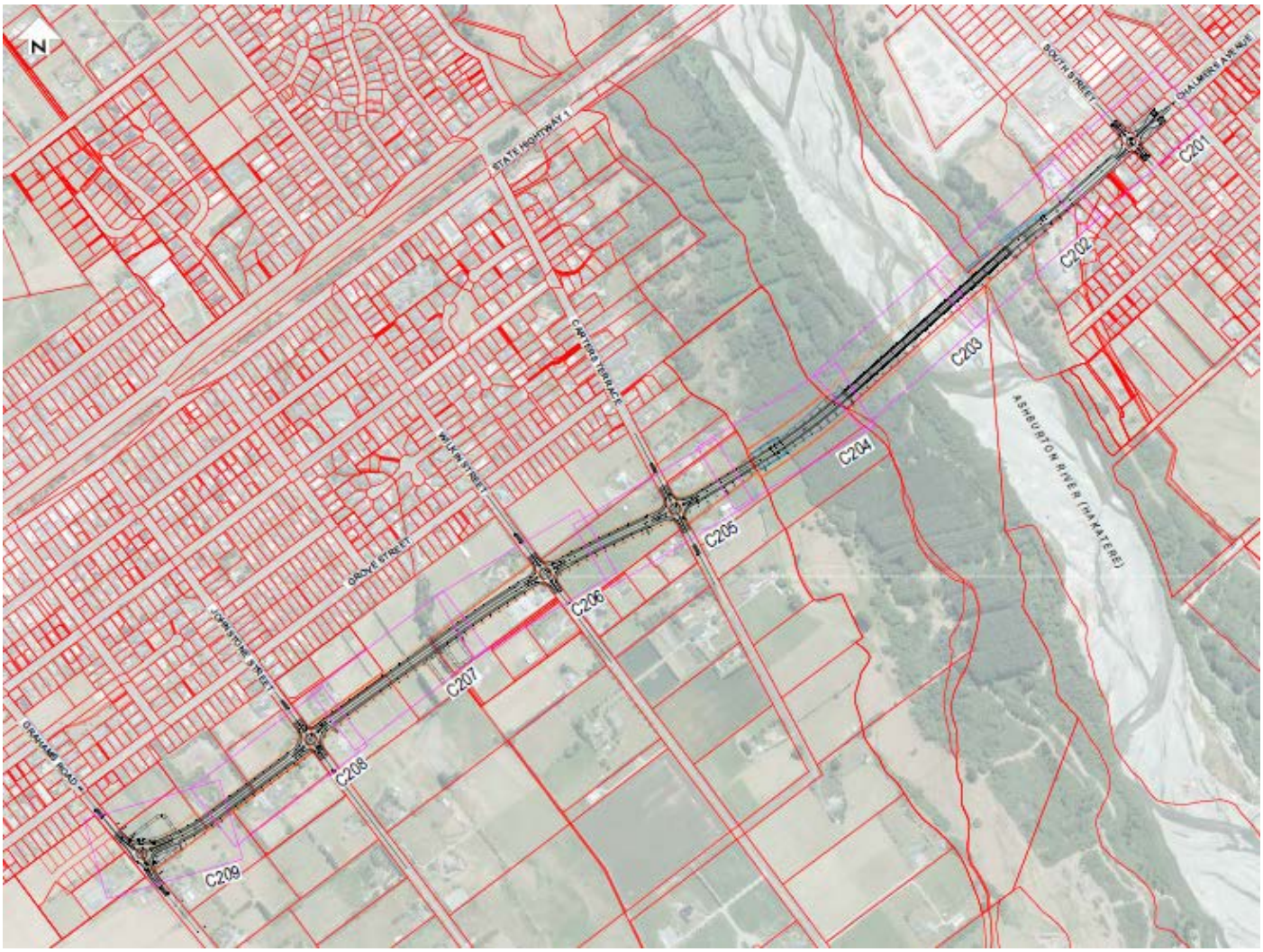
Appendix Y Road Safety Audit

URBAN CONNECTION
local and connected



Ashburton - Tinwald Connectivity DBC

Preliminary Design Stage Road Safety Audit Report

Prepared for Ashburton District Council

REV 0 - JULY 2022

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1 Background

1.1 Safety Audit Procedure

This report has been prepared in response to a request from Ashburton District Council to carry out a Preliminary Design Stage Road Safety Audit for the Ashburton – Tinwald Connectivity Project.

A road safety audit is a term used internationally to describe an independent review of a future road project to identify any safety concerns that may affect the safety performance. The audit team considers the safety of all road users and qualitatively reports on road safety issues or opportunities for safety improvement.

A road safety audit is therefore a formal examination of a road project, or any type of project which affects road users (including cyclists, pedestrians, mobility impaired etc.), carried out by an independent competent team who identify and document road safety concerns.

A road safety audit is intended to help deliver a safe road system and is not a review of compliance with standards.

The primary objective of a road safety audit is to deliver a project that achieves an outcome consistent with Safer Journeys and the Safe System approach, that is, minimisation of death and serious injury. The road safety audit is a safety review used to identify all areas of a project that are inconsistent with a safe system and bring those concerns to the attention of the client in order that the client can make a value judgement as to appropriate action(s) based on the risk guidance provided by the safety audit team.

The key objective of a road safety audit is summarised as:

- To deliver completed projects that contribute towards a safe road system that is increasingly free of death and serious injury by identifying and ranking potential safety concerns for all road users and others affected by a road project.

A road safety audit should desirably be undertaken at project milestones such as:

- Concept Stage (part of Business Case);
- Scheme or Preliminary Design Stage (part of Pre-Implementation);
- Detailed Design Stage (Pre-implementation / Implementation); and
- Pre-Opening / Post-Construction Stage (Implementation / Post-Implementation).

A road safety audit is not intended as a technical or financial audit and does not substitute for a design check on standards or guidelines. Any recommended treatment of an identified safety concern is intended to be indicative only, and to focus the designer on the type of improvements that might be appropriate. It is not intended to be prescriptive and other ways of improving the road safety or operational problems identified should also be considered.

In accordance with the procedures set down in the "NZTA Road Safety Audit Procedures for Projects Guidelines - Interim release May 2013" the audit report should be submitted to the client who will instruct the designer to respond. The designer should consider the report and comment to the client on each of any concerns identified, including their cost implications where appropriate, and make a recommendation to either accept or reject the audit report recommendation.

For each audit team recommendation that is accepted, the client shall make the final decision and brief the designer to make the necessary changes and/or additions. As a result of this instruction the designer shall action the approved amendments. The client may involve a safety engineer to provide commentary to aid with the decision.

Decision tracking is an important part of the road safety audit process. A decision tracking table is embedded into the report format at the end of each set of recommendations to be completed by the designer, safety engineer and client for each issue documenting the designer response, client decision (and asset manager's comments in the case where the client and asset manager are not one and the same) and action taken.

A copy of the report including the designer's response to the client and the client's decision on each recommendation shall be given to the road safety audit team leader as part of the important feedback loop. The road safety audit team leader will disseminate this to team members.

1.2 The Safety Audit Team

The road safety audit was carried out in accordance with the "NZTA Road Safety Audit Procedure for Projects Guidelines - Interim release May 2013", by:

- Jonno Fletcher, Urban Connection Limited, Christchurch (Team Leader)
- Jacques Steyn, Urban Connection Limited, Christchurch (Team Member)
- Fiona Chapman, Urban Connection Limited, Christchurch (Team Member)

A briefing meeting was held on Friday 10 June 2022. The Safety Audit Team (SAT) carried out a site inspection during the day in wet conditions on Monday 20 June 2022.

1.3 Report Format

The potential road safety problems identified have been ranked as follows: -

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 involved.

Reference to historic crash rates or other research for similar elements of projects, or projects as a whole, have been drawn on where appropriate to assist in understanding the likely crash types, frequency and likely severity that may result from a particular concern.

The frequency and severity ratings are used together to develop a combined qualitative risk ranking for each safety issue using the Concern Assessment Rating Matrix in Table 1 below. The qualitative assessment requires professional judgement and a wide range of experience in projects of all sizes and locations.

Table 1.3-1: Concern Assessment Rating 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

While all safety concerns should be considered for action, the client or nominated project manager will make the decision as to what course of action will be adopted based on the guidance given in this ranking process with consideration to factors other than safety alone. As a guide a suggested action for each concern category is given in Table 2 below.

Table 1.3-2: Concern Categories

Risk	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.

In addition to the ranked safety issues it is appropriate for the safety audit team to provide additional comments with respect to items that may have a safety implication but lie outside the scope of the safety audit. A comment may include items where the safety implications are not yet clear due to insufficient detail for the stage of project, items outside the scope of the audit such as existing issues not impacted by the project or an opportunity for improved safety but not necessarily linked to the project itself. While typically comments do not require a specific recommendation, in some instances suggestions may be given by the auditors.

1.4 Scope of Audit

This audit is a Preliminary Design Stage Road Safety Audit of the Ashburton – Tinwald Connectivity Project, located in Ashburton. The project is a new bridge link between Ashburton and Tinwald, with a new road connection to Grahams Road. The audit area includes the intersection of Chalmers Avenue and South Street in Ashburton, and sections of Carters Terrace, Wilkin Street, Johnstone Street and Grahams Road (where the new road alignment will intersect).

1.5 Documents Provided

The SAT has been provided with the following documents for this audit:

- Ashburton – Tinwald Connectivity – Drawing Set, No. 310205125-01-001 including:
    - Plans and Longitudinal Sections, Drawing No. C201 to C209, dated 07/06/22 and 15/06/22 (9 sheets)
    - Signs and Linemarking, Drawing No. C301 to C305, dated 15/06/22 (5 sheets)
    - Typical Cross Sections, Drawings No. C571 to C574, dated 07/06/22 to 15/06/22 (4 sheets)Vehicle Tracking Plans – for proposed roundabouts, dated 07/06/22 (10 sheets)

The SAT has also received a staging plan which gives a brief outline on the possible staged construction of the project.

1.6 Disclaimer

The findings and recommendations in this report are based on an examination of available relevant plans, the specified road and its environs, and the opinions of the SAT. However, it must be recognised that eliminating safety concerns cannot be guaranteed since no road can be regarded as absolutely safe and no warranty is implied that all safety issues have been identified in this report. Safety audits do not constitute a design review nor an assessment of standards with respect to engineering or planning documents.

Readers are urged to seek specific technical advice on matters raised and not rely solely on the report.

While every effort has been made to ensure the accuracy of the report, it is made available on the basis that anyone relying on it does so at their own risk without any liability to the safety audit team or their organisations.

1.7 Project Description

The project is a new bridge over the Hakatere (Ashburton) River, linking Ashburton to Tinwald and providing an alternative route to the SH1 river bridge. The new road corridor includes the following elements.

- Changing the Chalmers Ave/South St priority crossroad intersection into a 4 leg roundabout.

- A 360 m long, two-lane bridge over the Hakatere River. Cycle paths and shared paths will be provided on both sides of the bridge.
- A short bridge (60 m long) on the southern of the river over the Tinwald flood plain.
- A new collector road connection through Tinwald that runs parallel to Grove Street and intersects with the following roads:
    - Carters Terrace – a 4 leg roundabout is shown on the drawings. The SAT are aware that this intersection may be a priority crossroad, with priority given to collector road traffic (Carters has low traffic volumes)
    - Wilkin Street – a 4 leg roundabout is proposed
    - Johnstone Street – a 4 leg roundabout is shown on the drawings. The SAT are aware that this intersection may also be a priority crossroad, with priority given to collector road traffic (Johnstone has low traffic volumes and is a dead end)
    - Grahams Road – a 3 leg roundabout is proposed
- Cycle lanes and shared paths are proposed for both sides of the collector road.

The project also includes associated improvements, such as street lighting, drainage, line marking and signage improvements.

1.8 Items Not Considered

The auditors note the project is within the preliminary design stage and that many details have not been developed yet or provided to the SAT and therefore were not able to be audited. This includes, but is not limited to the following items:

- Lighting design
- Detailed cross-sections
- Services

2 Safety Audit Findings

2.1 Summary of findings

The frequency of risk rankings associated with this Road Safety Audit is provided below with the detailed findings to follow. This summary illustrates the degree of consideration that should be given when working through the findings.

Table 2.1-1: Summary of Findings

Serious	Significant	Moderate	Minor	Comment	Total
0	2	15	5	3	25

2.2 Safe System Assessment

The safe system assessment considers and quantifies the degree of alignment of a design or concept with Safe System principles with the objective of minimising death and serious injury.

The Safe System assessment matrix ensures consistent consideration of major crash types and prompts an assessment of the three components of risk management as they apply to each crash type, namely people exposure, crash likelihood and crash severity.

The aim of a safe system assessment (SSA) is to identify whether the project will produce a safe system outcome and the degree to which the project aligns with the safe system objectives. This assessment also identifies elements of the project which are not well aligned and will need to be strengthened to achieve a safe system.

2.2.1 Safe System Assessment Summary **Moderate**

Frequency Rating:	**Occasional**	***Severity Rating:***	**Likely**

The SAT have undertaken a Safe System Assessment (SSA) on the project. This compared the existing Ashburton to Tinwald corridor on SH1 with the proposed design which includes a new local link road east of SH1. Whilst this is a simplistic approach, it gives a high level indication of the safe system alignment of the proposed design, whilst acknowledging there will also be wider safety and other benefits across the wider network i.e. removing many of the local trips away from SH1.

The SSA summary scores for the existing corridor and proposed design can be seen in Figure 2-1. The SSA Matrices are provided in Appendix A.

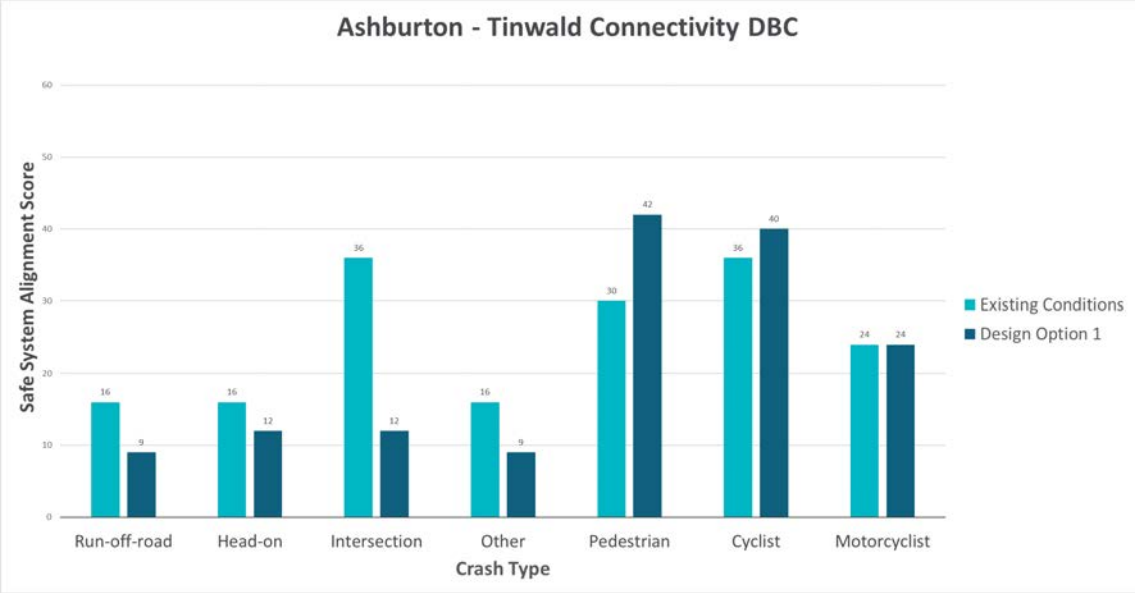

Figure 2-1 – Safe System Assessment Summary Scores

Based on the SSA completed and following may be concluded:

- The base case (existing or do nothing) has an existing moderate safety score of 174/448 for safe system alignment). The higher scoring areas (or lowest safety) are for intersections, pedestrians and cycle safety;
- Current intersection safety scores higher due to high traffic volumes and turn movements and priority controlled intersections
- Cycle and pedestrian safety scores higher due to the lack of current facilities on SH1 and high traffic volumes
- The design option case (proposed new road) has a moderate to low safety score of 148/448 for safe system alignment), which is an improvement over the base case
- Key differences with the proposed design include:
    - Run-off road crash safety improves due to lower traffic volume (exposure); reduced roadside hazards and reduced lane widths helping to control speed
    - Head-on crash safety also improves due to lower traffic volume (exposure); wide centreline (decreasing likelihood) reduced lane widths helping to control speed
    - Intersections are greatly improved due to lower volumes and proposed roundabouts which help reduce speed and the angle of crashes
    - Slight increase in scores (decrease in safety) for pedestrians and cyclists due to: increased trips (exposure); and potential for increased likelihood of crashes involving pedestrians and cyclists at or near proposed roundabouts
    - No change to motorcycle score

Recommendation:

1. *Consider options in the preferred design to reduce the likelihood and severity of crashes involving pedestrians and cyclists, for example treatments to reduce speeds further in conflict areas to less than 30 km/h impact speeds, and provide improvements to pedestrian and cyclist crossing points (i.e. mid-block away from intersections) and overall wider network connectivity; and;*
2. *Consider other safe system supporting treatments in the design to improve overall safety further;*
3. *Consider motorcyclists in the design and the need to provide specific motorcycle safety treatments*

Designer Response: *Generally Agree with SAT recommendations.*

1. *The design has been updated to increase the width of the on-road cycle lanes on sections where on street parking is provided from 1.5m to 1.8m to provide a buffer between cyclists and parked vehicles and reduce the risk of injury for cyclists on mid-block locations. Further opportunities to improve safety for pedestrians and cyclists by extending the facilities outside the direct project area into Tinwald should be explored during the Detailed Design, which includes potential additional mid-block pedestrian crossing facilities. Where there is a large distance between current proposed facilities, most likely between Wilkins and Johnstone as there is 450m between intersection crossing points. At this stage there is uncertainty regarding the nature of future land uses, and location of any additional facilities would need to meet key desire lines (which is partly dependent upon the types of adjacent land use). As such, at this stage no additional mid-block pedestrian refuges have been identified.*

2. *The introduction of raised platforms on the side road approaches, would highlight the crossing point to approaching drivers and play a part in managing speeds. Generally, on the main alignment if these are to be included, they need to be designed correctly to ensure HCV's don't have difficulties with navigating the road, and be designed in such a manner that any "Courtesy Crossings" are not misunderstood by Pedestrians/Cyclists/Motorists over who has right of way. To be developed during the Detailed Design phase.*

3. *The design of the roundabout central mountable aprons and safety barriers are seen as the main areas that will need further specific consideration of motorcyclists to ensure these features are suitable. To be developed during the Detailed Design phase.*

Safety Engineer:	***Agree with the additional improves from the designer***
Client Decision:	*Agree with the designer response*
Action Taken:	***No change to DBC, to be developed during Detailed Design***

2.3 General Issues

2.3.1 Speed Environment **Moderate**

Frequency Rating:	Occasional	*Severity Rating:*	Likely

The design proposes a 50 km/h posted speed limit along the main arterial road, indicating an urban land-use and roadside environment. However, the alignment passes through existing rural land to the south of Tinwald. While the SAT agrees with the 50 km/h speed limit for the proposed road for its planned use and level of development, initially there will be very little side friction or roadside features to indicate the safe and approproate speed for the corridor.

Furthermore, the connecting side roads all have posted speed limits above 50 km/h (between 70 km/h and 100 km/h) and the thresholds are currently closer to the developed area. This means the proposed speed limit will be out-of-context when compared to the level of development and adjacent rural section of road.

When combined with the straight alignment and wide cross-section, this will likely result in vehicle speeds in excess of 50 km/h. Although the reduced lane widths will provide some traffic calming, the overall cross-section is still wide and the lack of side friction will create the perception of a higher speed environment.

Figure 2-2 - Section of Proposed Road Through Existing Rural Land South of Tinwald

Figure 2-3 – Adjoining Sections of Rural Road, Left – Carters Terrace and Right – Wilkin Street

Recommendation:

1. *Consider additional speed management infrastructure to create a safe and appropriate speed environment to encourage lower speeds*
2. *Relocate the existing 50 km/h thresholds further south to include the proposed link road, connecting side roads and intersections*

Designer Response: *Agree with the SAT.*

1. *The horizontal alignment is not completely straight, which along with the narrower than standard vehicle lanes, helps promote slower speeds. Further opportunities to promote a 50kph speed environment, with midblock narrowing's, raised platforms etc., should be explored during Detailed Design and when adjacent development is better understood.*
2. *Drawings have been updated to clearly show the intended relocation of the 50 / 60kph speed thresholds on Carters / Willkins, and the 50 / 80kph speed threshold on Grahams to the South / East of the new road alignment, to result in a continuous 50 kph speed zone in Tinwald encompassing the new road alignment.*

Safety Engineer: ***Agree with extending the thresholds pass the proposed link road. Currently, the speed limit of the urban fringes for Wilkins/ Carters/ Johnstone are 60km/h and 80km/h for Grahams Rd. Temporary structures as roadside features could be introduced on the link road to induce traffic calming until there are further urban developments.***

Client Decision: *Speed limits will be reduced to include the new road and development. Changes to be included in the Speed Management Plan.*

Action Taken: ***Drawings updated to reflect current posted speed limits, but to be reviewed at Detailed Design phase to reflect any changes in ADC Speed Management Plan***

2.3.2 Cyclist Connections **Moderate**

Frequency Rating:	Occasional	*Severity Rating:*	Likely

The proposed design includes a mixture of on-road cycle lanes and shared path facilities. The SAT note the overall level of service for cyclists is generally improved when compared to the surrounding network. However, some connections and transitions are missing, particularly on the approaches to the roundabouts.

The proposed markings show the on-road cycle lanes ending and transitioning to shared path facilities in advance of the roundabouts. However, the shared path in some places is too narrow and there are no clear markings or signs proposed to communicate the shared facility, as shown below in Figure 2-4.

The crossing points through the splitter islands are too narrow for a shared path and there are no proposed transitions to the connecting local roads. This reduces the overall level of service for cyclists at these key locations and increases the likelihood of conflict with other path users or general traffic at entry / exit points. This reduces the attractiveness of the shared path facilities meaning cyclists are likely to remain on-road.

There will also be a desire to link from the proposed paths to the existing mountain bike trails running adjacent to the Ashburton River.

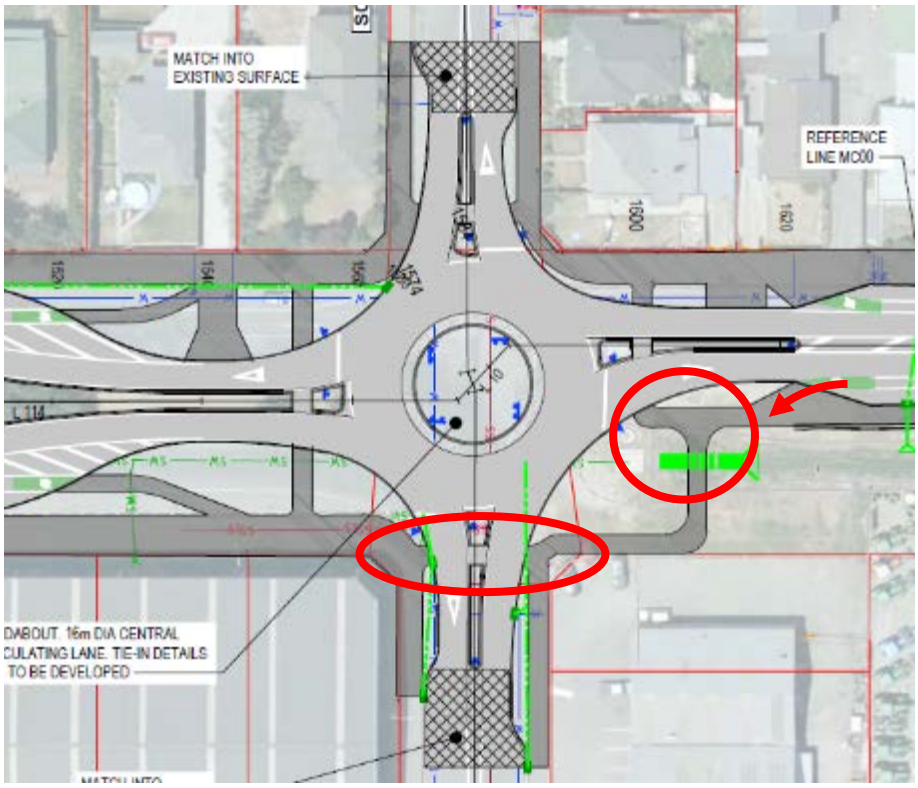

Figure 2-4 – Proposed Cyclist Facilities Showing Narrow Shared Path Facilities

Recommendation:

1. *Provide on / off ramp facilities on all legs of the roundabouts, including local side roads*
2. *Provide dimensions of the shared path and footpath facilities*
3. *Increase the width and depth of crossing points to accommodate both cyclists and pedestrians*
4. *Provide typical shared path treatments, including shared path symbols, signs, and green line marking*
5. *Consider improving cycling connections to local roads at key intersections by providing shared path to on-road transitions*
6. *Provide clear linkages to the mountain bike trails*

Designer Response: *Generally agree with SAT recommendations*

1. *The details of the transition for cyclists from the shared path to side roads will be further developed during the Detailed Design stage. Currently the transition at the end of the shared paths at the side roads of Carters, Wilkins and Johnstone, is over a kerb cutdown onto a widened section of shoulder, at Grahams it's directly on to the existing unsealed shared use path, and at South Street will be over a cutdown onto the carriageway.*
2. *All paths are minimum 2.5m wide – shown in the typical cross section*
3. *The crossing points in the splitter islands are minimum 2.5m wide with a minimum depth of 2.5m (varies up from this with island taper) this will accommodate both cyclists and pedestrians*
4. *Drawings have been updated to include the usual shared path start/end signage. Markings and signage will be further refined at detailed design stage.*
5. *Additional connection extensions along the side roads towards Tinwald will be developed during the detailed design phase, when adjacent development is better understood.*
6. *Drawings have been updated to include proposed off-road path connections to the North and South bank trails.*

Safety Engineer: ***Agree with the designer response. Await detailed design drawings for the cyclist connection.***

Client Decision: *Agree with the designer response.*

Action Taken: ***Minor updates to DBC drawings, to be further developed during Detailed Design***

2.3.3 Cyclist Pinch Points **Significant**

Frequency Rating:	Occasional	*Severity Rating:*	Very likely

The approach to the roundabouts, show the carriageway narrowing and may squeeze cyclists that remain on-road. More confident cyclists may take the lane, but some may position themselves to the left and without adequate shoulder width or markings, will place them in direct conflict with other vehicles. This increases the likelihood of a conflict between vehicles and cyclists using the intersection, particularly as vehicles track along the inside of the curve and across the path of a cyclist.

The SAT note the on-road cycle lanes transition via a ramp to the off-road path, immediately prior to the intersection. However, the traffic shoulder appears to narrow suddenly, providing little room for on-road cyclists. Refer to Figure 2-5. This may force a cyclist into the kerb or in direct conflict with vehicles approaching the roundabout, resulting in death or serious injury.

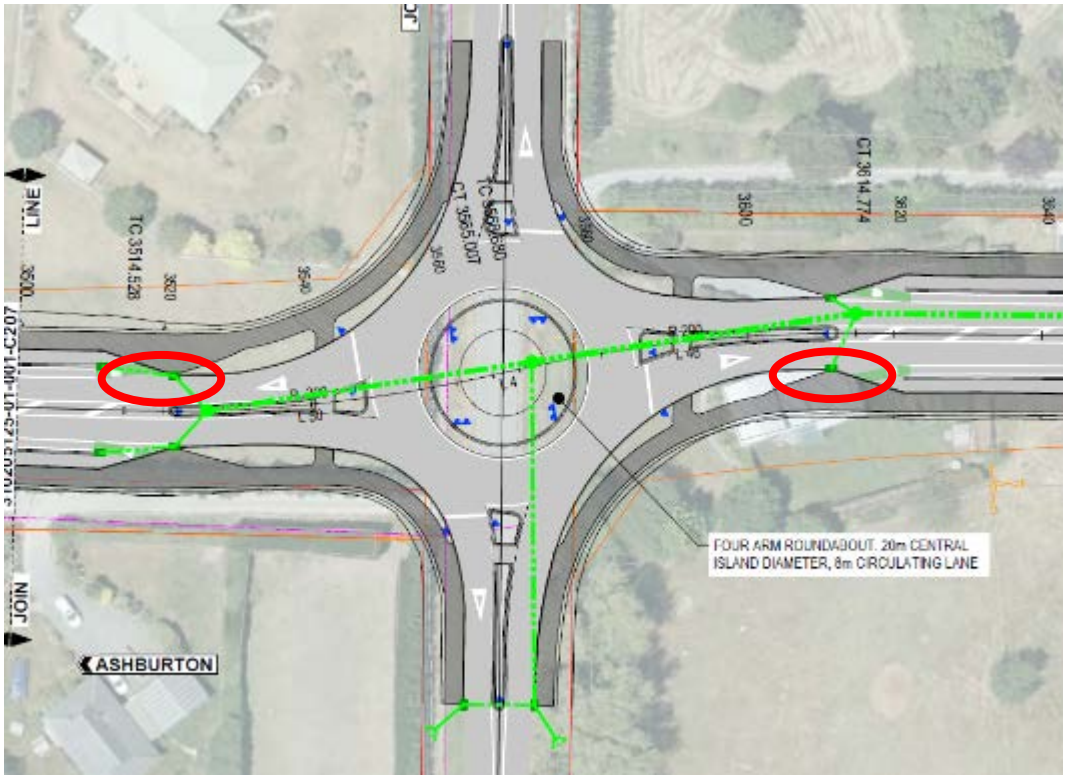

Figure 2-5 – Proposed Cyclist Facilities Showing pinch points on approach to roundabouts

Recommendation:

1. *Confirm the traffic lane and shoulder width is adequate for vehicles and cyclists to share on approach to roundabouts*
2. *Consider additional widening of traffic lanes by easing the kerb extensions, to help avoid this pinch point*

Designer Response:	*Partially agree with SAT recommendations* 1. *The combined approach traffic lane and shoulder width is 4.0m (shoulder kerb to island kerb), which is wider than the current Waka Kotahi recommended approach lane width of 3.2m for compact single lane roundabouts with shared use by cyclist and vehicles. This narrower width is to still allow for the expected HCV tracking without mounting/damage to kerblines, providing improved speed control compared to the Austroads default of 5.0m lane widths, while still being narrow enough to discourage vehicles from attempting to overtake cyclists on approach. The lane edge line is terminated prior to the taper from the 3.2m + 1.8m midblock lanes down to the 4.0m roundabout approaches, to highlight that confident cyclists should "take the lane". The addition of sharrow markings to the roundabout approaches and circulating lanes to be considered during the Detailed Design Phase, to reinforce the shared use by cyclists of the road space.* 2. *Disagree with SAT. The current proposed approach lane widths are already wider than current recommendations for a cyclist friendly compact single lane roundabout. Any increase in width is likely to increase vehicle approach speeds, and possibly encourage unsafe overtaking manoeuvres.*
Safety Engineer:	***Agree with the designer response***
Client Decision:	*Agree with the designer response.*
Action Taken:	***No change to DBC, to be developed during Detailed Design***

2.3.4 Pedestrian Connectivity **Moderate**

Frequency Rating:	Infrequent	*Severity Rating:*	Likely

The plans show a 2.5 m wide shared path along both sides of the majority of the new link road, including over the new bridge structure. This will provide a high quality level of service in an east-west direction, i.e. from Ashburton to Tinwald. Shared paths are also shown on the side roads at all new intersections (roundabouts), however, in the rural area (at Carters Terrace, Wilkin Street, Johnstone Street and Grahams Road) the paths discontinue approximately 50 m from the intersection. Refer to Figure 2-6.

The SAT acknowledge that path connections may be developed further at the next design stage. However, it is noted there are existing footpaths on each of the side roads servicing the existing residentail area adjacent to Grove Road. These paths currently terminate only approximately 100-150 m from the proposed intersections. This will leave a gap in the middle where pedestrians will be forced to walk along a rural grass verge, exposing them to risk of impact from vehicles in the adjacent traffic lane.

Furthermore, if the short section of road between the new link road and the side roads immediately south-east of Grove Road are connected with kerb and channel and footpaths, this will better highlight a similar (urban) environment and control of speeds.

Figure 2-6 – View south-east from Grove Road, along Carters Terrace. Note end of footpaths on both sides. Approximate location of proposed intersection shown (in red)

Recommendation:

1. *Consider wider network footpath connections at the next design stage*
2. *Provide a continuous footpath link from Grove Road to the new link road on all side roads (Carters, Wilkin, Johnstone, Grahams)*
3. *Consider kerb and channel (consistent cross section) for all side roads south-east of Grove Road to the new link road*

Designer Response:	*Agree with SAT recommendations* 1. *There is merit in exploring the above recommendations in the Detailed Design phase to integrate the existing Urban environment with the new alignment. These features do however go beyond the currently defined scope of the project and would be for Ashburton District Council to implement and fund. No changes to the preliminary design have been made.* 2. *As per 1 above, these links are currently outside the scope of the project.* 3. *There is a difference between the existing Tinwald cross-section, and current design requirements, due to the date Tinwald was developed. Integrating the currently very wide cross-section in Tinwald with a more modern narrower carriageway cross-section needs to be considered carefully if these additional linkages are to be incorporated.*
Safety Engineer:	***Agree with the designer response***
Client Decision:	*Agree with the designer response.*
Action Taken:	***No change to DBC, to be developed during Detailed Design***

2.3.5 Shared path conflict at driveways **Moderate**

Frequency Rating:	Infrequent	*Severity Rating:*	Likely

The proposed shared path will intersect with vehicle crossings along the entire route, where vehicles access adjoining properties. There are existing accesses located in the existing residential area of Ashburton and the SAT understand, eventually, new driveways will intersect the link road as development occurs adjacent to the new road.

A cyclist or pedestrian being struck by a vehicle entering or exiting one of these accessways has the potential to be seriously injured or killed. This is particularly true for small children on bikes, as they are more difficult to see and are more severely affected by an impact with a vehicle.

Therefore, it is important to provide clear sight lines and control speeds at these critical conflict points. This will be especially true as the land develops and new driveways are created, as path users may be surprised by new conflict points. Line marking and signage should also be used as supportive measures to raise the awareness for motorists and other road users to expect to encounter pedestrians and cyclists.

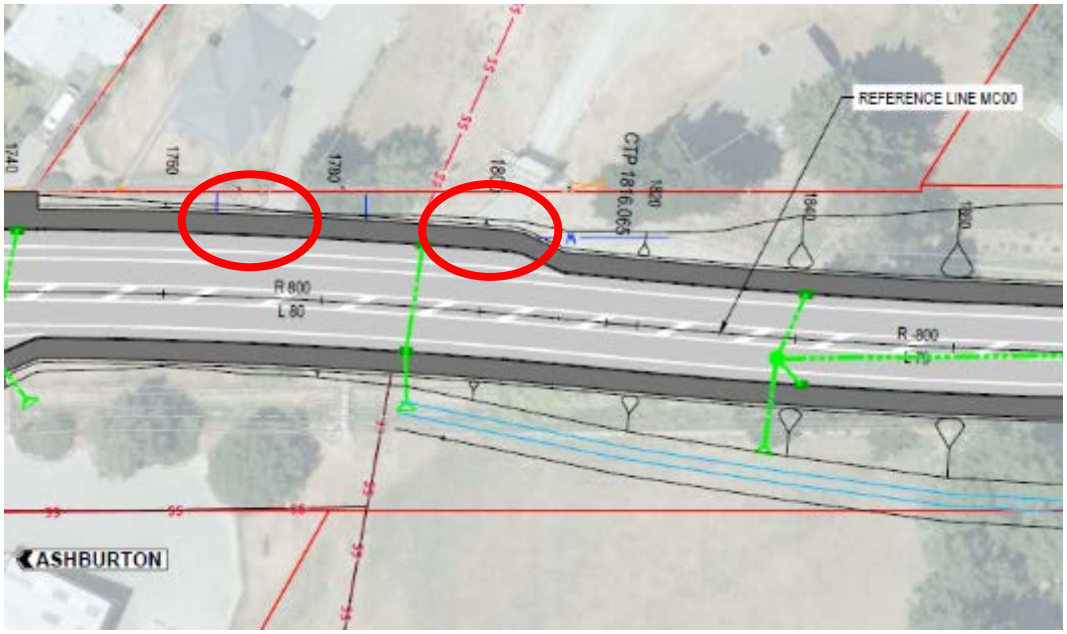

Figure 2-7 – Example of shared path vehicle crossing points

Recommendation:

1. *Provide clear sight lines at shared path vehicle crossing points, particularly those with high expected turning movements*
2. *Consider additional speed controls at vehicle crossings with high expected turning movements, such as vertical deflection or additional delineation*
3. *Install shared path line marking symbols at all vehicle crossings and confirm symbols face the direction of the exiting vehicle, as per best practice design guidelines*

Designer Response:	*Agree with SAT recommendations* 1. *At this stage there are no plans for high (or even moderate) trip generating activities to be introduced that would have direct access onto the corridor. ADC are at the initial planning stages for how land use along the corridor could develop in the future. The vertical and horizontal geometry generally does not create any restriction on sight lines to / from private accessways and the shared paths. In the most part there is clearance provided between the private property boundaries (possible fence locations which will restrict visibility) and the back of the shared paths, meaning visibility is maintained. Additional guidance through the District Plan may be required to enforce fence height and setback requirements for Urban private accessways adjacent to shared use paths, current guidance is mainly focussed on Rural accessways.* 2. *To be considered and developed during the Detailed Design phase, once adjacent land use is confirmed and high demand accessways are identified.* 3. *Additional markings to be considered during Detail Design Phase to highlight shared path crossing points with private accessways.*
Safety Engineer:	***Agree with the designer response***
Client Decision:	*Agree with the designer response.*
Action Taken:	***No change to DBC, to be developed during Detailed Design***

2.3.6 Pedestrian and Cyclist conflicts at Roundabouts — Moderate

Frequency Rating:	Infrequent	*Severity Rating:*	Very likely

Pedestrian and cycle crossings are shown provided on each quadrant of the roundabout. Roundabouts are considered a safe system treatment for vehicles by controlling the speed and angle of crashes, reducing the crash forces to below safe system tolerances i.e. less than 50 km/h for intersection crashes. However, they can be less safe for cyclists and pedestrians to negotiate.

Whilst the entry speeds of vehicles approaching the roundabout are likely to be lower than 50 km/h (as they prepare to give way), speeds are likely to be approaching 50 km/h as vehicles exit from the roundabout. If a crash were to occur with a pedestrian or cyclist crossing at the roundabout exits, it is possible to result in a DSI crash as impact speeds are likely to be above survivable speeds of 30 km/h for vulnerable road users. Refer to Figure 2-8.

Furthermore, more confident cyclists will typically 'own the lane' by cycling in the middle of the lane and have cars follow them on approach and around the roundabout. However, cyclists can be difficult to see by some drivers and fail to give way to cyclists using the roundabout. If entry, exit or circulating speeds of vehicles are too high, then any impact with a cyclist in the lane will likely result in a DSI.

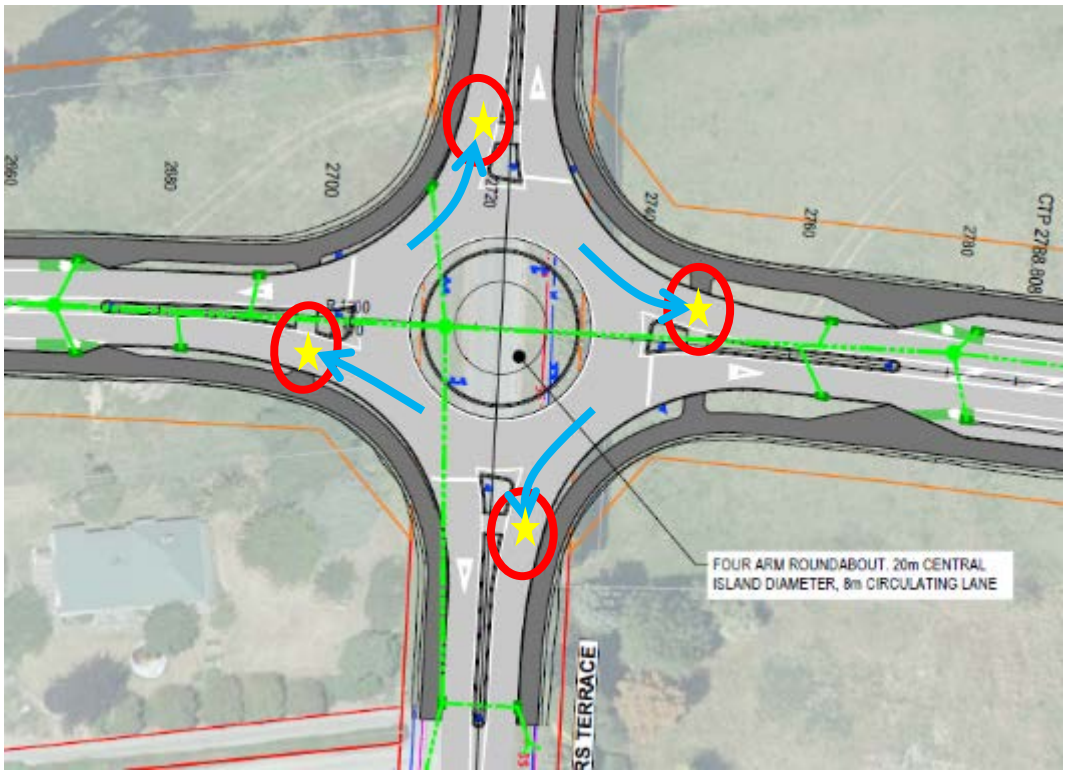

Figure 2-8 – Pedestrian and cyclist crossing facilities at roundabouts (high speed exit locations circled)

Recommendation:

1. *Consider raised safety platforms (RSP's) on approach and exit legs from roundabouts to control vehicle speeds*
2. *Consider formalised (zebra) crossings for pedestrians and cyclists to give vulnerable road users right of way*
3. *Consider improved crossing facilities away from intersections (i.e. mid-block)*

Designer Response:	*Agree with SAT recommendations* 1. *Raised platforms are likely to be introduced on the side roads, as the design is developed, but would be a "maybe" on the main route due to the needs of accommodating HCV's and the Collector nature of the future road. Consideration needs to be given to ensure any raised platforms do not cause the confusion which occurs at "courtesy crossings". To be developed during Detailed Design Phase.* 2. *Partially agree with SAT, the need for and location of any formal zebra crossings will be based on the future adjacent land use and expected desire lines. To be developed during Detailed Design Phase.* 3. *Excluding the section between South Street and Carters Terrace, which has limited potential for adjacent development and therefore likely to have limited crossing desire, other than to access the river trails. The future adjacent development is going to govern where any additional midblock crossing points will be required. ADC are at the initial planning stages for how land use will be designated, at which point additional crossing points may be considered. To be developed during Detailed Design Phase.*
Safety Engineer:	***Agree with the designer response***
Client Decision:	*Agree with the designer response.*
Action Taken:	***No change to DBC, consideration of raised platforms to be included Detailed Design***

2.3.7 Roundabouts - Visibility

Comment

Frequency Rating:	N/A	*Severity Rating:*	N/A

No sight distance checks for the proposed roundabouts were provided to the SAT (it is likely this will be completed at the next design stage). Sight distance is an important safety aspect for each roundabout, in particular, the following criteria must be met:

- Criteria 1 – approach sight distance (ASD): the alignment of the approach should be such that the driver has a good view of the splitter island, the central island and, preferably, the circulating carriageway
- Criteria 2 – relates to a driver entering a roundabout having adequate sight distance to potential conflicting movements i.e. a vehicle entering from the approach immediately to the right; and, a vehicle travelling on the circulating roadway

From an initial review of the plans, ASD appears to be satisfied in most instances due to the flat and straight alignment to most roundabouts. However, this should still be confirmed by the designer. Criteria 2 may be restricted in some instances, due to corner splays of existing houses (e.g. at Chalmers Street), fences and existing trees.

Recommendation:

1. *Confirm sight distance criteria is met for all roundabouts*
2. *Ensure existing and proposed planting, signs, poles etc are not within the visibility triangles for each roundabout, affecting interseciton visibility*

Designer Response:	*Agree with SAT recommendations* 1. *Both Criteria 1 and 2 sight distances are available at the intersections.* 2. *Final property boundaries are to be considered during the Detailed Design phase, but currently these are placed to ensure ADC retains control over the area under sight visibility triangles.*
Safety Engineer:	***Agree with the designer response***
Client Decision:	*Agree with designer response.*
Action Taken:	***No change to DBC, to be reconfirmed during Detailed Design***

2.3.8 Roundabouts – Landscaping Areas **Moderate**

Frequency Rating:	Occasional	*Severity Rating:*	Likely

There are no details about the proposed landscaping or structures within the roundabout central island (likely to be developed at the next design stage). It is important that any landscaping or structure within the roundabout central island is frangible to prevent serious injury if struck.

Also to note is any feature / structure could be a distraction for drivers, resulting in failure to give way, with subsequent side impact and rear-end crashes. Any landscaping or structure will require maintenance. This needs to be considered in terms of safety in design for maintenance workers, exposed to the risk of live traffic.

Furthermore, there are narrow strips shown between the carriageway and proposed footpaths on all the rural roundabouts. Refer to Figure 2-9. These areas will be difficult to maintain i.e. narrow mowing strip and will expose workers to the risk of adjacent live traffic. These locations are also critical for maintaining sightlines at the intersection and therefore any planting needs to be low rise.

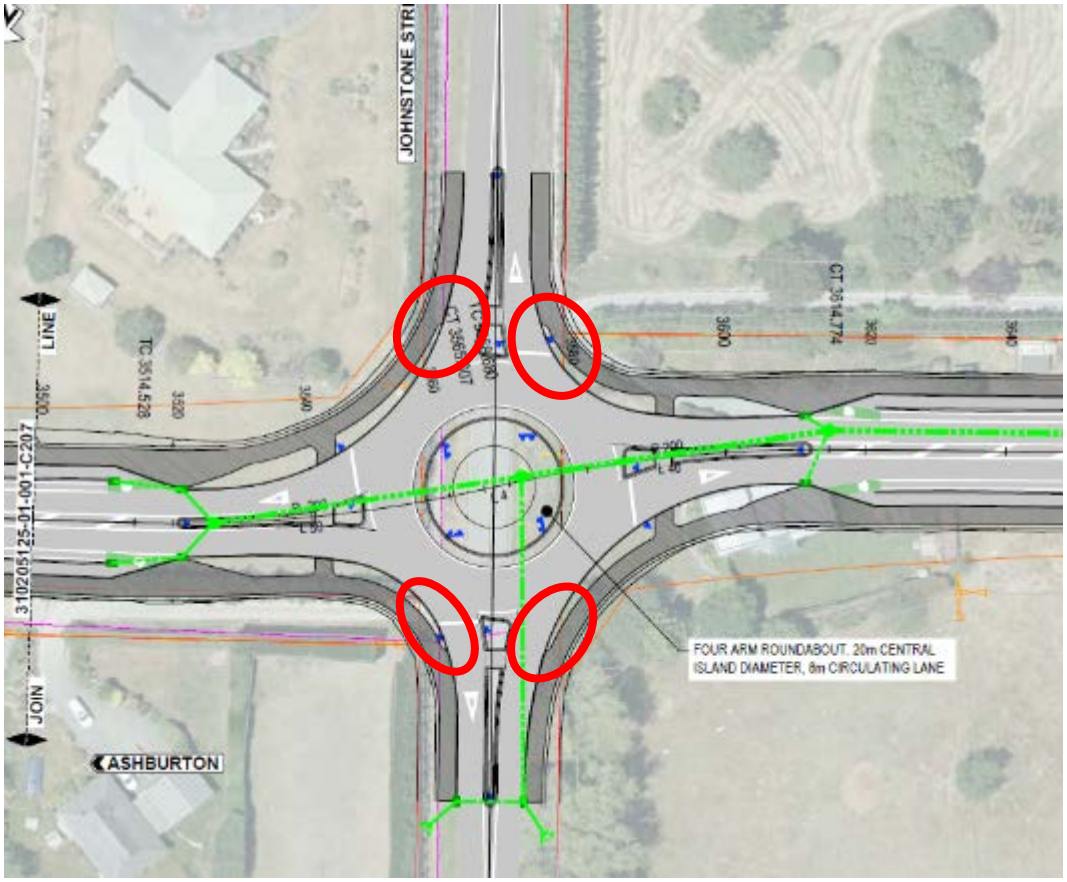

Figure 2-9 – Areas of narrow landscaping adjacent to carriageway and paths at roundabouts

Recommendation:

1. *Ensure any landscaping or structures located within the roundabout central island are frangible, non-distracting and are low maintenance*
2. *Provide low maintenance landscaping on the corner spays of roundabouts, preferably making these hardstand areas*
3. *If landscaping is provided on corner splays, ensure this is low-rise and does not impact with intersection sightlines*

Designer Response:	*Agree with SAT recommendations* 1. *Central islands will typically be hardscaped to remove the need for ongoing plant maintenance within the central islands. Final design treatment to be developed during Detailed Design Phase.* 2. *These areas between the kerbs and shared paths, are to either be grassed, low planting, or hardscaped with a contrasting surface finish. No final decision has been made. To be developed during Detailed Design Phase as per the Landscape and Urban Design Framework* 3. *Due to the requirement for sightlines, if these areas are to be planted, only low height ground cover plantings, <150mm plant height, should be used.*
Safety Engineer:	***Agree with the designer response***
Client Decision:	*Agree with designer response.*
Action Taken:	***No change to DBC, to be developed during Detailed Design***

2.3.9 Roundabout Central Island **Moderate**

Frequency Rating:	Infrequent	*Severity Rating:*	Likely

Few details are provided for the roundabout central island, however, it is acknowledged this is likely to be developed further at the next design stage. It appears from the tracking plans and typical cross-sections provided, a concrete apron will be utilised by larger vehicles to track over when turning. Refer to Figure 2-10.

Whilst these areas can benefit larger vehicles, they can increase the speed with which lighter vehicles travel through the roundabout. Furthermore, the kerbed areas around roundabouts can be a hazard to motorcyclists if they are not visible, leading to possible vaulting and loss of control crashes.

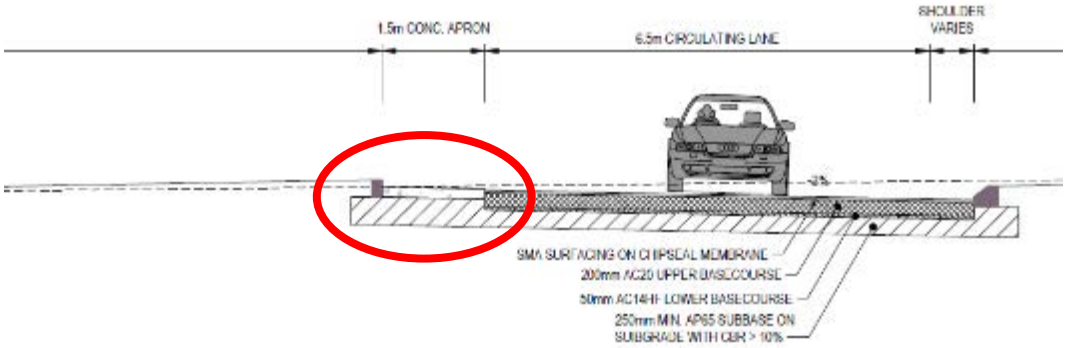

Figure 2-10 – Typical Cross-section through roundabout central island

Recommendation:

1. *Confirm design of roundabout central island at next design stage*
2. *Confirm any kerb is mountable*
3. *Consider motorcyclist safety in the design of the roundabout*

Designer Response: *Agree with SAT recommendations* 1. *Final shape, width, and surface finish, of the central island apron will be confirmed during the Detailed Design Phase.* 2. *The central island kerb will have a mountable kerb type. Typical cross-section drawings have been updated to reflect this.* 3. *Consideration of motorcyclist safety will form part of the development of the roundabout aprons and overall roundabout form during the Detail design phase.*
Safety Engineer: ***Agree with the designer response***
Client Decision: *Agree with designer response.*
Action Taken: ***Updated central island cross-section to show mountable kerbs, to be developed during Detailed Design***

2.3.10 Cross-section – Cycle Lanes **Moderate**

Frequency Rating:	Occasional	*Severity Rating:*	Likely

Typical cross-sections were provided for varying sections of the proposed road. This included: a 3.2 m traffic lane in each direction; 2.0 m flush median (replaced with a 0.6 m wide centreline across the bridge); 1.5 m cycle lane (with 1.7 m provided across the bridge); 2.1 m parking lane (or planted berm); and, 2.5 m shared path.

Regarding the 1.5 m wide on-road cycle lane, the SAT raise the following issues:

- With only 2.1 m of parking width provided and long lengths of kerbside parking proposed, there is increased risk of "dooring" issues with drivers exiting cars and cyclists colliding with doors
- The section from Carters Terrace to Grahams Road proposes a dish channel between the parking areas and cycle lane. This area can become trapped with gravel and other material, reducing the effective width for cyclists
- It is unclear why a 1.7 m wide cycle lane is provided across the bridge and 1.5 m in all other places

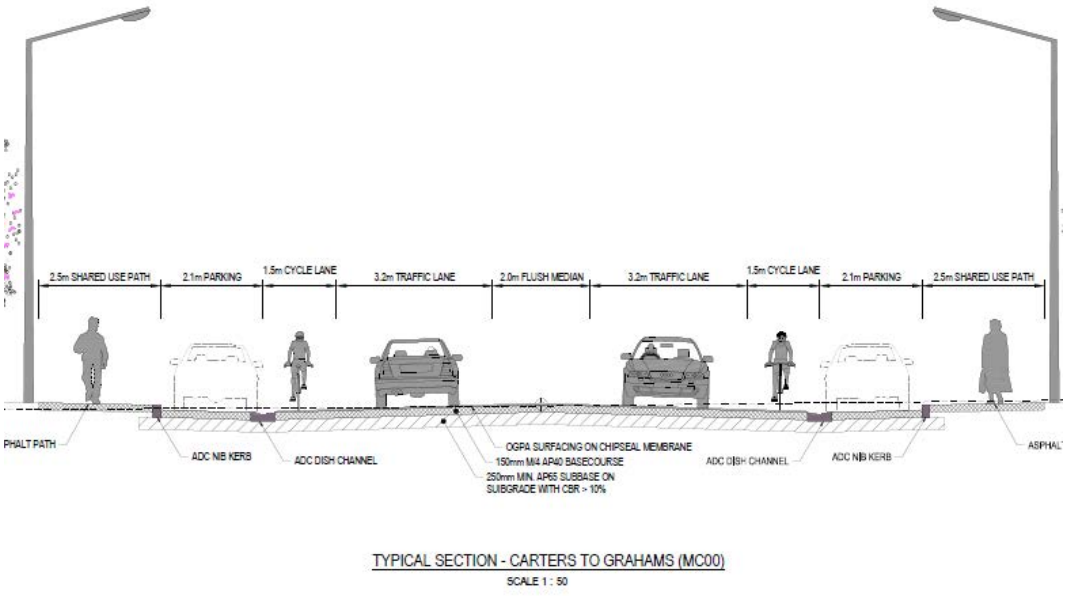

Figure 2-11 – Typical cross section

Recommendation:

1. *Increase the width of parking areas to reduce conflicts with adjacent cyclists*
2. *Consider reducing the length of parking areas, especially when this will remain largely rural*
3. *Consider widening cycle paths to 1.7 m to match the width provided across the bridge*

Designer Response: *Agree with SAT recommendations*

1. *The width of the cycle lanes has been increased to 1.8m where adjacent to parking to provide additional buffer between cyclists and parked vehicles.*
2. *Parking areas may be reduced by the inclusion of more planted berm areas when the adjacent land activity is known. To be developed during the Detailed Design phase.*
3. *The 1.7 cycle lane across the bridge is provided due to the potential for a variable height "step down", potentially up to 60mm, from the final asphalt level to the bridge deck and provides slightly more room over the structures, where a narrower wide centreline instead of flush median treatment is proposed. To be considered further at detailed design stage.*

Safety Engineer: ***Agree with the designer response***

Client Decision: *Agree with designer response.*

Action Taken: ***Updated on road cycle lanes past parking to 1.8m width. Further refinement of cycle lane widths, for consistency, to be completed during Detailed Design***

2.3.11 Driveways **Minor**

Frequency Rating:	Occasional	*Severity Rating:*	Unlikely

There are a number of existing rural driveways impacted by the proposed road, however, the plans do not detail where future access will be. Some of the existing accesses intersect very close to the roundabouts. Ideally, accesses will be located away from roundabouts to avoid conflict points and confusion.

The following issues are noted:

- Carters Terrace (sheet C205): existing access on the north-west quadrant – it will be difficult to turn right in with the existing splitter island
- Wilkin Street (sheet C206): existing access on the south-east quadrant – one driveway exists at the roundabout. A second access along Wilkin Street will conflict with the end of the shared path. Refer to Figure 2-12
- Johnstone Street (sheet C208): two existing properties on either side of the proposed link road, exit onto Johnstone Road at the roundabout. It is assumed these will have direct linkage to the new road
- Grahams Road (sheet C209): an existing property access is provided through the slitter island (this issued is described further in Section 2.8.3)

Furthermore, given the rural nature of some properties, larger vehicles are likely to be turning in and out. With an increase in traffic volumes and narrowing of some side roads, access points will need further investigation in terms of turning requirements and any additional carriageway widening required.

Rural driveways should also be sealed to avoid excess loose chip migrating onto the shared path or road shoulder, placing cyclists and motorcyclists at increased risk.

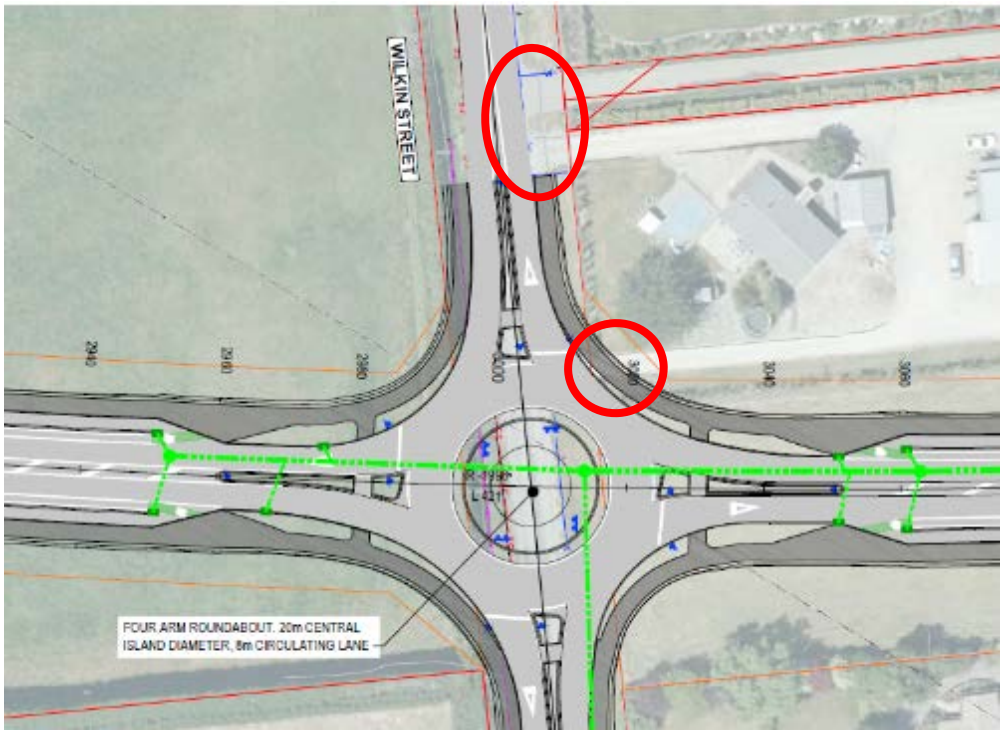

Figure 2-12 – Driveways impacted at Wilkin Street

Recommendation:

1. *Confirm property access points for all affected properties*
2. *Ensure property access is located away from intersections, where possible*
3. *Where access is close to the roundabout, ensure the splitter island length is carefully considered to avoid undesirable u-turn movements*
4. *Undertake vehicle tracking for key accesses, and where required, provide additional carriageway widening*
5. *Seal all rural driveways*
6. *Consider interaction with the shared path for all crossing points*

Designer Response: *Agree with SAT recommendations*

1. *Additional notes have been added to the drawings, to provide some guidance on interim thinking at accessways to be modified until final adjacent land use tis confirmed. To be fully considered at detailed design stage.*
2. *Some property owners have already indicated that they are happy to relocate their access away from the roundabouts but other will be considered / consulted at detailed design stage.*
3. *All accessways will be considered at Detailed Design.*
4. *To be completed at detailed design stage.*
5. *Accessways are proposed to be sealed to the boundary, as per ADC District Plan requirements.*
6. *Response in item 2.3.5 above. To be further considered during detailed design stage.*

Safety Engineer:	***Agree with the designer response***
Client Decision:	*Agree with designer response.*
Action Taken:	***No change to DBC, to be developed during Detailed Design***

2.4 Chalmers Avenue / South Street Intersection

2.4.1 Intersection Sight Distance **Moderate**

Frequency Rating:	Occasional	*Severity Rating:*	Likely

The existing trees located in the median on the northern side of Chalmers Avenue may restrict the visibility for vehicles approaching the roundabout from the north-eastern leg. Although some of the trees will need to be removed to accommodate the proposed roundabout, it is unclear which trees are to be retained or removed.

Adequate visibility is important for all vehicles approaching the intersection and the reduction in visibility reduces the distance and time for a driver to observe and react accordingly, increasing the risk of a conflict.

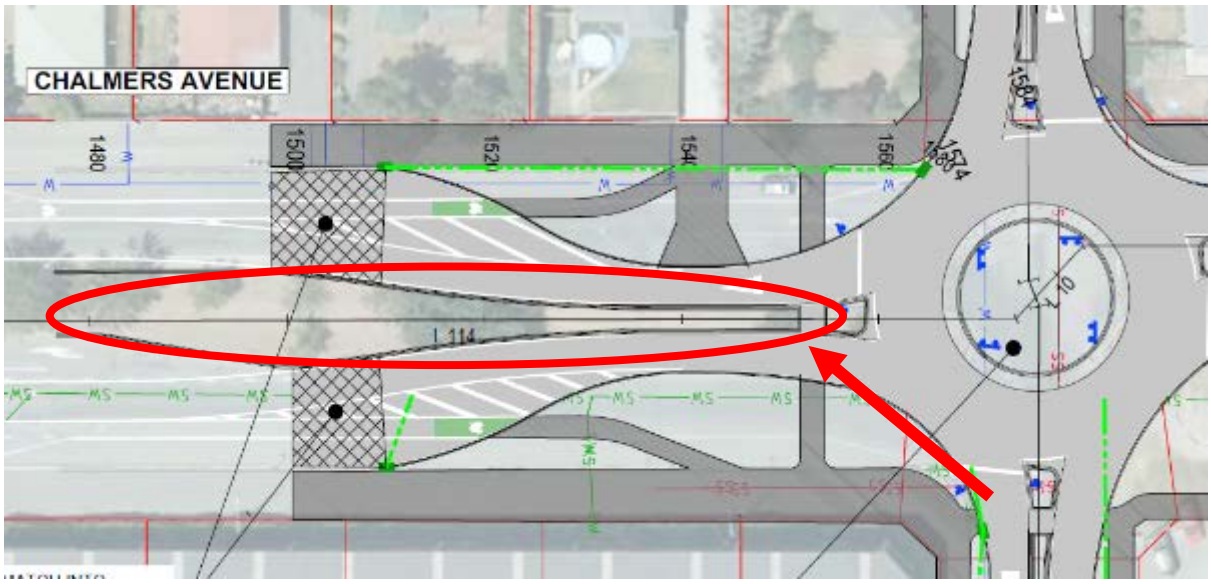

Figure 2-13 – Large Trees in the Existing Median on Chalmers Avenue

Recommendation:

1. *Confirm sight distances are achieved at the proposed roundabout*
2. *Confirm which trees are to be retained and which are to be removed*

Designer Response:	*Agree with SAT recommendations* 1. *Sight distances are achieved for both Criteria 1 and 2 with the current design.* 2. *Final tree clearance to be confirmed at Detailed Design, at this stage trees are proposed to be cleared up to ~STN 1480 – 1500*
Safety Engineer:	***Agree with the designer response***
Client Decision:	*Agree with designer response.*
Action Taken:	***No change to DBC, to be reconfirmed during Detailed Design***

2.4.2 Property Access Near Intersection **Minor**

Frequency Rating:	Occasional	*Severity Rating:*	Unlikely

The SAT note that accessways near the proposed roundabout will become left-in left-out (LILO) with the new splitter islands. This is generally not an issue for accessing the site, as vehicles approaching from the opposing side can turn-around at the roundabout. However, drivers wishing to exit and head north will need to turn left and then turn-around. When travelling south, there are no formal facilities to turn around before the next intersection at Carters Terrace, as shown in Figure 2-14. Drivers are unlikely to want to cross the bridge to the south and turn around at the next intersection due to the additional distance they would have to travel, as shown in Figure 2-15.This may encourage unsafe U-turn manoeuvres near the roundabout resulting in conflicts with opposing vehicles or cyclists. A mitigating factor would be the lower turning and approaching speeds near the roundabout.

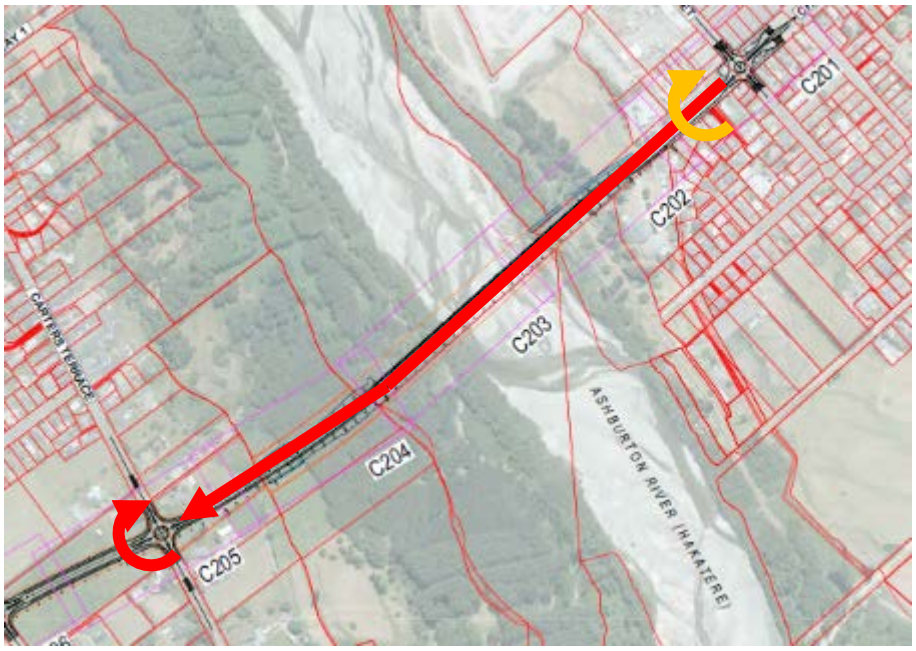

Figure 2-14 - Turn-Around Opportunities South of the Chalmers Avenue/South Street Roundabout

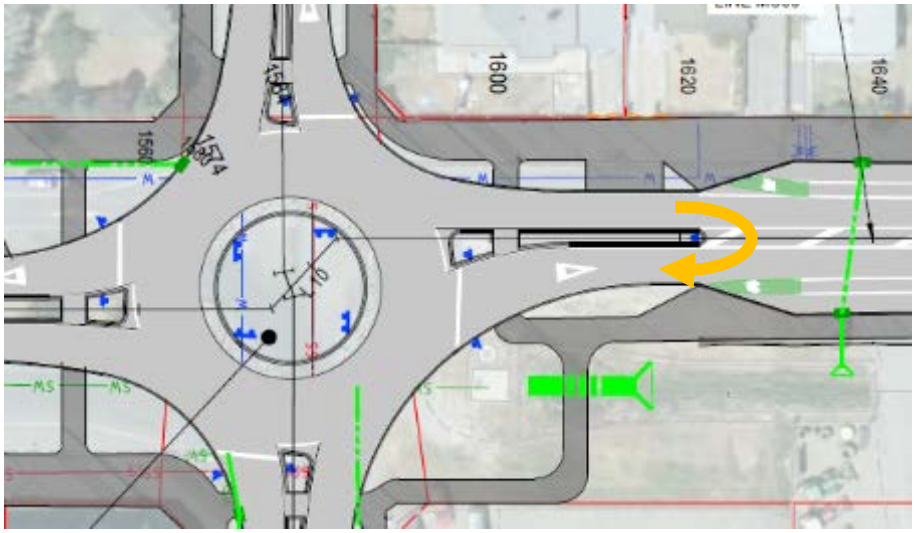

Figure 2-15 – Possible U-Turn Manoeuvres at the Chalmers Avenue/South Street Roundabout

Recommendation:

1. *Confirm vehicle tracking at vehicle crossings near the intersections is acceptable*
2. *Provide a kerbed median, similar to the splitter island at the intersection of Chalmers Avenue and Grahams Road to allow vehicles to turn out of nearby accessways*
3. *Consider providing a safe turn-around facility between the intersection of Chalmers Avenue and South Street and the new bridge*

Designer Response: *Partially agree with SAT recommendations*

1. *Vehicle tracking to be confirmed at specific accessways during detailed design.*
2. *Dropped area through island has been added to this splitter island to allow for right turn out movements.*
3. *Disagree with SAT, providing a specific U-Turn is not seen as being a requirement, once the design has been modified as per response 2 above, to account for the only likely demand for a U-turn. The current carriageway width of 12m (including the cycle lanes) allows for on road U-turn manoeuvres to be completed if required, as would be the case for a vehicle leaving the on street parking and wanting to return in the opposite direction.*

Safety Engineer: ***Agree with the designer response***

Client Decision: *Agree with designer response.*

Action Taken: ***Vehicle pass through area has been added to the design splitter island on this approach, to be developed during Detailed Design***

2.4.3 Driveway interaction with cycle ramps Moderate

Frequency Rating:	Occasional	*Severity Rating:*	Likely

The proposed design includes several transitions between the on-road cycle lanes and the shared path facilities. At CH1620 there is an existing vehicle crossing that intersects the cycle lane transition from shared path to cycle lane south of the proposed roundabout. This may lead to conflicts between cyclists entering the on-road facility and vehicles accessing the property. Although speeds are likely to be low, the conflict with vulnerable road users may result in serious injury.

Furthermore, the type of cutdown used for the cycle ramp transition has a lower profile than that of a vehicle crossing. The SAT note these details may be developed further at the next design stage. However, as no further information has been provided, it is assumed the cyclists and vehicles will share the same cutdown and it should be safe for all users.

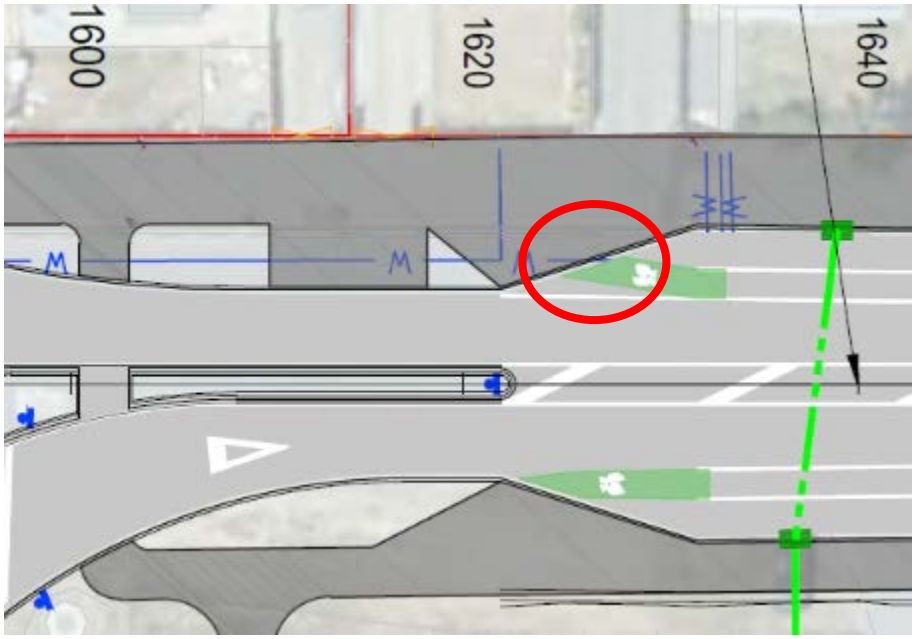

Figure 2-16 – Transition Between On-Road Cycle Lane and Shared Path Near a Vehicle Crossing

Recommendation:

1. *Consider treatments to improve the safety of the conflict point between the cycle lane transition and the vehicle crossing, including relocating/separating the two*
2. *Confirm cycle lane transition details at the next design stage, including kerb cutdown types*

***Designer Response**: Partially agree with SAT recommendations* 1. *With multiple accessways in this area conflict points are impossible to avoid, although consideration will be given to these at detailed design stage.* 2. *Final detail to be developed during the next project phase. Acknowledgment is given to the difference between an accessway cutdown (with short kerb upstand remaining) and pedestrian/cyclist cutdown (flush invert).*
Safety Engineer: Agree with the designer response. However, designer could adjust the cycle transition to avoid a driveway that is used by multiple properties.
***Client Decision:** Agree with designer response.*
Action Taken: No change to DBC, at this stage, but modifications to provide additional separation between different modes to be developed during Detailed Design

2.4.4 Chalmers Approach Geometry **Minor**

Frequency Rating:	Infrequent	*Severity Rating:*	Unlikely

The proposed design includes large, sealed areas with chevron line marking to the north of the roundabout that could be used as on-street parking. Parked vehicles may restrict the visibility between cyclists and through traffic, increasing the likelihood of conflicts between cyclists and turning vehicles. A vehicle may also block the cycle ramp.

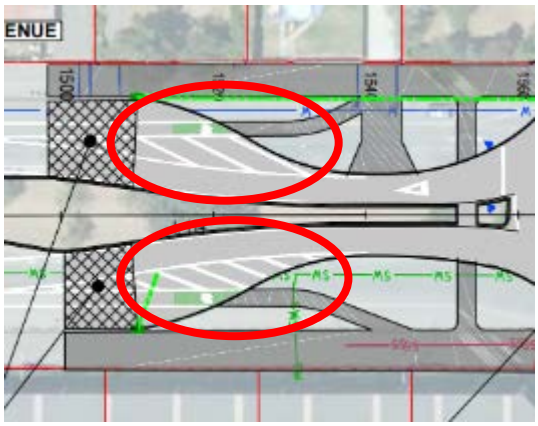

Figure 2-17 – Large Hatched Shoulders North of the Proposed Roundabout

Recommendation:

1. *Consider installing physical separation, such as kerb and channel, to separate and guide traffic towards the new roundabout*

Designer Response:	*Partially agree with SAT recommendations* 1. *A physical island in the location of the chevrons would make it difficult for those entering and exiting the kerb side parking. However the kerbside parking could be removed and carriageway narrowed further. This would possibly create a lot of green space in a very wide road corridor. Something to be considered more at detailed design stage.*
Safety Engineer:	***Agree with the designer response. However, delineators could be installed in the chevron line markings to discourage on-street parking in the area.***
Client Decision:	*Agree with designer response.*
Action Taken:	***No change to DBC, to be developed during Detailed Design***

2.5 Midblock Issues

2.5.1 Bridge Maintenance Access

Comment

Frequency Rating:	**N/A**	***Severity Rating:***	**N/A**

Maintenance access will be required for the new bridge structures. No information has been provided, however, it is expected this will be considered at subsequent design stages. Designing for safe access (including location, frequency, design vehicle etc) will be important to protect workers and the general public.

Recommendation:

1. *Consider maintenance access for the bridge structures at the next design stage*

Designer Response:	*Agree with SAT recommendations* 1. *Maintenance access from the roadway will be required to be completed while working under an approved temporary traffic management plan. Access to the underside of the structures would be via the proposed off-road paths. To be further considered during Detailed Design.*
Safety Engineer:	***Agree with the designer response***
Client Decision:	*Agree with designer response.*
Action Taken:	***No change to DBC, to be developed during Detailed Design***

2.5.2 Stormwater Structures **Moderate**

Frequency Rating:	Infrequent	*Severity Rating:*	Likely

Two stormwater treatment basins are proposed to the south of the new road alignment, through chainage 3220-3300, as shown in Figure 2-18. The SAT have reviewed the cross-sections, which indicate slopes of 1:4, however, it is not clear if this is the verge slope of the road or the stormwater basin. The stormwater basins may also contain standing water which would be a hazard if any vehicle were to run off the road in this location.

Furthermore, although a 1:4 slope is considered traversable for a car, it is not considered recoverable for cars or trucks. It is considered the minimum safety standard. The SAT acknowledge that some constraints along the corridor may limit slopes. However, a 1:4 slope should be the minimum and where possible, a recoverable slope of 1:6 or flatter be provided, to reduce the risk of rollover.

There is also a headwall on both sides of the road at chainage 3260, where the verge slope is steeper in this localised area. Any errant vehicle in this location is likely to roll or strike the headwall, likely to result in a DSI crash.

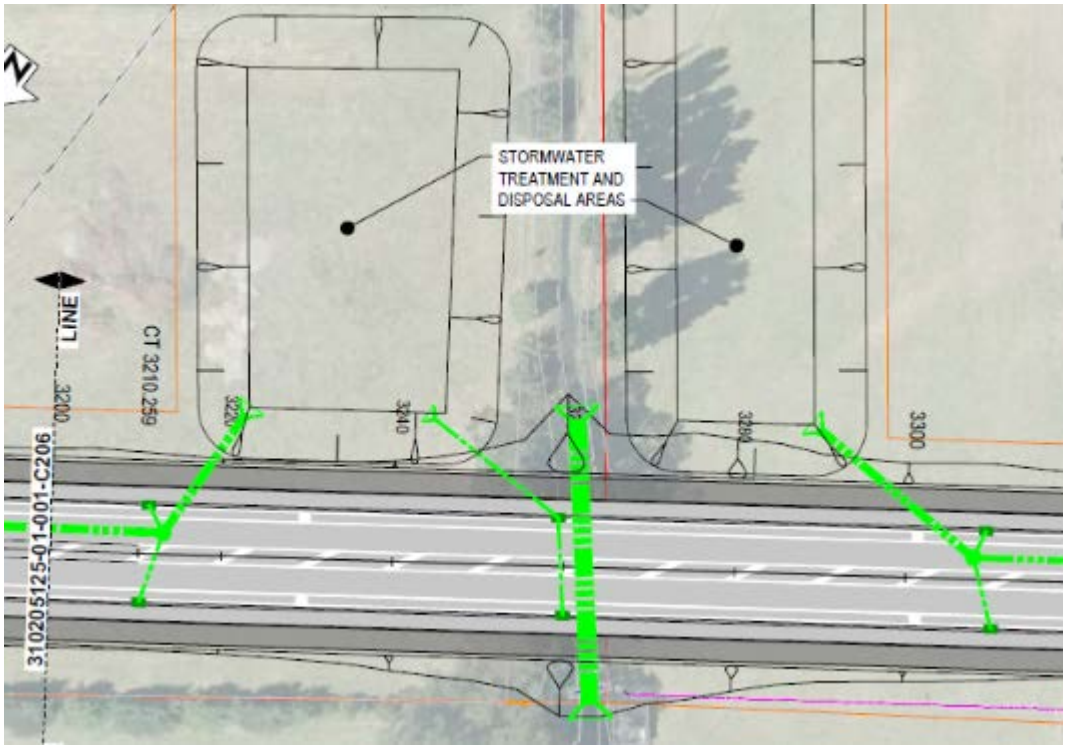

Figure 2-18 – Stormwater Basins, Ch 3220-3300

Recommendation:

1. *Confirm side slopes and aim for 1:6 slopes or flatter, where possible*
2. *If hazards cannot be removed, consider a roadside barrier*
3. *Confirm details and roadside protection for the stormwater basins*

Designer Response:	*Partially agree with SAT recommendations* 1. *Side slopes of the SW basins have been designed at 4H:1V slopes to match the verge slopes. With the basins being located a minimum of 6.0m away from the traffic lanes, and not holding standing water for a period longer than 24 hours following a major event (during minor events the ponds will not hold any surface water), it is not considered a requirement to flatten off the slopes further. Additional land purchase would need to be considered if 6H:1V slopes are to be allowed for due to the reduction in storage capacity.* 2. *Based on an Austroads Part 6 assessment, a safety barrier would not be required in this location, due to the distance from the traffic lane, posted speed, and traffic volume.* 3. *The Carters Creek headwalls are located a minimum of 12m from the traffic lanes and deemed to not required any protection. The batter slopes in this area are a consistent 4H:1V No further protection is deemed to be required.*
Safety Engineer:	***Agree with the designer response***
Client Decision:	*Agree with designer response.*
Action Taken:	***No change to DBC, to be reconfirmed during Detailed Design***

2.6 Carters Terrace Intersection

2.6.1 Proposed Alternative Option **Moderate**

Frequency Rating:	Occasional	*Severity Rating:*	Likely

The SAT understand the future traffic volume and turning flows at Carters Terrace will be very low. It is understood that a priority controlled intersection is proposed as an alternative to a roundabout. The SAT note the following:

- A priority controlled intersection is less safe than a roundabout. A roundabout is considered a safe system solution, where as a priority controlled intersection is not. Should a crash occur at a priority controlled intersection, impact speeds are likely to exceed the safe system tolerance of 50 km/h for a side impact crash. Whereas a roundabout helps to achieve lower speeds and reducing the angle of crash impact (intending to reduce impact speeds below 50 km/h)
- A priority controlled intersection is likely to require additional widening to accommodate right turn movements to avoid impeding straight through traffic and swerving into the cycle lanes
- The SAT are unclear why a priority controlled or roundabout intersection is required in this location, given there is very little proposed side road traffic, only a few properties along Carters Terrace (south of the proposed link road), and Carters Terrace joins Wilkin Street further to the south (as shown in Figure 2-19).
- A roundabout is proposed at the intersection of the link road and Wilkin Street, which is located only approximately 280 m from Carters Terrace
- Should a priority controlled intersection be preferred, the SAT recommend it is created left in, left out (LILO). The right turn out from Carters south leg will require only a short (280 m) distance to turn at the Wilkin Street roundabout. Right turning from Carters north leg will be more problematic as it will force traffic back over the bridge to Chalmers Street. However, this could be addressed by appropriate advanced signage

Figure 2-19 – Aerial view of proposed alignment with intersections at Carters, Wilkin and Johnstone

Recommendation:

1. *Confirm the requirement for a roundabout at the intersection with Carters Terrace*
2. *If a priority controlled intersection is preferred, consider making this left in left out only and forcing traffic to use the adjacent roundabout at Wilkin Street*

Designer Response:	*Partially agree with SAT recommendations* 1. *Due to the low number of turning movements shown in the model at Carters Terrace, the roundabout has been removed from the Carters Terrace intersection.* 2. *Consideration of making this intersection left in left out via a solid central median island, to be considered during detailed design. Acknowledging that this is likely to lead to an increase in U-turn movements at the Wilkins intersection and undesirable mid-block U-turns.*
Safety Engineer:	***Agree with the designer response. A raised platform could be considered as an alternative option.***
Client Decision:	*Agree with designer response.*
Action Taken:	***No change to DBC, to be developed during Detailed Design***

2.7 Johnstone Street Intersection

2.7.1 Offset Intersection **Minor**

Frequency Rating:	Occasional	*Severity Rating:*	Unlikely

The proposed alignment of the new link road has a slight deviation where it intersects Johnstone Street, as shown in Figure 2-20, which includes the roundabout option. While the proposed roundabout at the Johnstone Street intersection appears to accommodate this offset, if the alternative priority controlled intersection option is adopted, there may be issues with the offset. Although right-angle crossing type crashes can be reduced because of the elimination of the direct crossing manoeuvre, the rural offset intersection is still likely to increase overall intersection crashes when compared to a roundabout, or conventional crossroads.

The SAT acknowledge this may be detailed at the next stage of the design. However, it has been raised to highlight another benefit of installing a roundabout as opposed to a priority controlled intersection.

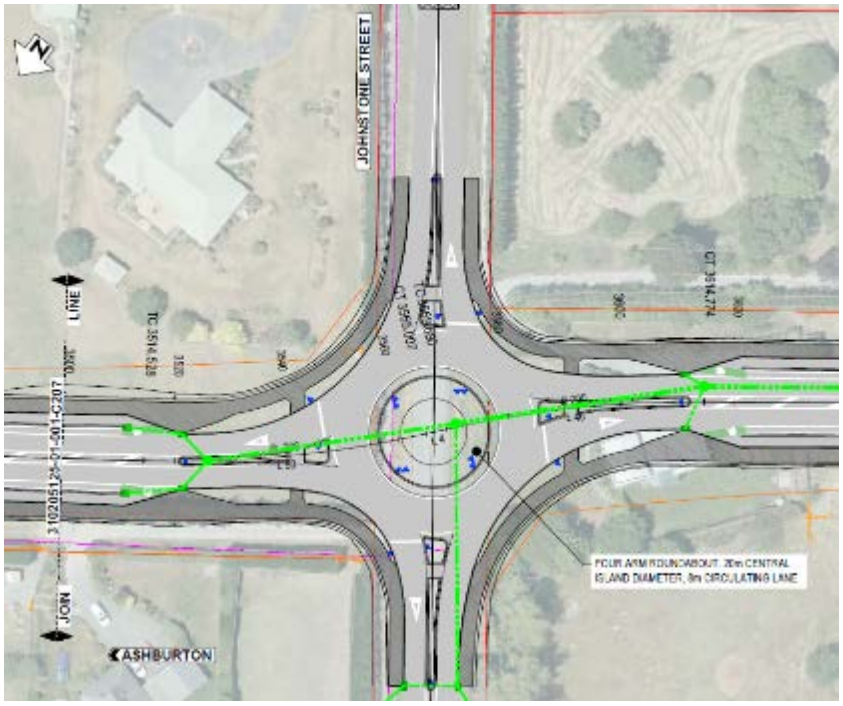

Figure 2-20 – Proposed Roundabout at Johnstone Street

Recommendation:

1. *Proceed with the roundabout option for the Johnstone Street intersection*
2. *If a priority controlled interseciton is preferred, consider making this a left in left out only. This would need to be considered across the wider network of forcing traffic to the adjacent roundabouts at Wilkin Street and Grahams Road*

Designer Response:	*Partially agree with SAT recommendations* 1. *Due to the low number of turning movements shown in the model at Johnstone Street, the roundabout has been removed from the Johnstone intersection.* 2. *Consideration of making this intersection left in left out via a solid central median island, to be considered during detailed design. Acknowledging that this is likely to lead to an increase in U-turn movements at the Wilkins and Grahams intersection and undesirable mid-block U-turns.*
Safety Engineer:	***Agree with the designer response. A raised platform could be considered as an alternative option.***
Client Decision:	*Agree with the designer response.*
Action Taken:	***No change to DBC, to be developed during Detailed Design***

2.8 Grahams Road Intersection

2.8.1 South-North Deflection **Moderate**

Frequency Rating:	Occasional	*Severity Rating:*	Likely

A 3-legged roundabout is proposed at the end of the link road and Grahams Road. The movement from south to north on Grahams Road appears to have minimal deflection which is likely to promote high speed on approach and through the roundabout. Refer to Figure 2-21. This is especially apparent when compared to the north-south movement, which has much higher deflection and subsequently, speeds are likely to be much lower.

It is important to aim to balance the approach legs for roundabouts to avoid speed differential between movements. A southbound vehicle on Grahams Road may approach the roundabout too fast, overshoot the intersection and collide with a vehicle in the circulating lane. It is likely that impact speeds may be in excess of 50 km/h, therefore, above safe system tolerance for intersection crashes.

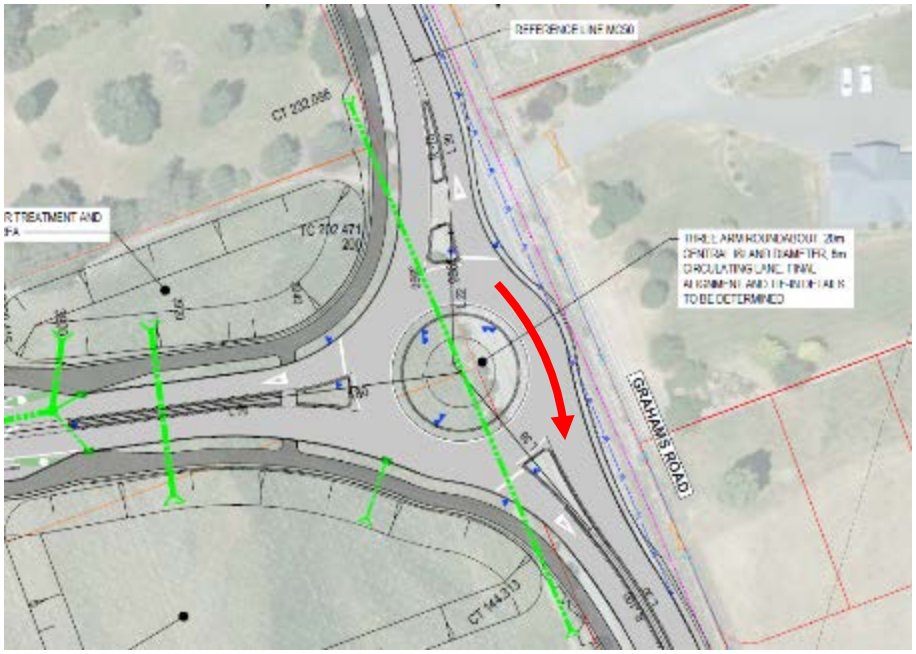

Figure 2-21 – Northbound Vehicle Path at the Proposed Roundabout at Grahams Road

Recommendation:

1. *Undertake design modifications to the roundabout to improve deflection for the south-north movement and provide better balance between the 3 legs*

Designer Response:	*Partially agree with SAT recommendations* 1. *All three approaches meet the desirable 55m entry path radius covered in Austroads Part 4B. Additional speed control is provided by the reverse curve geometry on the approaches. Bbalancing the roundabout legs, by moving the central island North West or South East was considered but results in substandard geometry on the other two approach legs, plus additional land purchase being required. Ideally the central island should be located online with Grahams Road but this is not possible due to property restrictions, the current arrangement is a compromise. Design to be refined in the next phase.*
Safety Engineer:	***Agree with the designer response.***
Client Decision:	*Agree with the designer response.*
Action Taken:	***No change to DBC, to be developed during Detailed Design***

2.8.2 Left turn conflict with crossing Significant

Frequency Rating:	Occasional	*Severity Rating:*	Very likely

In addition to the high speed movement south-north on Grahams Road, highlighted in 2.8.1 above, there is also a likely high speed left turn movement off Grahams Road. Refer to Figure 2-22. This movement will be largely unimpeded except for give way to any circulating vehicle or right turn from Grahams northbound. The left turn movement is likely to be undertaken at high speed, as sightlines appear good (their view will be largely straight ahead to any circulating vehicle or southbound vehicle on Grahams) and there is relatively little deflection.

The main concern is impact with any pedestrians or cyclists using the crossing point on the new link road. Path users will be vulnerable as they will have little time to react to high speed left turn movements. Any crash will vulnerable road users in this location is likely to result in a DSI as the impact speed would far exceed the safe system survivable speed (<30 km/h impact speed).

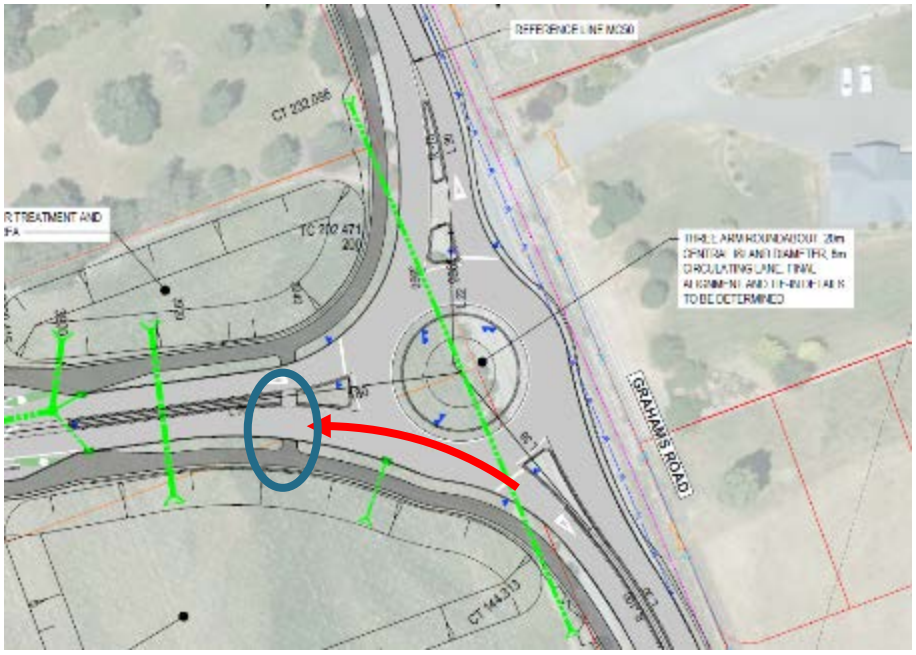

Figure 2-22– Left turn movement from Grahams Road

Recommendation:

1. *Undertake geometric changes to the roundabout to increase the deflection and lower the speeds of left turn movements*
2. *Consider a raised safety platform for the shared use path crossing*

Designer Response:	*Partially agree with SAT recommendations* 1. *As per response to item 2.8.1 above, design to be refined during the next design phase. But is currently a compromise due to property restrictions.* 2. *A raised platform to be considered during the Detailed Design phase*
Safety Engineer:	***Agree with the designer response.***
Client Decision:	*Agree with the designer response.*
Action Taken:	***No change to DBC, to be developed during Detailed Design***

2.8.3 Property Access **Minor**

Frequency Rating:	Infrequent	*Severity Rating:*	Unlikely

The proposed design shows a gap in the splitter island on the southern leg of the roundabout near the property access on the western side of Grahams Road (shown in Figure 2-23). It is assumed this is to allow vehicles to turn right in-and-out of the property. However, the gap does not appear to be large enough for vehicles to safely perform the manoeuvre. This may result in blockage at the exit of the roundabout, resulting in nose-to-tail crashes. Road users will be confused by the turning movements so close to the roundabout (particularly right turn in) and the turning vehicle indicators may also confuse drivers, leading to crashes.

The SAT acknowledge this may be detailed further in the next design stages. However, as no vehicle tracking has been provided for this access, it is unclear what vehicles it has been designed for and if they will be able to manoeuvre through the gap.

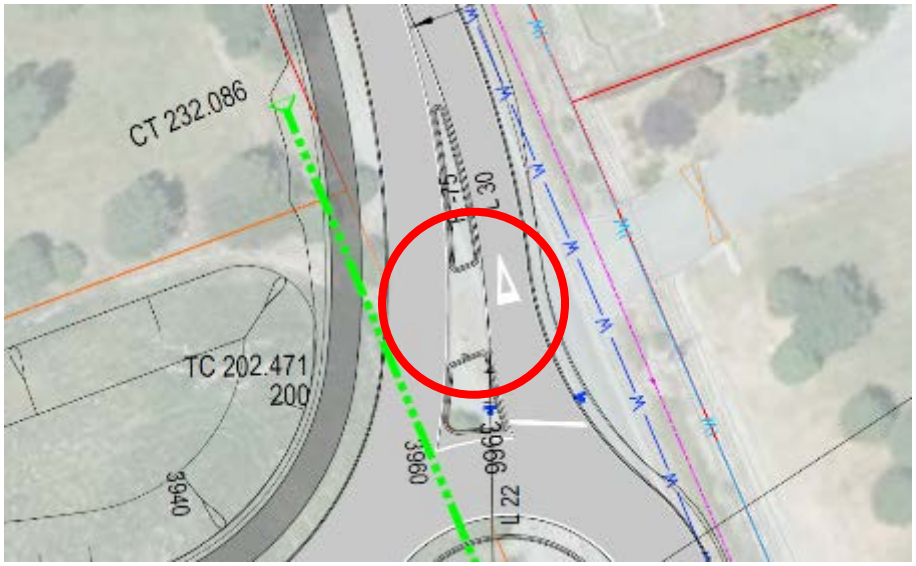

Figure 2-23 – Gap in Splitter Island at the Grahams Road Roundabout

Recommendation:

1. *Investigate if alternative access further away from the roundabout can be provided*
2. *Confirm the design vehicle, turn volumes and vehicle tracking for accessing the property through the gap in the splitter island for all relevant design vehicles*
3. *Undertake additional widening to allow straight through vehicles on Grahams Road to safely pass*

Designer Response:	*Partially agree with SAT recommendations* 1. *To be considered during Detailed Design.* 2. *Splitter island design to be refined for expected vehicle usage during Detailed Design* 3. *This would require additional land take and increase exit speeds from the roundabout so is likely to be undesirable. To be considered during Detailed Design.*
Safety Engineer:	***Agree with the designer response.***
Client Decision:	*Agree with the designer response.*
Action Taken:	***No change to DBC, to be developed during Detailed Design***

2.8.4 Adjacent Subdivision Development Comment

Frequency Rating:	N/A	*Severity Rating:*	N/A

An adjacent new subdivision is currently under construction immediately south of the proposed roundabout, with access off Grahams Road, as show in Figure 2-24 and 2-25. The SAT raise the following comments:

- The subdivision is likely to generate high levels of traffic, with turning movements at an access close to the roundabout
- It would be desirable to have the subdivision access off a fourth leg of the roundabout, if possible
- The subdivision will also generate additional pedestrian and cycle movements. This will lead to increased demand for a shared path along the west side of Grahams Road

Figure 2-24 - New Subdivision on Grahams Road Under Construction

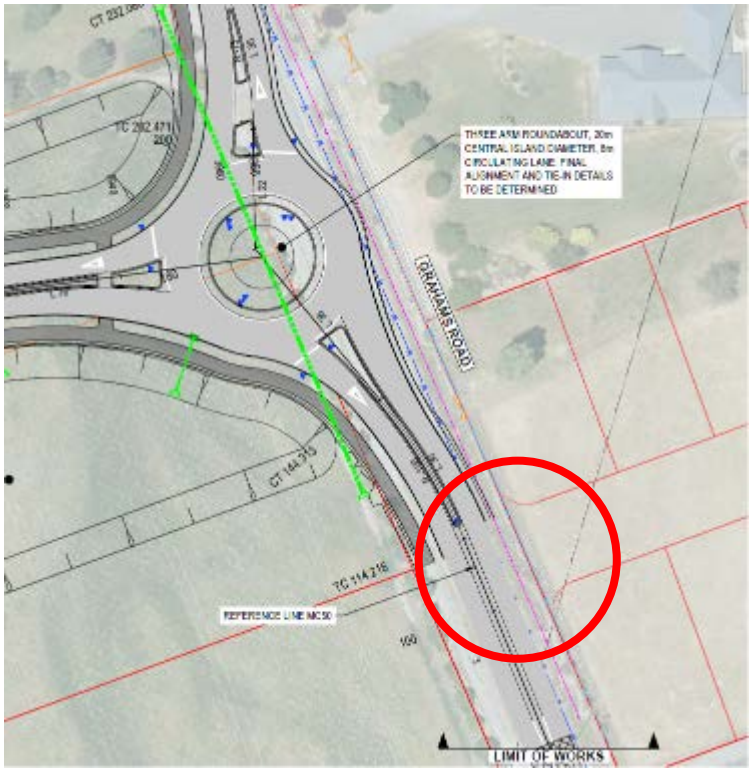

Figure 2-25 – Access to New Subdivision

Recommendation:

1. *Investigate whether the roundabout can be re-designed to access the subdivision off a fourth leg*
2. *If the access has to remain, undertake additional widening and provide a right turn bay into the subdivision*
3. *Consider future shared path design along the west side of Grahams Road*

Designer Response: *Partially agree with SAT recommendations*

1. *The approach road geometry does not lend itself to a full 4 arm roundabout without significant additional land take and deviating out of the existing designation. Concepts to be looked at during next design phase.*
2. *Additional widening on Grahams Road has been included in the design already, which allows for 2x0.5m shoulders, 2x3.5m traffic lanes, and a 2.5m central median, which allows for the placement of a right turn bay treatment. To be fully developed during detailed design.*
3. *To be considered during Detailed Design.*

Safety Engineer: ***Agree with the designer response.***

Client Decision: *Agree with the designer response. Not sure there will be high levels of traffic from the subdivision which has access from both Grahams Rd and Grove St at the other end of the subdivision.*

Action Taken: ***No change to DBC, to be developed during Detailed Design***

2.8.5 Stormwater Basin **Moderate**

Frequency Rating:	Infrequent	*Severity Rating:*	Likely

The proposed design includes a large stormwater basin on the northern side of the Grahams Road roundabout. No further details have been provided and it is unclear what the gradient of the side slopes are or how deep the basin will be. As the basin is located near the roundabout (on outside of curve), there is an increased likelihood of an errant vehicle reaching it. If the side slopes are not traversable, an errant vehicle may overturn, resulting in injury to the occupants of the vehicle.

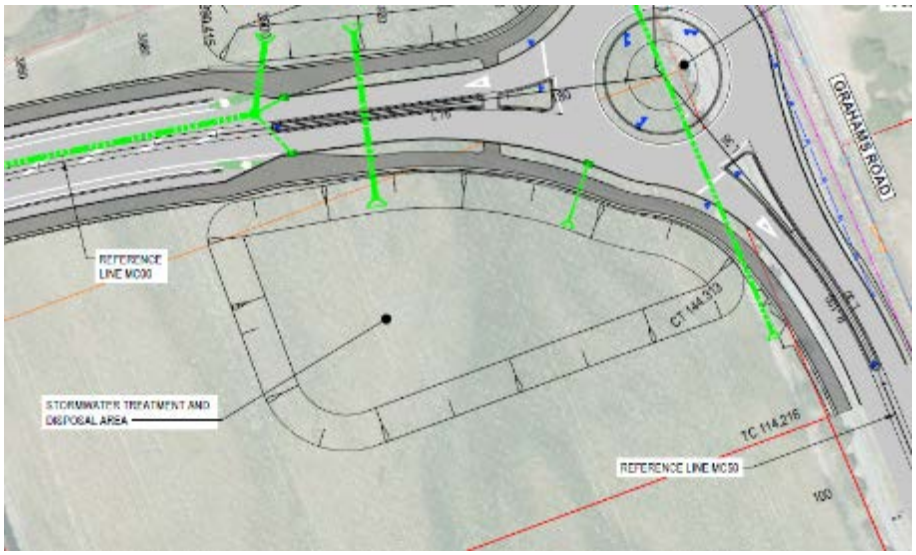

Figure 2-24 - Proposed Stormwater Basin at the Grahams Road Roundabout

Recommendation:

1. *Provide further details of the stormwater basin, including typical cross-sections, side slopes and depth*

Designer Response:	*Partially agree with SAT recommendations* 1. *Design details of the Grahams Road SW basins are consistent with the Carters Creek SW basins responded to in Item 2.5.2 above.*
Safety Engineer:	***Agree with the designer response.***
Client Decision:	*Agree with the designer response.*
Action Taken:	*No change to DBC, to be developed during Detailed Design*

3 Audit Statement

We certify that we have used the available plans, and have examined the specified roads and their environment, to identify features of the project we have been asked to look at that could be changed, removed, or modified in order to improve safety. The problems identified have been noted in this report.

Signed: Provided on pdf Date: 7 July 2022

Jonno Fletcher,
Principal Transport Engineer, Urban Connection Limited

Signed: Provided on pdf Date: 7 July 2022

Jacques Steyn,
Transport Engineer, Urban Connection Limited

Signed: Provided on pdf Date: 7 July 2022

Fiona Chapman,
Transport Engineer, Urban Connection Limited

Designer:	*Name: …Nigel Lister……*	*Position: …Principal Project Engineer…*
	Signature……	*Date…13 July 2022……*
Safety Engineer:	*Name: …Martin Lo ……*	*Position: …Roading & Safety Engineer*
	Signature……	*Date…18 July 2022……*
Project Manager:	*Name: …Mark Chamberlain……*	*Position: …Roading Manager*
	Signature……	*Date…18 July 2022……*
Action Completed:	*Name: …Nigel Lister……*	*Position: …Principal Project Engineer…*
	Signature……	*Date…20 July 2022……*

Project Manager to distribute audit report incorporating decision to the designer, Safety Audit Team Leader, Safety Engineer, and project file.

Date: …22 July 2022……..

Appendix A – Safe System Assessment Matrices

ADC Ashburton - Tinwald Connectivity DBC - Prelim Design RSA_Rev0

Document Status CLIENT REVIEW

Revision	Prepared by:	Reviewed by:		Approved by:		
		Name	Signature	Name	Signature	Date
0	Jonno Fletcher / Jacques Steyn	Steve James	Provided on PDF	Tony Harrison	Provided on PDF	08/07/2022