Appendix M. Preliminary design report

bonisch

Preliminary Design Report

15 DECEMBER 2020

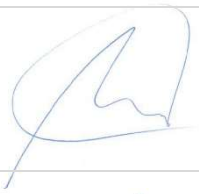
Dunedin Tunnels Trail

BUSINESS CASE – PRELIMINARY DESIGN

Revision A - for client comment

Quality Assurance Statement

Contract number	7332
Contract title	Dunedin Tunnels Trail
Project Manager	Glenn O'Connor
Revision	A – Issued for client comment

	Name	Signature	Date
Prepared by	Simon Collie		15/12/2021
Reviewed by	Glenn O'Connor		17/12/2021
Approval for issue	Glenn O'Connor		17/12/2021

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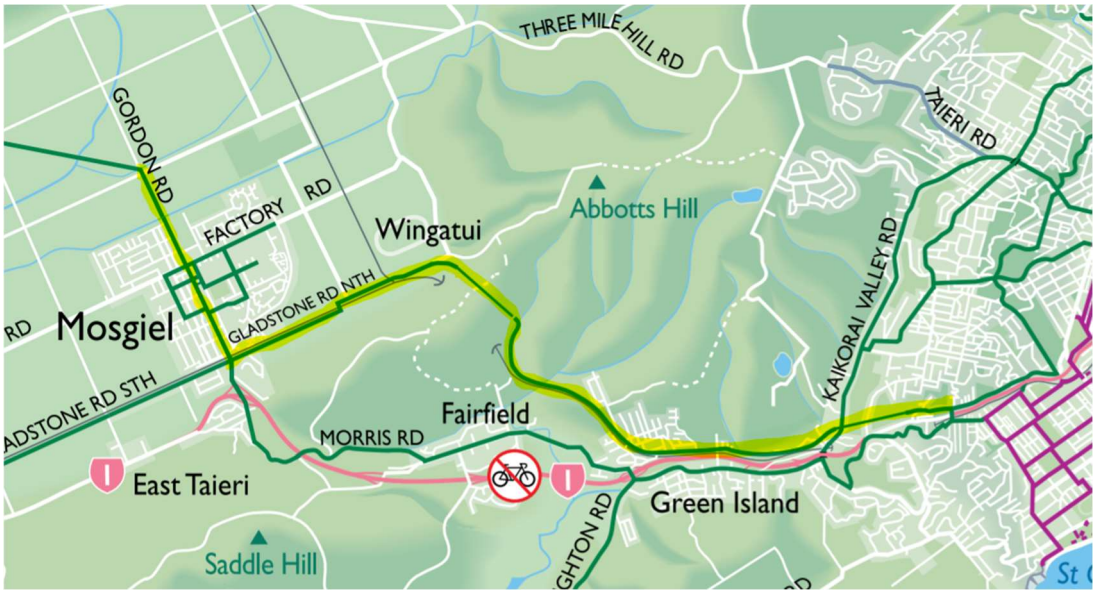
1. Introduction and purpose of report

The Dunedin Tunnels Trail Project aims to connect Dunedin's urban cycle network with Mosgiel and beyond. The intention of this project is to provide a safe and user-friendly transport corridor as part of the DCC Strategic Cycle Network linking Mosgiel through to the Caversham valley, incorporating linkages to suburbs as practical in-between (Burnside, Abbotsford).

The project has been initiated based on the Strategic Cycle Network which identified a corridor that utilised Gordon Road through Mosgiel, Gladstone Road North, the Chain Hills decommissioned rail tunnel, KiwiRail Corridor through to Burnside, access through private properties through Burnside to Kaikorai Valley Road and the Caversham decommissioned rail tunnel to then link to current and future cycleways at Barnes Drive and South Road. This route is shown highlighted below (excerpt from the DCC Integrated Transport Strategy):



The Dunedin City Council (DCC) has identified this project as one of its major projects and has included it within their Major Projects Programme. Bonisch Consultants Limited (Bonisch) has been engaged by DCC to complete a Project Business Case and associated Preliminary Design for this project.

The purpose of this report is to detail the Preliminary design completed following identification of the preferred route. This report covers the Civil Engineering geometric design components. Please refer to attached documents and the full business case for full design documentation. Also note land requirements have not been included in the design plans or report.

2. Scope and Limitations

The purpose of this preliminary design is to bring a higher level of understanding of the likely design treatment, risks, issues, constraints, and costs associated with the identified preferred route option identified through the business case process. The below details the intended scope and limitations of the preliminary design:

2.1 INVESTIGATIONS AVAILABLE AND DEFERRED

2.1.1 INVESTIGATIONS UNDERTAKEN TO DATE

- Archaeological assessment
- Contaminated land Preliminary site investigation
- Preliminary geotechnical appraisal
- Structural assessment of existing tunnels and structures
- CPTED and IPTED assessment

2.1.2 INVESTIGATIONS DEFERRED TO DETAILED DESIGN STAGE

DCC have decided to defer the below investigations until the detailed design phase of the project:

- Geotechnical site investigations
- Topographical survey
- Contaminated Land detailed site investigation
- Potholing for services
- Carbon Assessment
- Air quality assessment

2.2 DESIGN SCOPE, ASSUMPTIONS AND LIMITATIONS

2.2.1 GENERAL

- No topographical survey information is available. DCC lidar has been used for 3d design which is understood to have an average accuracy of +/- 300mm. This limits the accuracy of the 2D and 3D design accordingly
- No geotechnical testing data is available – assumptions on site stratigraphy, depths, bank stability / batter slopes and ground strength have been made based on observed site conditions.
- Existing services have been assessed based on available GIS data. No physical investigations or detailed review of historical as-built plans has been completed.
- Some areas of the route have not been able to be accessed during the design phase. Where site visit was not practical this has been supplemented with aerial photography and kiwirail track videos.

2.2.2 PAVEMENT

- Pavement design depth for road widening is assumed to match existing typical road pavement depth
- Off road pavement design to be based on assumed CBR and light traffic loading (Ute). Existing Top-soil depths assumed to be 300mm

2.2.3 GEOTECHNICAL

- Areas for retaining will be identified only, no retaining wall design will be carried out with cost estimates based on either gabion baskets of timber pole and panel walls.

2.2.4 STORMWATER

- Drainage design is to concept level only to indicate strategy and identify likely solutions.
- Detailed catchment assessments and sizing of infrastructure has not been completed.
- On road stormwater design is based on relocation or extension of existing infrastructure
- Off road stormwater design consists of channels and culverts to discharge runoff away from the path

- Bridges - no catchment assessment and flood event flow calcs to be undertaken. Design assumes matching existing waterway area + 1m freeboard.
- Tunnels – concept design in typical section and assumed longitudinal grade with collection and discharge at the low point.

2.2.5 SERVICES

- Design to avoid existing rail services in the rail corridor where possible
- Where service relocations are likely to be required these will be identified on the plans.

2.2.6 STRUCTURES

- Concept design sketches to be provided for new and modified structures.

2.2.7 TRAFFIC SIGNALS AND INTERSECTIONS

- 2d geometric design and layout to be undertaken. No signal phasing, cabling and pole design has been undertaken as part of preliminary design.

2.2.8 LIGHTING

- Lighting design inputs have been provided by Network Electrical Services Limited to level P5 from Abbotsford to Barnes Drive and Level P3 in the tunnels. Lights are LED and similar to those specified for the SH88 shared path. Proposed trenches and cabling will be allowed for within estimate but not shown on the plans.

2.2.9 TUNNELS

- It is assumed that both the gas line and HV electrical cables can be replaced with new infrastructure buried in the base of the tunnel. There are risks associated with this assumption which require further investigation in the detailed design phase. Potholing is required to determine existing service location to ensure there is an available corridor to bury these services in the base of the tunnel and that the existing material is suitable to open trench into and be reused as backfill.
- It has been assumed that the wastewater and water mains will remain in the tunnels – reconfirmed with Jared Oliver (DCC 3 waters) on the 19/10/21.
- It has been assumed that sealing of wastewater manholes and air valves will be an acceptable solution to DCC to allow the wastewater mains to remain in the tunnel. No investigation into downstream impacts of this change has been undertaken as part of the preliminary design.
- Alternative buildings / protection for the PRV's and flow meters at either end of the Caversham tunnel will be identified on the preliminary design plans.

2.2.10 DESIGN DRAWINGS

- On road sections have been designed in 2d with drawings of plan layout and typical section. The design identifies the proposed roadmarking layout, and areas of pavement modification
- Off road sections have been designed in 3d with drawings of plan layout and longsections plus cross sections at 20m intervals. Design has been based on the DCC lidar surface where available.
- Tunnel design has been based on a typical cross section.
- Concept design and sketches for new bridges and boardwalk have been provided.

3. Preferred Route

The preliminary design has been completed of the preferred route, identified through the business case process. The route is from the intersection of Factory Road / Wingatui Road in Mosgiel to Barnes Drive in Caversham. The preferred route is detailed below:

- Begin at the intersection of Factory Road and Wingatui Road to the rail corridor (Taieri Branch),
- The route then follows the rail corridor (Taieri Branch) to Gladstone Road. The route deviates from the rail corridor through racecourse land within existing drainage easements / driveways to reach Gladstone Road.
- The route follows Gladstone Road to the Chain Hills Tunnel which is accessed from Gladstone Road via the existing property driveway and Tunnel easement.
- The route then goes through the Chain Hills Tunnel
- The route then follows the old rail corridor formation, converging and departing the rail corridor (Main South Line).
- The route crosses beneath the Abbots Creek bridge (bridge number 254) on the Main South line to transfer from the northern side of the rail to the southern side.
- The route follows the sand pit (owned by Fulton Hogan) to meet the existing gravel footpath reserve parallel to Grandvista Drive.
- The route follows the existing gravel footpath reserve parallel to Grandvista Drive to the Abbotsford underpass
- The route uses the existing underpass to cross from the southern side to the northern side of the rail corridor (main south line)
- The route then follows the rail corridor (main south line) to the North Taieri Road bridge
- The route crosses the rail corridor via a new bridge then follows Abbotsford Road and Unsworth St to the existing pedestrian bridge to Runciman St.
- The route then crosses the rail corridor via a new bridge (replace the existing pedestrian bridge)
- The route then follows Runciman St to Neill St within the road corridor, and diverts back into the rail corridor at Neill St to the Haraway Underpass.
- The route crosses the rail corridor via the Haraway underpass
- The route then follows the rail corridor (main south line) and SH1 Motorway within a combination of rail and motorway designated lane to Kaikorai Valley Road.
- The route crosses the rail corridor over the old Kaikorai Valley Road bridge then follows Kaikorai Valley Road to the Caversham Tunnel Entrance.
- The route then passes through the Chain Hills Tunnel
- The route then follows the existing path to Barnes Drive.

4. Project objectives and desired outcomes

Project objectives and desired outcomes were presented in the Project Brief. This is summarised below:

Dunedin is already well served with road connections for motor vehicles. The project objective is to achieve a more even balance for other types of road users and the Tunnels route will extend the cycle network from Dunedin to Mosgiel.

The key objectives for the Tunnel Project are:

- Improve road safety for cyclists traveling between Dunedin and Mosgiel.
- Improve network access for cyclists.
- Increase the level of service of cycle infrastructure between Dunedin and Mosgiel.

- Increase residents' satisfaction with cycle infrastructure in Dunedin city.
- Increase the number of cyclists travelling to work and school by bicycle.
- Work towards connecting Dunedin to cycle networks beyond the city, e.g. Gold Trail.

The key outcomes for this project are:

- Improvements in road safety by providing an alternative, dedicated route for pedestrians and cyclists between Mosgiel and Dunedin with gradients suitable to all levels.
- Increase in the number of cyclists travelling to work and school by bicycle, measured by annual counting.
- Increase in residents' satisfaction with suitability of Dunedin's provision for cycling, measured through Dunedin's annual Residents' Opinion Survey.
- Improvement in access to cycling in Dunedin, measured by lengths of completed and connected primary routes.

5. Background and work to date

This project has been in discussion and thinking within DCC and the wider community for some time. The Dunedin Tunnels Trail Trust (DTTT) has been an active supporter and advocate for this project. Due to this history, there have been a number of investigations and reports completed on this project over time. Those made available to the project team have been taken into consideration. The Project Business Case methodology has provided for a stand-alone process to confirm the preferred option and enable conceptual and preliminary design.

Refer to the business case for full background and work to date.

6. Design philosophy

6.1 DCC PROJECT BRIEF ACCEPTANCE CRITERIA

The Project Brief project output description requirements included acceptance criteria set out by the DCC transport team. The acceptance criteria's that are relevant to the preliminary design are summarised below:

1. Outputs comply with:
   a. DCC standards for road and cycleway construction.
   b. NZTA Guidelines and standards for road and cycleway construction, including NZ Cycle Trail Design Guide.
   c. KiwiRail policies for public pathway safety.
2. Design is consistent (where possible) along the full length of the route.
3. Cycleway width of 3 metres (where possible) along the full length of the route.
4. Cycleways are comfortable to ride. They have a surface that is as smooth as possible and well-maintained; they follow a direct route with as few obstructions as possible.
5. Outside of the rail corridor, cycleway maintains appropriate gradient and only where necessary has drop kerbs that are built to pram crossing standard (ramps have shallow angles).

6.2 DESIGN PHILOSOPHY

With reference to the Project Objectives / Desired Outcomes, Acceptance Criteria and ILM Problem Statements a Design Philosophy was developed to guide concept development, and continued through the preliminary design. This considered typologies in a sequential order based

on a typology hierarchy. Where a workable option was found to be suitable typologies lower in the hierarchy were not considered further in the unless there are obvious other practical options.

The typology hierarchy developed for this project was:

1. Shared bi-directional path / trail.
2. Separated Cycleway / Cycle Only paths bi-directional.
3. Separated Cycleway / Cycle Only paths one-way.
4. Traditional on-road Cycle Lanes.
5. Sealed shoulders.
6. Mixed traffic lanes.
7. Neighbourhood greenways.

Note that advisory shoulders have not been considered as an appropriate solution within this route. It is understood these have not been applied through Dunedin previously, therefore road users may not understand their use.

7. Design Standards

There are two overarching design standards which are applicable to the preliminary design of this route. These design standards have been utilised in the development of the design. They are:

NZTA Cycling network guidance – Planning and Design

This is an online resource developed by NZTA that provides standards, guidelines and advice to the design of cycle network facilities for a range of different applications and situations. This provides key information and links to supplementary design standards and documentation that can be applied depending on the nature of the cycleway / walkway and the wider context it sits within. Key supplementary guidelines include:

- Austroads Guide to Road Design Part 6A – Paths for Walking and Cycling (referred to as Austroads guide throughout).
- Austroads Cycling Aspects of Austroads Guides (referred to as Austroads guide throughout).
- NZTA considering historic heritage in walking and cycling projects.
- NZTA Technical note TN002 – Updated guidance for separated cycleways at side roads and driveways (referred to as NZTA TN002 throughout).
- NZTA Technical note TN004 – Buffered Cycle Lane Design 2020 (referred to as NZTA TN004 throughout).
- NZTA HIGH-USE DRIVEWAY TREATMENT FOR CYCLE PATHS AND SHARED PATHS Design guidance note
- Queensland Government Technical Note 133 – Guidance on the widths of shared paths and separated bicycle paths. Note the link provided on the NZTA website is inactive. We understand this has been supersede by Speed Management on shared paths guidance released in August 2020. (referred to as QG TN133 throughout).
- VicRoads Cycle Notes 21 – Widths of off-road shared use paths (referred to as VicRoads CN21 throughout).
- MBIE – New Zealand Cycle Trail Design Guide (referred to as Trail Design Guide throughout).
- Christchurch City Council – Major Cycleway Best Practice Design Guide 2016 (referred to as CCC guide throughout).

KiwiRail Track Engineering Standard – Public Pathways on the Road Corridor and KiwiRail Design Guidance for Pedestrian & Cycle Rail Crossings (referred to as KiwiRail Standard throughout)

This document provides guidance for parties wishing to build a public pathway, including cycleways, on the operational rail corridor. It does not specify cycleway or walkway design standards; rather it identifies general objectives to guide cycleway/walkway design adjacent to operational railway corridors.

8. Key Design Parameter Summary

The preferred route selected through the business case process includes shared path typology in close proximity to roading and within the rail corridor, on-road buffered cycle lanes, and neighbourhood greenways.

Key project specific design parameters have been determined from the above guidelines and summarised below. Where the path design deviates from the project specific design parameters it will be noted later in the report.

8.1 SHARED PATH – ADOPTED KEY PARAMETERS

8.1.1 PATH WIDTH

The acceptance criteria provided by DCC provides a preference for 3m wide paths to provide consistency to other shared paths within the region e.g. Peninsula Connection, Portobello Road etc.

NZTA guidance references the Austroads guide for overall guidance and specifically VicRoads CN21 and QG TN133 in regard to width. The Trail Design Guide is also considered applicable to determining width.

These guides first consider the number of cyclists and pedestrians using the space. Austroads figure 5.4 shows there is a relatively high threshold of use before a 3m shared path becomes unsuitable. Advice provided from the Business Case team indicates the majority of the path would fall within the 2.5-3.0 shared path range of these graphs, however with potential for key access points to trend into the 2.5 cycle + 1.5 pedestrian path recommendation.

Path width guidance from the various guides is summarised in the below table:

Shared Path Width Guidance Summary

Guidance	Description	Desirable Minimum (m)	Min - Max Typical (m)	Notes
Austroads	Local Access Path	2.5	2 - 3	Values in QG TN133 reference Austroads
Austroads	Regional Path	3	2.5 - 4	
VicRoads	Recreational and Regional Commuter Path	2.5		Allows a clearance of 0.5m between path users when passing
VicRoads	Recreational and Regional Commuter Path. Assumes passing and meetings between users is frequent, bicycle speeds exceed 25km/hr and there are a more diverse range of users	3		Allows a clearance of 1m between path users when passing. In most circumstances, new shared use paths should be 3.0m wide.
Trail Design Guide	Grade 1 Trail (easiest)	2.5	2 - 4	Minimum recommended width for tunnels if 2.0m

CCC Guide	Shared Pathway: 50/50 directional split (peak ped+cyc two-way volumes >250/hr)	3	3-4	Desirable design is 4m for 50/50 direction split, and 3m for 90/10 direction split

The next consideration is the classification of the path. As this path would form part of the Dunedin Strategic Cycle Network it is considered to be a path of Regional Standing when assessing against Austroads guidance.

Design parameters selected for path width:

Desirable Width – 3m

Minimum Width (to avoid obstructions over short distances) – 2.5m

Where no alternatives are available in the typology hierarchy further reduced width can be considered with additional controls in place.

8.1.2 KIWIRAIL CLEARANCES

KiwiRail Standard clause 8.5.1 states there must be a clear and defined boundary between the pathway and operational track area. This must ensure there is no possibility of any pathway user accidently leaving the pathway. This is typically achieved through provision of fencing ranging in height from 1.2m to 1.8m.

KiwiRail Standard clause 8.2 states setback requirements for trackside fencing of a proposed pathway.

Design parameters selected for KiwiRail Track Clearance and Fencing:

For concept design provision for fencing will be included wherever the path is located adjacent to Rail Tracks unless there is a substantial natural barrier between.

Desirable setback – 6m from the track centreline with 1.2m high fencing

Minimum setback – 5m from the track centreline with 1.2m high fencing

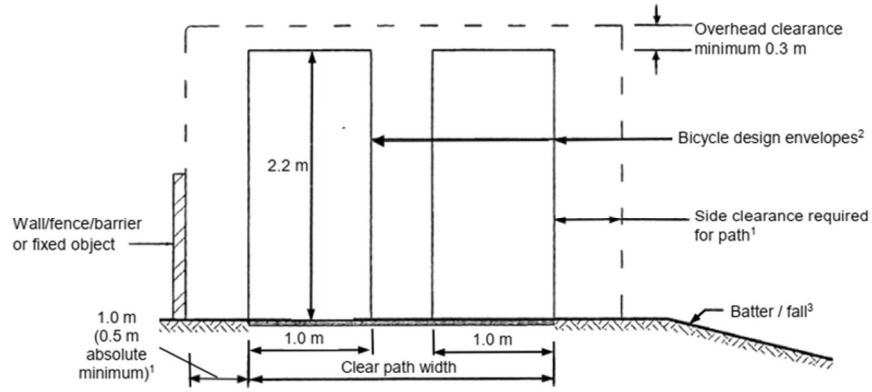
Absolute minimum setback – 4m from the track centreline with 1.8m high fencing (may be permitted on a case-by-case basis, by exception).

In some isolated locations where the absolute minimum setback is not able to be achieved a solid fence barrier is proposed.

8.1.3 PATH CLEARANCES

Austroads Guide Figure 5.7 provides a clearance envelope for cycle paths to allow for design of adequate separation between the path and surrounding features or hazards (fixed objects, vertical drops, steep batters). This is inserted below for reference:

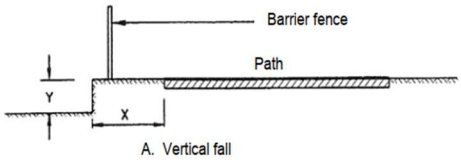
Figure 5.7: Clearances between cyclist envelope and potential path hazards



1 *This may be reduced to 0.3 m where a fence or obstacle has smooth features.*
2 *Refer to Section 3.2.2 for guidance on bicycle design envelopes.*
3 *Refer to Section 5.5.3 for guidance on batters and need for a fence.*

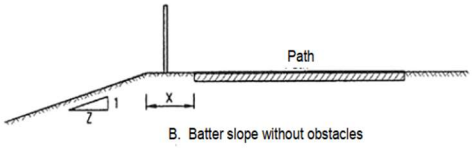
Austroads Figure 5.10 sets out requirements for fencing and barriers at batters and vertical drops. This provides a table that relates proximity and slope of a batter to a fencing requirement.

Figure 5.10: Requirement for fence barriers at batters and vertical drops



A. Vertical fall

	X (m)	Y (m)
Fence not required*	<2	<0.25
Partial barrier fence required	<5	0.25 to 2
Full barrier fence required	<5	>2

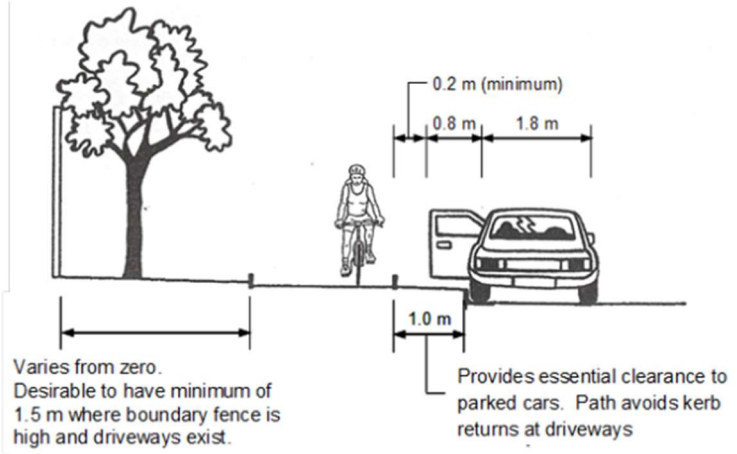


B. Batter slope without obstacles

	X (m)	Z (m)
Fence not required	<1 1 to 5	>8 >3
Partial barrier fence required	<5	1 to 3
Full barrier fence required	<5	<1

Austroads Figure 5.8 provides desirable clearances for shared paths within berms including from boundaries with fence lines and driveways, and from road corridors with parked cars. This is inserted below for reference:

Figure 5.8: Location of path in road reserve



For further context the CCC guide provides desirable and desirable minimum offsets for separated path location in the road reserve in table 7-2 inserted below:

Boundary Offset	5 m from boundary	Absolute Minimum 3 m Possible exemption to rule where adjacent to park or reserve, where no street vehicle access and open view along frontage but his needs justification and mitigation measures for safety of users. Footpaths should be maintained and retained as a separate facility unless the whole area is to be shared.
Width between edge line of driving vehicle/parking and cyclist	1 metre	Absolute Minimum 0.6 m where no parking 0.85 metres adjacent to on-street parking

Design parameters selected for path clearances:

- Path side barrier fence offset – desirable 0.5m, absolute min 0.3m. This has been adopted on the basis that the fence will be constructed of smooth materials and the path width of 3m could be slightly sacrificed through detailed design if required to provide additional clearance. This offset will also be applied to adjacent boundary fence lines where there are no vehicle accessways crossing.
- Requirement for fencing adjacent batters and vertical drops. For the purpose of preliminary design this has been simplified to provide fall protection fence / barrier where the vertical slope depth is in excess of 1m with a batter slope of steeper than 1 in 3. Note that the assumed batter slope for path construction is 1 in 1 from the 1 in 3 batter to water table, with no barrier unless the slope depth is in excess of 1m. This to align with the intent of the standard while acknowledging the limitations of available corridor to achieve desirable slopes in all locations.
- For Boundary offset where there are vehicle accessway crossings a desirable clearance of 3.0m has been adopted as a mid-point between Austroads and CCC guidance. This is considered appropriate on the basis that shared paths will likely not be possible in areas with large amounts of vehicle crossings in the context of this site, and it provides space for a vehicle to partially exit a property and give way to path users (3.0m is approximately over half the length of a 5.0m standard vehicle). In short areas of constrained width, a reduced offset of 1.5m may be adopted in the design as an absolute minimum when combined with appropriate supplementary design elements.
- For width between traffic / parking and the path a desirable clearance of 1.0m has been adopted in accordance with Austroads and CCC guidance. Minimums of 0.6m where there is no parking and 0.85m adjacent to parking from CCC guidance have also been adopted. Absolute minimum of no additional separation has been adopted where adjacent parking or traffic lanes are larger than minimum widths or low use, and where kerb and channel provides 0.5m (back of kerb to edge of seal) visual separation.

8.1.4 GRADE

Austroads Guide clause 5.4.3 states that grades should not exceed 5% unless unavoidable. They provide discussion that where gradients in excess of 5% occur approaches should be widened, and clear escape routes and recovery areas included within the design. As a guide they note: a grade greater than 10% over 50m with horizontal curves or a grade greater than 12% over 50m on straight paths should be avoided.

The Trail Design Guide states in Table 2 for Grade 1 (easiest) trails that:

- 98% of the trail should have a grade between 0-2 degrees (0% to 3.5%),
- Between 2 and 3 degrees (3.5% to 5.2%) for no more than 100 metres at a time,
- And between 3 and 4 degrees (5.2% to 7%) for no more than 10m at a time.

Design parameters selected for vertical grade

A desirable maximum grade of 5% has been targeted.

Absolute maximum grades of 10% or greater have been kept to a minimum (short lengths of less than 100m) through constrained sections. Where these grades occur path widening and rest areas should be incorporated in the detailed design phase.

8.1.5 DRAINAGE

Path drainage is proposed to be achieved in general accordance with the recommendations in the Austroads guidance. It is proposed to generally provide for minor water tables on both sides of the path where it is crowned, or a minor water table on one side of the path where it is single cross fall. Where the above catchment is minor, or where there are adjacent parallel flow paths or channels water tables may be omitted and surface flow directed over the path to these features.

A minimum 150mm wide shoulder is proposed matching the path crossfall, and then batters to water tables are proposed at 1V:3H.

Intermittent minor culverts can be provided beneath the path to maintain exiting flow paths.

8.1.6 BATTERS

Batter tie ins to existing ground for cut and fill have been set at 1V:1H for the purposes of completing 3D design. This has been done based on site observation of existing ground batters throughout the route area generally showing stable batters at approximately this grade. This assumption shall be confirmed with Geotechnical testing as part of the detailed design phase.

8.1.7 SURFACING / PAVEMENT DESIGN

Pavement design has been driven based on construction practicalities rather than for specific axle loading or frequency given the nature of the path.

The main determining factors were the assumed topsoil depth of 0.3m would need to be cleared to allow construction of the path, and the best practise requirement of providing layer thickness of pavement 2.5 x the largest stone thickness.

Based on the above, pavement construction thicknesses of approximately 0.3m have been used. This is typically suitable for minor road construction, with proof rolling of the subgrade to identify any areas of concern for undercutting. The exception to this is where the path is located on exiting granular track construction. In this instance it is proposed to trim the existing surface and re-dress to increase the surface shape and quality.

For the unsealed section of the path the surface course will be selected at a later date, but the intention is to utilise a local material that would provide a tightly bound surface suitable for a cycle path.

For the sealed sections of the path DG7 asphalt of 30mm thickness has been selected, which is a typical footpath mix. It is proposed to not include timber edging for the path to reduce cost and instead use an in-situ formed mitred edge with the asphalt.

8.1.8 LIGHTING AND CCTV

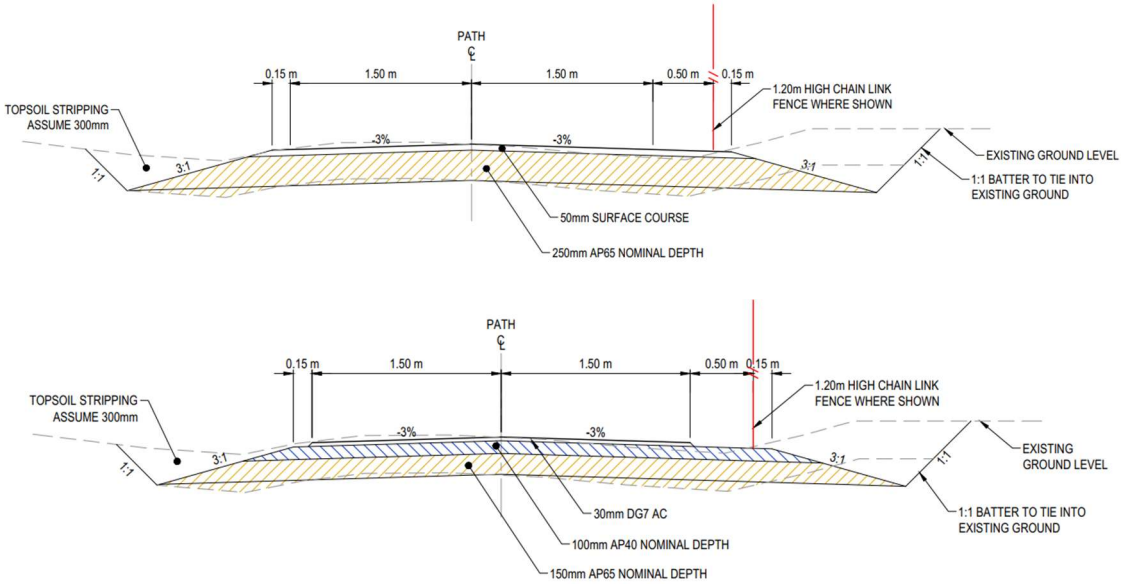
Concept level lighting design has been undertaken by Network Electrical Services (NES) for the Tunnels Trail between Abbotsford and Barnes Drive as well as through Both Tunnels. They have allowed for lighting to level P5 along the tunnels trail using a TerraLed Mini 18LED 25W 3000K MX1 at a mounting height of 4m and spacing of 40m. This is very similar to the lighting design used for the SH88 shared path.

The Caversham and Chainhills tunnel lighting design is based on using Securelite 26W File 2 3000K units at approximate spacing of 7.1m to provide lighting to level P3. There is allowance for emergency lighting in the form of a dedicated battery backup light every 40m to provide lighting

on a separate circuit that will be linked to the normal lighting circuits to come on if a circuit fails. CCTV has been designed for full coverage along the length of the tunnels. The cameras will be connected to a server and hard drive (location to be confirmed during detailed design).

8.1.9 DESIGN TYPICAL CROSS SECTION

From the above parameters a typical cross section has been developed as below for use in the preliminary design:



8.2 ON-ROAD CYCLELANES – BUFFERED CYCLELANES - ADOPTED KEY PARAMETERS

Where cycle-lanes are unable to be accommodated through a shared path buffered on-road cycle lanes in accordance with NZTA TN004 were selected as the preferred option. This is suitable for areas where the on-road speed limit is 50km/hr or less.

The proposed cross section would include 1.5m Cycle lanes, 0.5m painter buffer flush median and 3m wide existing traffic lanes. Where parking is provided additional cyclelane width would be required.

The intent of this design is to provide a suitable buffer width to separate traffic and cyclists as much as practical. This was also recommended within the concept phase safety audit.

NZTA TN004 design width table 1 is included below for context:

Table 1: basic parameters for cross-section elements for buffered bike lane design

Key	Element	Desirable min	Acceptable min	Practical max
	Parallel parking	2.0	2.0	2.5
	Cycle lane – next to parallel parking	1.8	1.7	2.0
	Cycle lane buffer – traffic side	1.0	0.3	1.0
	General traffic lane	3.2	2.9	4.5
	Cycle lane buffer – traffic side	1.0	0.3	1.0
	Cycle lane – kerbside	1.6	1.4	1.8
	Flush median	2.5	0.5	4.0

8.3 ON-ROAD CYCLELANES – GREENWAY - ADOPTED KEY PARAMETERS

Where there is insufficient width for shared path or buffered on-road cycle lanes a neighbourhood greenway will be adopted in general accordance with the CCC Guide. The kay parameters from that guide have been included below for reference. Where greenways are proposed it is required that the posted speed limit is reduced to 30km/hr.

Table 9-2: Neighbourhood Greenways Desirable Design Objectives

Design Attribute	Desirable Design	Desirable Minimum (to be agreed by exception by the Best Practice Guide Team)*
Neighbourhood Greenways – Traffic Volumes	1000vpd desirable – 1500vpd max (consider peak hour flows close to major generators)	1000vpd desirable – 1500vpd max NZTA to supply new data on volumes based upon work underway
Neighbourhood Greenways – Traffic Speeds	30km/hr Max Posted (preferred design speed is 20km/hr for people on cycles)	30km/hr posted
Neighbourhood Greenways – length of straight sections	300 metres	400 metres[7]
Road width excluding parking but including channel	6.26 metres	6.5 metres (An existing 9 metres wide street can be reduced to 6.5m by providing 2.5m indented parking bays).

Design Attribute	Desirable Design	Desirable Minimum (to be agreed by exception by the Best Practice Guide Team)*
Traffic Management Approach	Some examples (not limited too): • street entrance or exit restrictions; • median islands at intersections with cycle gaps; • mid-block or street-end closures for vehicles with by-passes for cycling; • diagonal diverters at intersections to prevent through traffic; • Raised tables	Bypass via shared path
Side roads and access treatments	Neighbourhood Greenways for Major Cycleway should take priority	Signage and markings
On-street parking provision	No more than 40% of length of street is used for parking	No more than 50% of the length of the street is used for parking
Main road crossings	Traffic Signals on arterials and collectors	Kerb extensions, raised platforms and central islands

**and be ratified by the MCR Steering Board*

9. Preliminary Design – Mosgiel to Chain Hills Tunnel

The preliminary design considerations for this section are detailed below.

9.1 FACTORY ROAD – WINGATUI RD TO RAIL CORRIDOR (TAIERI BRANCH) – BUFFERED ON-ROAD CYCLELANES.

Buffered on-road cycle lanes in accordance with NZTA TN004 were selected as the preferred option for this road section (as per the concept design). This is accommodated by completing sealed shoulder widening on each side of the existing carriageway.

- DCC have considered cycle facility design on Factory Road west of Wingatui to complete the link between the marked cycle lanes and this section. This is outside of the scope of this project.
- It is recommended the speed limit on factory road be lowered from 70km.hr to 50km/h, and the design is completed on this basis. At the western end of the site, it is proposed to include a threshold treatment to lower speeds.
- DCC has noted issues with drainage in this area, water tables have been provided with culverts, it is recommended to investigate the potential for soakage pits within the water table if ground conditions allow.
- The existing carriageway is not located in the centre of the road corridor. Widening has been shown symmetrically. It is recommended actual widening distribution is considered during detailed design to provide more clearance to the south.
- There is existing vegetation encroaching over the southern boundary that will need to be cleared if widening is completed as shown on the preliminary design drawings.
- There is an existing gravel parking area outside 239 Factory Road that is used for riding for the disabled. Detailed design will need to consider how to safely provide parking for riding for the disabled.
- It is assumed accessways will be sealed to the boundary.
- No mailbox bays have been allowed for (outside of scope).
- The proposed on-road cycle lanes will cross the existing rail crossing (Taieri Branch). The existing signalised treatment is considered suitable as cyclists will be on-road. The rail crossing requires widening to match the proposed seal width, with the full width of the rail crossing upgraded to provide a better surface.
- The transition between on-road cycle lanes and off-road shared path is via a hook turn box provided for cyclist waiting to turn right to allow a safe space for cyclists to exit the on-road facility. Cyclists exiting the shared path to enter the on-road facility will have a give way control.
- A parking area is proposed adjacent to the path and driveway.

NORTH TAIERI LINE RAIL CORRIDOR / WINGATUI RACECOURSE – FACTORY ROAD TO GLADSTONE ROAD NORTH – shared path

An unsealed shared path within the rail corridor and Wingatui racecourse is proposed for this section.

- The path is located in the existing berm area. The intent is to strip topsoil and locate path on stripped surface.
- Water tables to be created where there are none existing. Where there are adjacent water tables direct path runoff to these. Minor culverts / soak pits may be required to maintain existing flow paths.
- At ch 1550 - 1760 the path deviates from the rail corridor into the drainage easement within the racecourse land. This avoids locating the path on the steep rail embankment. Screening with planting and a sheep fence is proposed to mitigate impact on racecourse and horses.

- At ch 1760 - 2150. The path uses the existing access track to the wastewater pump station / shared driveway to properties. The path is shared use with vehicles. The intent is to trim the existing surface and re-finish with a surface course aggregate suitable for the cycle path. Consideration of isolated pull off bays in detailed design is recommended. Clear signage will be important to convey the shared use arrangement. Additional fencing is required to formalise space in this area. Consideration of a cattlestop, gates and bollards is likely required to maintain access for the path and prevent stock from exiting the area to the road or to the path.

9.2 GLADSTONE ROAD NORTH – WINGATUI TO CHAIN HILLS TUNNEL TRACK – NEIGHBOURHOOD GREENWAY

It is proposed to designate this section of Gladstone Road North as a neighbourhood greenway.

- A single facility greenway is proposed for this section in line with the concept design safety audit.
- Reduce speed limit from 50km/hr to 30km/hr. Include raised tables and threshold kerbs with planting to re-enforce speed environment. Remove centreline and add sharrow markings. Note liaison is required with the racecourse to ensure raised platforms are suitable for horse floats.
- There is sufficient road reserve to provide a designated parking area for trail users. A footpath may be required to link the parking area to the tunnel access. This should be considered in detailed design.
- At the transition to the tunnel access path provide isolated seal widening as a refuge point for cyclists. No hook turn bay is provided as the greenway has designated the road as shared.

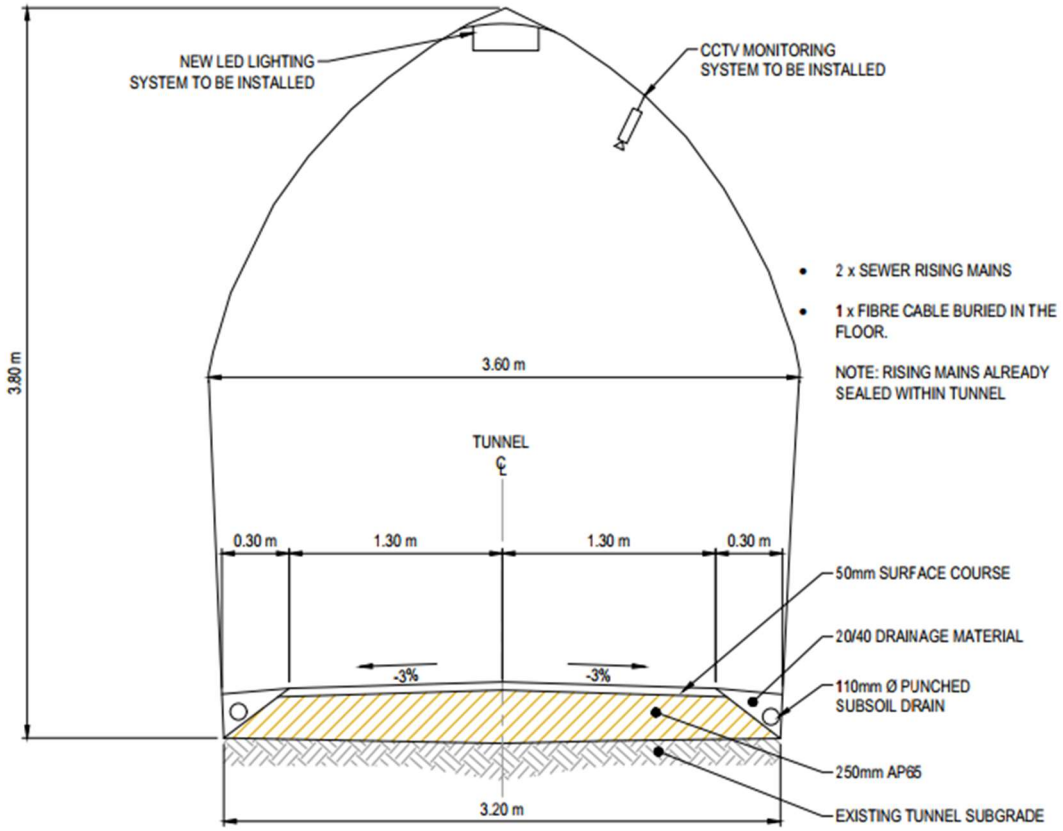
9.3 CHAIN HILLS TUNNEL TRACK – GLADSTONE ROAD TO CHAIN HILLS TUNNEL – SHARED PATH

An unsealed shared path within the designated easement is proposed for this section.

- Locate path separate to vehicle access where practical in this section.
- The path alignment could be changed to follow alongside water table once surveyed.
- Intent is to strip topsoil and build path to match surrounding level. Use of single cross fall to maintain existing overflow flow over path is considered appropriate for smaller catchments.
- Path to be cut into bank to improve vertical geometry ch 2840 - 3030. Intent is for lower sections to be built up against the side of the bank, and then cut into the side of the bank as it reaches the higher sections. Path edge to be fenced for fall protection.
- Widening on tight corners to be considered in detailed design, along with providing rest points on the incline up the hill.
- Grades are maintained below 10%, however they are above 5% for this section.
- Path is shared with vehicle driveway from ch 3030 – 3100. Investigate if these facilities can be separated in detailed design phase.
- Existing surface to be trimmed and redressed with surface course.
- Existing shed structures to be removed on tunnel approach for CPTED requirements. Existing vegetation to be trimmed and thinned as well.

9.4 CHAIN HILLS TUNNEL

An unsealed shared path within the tunnel is proposed for this section. The design is based on the typical section as shown below.



- Existing services will be retained in the tunnel floor. These include a fibre optic cable and 2 x rising sewer mains. DCC 3 waters has expressed interest in installing a watermain in the base of the Chainhills Tunnel in conjunction with this project for future proofing the water supply to Mosgiel.
- Drainage of the tunnel will be provided both sides of the unsealed surface and run from the Mosgiel end Portal to the Dunedin end portal
- Lighting and CCTV have been allowed for in the preliminary design as described above. Lighting is to level P3 including emergency lighting and CCTV.
- Structural repairs will be required to bring the tunnel up to a serviceable state suitable for public use of the tunnel. This includes reappointing some of the brick work and may include other scope items. These are currently being monitored and the full scope of work will be confirmed in the detailed design stage. Refer to July 2021 DCL report – Chain hills Tunnel: Stage 2 Preliminary Report

10. Preliminary Design –Chain Hills Tunnel to Haraway Underpass

The preliminary design considerations for this section are detailed below.

10.1 MAIN SOUTH LINE RAIL CORRIDOR – CHAIN HILLS TUNNEL TO ABBOTS CREEK BRIDGE – SHARED PATH

Intent is to locate the path on the historical rail embankment.

An unsealed path is proposed for this section.

- The intent is to locate the path on top of the historical rail embankment and follow this from the chain hills tunnel to ch 1380.
- Where path is located on an existing gravel track surface this is to be trimmed and then redressed with AP40 and surface course to provide a compact surface. Where existing construction ends, the intent is to strip existing topsoil and vegetation and form a new path with water tables.
- It is notable that there is no lidar information is available for use ch 140 – 1370 of this section. Vertical design through this section is based on reusing the existing track surface.
- Fencing is required to separate the path from adjacent farmland. This has been shown indicative only.
- Regular minor culverts will be required to maintain existing drainage paths.
- A Gravel hardstand turn around bay for emergency services / Kiwirail access parking is included at Ch 800.
- Ch 1380 to Ch 1480 encroaches on a potential future double tracking project that is proposed by DCC. The design philosophy for this section is to install the path relative to the existing rail location, and that should any future double tracking project go ahead the relocation of the path to accommodate this would form part of that project. This would likely require more extensive retaining and modification to the hillside that is not cost effective to complete unless the double tracking project goes ahead. A reduced path width and reduced track offset has been adopted in this section to minimise the extent of hill modification and retaining.
- An area of existing gravel hardstand at Ch1380 will be incorporated to facilitate a turnaround bay for emergency services / KiwiRail access parking / DCC services access
- The path gradient is 8.4% between Ch 1485 to Ch 1520. This is required to navigate down to suitable level to tie into boardwalk.
- Between Ch 1525 to Ch 1720 the path transitions to boardwalk and then on to bridging to traverse steep grades and provide a high-quality transition beneath the existing rail bridge. This allows the path to cross from the north to the south side of the rail corridor, as well as cross Abbots Creek. It is expected this section can serve as a tourist attraction providing a unique section of path making use of the historical rail bridge.
- Boardwalk / Bridging is proposed at 4m width. The rail bridge it is intended to be approx. 5m above ground level so it can pass above the first row of girder beams beneath Abbots Creek rail bridge. A debris screen will be required under the rail bridge to protect path users.

10.2 MAIN SOUTH LINE RAIL CORRIDOR –ABBOTS CREEK BRIDGE TO GRANDVISTA DRIVE RESERVE – SHARED PATH

An unsealed path is proposed for this section, adjacent to the sandpit (owned by Fulton Hogan).

- Single cross fall or crowned to be determined.
- Proposed to use existing drainage channel adjacent to rail corridor for path drainage.
- Desirable offset from rail track is provided at approx. 14m offset.
- At Ch 1720 there is a potential future link route to Fairfield.
- Potential playground / reserve activation at ch 2140.
- Ch 2170 to Ch 2200 path gradient is 8.4%. This is required to navigate existing ground contour. Path is realigned here to minimise gradient.

10.3 GRANDVISTA DRIVE RESERVE –RAIL CORRIDOR TO ABBOTSFORD UNDERPASS – SHARED PATH

An unsealed path is proposed for this section.

- Note lidar from Ch 2200 to Ch 2220 is not expected to be accurate, pre-dating stormwater modifications to facilitate Grandvista Drive Stormwater.
- Widen existing gravel path 0.6m on each side to provide 3m path width.
- Surfacing upgraded to match unsealed path surface for ride quality.
- Existing bollard lighting to remain.
- Asphalt approach to Abbotsford underpass.
- Existing Abbotsford underpass to be utilised. Existing height 2.1m. Install warning signage on approach and include head protection. grades on approach to underpass above 5%, less than 10%
- Underpass location provides path linkages to Grandvista Drive to the south, and to Abbotsford and Abbotsford School to the north.

10.4 MAIN SOUTH LINE RAIL CORRIDOR –ABBOTSFORD UNDERPASS TO NORTH TAIERI ROAD BRIDGE – SHARED PATH

Path surface changes to asphalt from the underpass, and the path will be lit from streetlighting. A sealed shared path is proposed for this section.

- Path navigates the school reserve area then raises up to run alongside the rail corridor.
- Path offset to rail in this location reduced to 5m to maintain cut batters inside of the northern boundary. This may not be necessary in detailed design depending on bank stability and LIDAR accuracy
- Kiwirail ducting is located in close proximity to the proposed rail protection fence. Investigation and consideration of this is required in detailed design. It may require duct relocation or a change to fence design / installation methodology.
- Ch 2560 - 3160 (600m) of cycle track to carry out dual function of cycle trail and KiwiRail service road. Passing bays to be included in this section during detailed design.
- Existing stormwater mains crossing the rail corridor to be utilised as outlet for stormwater.
- East of North Taieri Road the rail corridor includes extensive retaining on the northern side with steep banks on both sides and limited width. This makes continuation of the path within the rail corridor difficult to achieve with reduced offsets. This would also create a sub-standard environment from a CPTED point of view. The design solution to this is to cross the rail using a proposed overbridge. The overbridge would have a 20m approx span, with 4.9m clearance to the tracks (consider a lower level to match existing road bridge clearance in detailed design).
- The proposed overbridge has been located on the western side of the North Taieri Bridge, and the subsequent crossing of North Taieri Road managed through a change in priority at the intersection with Abbotsford Road. This would also involve the path deviating from the rail corridor and following an existing access track up to road level (potentially to remain shared as Kiwirail access), removal of the pedestrian crossing, closing of pedestrian access to the existing bridge, bus stop relocation, associated traffic calming and boardwalk extensions to facilitate the proposed crossing. This is considered the most effective approach to slow speeds and provide a suitable crossing.
- Alternatively, the path could cross North Taieri Road north of the existing bridge without the change in intersection priority and then locate the proposed overbridge on the eastern side of the North Taieri Bridge. A suitable control and traffic calming would be required for this crossing (likely signals). This may be challenging with the steep approaches with bends on the road.
- Both of the above options should be considered in detailed design, and consultation with the community held on the alterations to this area.

10.5 ABBOTTSFORD ROAD / UNSWORTH STREET - RAIL CORRIDOR TO RUNCIMAN STREET – SHARED PATH

A sealed shared path is proposed for this section.

- Remove existing path and replace with new 3m wide path on Abbotsford Road.
- Unsworth St changed to one-way to accommodate shared path with new kerb and channel reducing carriageway width to 4.5m. Kerb extension proposed at Abbotsford Road intersection to reduce entry width.
- Demolish existing pedestrian bridge at Unsworth Street.
- Install new boardwalk / bridge over rail corridor. 20m span approx with 4.9m vertical clearance to tracks (consider lowering to match adjacent road bridges during detailed design).
- Boardwalk ramp bridge approaches are required on both sides with steps as well.
- Retaining wall / boardwalk landing is required to transition back to kerb side path on north side.

10.6 RUNCIMAN STREET / NEILL STREET / RAILCORRIDOR – UNSWORTH STREET TO HARAWAY UNDERPASS – SHARED PATH

A sealed shared path is proposed for this section.

- A Shared path is proposed against the existing kerb and channel which will include a fall protection barrier.
- Cyclists give way to road traffic at Neill St
- CH 3960 – 4160 has been designed to sit in the rail corridor on an existing earthworks platform. To avoid steep vertical grade and CEPTED concerns this section could be realigned to Neill St. Consider both options in detailed design phase.
- Max grades are breached in transition down existing pedestrian bridge approach at CH 3980. Existing grade at approx 15% and this has been maintained in the preliminary design. Significant retaining and or structural works will be required to reduce this grade below 15%.
- New Kerb is required on Neill St from ch 4180 to 4280 in conjunction with a new fence with access gates to separate the rail corridor.
- Path shares existing rail corridor access track ch 4500 - 4560. Some widening may be required to provide separated facility if practical. To be investigated during detailed design.
- Existing underpass to be used. Remove chicane and barriers, allow to upgrade lighting, paint throughout and landscape at entrances.

11. Preliminary Design –Haraway Underpass to Caversham

The preliminary design considerations for this section are detailed below.

11.1 RAIL CORRIDOR / SH1 MOTORWAY CORRIDOR –HARAWAY UNDERPASS TO KAIKORAI VALLEY ROAD – SHARED PATH

A sealed shared path is proposed for this section.

- On exit from the existing underpass the track offset is below minimum allowance. A solid barrier protection fence is proposed until a desirable offset can be achieved.
- A fenced turn around area with gate at ch 100 is proposed to accommodate emergency vehicles that would enter from the east.

- A crowned shared path is proposed with a rail protection fence on the north side, and a motorway protection fence on the south side.
- At Ch 190 it is proposed to install a bridge deck on the existing bridge abutments. This will result in the approaches to and on the bridge deck having below minimum track offset. A solid barrier protection fence is proposed until a desirable offset can be achieved.
- At Ch 260 it is proposed to use the existing rail bridge. This will result in the approaches to and on the bridge deck having below minimum track offset. A solid barrier protection fence is proposed until a desirable offset can be achieved.
- From Ch 280 the path is located to achieve a 6m clearance offset from the track centreline to the rail protection fence. The path also begins encroaching on motorway designated land at this approximate location, with a clearance from the motorway guardrail to the motorway protection fence approximately 4.9m.
- At Ch 660 the path is closest to the motorway with a clearance from the motorway guardrail to the motorway protection fence approximately 1.5m.
- At Ch 680 to 800 the path deviates closer to the rail corridor with a clearance below minimum track offset of approximately 3.5m. This has been done to locate the path on the existing earthworks mound and avoid batter filling on the motorway side. This offset can be increased to 4m through reduction in path width and clearzone between the path fence. This can be considered in detailed design once topo survey provides a accurate understanding of location and levels of the various features.
- There are existing KiwiRail ducting and Vodafone fibre cables within this route zone that may clash with the proposed fencing or may limit earthworks ability without relaying these.
- At CH 820 the track clearance is increased to approx 4.3m with full path width and desirable clear zones. A 1.8m protection fence is likely required in this section unless the design widths are reduced to achieve a 5m offset.
- Ch 940 to Ch 1000 the path deviates around existing Kiwirial switch gear infrastructure. To accommodate this, it is proposed to install retaining adjacent to the main south road off ramp approx 2m in height. Immediately following this the path returns to a desirable track offset of 6m and deviates away from the motorway by continuing to follow the rail track.
- At Ch 1040 a gravel access track is proposed to main south road for emergency services access to the path and to provide a potential CPTED escape route for users.
- Ch 1280 to 1440 the rail corridor land is occupied by industrial businesses. It is proposed to relocate the existing property fence lines back to provide space for the path.
- Ch 1460 to 1560 earthworks are required to allow the path to elevate up to reach Kaikorai Valley Road old bridge crossing over the rail tracks. This existing bridge and section of path is proposed to accommodate emergency vehicle access. The existing vegetation on the bridge is understood to be planned to be removed by others. The existing footpath on the bridge requires widening.

11.2 KAIKORAI VALLEY ROAD –RAIL CORRIDOR TO CAVERSHAM TUNNEL – SHARED PATH

A sealed shared path is proposed for this section.

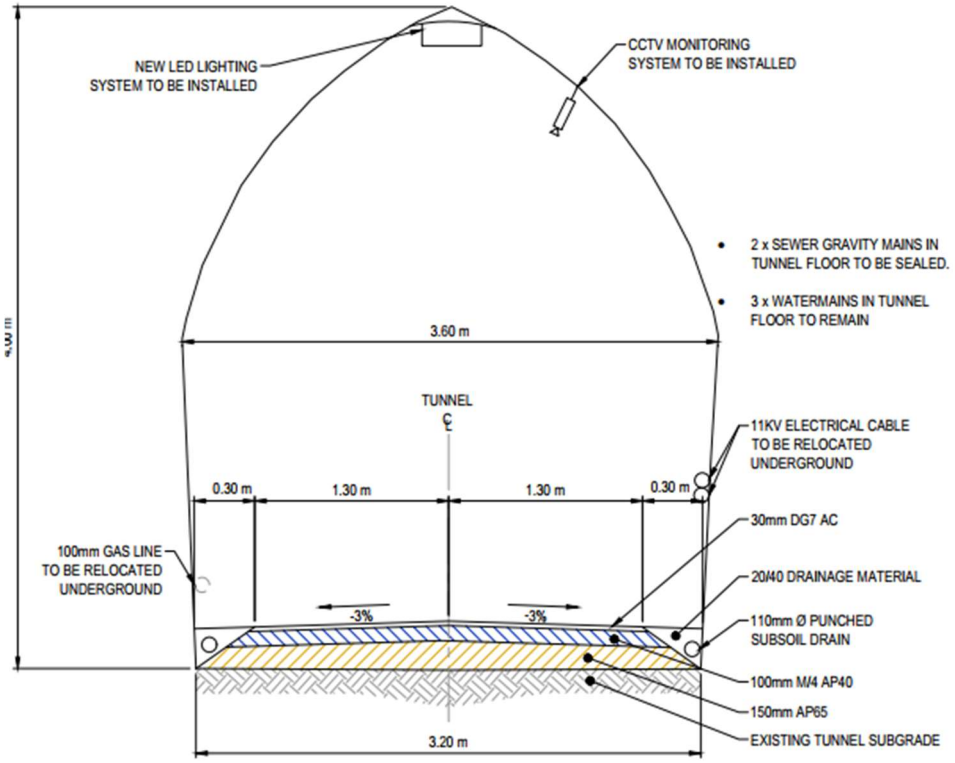
- McLeods Road access to Kaikorai Valley Road is proposed to be closed and a new access from Eclipse Road provided at the western end of Eclipse. This simplifies traffic movements at the Kaikorai Valley Road / Eclipse Road intersection allowing for a narrowed road carriageway suitable for a cycle crossing.
- The path is aligned from the bridge to Eclipse Road to allow for existing circulating movements around businesses on McLeods Road to still function, while also reducing path conflict with industrial activities.
- Consideration was given to providing for a right turn bay for vehicles turning from Kaikorai Valley Road into Eclipse Road. This was discounted as there was insufficient space to provide this without extensive modification to the eastern side of Kaikorai Valley Road,

along with the proximity to the Kaikorai Valley Road bridge providing challenges in achieving appropriate length tapers. This is not an existing facility therefore was considered out of scope for the purposes of the cycleway project, and the amendments made as part of the cycleway project do not preclude future modification to the intersection if deemed necessary.

- Ch 1680 to Ch 2220 a shared path is designed on the western side of Kaikorai Valley Road. This is accommodated via removal of the existing on-road cycle lanes to provide sufficient space to install new kerb and channel and shared path generally within the existing roading corridor. The design intent is to provide off road cycle and pedestrian facility with the provision of on-road lane widths suitable for confident cyclists, along with flush median and maintaining existing parking arrangements. There is a steep bank to the west of Kaikorai Valley Road, so widening the existing road corridor was ruled out. A fall protection fence is required.
- At Ch 2220 a signalised crossing point is proposed.
- In order to navigate down to the tunnel entrance significant earthworks are proposed for DCC owned land to create a switch-back alignment cut into the existing ground. This will include handrails. Services clashes will require realignment as necessary. Retaining may be required if the cut bank is not form from rock. The use of boardwalk approaches within the existing tunnel opening are proposed to align path around the existing valve housing. It is also proposed to modeify the existing valve house building to be a more visually permeable structure form a CPTED perspective – this may take the form of a steel cage which will be developed during the detailed design stage.
- Stormwater is proposed to be isolated from entering the tunnel through use of bunding and a new SW outlet across Kaikorai Valley Road (through the existing services duct).

11.3 CAVERSHAM TUNNEL

A sealed shared path within the tunnel is proposed for this section. The design is based on the typical section as shown below.



- Existing services will be retained or relocated to the tunnel floor. These include
  - 2 x 6KV HV electrical cables to be relocated underground in the tunnel floor, a 100mm gasmain to be relocated underground in the tunnel floor.
  - 3x water mains to remain.
  - 2x wastewater mains to remain with all manholes to be sealed. Note that the downstream effects of sealing the gravity sewer system have not been investigated and should be during the detailed design phase. Historically in significant storm events, the sewer manholes in the Caversham tunnel have be known to discharge sewage into the tunnel without his relief it is expected that the sewer network will surcharge at an alternative location downstream. DCC have confirmed that there are no current plans to redirect wastewater away from the Caversham tunnel.
- Drainage of the tunnel will be provided both sides of the asphalt surface and run from the Kaikorai Valley end Portal to the Dunedin end portal. The first 343 metres from the Kaikorai valley end has been assumed to be a level gradient before becoming a 1.5% gradient to the Dunedin End Portal. The drainage system has been designed to operate under surcharge for the first 343m (flat section) to avoid constructing deep trenches to facilitate drainage that will clash with existing services and be cost prohibitive to construct.
- Lighting and CCTV have been allowed for in the preliminary design as described above. Lighting is to level P3 including emergency lighting and CCTV.
- Structural repairs will be required to bring the tunnel up to a serviceable state suitable for public use of the tunnel. This includes scaling of the tunnel wall and roof to remove any loose debris. Further geotechnical investigations are required during the detailed design phase to refine the scope of remedial works required for the tunnel. Please refer to Geosolve September 2020 report - Preliminary Geotechnical and Structural Dilapidation Assessments of the Tunnels and Bridges for the DCC Tunnels Trail Project - for the current recommendations of remedial works required for the tunnel.

11.4 CAVERSHAM TUNNEL TO BARNES DRIVE – SHARED PATH

A sealed shared path is proposed for this section.

- Ch 3230 – 3400 the design consists of a sealed path constructed over existing ballast path. Water tables shaped.
- A minor Stormwater pumpstation and rising main is proposed to deal with no overland flow outlet from the tunnel entrance. Minor flows expected with western end of the tunnel isolated from inflow. Location to be determined in detailed design
- Existing pedestrian bridge above to remain closed. Investigate improving fencing around / removing deck.
- Existing guard rail and cantilevered boardwalk at road level to remain. There is an existing 2m approx solid board fence. CPTED report recommends removal. Consider acoustic impacts of removal and other ways to increase passive surveillance into tunnel entranceway.
- Vegetation trimming and maintenance required to clear banks and open canopy above.
- Existing water valve house to remain. re-configure to smaller structure / replace with visually permeable structure (cage or similar)
- CH 3410 Smooth transition in level from path into tunnel
- CH 3410 – 3679 - Widen existing path with minor retaining as required.