style-type: none"> • Crashes are likely to be: Occasional • Death or serious injury: Likely • Risk ranking: Moderate 	

The proposed central island has a very low profile with a 50 mm lip above the road surface. The following publications both acknowledge that raised edges at small roundabouts are a risk to motorcyclists, particularly at night.

- Making roads motorcycle friendly (Motorcycle Safety Advisory Council)
- Infrastructure Improvements to Reduce Motorcycle Casualties (Austroads Publication No. AP-R515-16)

A small roundabout with a low profile with edges that are difficult to detect or mount could cause a rider to lose control if they run over these - an issue that is not experienced by cars and other larger vehicles. There is design guidance on roundabout apron edges that are considered more suitable for motorcycles.

Recommendations:

2.2.7.1.	Refer to Recommendation 2.2.6.1.
2.2.7.2.	That the outside of the roundabout is clearly defined and delineated.
2.2.7.3.	That the designer provides an alternate central island edge profile that is safer for motorcyclists.

Designer Response: The roundabout central island needs to be mountable for large vehicles negotiating the roundabout (turning right in particular), hence the low profile edge. However the Designer agrees that it could be painted (white or yellow) to make it more visible. The existing street lighting is being improved, with LED luminaires replacing the existing – the visibility of this intersection at night will be greatly improved.

Safety Engineer: *Accepts Designers response*

Client Decision: *Accepts Designers response*

Action Taken: [Click here to enter text.](#)

2.2.8. Sight lines at zebra crossings	Moderate
<ul style="list-style-type: none"> • Crashes are likely to be: Occasional • Death or serious injury: Likely • Risk ranking: Moderate 	
<p>Sheet E051 indicates that streetlights will be located directly in front of the pedestrian entry point on the approaches to both zebra crossings. The street light poles will restrict intervisibility between drivers and pedestrians waiting at or approaching the crossings.</p>	
Recommendations:	

2.2.8.1.	Relocate the streetlights (4) to the departure side of the crossings and ensure that the standard of lighting is still achieved for the roundabout and crossings.
<p>Designer Response: A Street Lighting Design was undertaken for this Project, and the Lighting Engineers specified the positions of the street lights in accordance with the relative lighting design standards. In addition the Pedestrian Planning and Design Guide, Chapter 17 advises the following “For other pedestrian crossing points, RCAs should place floodlights on the approach side(s) to better illuminate pedestrians using the crossing [82]. This should be done by:</p> <ul style="list-style-type: none"> • identifying the pedestrian crossing points that are used at night • identifying the risks to pedestrians at each location • identifying the current lighting levels at each location • ranking locations by these three criteria and improving the sites with the greatest need. <p>Designer recommends no change to Design</p>	
Safety Engineer: <i>Accepts Designers response</i>	
Client Decision: <i>Accepts Designers response</i>	
Action Taken: Click here to enter text.	

2.2.9. Two stage crossings	Moderate
<ul style="list-style-type: none"> • Crashes are likely to be: Occasional • Death or serious injury: Likely • Risk ranking: Moderate 	
<p>Both zebra crossings are marked continuously across the road, meaning that;</p> <ul style="list-style-type: none"> • An approaching driver is required to stop when a pedestrian steps on to the crossing. This is unlikely to happen when a vehicle is exiting the roundabout and a pedestrian is entering the crossing on the approach side. This puts the driver and pedestrian in a dilemma zone, if they meet at the island location, with either party being unsure of priority. • A pedestrian should cross both the approach and departure lanes in one movement. It will not be possible for a pedestrian starting to cross from the approach side of the crossing to assess the likely turning movements of all vehicles approaching the other legs of the roundabout. As such, they will start to cross and have to hope that any vehicles exiting the roundabout will stop for them at the crossing. <p>A drivers’ attention approaching a roundabout is focused on approaching and circulating traffic and typically does not redirect to the roundabout exit until they are leaving the roundabout. Drivers are unlikely to be aware of the zebra crossing or</p>	

anyone using it until they are very close to it, when it may be too late to stop as they are legally required to do.

This same issue applies at the courtesy crossings where pedestrians have no legal right of way. Drivers exiting the roundabout are more unlikely to stop at a courtesy crossing. It is not clear if the courtesy crossings are intended to operate as two stage crossings and we note that the pedestrian refuge width currently available is considered insufficient for people with bikes or pushing a pram.

Recommendations:

2.2.9.1. If the zebra crossings are retained at the roundabout, the median islands are amended to allow the zebra crossings to operate as two stage crossings similar to Fig 15.13 of the Pedestrian Planning and Design Guide, with a minimum refuge width of 1.8 m.

2.2.9.2. If the courtesy crossings are retained at the roundabout, the median islands are amended to allow the courtesy crossings to operate as two stage crossings with a minimum refuge width of 1.8 m.

Designer Response: Designer agrees with SAT, design will be changed to have zebra crossings as two stage crossings

Safety Engineer: *Accepts Designers response*

Client Decision: *Accepts Designers response*

Action Taken: [Click here to enter text.](#)

<p>2.2.10. Lane width at median islands</p>	<p>Moderate</p>
<ul style="list-style-type: none"> Crashes are likely to be: Occasional Death or serious injury: Likely Risk ranking: Moderate 	
<p>The proposed design is focused on providing for the shared path users at the roundabout, however the safety of on road cyclists should also be considered.</p> <p>The available width on the roundabout approach and departure lanes is constrained by the kerb and raised median island kerb with no space for evasive manoeuvres. To prevent motorists from passing cyclists when it may not be safe to do so, best practice guidance recommends lane widths between 3.0m and 4.2m should be avoided. Scaling the plans provided indicates that some of the roundabout approach and departure lanes fall in this range. Cyclists are particularly at risk from large vehicles in this situation.</p>	
<p>Recommendations:</p>	

2.2.10.1.	<p>That roundabout approach and departure lanes provide a minimum lane width between kerb faces of 4.2m.</p> <p>Alternately the approach lane widths could be reduced to 3.0 m which requires riders to take the lane which is considered only suitable for competent riders which may not be desirable in this situation due to the proximity of the school.</p>
<p><i>Designer Response: Designer recommends no change to design. Lane widths (at the narrowest point between kerb and island) varies between 3.3m and 4.1m. Road layout and thus, lane widths are greatly restricted by turning movements for larger vehicles, available road reserve and position of poles for existing overhead power network. Majority of on road cyclists are competent riders, and particularly with the provision of a shared path along the southern side of Springfield Rd it is expected the less competent cyclists will use the shared path or dismount and utilise the intersection as a pedestrian would.</i></p>	
<p>Safety Engineer: <i>Accepts Designers response</i></p>	
<p>Client Decision: <i>Accepts Designers response</i></p>	
<p>Action Taken: Click here to enter text.</p>	

2.2.11.	Cycle access to the shared path	Minor
<ul style="list-style-type: none"> • Crashes are likely to be: Infrequent • Death or serious injury: Unlikely • Risk ranking: Minor 		
<p>Noting that there are no cycle lanes on Otonga or Springfield Road, the proposed design makes no provision for on road cyclists to access the CyWay path or for cyclists using the CyWay path to return to the road.</p>		
<p>Recommendations:</p>		
2.2.11.1.	<p>That appropriately located access and exit links are provided that include kerb cut downs, surface colouring and cycle symbols that safely connect the road and CyWay path.</p>	
<p><i>Designer Response: There are a number of driveway accesses that are available along the Southern side of Springfield Rd for road cyclists to enter/exit the shared path facility on this side of the road. Designer recommends no change to design.</i></p>		
<p>Safety Engineer: <i>Accepts Designers response</i></p>		
<p>Client Decision: <i>Accepts Designers response</i></p>		

Action Taken: [Click here to enter text.](#)

2.3. Signs & markings

2.3.1. Tactile guidance missing		Comment
<ul style="list-style-type: none"> <i>Risk ranking:</i> Comment 		
<p>Opus Consultants have informed us that no tactile guidance pavers are shown on the drawing but this will be added later. For completeness this should be included on the detail design drawings. A lack of tactile guidance could result in a vision impaired pedestrian entering the roadway when it is not safe to do so.</p>		
Recommendations:		
2.3.1.1.	That tactile pavers are provided in accordance with RTS 14.	
<p><i>Designer Response:</i> Designer accepts STA's recommendation, tactile pavers will be provided.</p>		
<p>Safety Engineer: Accepts Designers response</p>		
<p>Client Decision: Accepts Designers response</p>		
Action Taken:		Click here to enter text.

2.3.2. PW-8 Signs not required		Comment
<ul style="list-style-type: none"> <i>Risk ranking:</i> Comment 		
<p>MOTSAM does not require the PW-8 Rotary Junction warning signs where the RG-6.1 Roundabout Give Way sign is clearly visible to approaching drivers for at least 60m in urban areas. This clear distance looks to be achieved on all approach legs.</p>		
Recommendations:		
2.3.2.1.	That the PW-8 Rotary Junction signs are not required and should be removed from the four approaches.	
<p><i>Designer Response:</i> Designer accepts STA's recommendation, the PW-8 signs will be removed from design.</p>		
<p>Safety Engineer: Accepts Designers response</p>		
<p>Client Decision: Accepts Designers response</p>		

Action Taken: [Click here to enter text.](#)

2.3.3. Relocate PW-39 Hump signs	Minor
<ul style="list-style-type: none"> Crashes are likely to be: Infrequent Death or serious injury: Unlikely Risk ranking: Minor 	
<p>MOTSAM notes that when used in conjunction with speed control road humps, the PW- 39 sign should be located adjacent to the hump and located where approaching drivers have an uninterrupted view of it over a distance of at least 60 m. Although their exact locations not shown on the plans, the proposed hump signs look to be different distances from the ramps on every approach which is not a safe system approach for drivers.</p>	
Recommendations:	
2.3.3.1.	Relocate the PW-39 Hump signs in accordance with MOTSAM.
<p><i>Designer Response: Designer accepts STA's recommendation, the PW-39 signs will be located in accordance with MOTSAM.</i></p>	
<p>Safety Engineer: Accepts Designers response</p>	
<p>Client Decision: Accepts Designers response</p>	
<p>Action Taken: Click here to enter text.</p>	

2.3.4. Belisha beacons missing	Minor
<ul style="list-style-type: none"> Crashes are likely to be: Infrequent Death or serious injury: Likely Risk ranking: Minor 	
<p>MOTSAM requires PW-65 Belisha Beacon Disks to be installed at zebra crossings.</p>	
Recommendations:	
2.3.4.1.	If the zebra crossings are retained, PW-65 Belisha Beacon Disks are installed in accordance with MOTSAM.
<p><i>Designer Response: Designer accepts STA's recommendation, the PW-65 Belisha disks will be installed in accordance with MOTSAM.</i></p>	
<p>Safety Engineer: Accepts Designers response</p>	

Client Decision:	Accepts Designers response
Action Taken:	Click here to enter text.

2.3.5. Concrete ramp markings		Comment
<ul style="list-style-type: none"> <i>Risk ranking:</i> 		Comment
<p>Concrete ramps are proposed ahead of all crossings. We note that standard road marking wear very quickly on a concrete surface and will may lose their effectiveness as a warning and speed control unless regularly re-marked.</p>		
Recommendations:		
2.3.5.1.	That a high specification, harder wearing paint or permanent road marking material is considered for the ramp markings.	
<p>Designer Response: <i>Designer accepts STA's recommendation and will state on the design a 'cold applied plastic' line marking to be used on the concrete ramps.</i></p>		
Safety Engineer:		Accepts Designers response
Client Decision:		Accepts Designers response
Action Taken:		Click here to enter text.



3. Audit statement

We certify that we have used the plan to identify road safety issues that could be changed, removed or modified in order to improve safety. The problems identified have been noted in this safety audit report.

21 issues were identified and are summarised in Table 4 below.

Table 4: Summary of Issues

Serious	Significant	Moderate	Minor	Comments	Total
0	0	10	6	5	21

Safety Audit Team Leader: Warren Lloyd Position Traffic Engineer and Transport Planner, Director, ViaStrada

Signature  Date 13 July 2017

Designer: Name Jess Dallaway Position Senior Project Engineer, Opus

Signature _____ Date 18 July 2017

RLC Safety Engineer: Name Peter Dine Position _____

Signature _____ Date 18 July 2017

Client decision: Name Jodie Lawson Position Sustainable Transport Team Leader, Rotorua Lakes Council

Signature _____ Date 18 July 2017



Action Completed: Name

Position

Signature

Date

*Project sponsor to distribute audit report
incorporating decision to designer, Safety Audit Team
Leader, Technical Services Design Manager and
project file*

Date



Appendix A Reviewed plans

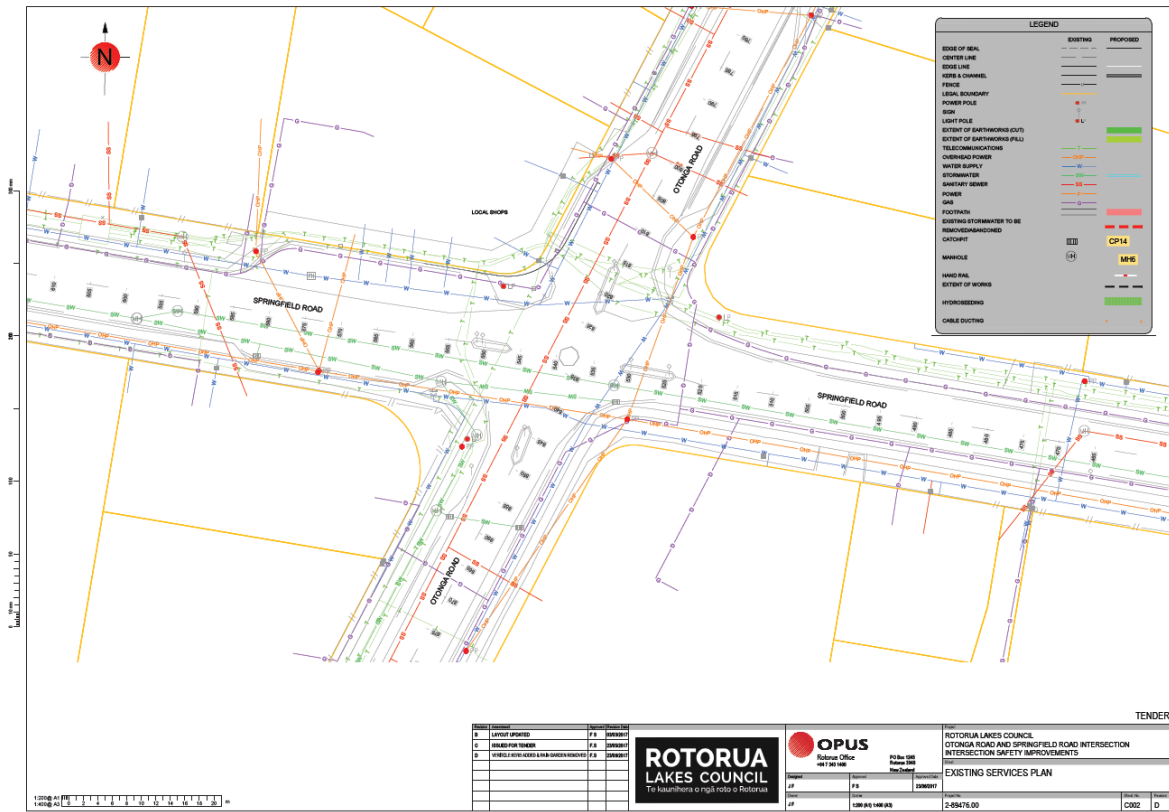


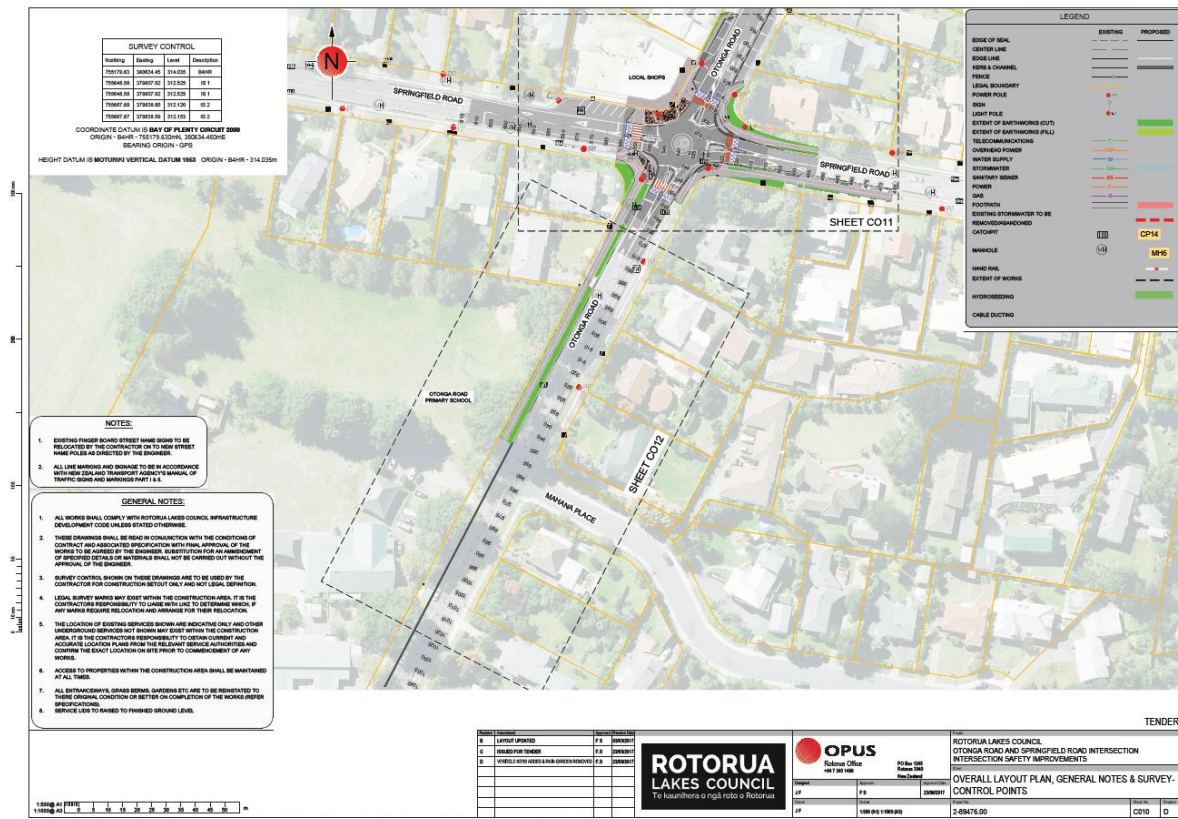
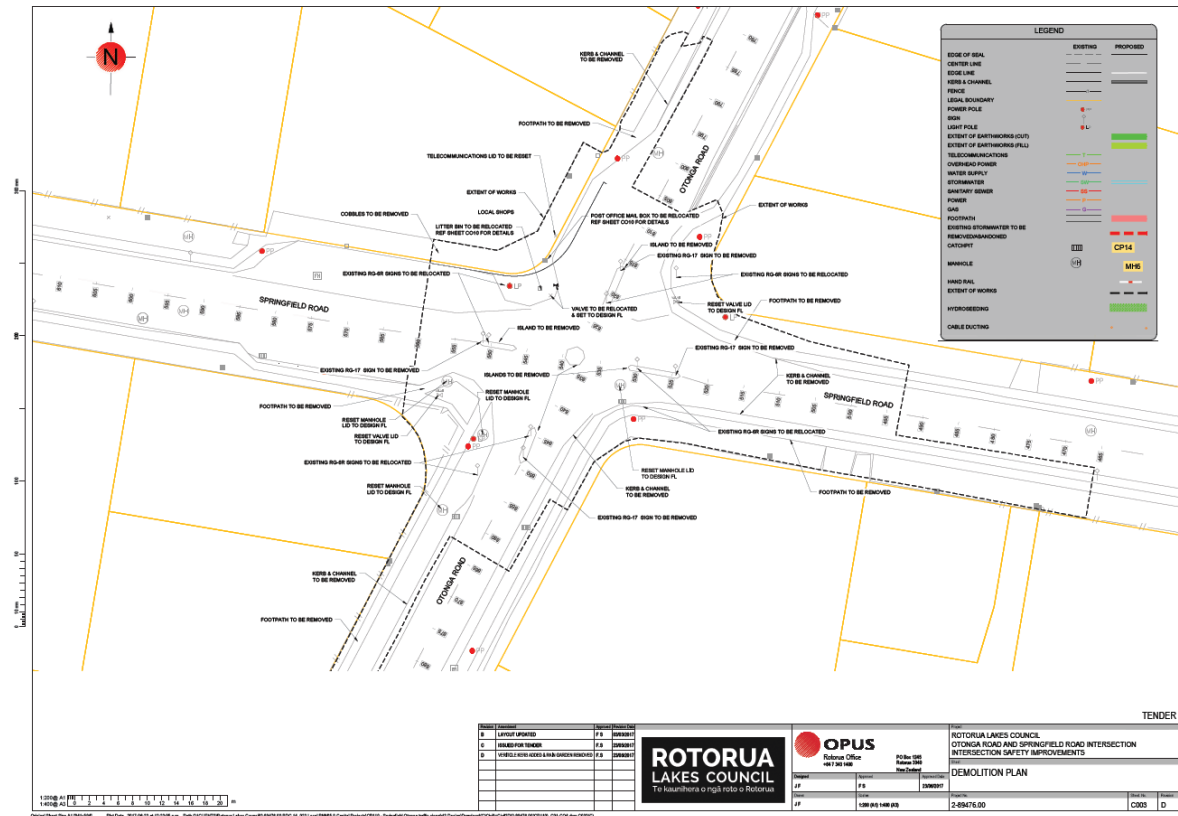
ROTORUA LAKES COUNCIL OTONGA ROAD AND SPRINGFIELD ROAD INTERSECTION INTERSECTION SAFETY IMPROVEMENTS

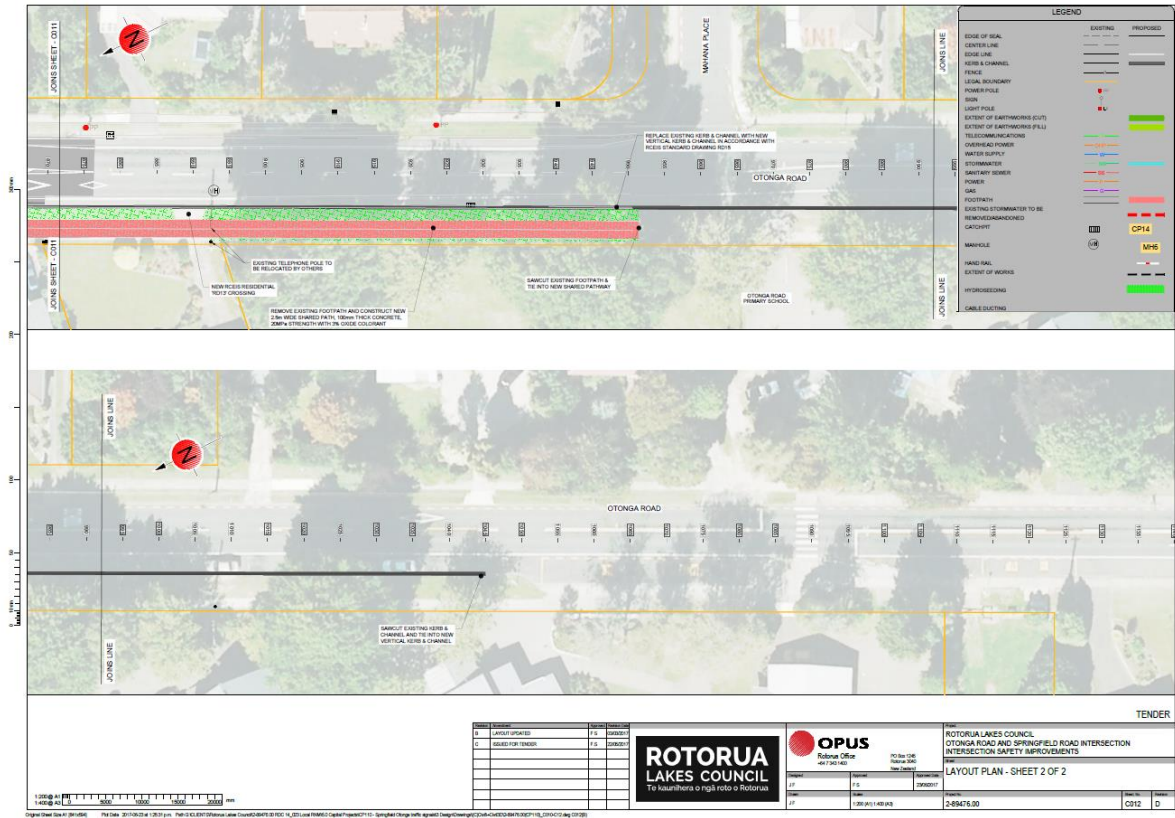
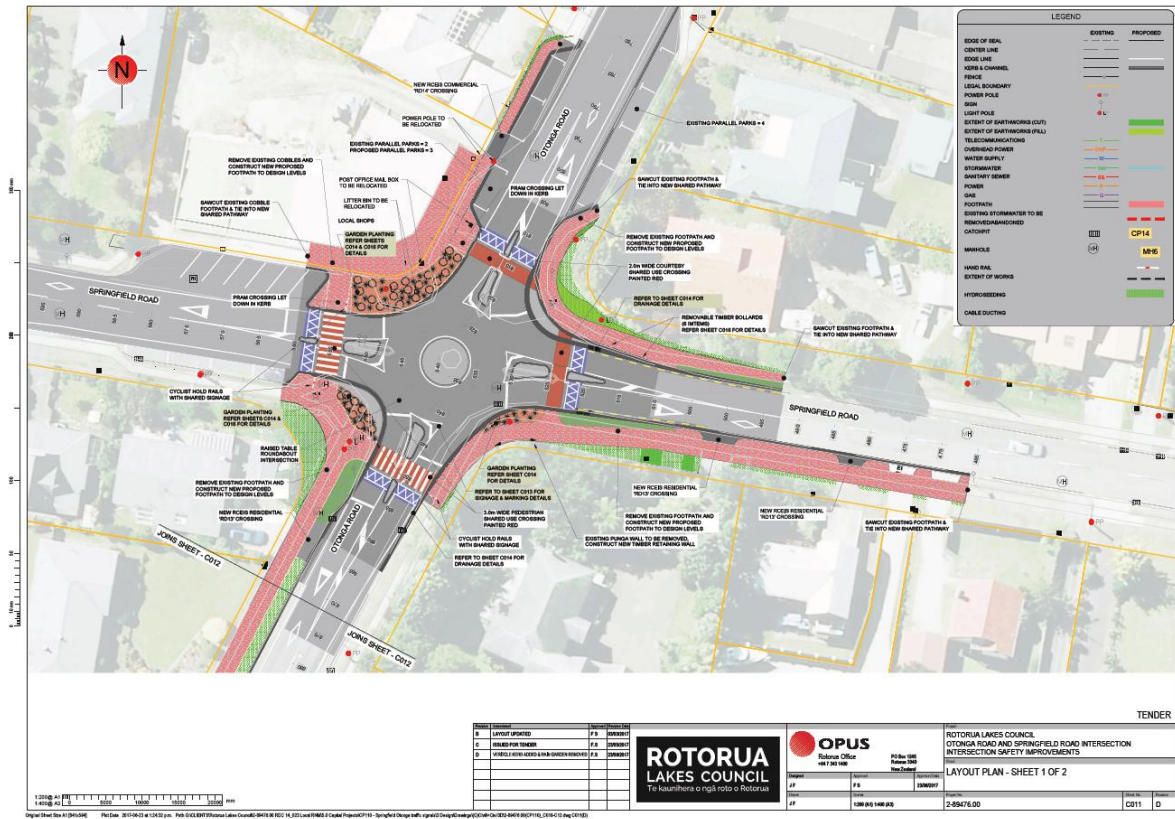
TENDER

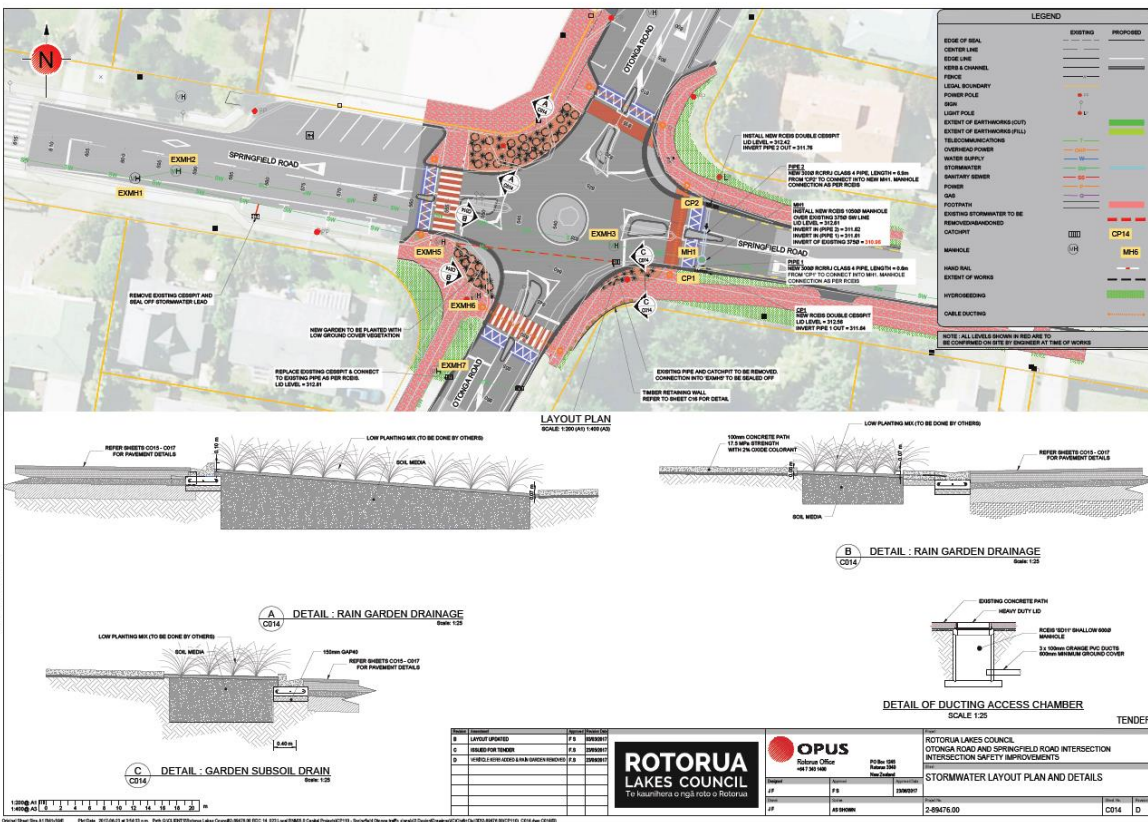
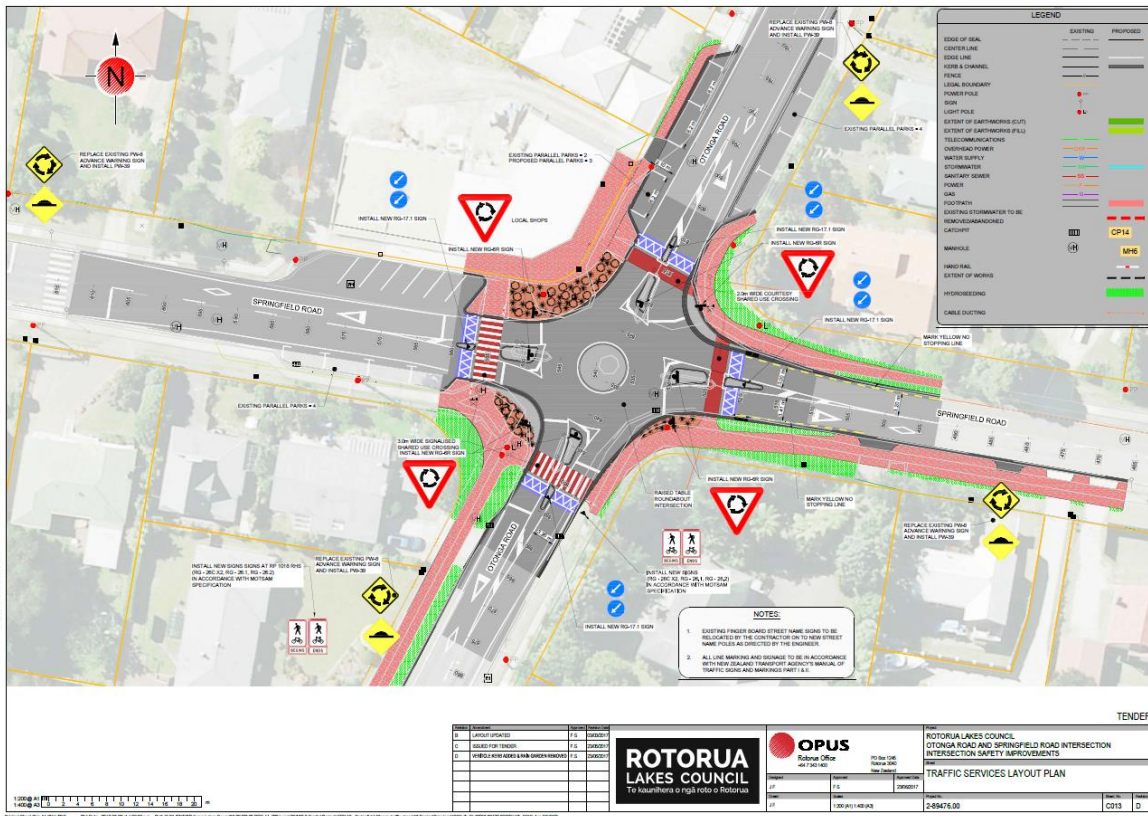
Project No: 2-89476.00(CP110)

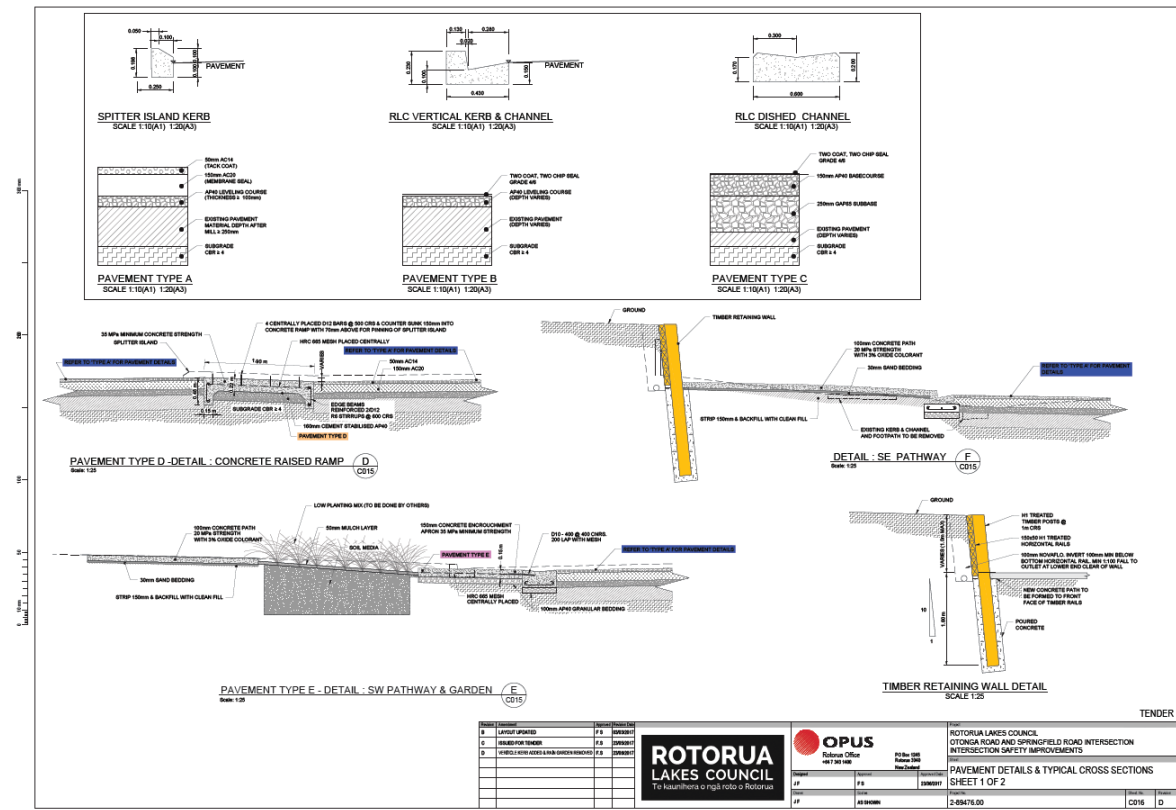
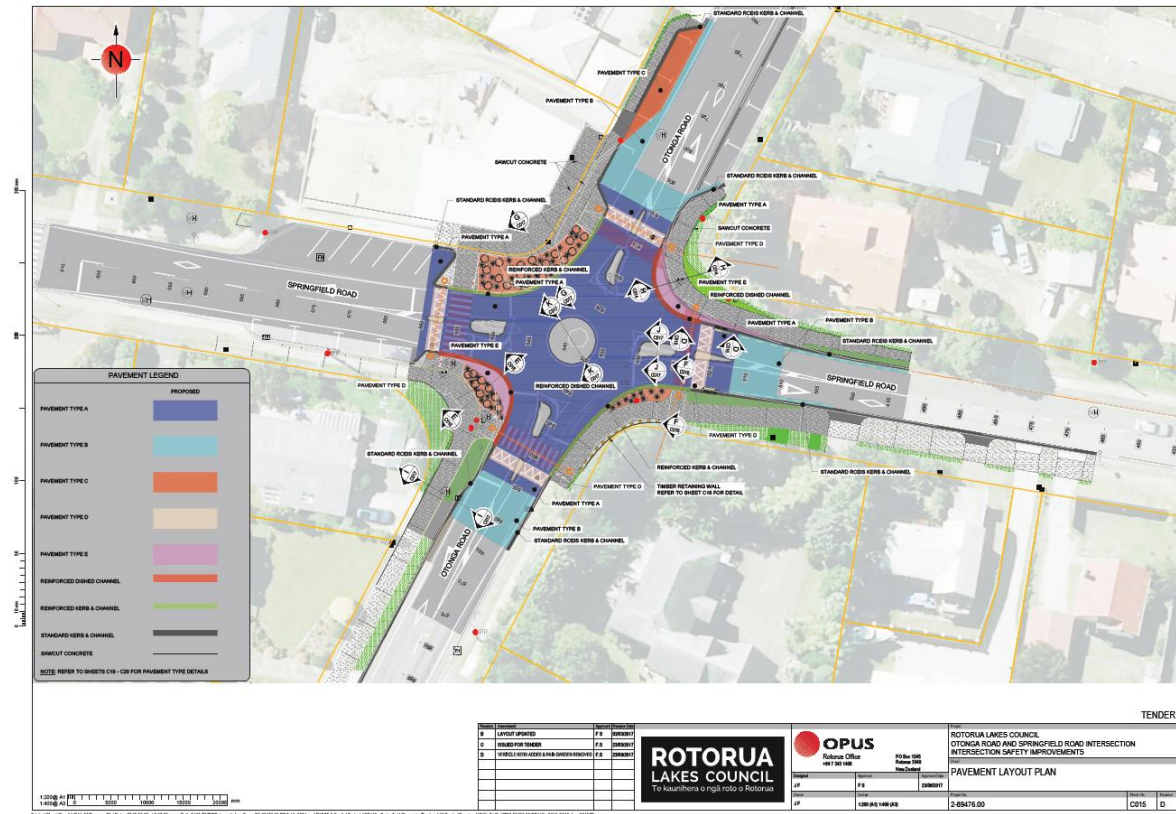
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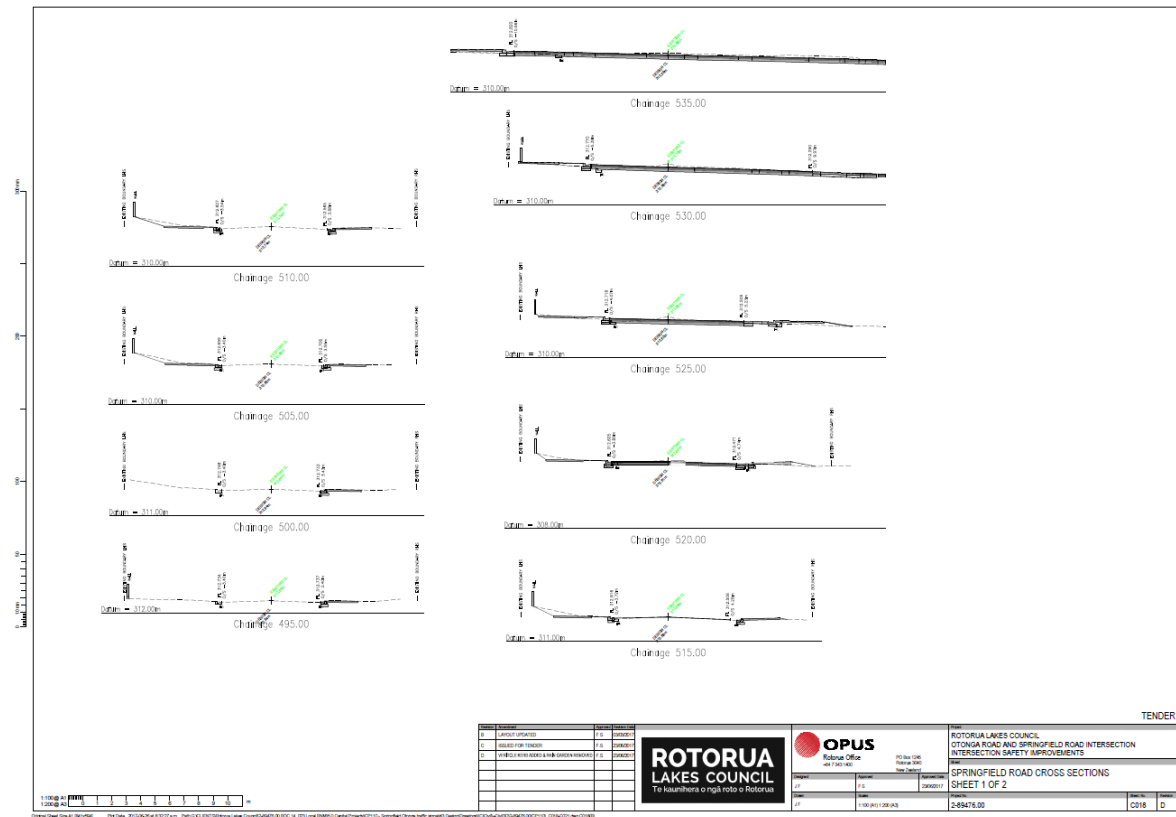
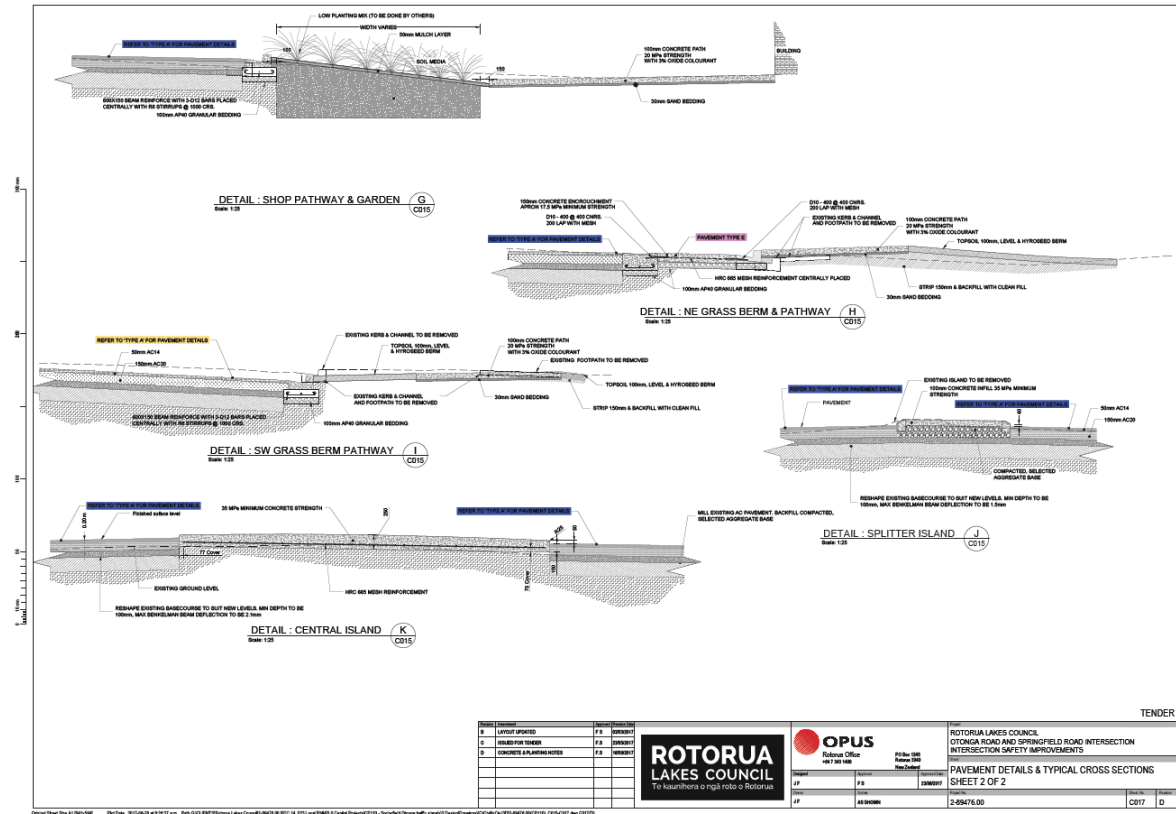


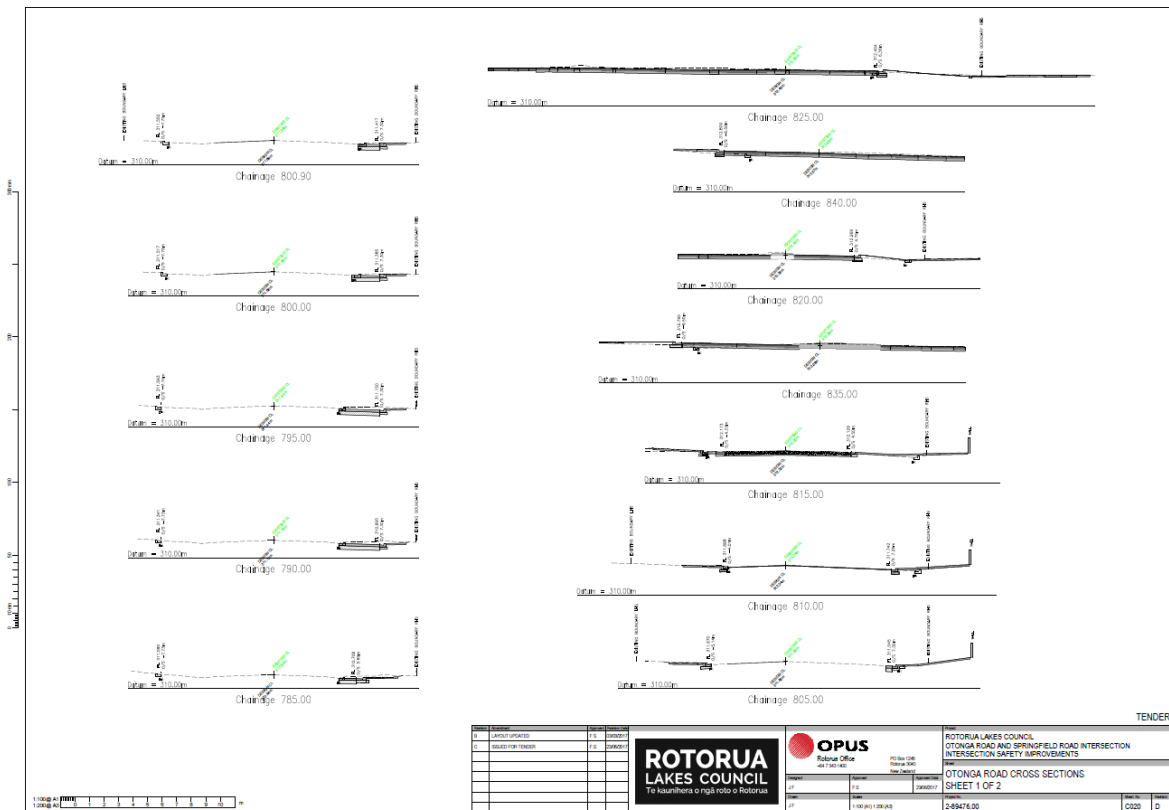
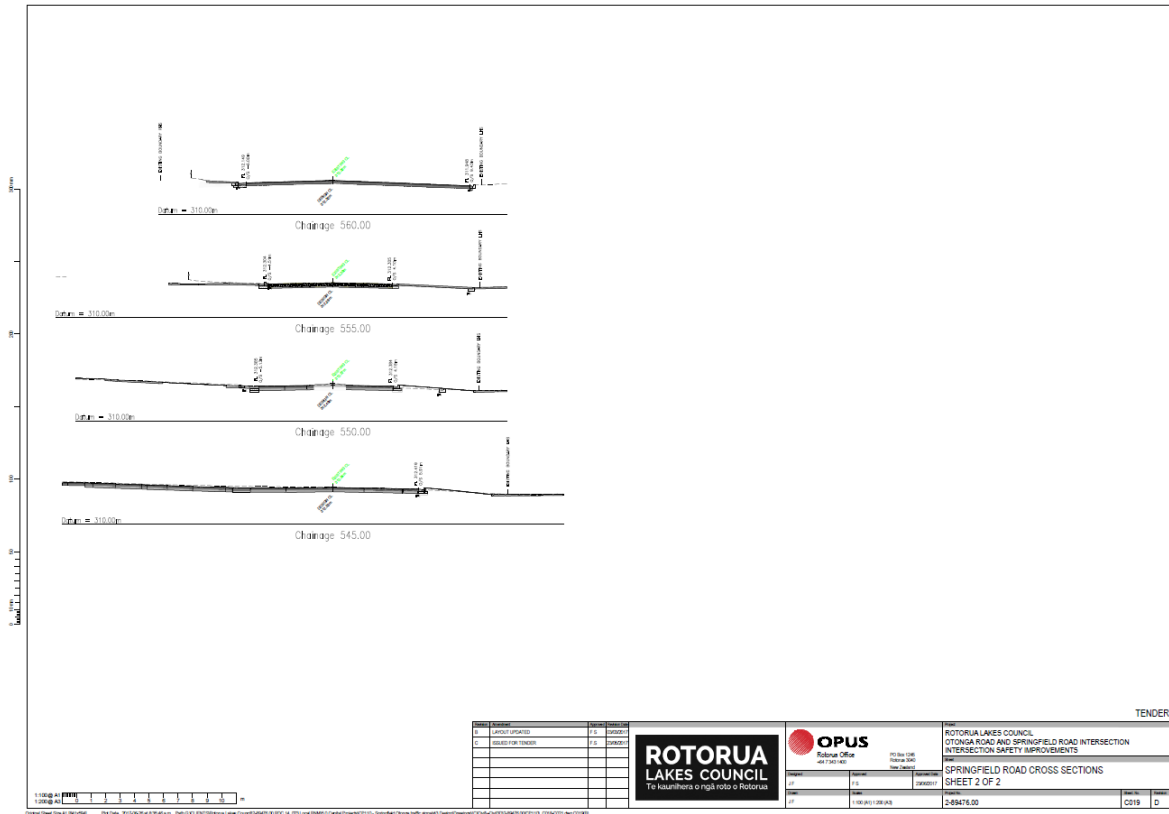


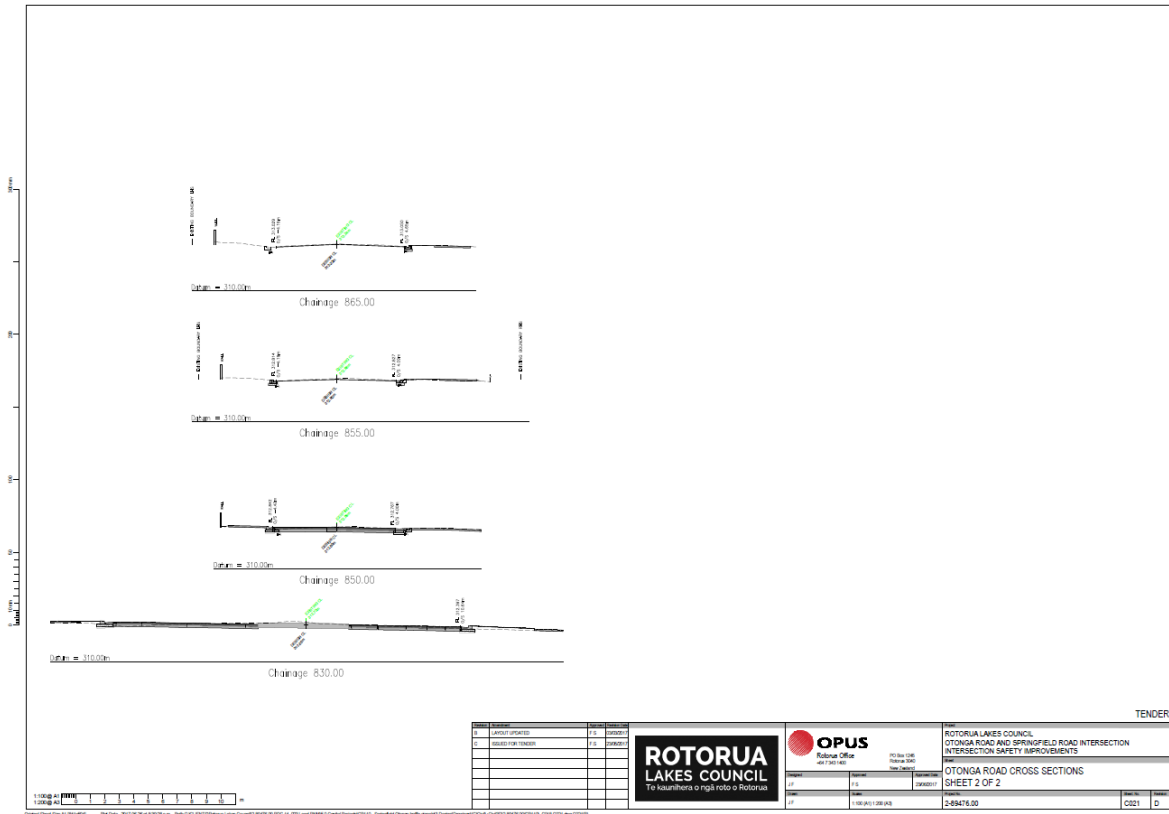












REVISED	DATE	BY	REASON
1	15/01/2016	OPUS	ISSUED FOR TENDERS

OPUS
Robur Office
401 Tairāwhiti Ave
Rotorua 3101

ROTORUA LAKES COUNCIL
OTONGA ROAD AND SPRINGFIELD ROAD INTERSECTION
INTERSECTION SAFETY IMPROVEMENTS
OTONGA ROAD CROSS SECTIONS
SHEET 2 OF 2

DATE: 15/01/2016
SCALE: 2:89476.00
DRAWN: [Name]
CHECKED: [Name]

LEGEND

- A1 Disconnect and remove the existing luminaire and on the existing bracket arm and reticulation pole, supply and install a new AEC ITALO 1 STAN 1 4.7-4M (6,970 lumens) 67W LED luminaire. The luminaire shall be mounted at a height of 6.0m and tilted at an angle of 0° to the horizontal.
- A2 Disconnect and remove the existing luminaire and on the existing outback arm and column, supply and install a new AEC ITALO 1 STAN 1 4.7-4M (6,970 lumens) 67W LED luminaire. The luminaire shall be tilted at an angle of 0° to the horizontal.
- B Supply and install a ground painted black and white Pedestrian Crossing octagonal galvanneal steel column with 1.0m curved outback arm complete with Amber Disc and a new AEC ITALO 1 OP-0X 4.7-1M (6,730 lumens) 52W LED luminaire. The luminaire shall be mounted at a height of 5.0m and tilted at an angle of 0° to the horizontal.
- C Disconnect and remove the existing luminaire and on the existing outback arm and column, supply and install a new AEC ITALO 1 STAN 1 4.7-4M (6,970 lumens) 67W LED luminaire. The luminaire shall be mounted at a height of 6.0m and tilted at an angle of 0° to the horizontal.
- R Relocate the existing column and outback arm to the position shown. Disconnect and remove the existing luminaire and supply and install a new AEC ITALO 1 STAN 1 4.7-4M (6,970 lumens) 67W LED luminaire. The luminaire shall be tilted at an angle of 0° to the horizontal.
- E Existing column and luminaire to remain unchanged.

DETBACKS

TYPICAL COLUMN DESIGNATION

Column number: 03
Luminaire and Column type: A12

TABLE 2.2 - VALUES OF LTP FOR NEW ZEALAND CATEGORY V LIGHTING - AS/NZS 1158.1.1:2005

Lighting Subcategory	For Straight Sections, Curves and Intersections.					For Intersections and Other Specified Locations.	
	Average Canopyway Luminaire ^a (E _c) cd/m ²	Overall Uniformity ^{a,4} (U _o)	Longitudinal Uniformity ^a (U _l)	Threshold Contrast ^a (TC) %	Surround Veilance Illuminance ^a (E _v) %	Point Horizontal Illuminance ^{a,5} (E _{ph}) lux	Illuminance (horizontal) Uniformity ^a (U _h)
V3	0.75	0.33	0.3	20	50	7.5	6

TABLE 3.5 - VALUES OF LTP FOR NEW ZEALAND PEDESTRIAN CROSSINGS - AS/NZS 1158.4:2015

Lighting Subcategory	Point Horizontal Illuminance - Marked Crossway ^{a,6} (E _{ph}) lux	Point Horizontal Illuminance - Surrounds (E _{ph}) lux	Point Vertical Illuminance - Marked Crossway ^{a,6} (E _v) lux
	X1	30	10

GENERAL NOTES

- All distances are in meters unless stated otherwise.
- All work shall conform to the requirements of Rotorua District Council (RDC) M30/2014 Specification and Guidelines for Road Lighting Design, AS/NZS 1158, AS/NZS 3000:2007, ECP NZ Electrical Code of Practice For Electrical Safety Distances and Union.
- Ensure that all columns are well clear of underground services. If necessary positions may be altered by up to 1m while retaining general pole arrangement to avoid clashes with underground services, confirm with the Designer first.
- Ensure the RDC Asset Database is accurately updated for every new or modified road light location.
- The existing luminaires, columns, mounting brackets and lamps that have been removed shall be offered back to RDC for reuse elsewhere. These works shall include the removal and disposal of old luminaires, columns, mounting brackets and lamps not wanted by the client.
- The internet wiring between the terminal blocks and the luminaire shall be circular 2C 2.5mm² Neutral Screen cable.
- All luminaires shall be fitted with a 7 Corbad Nema Socket (compliant with ANSI C136.41:2013) plus strobing cap (for future use).
- All new road lighting columns shall be in accordance with the NZ Transport Agency MS2-2012 Road Lighting Column Specification, manufactured to NZS 4676, galvanneal to AS/NZS 4680:2006, and painted to RDC specification.
- Luminaire tilt shall be 0° to the horizontal for all new luminaires installed unless stated otherwise.

SPECIFIC NOTES

- The Springfield Road/Otonga Road Roundabout has been designed to the V3 Road Lighting Sub-Category of AS/NZS 1158.1.1:2005 and the Pedestrian Crossings on Springfield Road and Otonga Road have been designed to the X1 Road Lighting Sub-Category of AS/NZS 1158.4:2015.
- Installation of columns shall be performed in accordance with NZECP34 - Electrical Safety Distances. Clearance to be confirmed prior to works start.
- Both the Otonga Road and Springfield Road Pedestrian Crossing Surrounds are non-compliant with the minimum 10lux requirement. This is considered acceptable as the pathway does not extend 3m beyond the end of the crossings due to trees at the Otonga Road crossing and a shop front at the Springfield Road crossing.
- There is an area at the southern end of Otonga Road where the Roundabout and its surrounds fall below the minimum levels of lighting (7.5lux and 3.75lux respectively) due to overhead lines preventing the addition of lighting columns in that particular area. This is considered acceptable as the Otonga Road Pedestrian Crossing lighting will significantly increase the illuminance levels in this area.

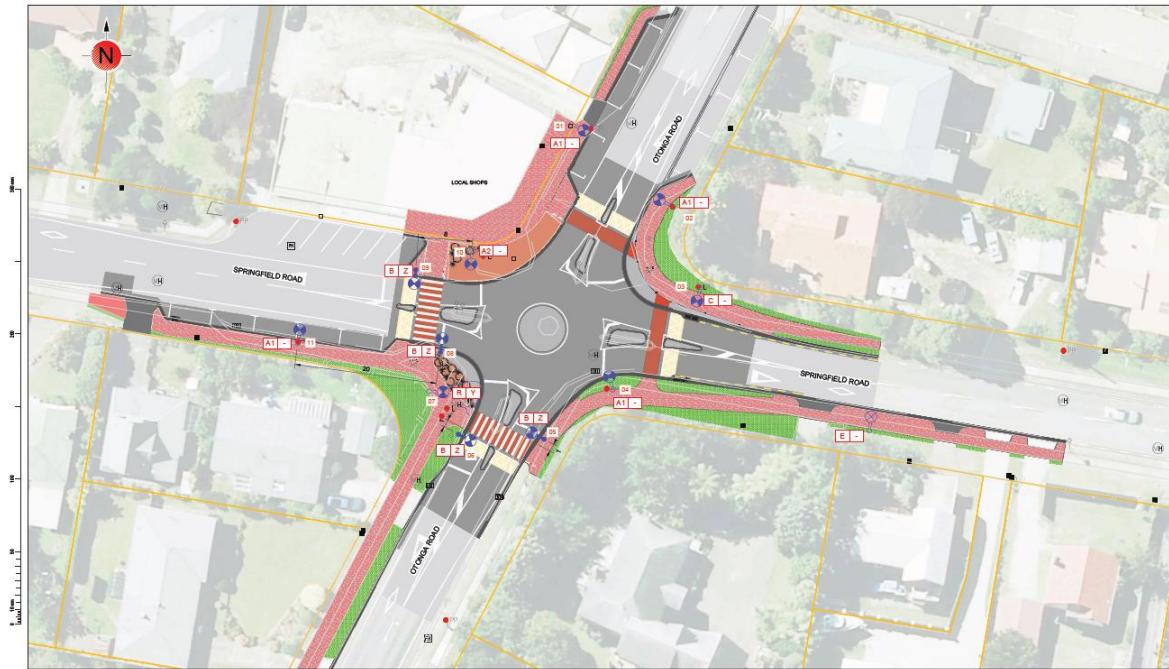
CALCULATION RESULTS

ILLUMINATION CALCULATION SUMMARY

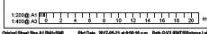
Sub-Category	Label	Calc Type	Units	Max	Min	U _h
Sub-Category V3 - Otonga Road/Springfield Road Roundabout	Roundabout	Illuminance	Lux	44.8	3.6	12.4
	Roundabout surrounds	Illuminance	Lux	43.1	2.4	18.0
Sub-Category X1 - Pedestrian Crossings	Springfield Road Pedestrian Crossing	E _{ph} - Marked Crossing (Lux)	Lux	51.0	8.7	19.8
	Springfield Road Pedestrian Crossing	E _{ph} - Surrounds (Lux)	Lux	51.5	9.3	20.0
	Otonga Road Pedestrian Crossing	E _{ph} - Marked Crossing (Lux)	Lux	51.5	9.3	20.0

DRAWING IN PROGRESS
PLOTTED ON 2016-09-01 AT 10:25:24
PRELIMINARY





DRAWING IN PROGRESS
 PLOTTED ON 2017-03-01 AT 8:30 am
 PRELIMINARY



REV	DATE	DESCRIPTION
1	2017-03-01	ISSUED FOR COMMENT



ROTORUA LAKES COUNCIL OTONGA ROAD AND SPRINGFIELD ROAD INTERSECTION INTERSECTION SAFETY IMPROVEMENTS	
STREET LIGHTING PLAN SHEET 2 OF 2	
PROJECT NO: 1608 (REV 1.000)	DRAWING NO: 2-25478.00
DATE: 2017-03-01	SCALE: ESS1 A

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Appendix B CAS report

Plain English report, run on 06-Jul-2017 Page 1

First Street	ID	Second street [I] or landmark Distance (R)	Crash Number	Date DD/MM/YYYY	Day Time DDD HHMM	Description of Events	Crash Factors (ENV = Environmental factors)	Road	Natural Light	Weather	Junction	Ctrl	Tot Inj F S M A E I T R N
OTONGA ROAD	I	SPRINGSFIELD ROAD	201446711	03/11/2014	Mon 1900	VAN1 SBD on OTONGA ROAD hit turning CAR2	VAN1 Did not check / notice another party behind	Dry	Bright	Fine	Roundabo	Give Way Sign	
OTONGA ROAD	I	SPRINGSFIELD ROAD	201534177	09/03/2015	Mon 1418	CAR2 turning right hit by oncoming VAN1 MED on OTONGA ROAD	VAN1 Failed to give way at a priority traffic control, Did not check / notice another party	Dry	Bright	Fine	Roundabo	Give Way Sign	
SPRINGSFIELD ROAD	30W	OTONGA ROAD	201542555	04/08/2015	Tue 0805	CAR1 EBD on SPRINGSFIELD ROAD hit rear end of CAR2 STOP/SLOW FOR QUEUE	CAR1 failed to notice car slowing, attention diverted by Call phone ENV: road slippery (rain)	Wet	Overcast	Light Rain	Roundabo	Give Way Sign	
SPRINGSFIELD ROAD	I	OTONGA ROAD	201731223	24/01/2017	Tue 2030	VAN1 EBD on SPRINGSFIELD ROAD missed CAR2 MED on VAN1 hit Traffic Island, Traffic Sign	VAN1 misjudged size or position of vehicle and failed to adjust to NZ road rules and road conditions	Dry	Twilight	Fine	Roundabo	Give Way Sign	
SPRINGSFIELD ROAD	I	OTONGA ROAD	201611163	05/02/2016	Fri 0904	CAR1 MED on OTONGA ROAD hit CUC1 MED crossing at right angle from right	CAR1 Failed to give way at a Check / notice another party	Wet	Overcast	Light Rain	Roundabo	Give Way Sign	1