CREAMERY ROAD PRECINCT STRUCTURE PLAN

CONCEPT DESIGN AND OPINION OF PROBABLE COSTS REPORT

07 May 2024

Prepared for:
City of Greater Geelong

Prepared by:
Stantec

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Table of Contents

EXECUTIVE SUMMARY V

ACRONYMS / ABBREVIATIONS VII

1 INTRODUCTION 8
1.1 Project Appreciation 8
1.2 Purpose of this Report 9
1.3 Data Sources 10
1.4 Design Workshops 12
1.5 Work completed to date 12

2 EXISTING CONDITIONS 13
2.1 Topography 13
2.2 Existing Roads 13
2.3 Site Walkover 14
2.3.1 Creamery Road 14
2.3.2 Geelong-Ballan Road – Midland Highway Intersection 15
2.3.3 Geelong-Ballan Road 16
2.3.4 Geelong-Ballan Road – Evans Road Intersection 17
2.3.5 Evans Road (South of CC 12) 17
2.3.6 Evans Road (Existing Warners Road Intersection) 19
2.3.7 Evans Road (Existing Valleyside Drive Intersection) 19
2.3.8 Evans Road (Existing Lovely Banks Road Intersection) 20

3 DESIGN ASSUMPTIONS AND INSTRUCTIONS 21

4 TRANSPORT MODELLING 23
4.1 Overview 23
4.2 Interim vs Ultimate Traffic Volumes 23

5 ROADS PROJECTS 24
5.1 Road Locations 24
5.1.1 Road Naming Conventions 24
5.2 Cross Sections 26
5.2.1 CCC - Standard 26
5.2.2 CCC – Activity Centre 27
5.2.3 CCC – Variation 27
5.2.4 CCC – Evans Road 29
5.2.5 Evans Road 30
5.2.6 Midland Highway 31
5.2.7 Geelong Ballan Road 32
5.3 Design References 32
5.4 Horizontal Geometry 33
5.5 Vertical Geometry 35
5.6 Earthworks 38
5.7 Road Project Extents 38
5.8 RD 01 38
5.9 RD 02 41

6 INTERSECTION PROJECTS 43
6.1 Design Criteria 43
6.2 Design Parameters 43
6.3 Earthworks 51
6.4 Intersection Project Extents 51
6.5 IN 01 51
6.6 IN 02 52

6.7 IN 03 52
6.8 IN 05 53
6.9 IN 06 54
6.10 CC 07 54
6.11 CC 09 55
6.12 CC 12 55
6.13 ER 14 56
6.14 ER 15 56
6.15 ER 16 57
6.16 ER 17 58
6.17 POS 01 58

7 CULVERT PROJECTS 59
7.1 Background 59
7.2 Preliminary Assessment 59
7.3 Culvert Project Extents 59
7.4 CU 01 60
7.5 CU 02 60
7.6 CU 03 61

8 UTILITIES 62
8.1 Before-You-Dig-Australia 62
8.2 Identified Utilities 62
8.2.1 Road projects 62
8.2.2 Intersection projects 63

9 OPINION OF PROBABLE COSTS 68
9.1 Background 68
9.2 Earthworks Assumptions 68
9.3 Project Extents 68
9.4 Opinion of Probable Cost Summary 68

LIST OF TABLES

Table 1.1: Data Sources 10
Table 2.1: Existing Road Network Geometrical Features 14
Table 5.1: Horizontal Design Criteria – RD 01 (CCC – Activity Centre) 33
Table 5.2: Horizontal Design Criteria – RD 01 (CC 07 to CH 945 and CC 09 to CH 1840) (CCC – Variation), RD 01 (IN 06 to CC 07, and CH 1840 to IN 01) and RD 02 to ER 14 (CCC - Standard) 33
Table 5.3: Horizontal Design Criteria – RD 02 (Evans Road north of ER 14) 34
Table 5.4: Vertical Design Criteria – RD 01 (CCC – Activity Centre) 35
Table 5.5: Vertical Design Criteria – RD 01 (CC 07 to CH 945 and CC 09 to CH 1840) (CCC – Variation), RD 01 (IN 06 to CC 07, and CH 1840 to IN 01) and RD 02 to ER 14 (CCC - Standard) 36
Table 5.6: Vertical Design Criteria – RD 02 (Evans Road north of ER 14) 37
Table 6.1: Design Parameters – IN 01 43
Table 6.2: Design Parameters – IN 02 44
Table 6.3: Design Parameters – IN 03 45
Table 6.5: Design Parameters – IN 05 46
Table 6.6: Design Parameters – IN 06 47
Table 6.7: Design Parameters – CC 07 48
Table 6.9: Design Parameters – CC 09 48
Table 6.12: Design Parameters - CC 12 49
Table 6.13: Design Parameters – ER 14 49
Table 6.14: Design Parameters – ER 15 49
Table 6.15: Design Parameters – ER 16 50
Table 6.16: Design Parameters – ER 17 50
Table 7.1: Design Parameters – CU 01 60
Table 7.2: Design Parameters – CU 02 61
Table 7.3: Design Parameters – CU 03 61

Table 8.1: Identified Utilities – RD 01 62
Table 8.2: Identified Utilities – RD 02 62
Table 8.3: Identified Utilities – IN 01 63
Table 8.4: Identified Utilities – IN 02 64
Table 8.5: Identified Utilities – IN 03 64
Table 8.6: Identified Utilities – IN 05 64
Table 8.7: Identified Utilities – IN 06 66
Table 8.8: Identified Utilities – CC 07 66
Table 8.9: Identified Utilities – CC 12 66
Table 8.10: Identified Utilities – ER 14 66
Table 8.11: Identified Utilities – ER 15 66
Table 8.12: Identified Utilities – ER 16 66
Table 8.13: Identified Utilities – ER 17 67
Table 9.1: Road Projects 69
Table 9.2: Intersection Projects 69
Table 9.3: Culvert Projects 69
Table 9.4: Crossing Projects 69

LIST OF FIGURES

Figure 1.1: Western Geelong Growth Area (left) with the Creamery Road PSP area (right) 9
Figure 2.1: Topography of Creamery Road PSP Area (image sourced from VicMaps and modified by Stantec dated 20/12/2022) 13
Figure 5.1: Key Sections of RD 01 (image sourced from image sourced from Final Concept Design Submission dated 16 February 2024 and modified by Stantec 24
Figure 5.2: Key Sections of RD 02 (image sourced from image sourced from Final Concept Design Submission dated 16 February 2024 and modified by Stantec 25
Figure 5.3: CCC Standard Cross Section (image sourced from *2022.01.30 - Cross-Sections V10 (2).pdf*) 26
Figure 5.4: CCC Activity Centre Cross Section (image sourced from *2022.01.30 - Cross-Sections V10 (2).pdf*) 27
Figure 5.5: CCC Variation Cross Section with Frontage Road on LHS (image sourced from *2023.09.07 - CCC Cross-Sections V2.pdf*) 28
Figure 5.6: CCC Variation Cross Section with Frontage Road on RHS (image sourced from *2023.09.07 - CCC Cross-Sections V2.pdf*) 28
Figure 5.7: CCC Evans Road Cross Section (image sourced from *Appendix_Cross Sections V3 (2022.02.15).pdf*) 29
Figure 5.8: Evans Road Cross Section (image sourced from *2022.01.30 - Cross-Sections V10 (2).pdf*) 30
Figure 5.9: Midland Highway Cross Section (image sourced from *2022.01.30 - Cross-Sections V10 (3).pdf*) 31
Figure 5.10: Geelong Ballan Road Cross Section (image sourced from *2022.01.30 - Cross-Sections V10 (3).pdf*) 32
Figure 5.9: RD 01 alignment (image sourced from Final Concept Design Submission dated 16 February 2024 and modified by Stantec) 38
Figure 5.10: Approx. Earthworks at Intersection CC 12 (image sourced from Stantec's Final Concept Design Submission dated 16 February 2024) 39
Figure 5.11- U-Turn Facility (image sourced from Stantec's Final Concept Design Submission dated 16 February 2024) 40
Figure 5.12: RD 02 alignment (image sourced from Final Concept Design Submission dated 16 February 2024 and modified by Stantec) 41
Figure 5.13: RD 02 from CC 12 to PSP Site Boundary (image sourced from Stantec's Final Concept Design Drawings dated 16 February 2024) 42
Figure 5.14: Earthworks batters on western side of RD 02 (image sourced from Stantec's Final Concept Design Drawings dated 16 February 2024) 42
Figure 7.1: Culvert Crossing CU 01 (image sourced from Stantec's Final Concept Design Submission dated 16 February 2024) 60

Figure 7.2: Culvert Crossing CU 02 (image sourced from Stantec's Final Concept Design Submission dated 16 February 2024)..... 60
Figure 7.3: Culvert Crossing CU 03 Final Concept Design Submission dated 16 February 2024) 61

LIST OF APPENDICES

APPENDIX A TRANSPORT MODELLING REPORT 1
APPENDIX B FINAL CONCEPT DESIGN DRAWINGS..... 2
APPENDIX C CONCEPT DESIGN COMMENTS REGISTER..... 3
APPENDIX D OPINION OF PROBABLE COSTS..... 4
APPENDIX E BEFORE YOU DIG AUSTRALIA RESPONSES (MARCH 2024) 5

Executive Summary

Stantec were engaged by the City to develop concept designs and opinion of probable costs for transport infrastructure projects to inform the preparation of a Developer Contributions Plan (DCP) for the Creamery Road Precinct Structure Plan (PSP).

The Creamery Road PSP is located in Western Geelong Growth Area (WGGA). The PSP is bordered by Midland Highway to the South, Geelong Ring Road to the east, Ballarat Railway Line to the north and Geelong – Ballan Road to the west. The PSP will be the first in the WGGA and will have approximately 3,000 dwellings, associated local activity centre and education uses. Refer Section 1 for an appreciation of the Project and background that informed the concept designs.

The Creamery Road PSP area is a relatively flat greenfield site, predominantly used for farming and agricultural practises with low-density housing. The Cowies Creek waterway and its tributary run in a west-east alignment along the north-eastern border of the Site. Stantec completed a walkover of the PSP Site on 22 December 2022 to observe the existing conditions and identify key constraints relevant to the concept designs. Further discussion on existing conditions is provided in Section 2.

A number of critical design assumptions were made during the development of the concept designs, and key instructions were received from the City that contributed to the design outcomes. Section 3 provides a comprehensive listing of design assumptions and key instructions on this project.

Strategic transport modelling was used to inform the intersection designs. Specifically, a version of the State-wide Strategic Transport Model (S-VITM) that has been used to inform growth area planning for the City of Greater Geelong was used. Refer Section 4 for a brief overview of Transport Modelling and Appendix A for the Transport Modelling Report completed by Stantec.

The concept design of transport infrastructure associated with the Creamery Road PSP consisted of road, intersection, culvert and crossing projects. The road network consisted of two main control alignments: RD 01 connecting from the Midland Highway at the southern boundary of the site to Geelong-Ballan Road to the west, and RD 02 along the existing Evans Road through to a connection point with a future Anakie Road intersection. RD 01 and RD 02 represent the Clever and Creative Corridor (CCC) network through the PSP Site and along Evans Road, with varying cross sections designed by others and provided to Stantec. Section 5 details the basis of design for RD 01 and RD 02 including design criteria, references and methodology.

Intersection projects consisted of five (5) intersections along Geelong-Ballan Road and Midland Highway (IN 01, IN 02, IN 03, IN 05 and IN 06), three (3) along the proposed CCC through the PSP Site (CC 07, CC 09 and CC 12), and four (4) along the proposed CCC along Evans Road (ER 14 to ER 17). A Pedestrian Operated Signalised (POS) crossing is located on the northern approach to CC 12. Section 6 details design criteria used in the development of intersection concept designs and highlights the key elements noted for each.

Culvert projects consisted of three (3) culvert arrangements: CU 01 located on RD 01 between CC 09 and CC 10, CU 02 at the existing Cowies Creek crossing on RD 02, and CU 03 on the eastern approach Connector Road on CC 09. Refer Section 7 for further details on the design justification of culvert projects.

A BYDA investigation was completed to understand the extent of existing utilities assets in the vicinity of new projects and possible impacts that would inform costings. Section 8 provides a list of affected asset owners, type and location of the identified utilities.

Stantec engaged WT Partnership to undertake calculation of quantities and development of Opinion of Probable Costs (OPC) for the associated transport infrastructure projects within the Creamery Road PSP and Evans Road. This consisted of ultimate designs for the CCC and interim designs for intersections on the Midland Highway and Geelong – Ballan Road. Refer Section 9 and Appendix D for details of the costings developed by WT Partnership.

Acronyms / Abbreviations

BYDA	Before You Dig Australia
DTP	Department of Transport and Planning
GIS	Geographic Information System
PSP	Precinct Structure Plan
PIP	Precinct Infrastructure Plan
RFQ	Request For Quote
VPA	Victorian Planning Authority
The City	City of Greater Geelong
IDM	Infrastructure Design Manual
CCC	Clever and Creative Corridor
WGGA	Western Geelong Growth Area
NWGGA	Northern and Western Geelong Growth Area
AGRD	Austroads Guide to Road Design

1 Introduction

1.1 Project Appreciation

The Creamery Road Precinct Structure Plan (PSP) is located in Western Geelong Growth Area (WGGA). The PSP is bordered by Midland Highway to the South, Geelong Ring Road to the east, Ballarat- Geelong Railway Line to the north and Geelong – Ballan Road to the west. The PSP will be the first in the WGGA and will have approximately 3,000 dwellings, associated local activity centre and education uses.

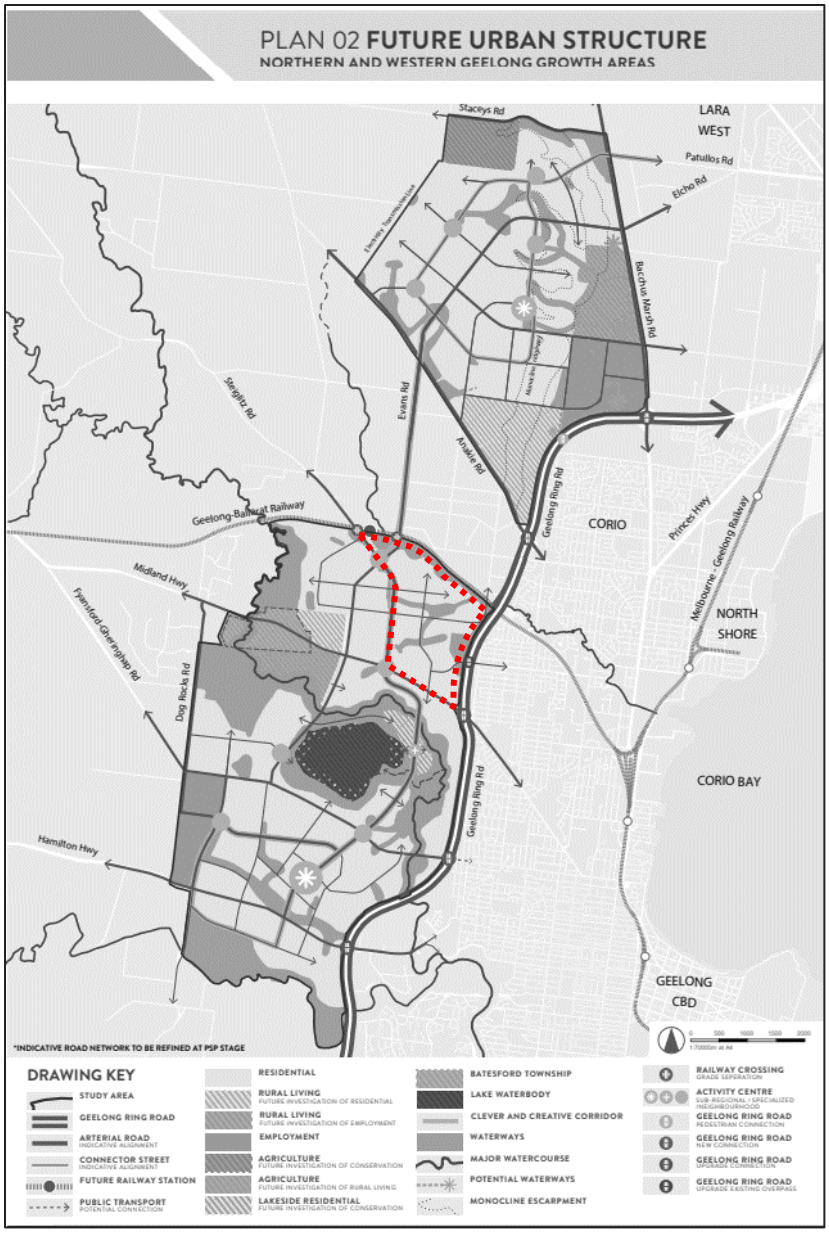
When complete, the precinct will feature:

- The Clever and Creative Corridor (CCC)
- A neighbourhood activity centre located on the CCC
- Cowies Creek corridor open space network that includes a shared path and connection to the existing Ted Wilson Trail via a new connection under the rail bridge at Bluestone Bridge Road
- Myers Reserve
- The constructed waterway network.

The PSP is currently being prepared by the City of Greater Geelong (the City) in consultation with authorities, landowners and major stakeholders.

Figure 1.1 shows the location of the Creamery Road PSP in the context of the Northern and Western Geelong Growth Area (NWGGA) Future Urban Structure (FUS). It is noted that some elements shown in Figure 1.1 have been superseded (e.g. the CCC) and is provided for context clarification of the Creamery Road PSP site context.

Figure 1.1: Western Geelong Growth Area (left) with the Creamery Road PSP area (right)



1.2 Purpose of this Report

Stantec have been engaged by the City to develop concept designs and opinion of probable costs for transport infrastructure projects to inform the preparation of a Developer Contributions Plan (DCP) for the Creamery Road PSP. The projects included:

- Eight (8) ultimate and five (5) interim intersections
- The extent of the CCC road segments between intersection extents through the Creamery Road PSP for the ultimate scenario
- Determination of the land take area required to deliver the ultimate intersection arrangements and road sections
- Three (3) culverts

In addition to the Creamery Road PSP, Stantec's scope also includes developing concept design and opinion of probable costs for the transport infrastructure projects from the PSP site boundary on Evans Road to the southern extent of the Anakie Road intersection at the Heales Road West PSP site boundary. These are referred to as Global DCP items and included:

- Four (4) ultimate intersections
- The extent of upgrade required on Evans Road for the ultimate scenario.

1.3 Data Sources

Table 1.1 provides a summary of the data supplied to Stantec by The City and stakeholders. These data sources have been considered in the development of the concept designs and opinion of probable costs for the various transport infrastructure projects.

Table 1.1: Data Sources

Data Description	File Name(s)	Provided By	Prepared By	Original Date of Receipt
Cross Sections and Intersection Arrangements	Appendix_Cross Sections V3 (2022.02.15).pdf Appendix_Intersections V3 (2022.02.15).pdf	The City	PMP Urbanists	17.03.2022
	2022.11.30 – Cross-Sections V8.pdf			18.01.2023
	2022.11.30 – Cross-Sections V10(2).pdf			05.05.2023
	2022.01.30 - Cross-Sections V10 (3).pdf			01.11.2023
Approximate Existing Services Information	Various	BYDA	BYDA	15.08.2022
Existing Drainage Data	Drainage_Pipes.shp Drainage_pits.shp	The City	Alluvium	17.08.2022
Future Urban Structure Base Plan	CreameryRd_PSP.shp	The City	The City	17.08.2022
	Plan 12c Street Network LEGEND.pdf Plan 12c Street Network.pdf			23.01.2023
	CRPSP_Future Urban Structure_19.10.2023 (1).pdf			01.11.2023
Cadastral boundaries	Parcels.shp	The City	The City	17.08.2022
	2023.10.19_CRPSP_FUS_v22_Stantec.dwg	The City	The City	01.11.2023
Aerial Imagery	Various	The City	The City	26.08.2022
LiDAR Data	Various	The City	The City	30.08.2022
Retarding Basin Technical Report	R0120255_Creamery Rd_DSS_Draft Functional Design Report_V1.pdf Appendix A. R0120255.10_V3_Cowies Crk SWMS_Creamery Rd DSS Review - Memo Report for Stakeholder Distribution.pdf	The City	Alluvium	27.10.2022, 01.12.2023

Data Description	File Name(s)	Provided By	Prepared By	Original Date of Receipt
Retarding Basin MUSIC model	Creamery Road_GeelongNorth_1971-1980_6min_infilled FUNC DESIGN V2.sqz	The City	Alluvium	27.10.2022, 01.12.2023
Retarding Basin RORB model (Noted as Current)	Func_Cowies_2022_Current_Ensemble.par Func_Creamery Road Catchment Current.catg Func_Creamery Road Catchment Current_batch.out	The City	Alluvium	27.10.2022, 01.12.2023
Retarding Basin RORB model (Noted as Developed)	Func_Cowies_2022_Dev_Ensemble_1%AEP.par Func_Creamery Road Catchment Dev_1%AEP.catg Func_Creamery Road Catchment Dev_1%AEP_batch.out	The City	Alluvium	27.10.2022, 01.12.2023
Retarding Basin RORB model (Noted as Input)	ARR_DataHub_Cowies_-38 085_144 319.txt depths_-38.085_144.319_all_design.csv SSmainland_Increments.csv	The City	Alluvium	27.10.2022, 01.12.2023
Retarding Basin Design Reference	Creamery Rd Precinct Drainage draft functional design_design lines.dwg	The City	Alluvium	27.10.2022, 01.12.2023
Retarding Basin Design Drawings (PDF)	P0120225_Cowies_Creek_DSS_Final Functional_Design_Drawings_20221104.pdf	The City	Alluvium	05.11.2022, 01.12.2023
Tree Protection Zones	Creamery Road PSP TPZ 20211012.shp CRPSP_TPZs (20211012) – Critical Value.shp CRPSP_TPZs (20211012) - High Value.shp	The City	ENSPEC	17.01.2023
PSP Servicing	Creamery Road PSP Servicing Plan - FINAL.pdf	The City	GHD	01.11.2023
Tree Survey Report	ENSPEC - Creamery Road PSP Tree Survey 20220512.pdf Tree Points Separated_new boundary.dwg	The City	ENSPEC	01.11.2023
Growling Grass Frog Conservation Management Plan	Draft Cowies Creek Conservation Area Conservation Management Plan .pdf	The City	Biosis	01.11.2023
PSP Servicing	Creamery Rd Services COMMS.dwg Creamery Rd Services ELEC.dwg Creamery Rd Services GAS.dwg Creamery Rd Services POTABLE WATER.dwg Creamery Rd Services RECYCLED WATER.dwg Creamery Rd Services SEWER.dwg Creamery Rd Services SEWER SEQUENCING.dwg Creamery Rd Services WATER SEQUENCING.dwg	The City	The City	11.12.2023

1.4 Design Workshops

Four (4) workshops were undertaken during the development of the Concept Designs as follows:

- Draft Concept Design Workshop held at The City Offices on 19 December 2022. The Workshop was attended by Stantec, The City and DTP representatives both in-person and virtually (online) for presentation and discussion of the Draft Concept Design documentation and previous transport modelling completed. Consolidated review comments received (9 January 2023) following the Draft Concept Design submission have been included in Appendix C.
- Workshop held virtually via Microsoft Teams on 16 February 2023. The Workshop was attended by Stantec and The City for presentation and discussion of the Draft Concept Design of the Pedestrian Operated Signalized (POS) crossing project POS 01.
- Draft Concept Design Workshop held virtually via Microsoft Teams on 18 January 2024. The Workshop was attended by Stantec, The City and DTP representatives for presentation and discussion of the Draft Concept Design documentation. Consolidated comments were received (25 January 2024) following the Draft Concept Design submission have been included in Appendix C.
- Final Concept Design Workshop held virtually via Microsoft Teams on 26 February 2024. The Workshop was attended by Stantec and The City for presentation and discussion of the Final Concept Design documentation.

1.5 Work completed to date

Stantec was originally engaged in August 2022 to complete the concept design and opinion of probable costs for Transport Projects for the CRPSP. The work included the design and costing of four (4) intersections along Geelong-Ballan Road and two (2) intersections along the Midland Highway, six (6) along the proposed CCC through the Site, and four (4) on the proposed CCC along Evans Road. A Pedestrian Operated Signalised (POS) crossing is located on the northern approach to CC 12.

A review of the transport items in the DCP was undertaken by Stantec in mid-2023. The review recommended the following changes to the DCP:

- The removal of one intersection from the Geelong – Ballan Road (IN-04)
- The removal of three intersections from the CCC being CC-08 and CC-10 and CC-11.
- A redesign of the CCC to be bus only between CC-07 and CC-11.
- A design that allows the ability for cars to access residential areas through re-imagined “P-Turns”.

The removal of signalised intersection and the bus only CCC resulted in a need redesign the majority of intersections to accommodate the redistributed traffic demand, as set out in this report.

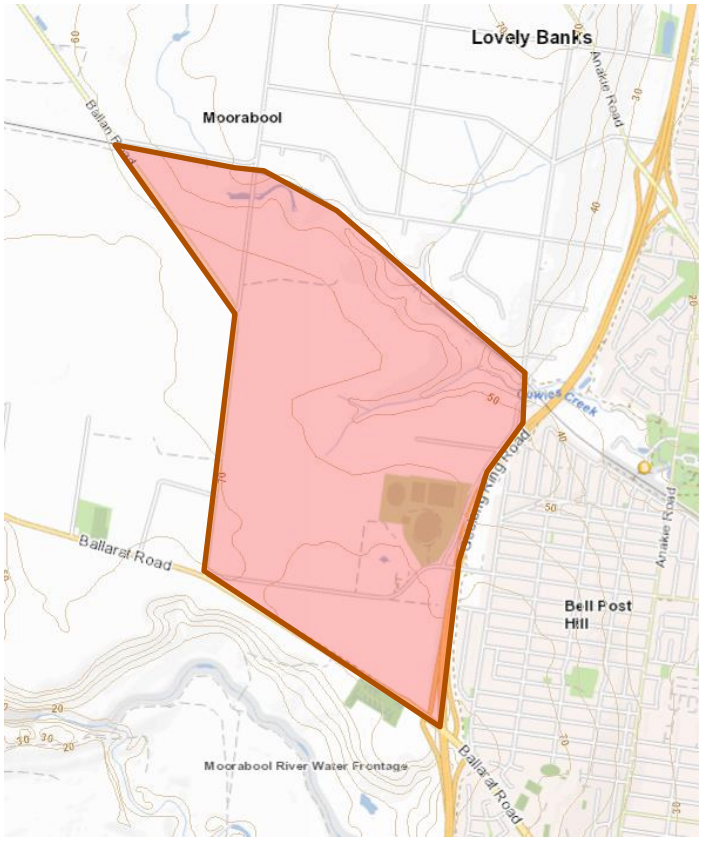
2 Existing Conditions

2.1 Topography

The Creamery Road PSP area is a relatively flat greenfield site, predominantly used for farming and agricultural practises with low-density housing. The Cowies Creek waterway and its tributary run in a west-east alignment along the north-eastern border of the Site.

The Site generally slopes in a south-west to north-east direction, increasing in steepness towards Cowies Creek and its tributary at the border. The average grade across of the Site is less than 5%, however grades between 5 – 15% are noted in much of the north-eastern Site boundary along Cowies Creek.

Figure 2.1: Topography of Creamery Road PSP Area (image sourced from VicMaps and modified by Stantec dated 20/12/2022)



2.2 Existing Roads

There are two major roads that border the PSP area, namely the Midland Highway to the south and Geelong-Ballan Road to the west. In addition, there are two minor roads dividing the PSP area, namely Creamery Road running in an east-west alignment from Rollins Road to the intersection of Geelong-Ballan Road and the Midland Highway, as well as Evans Road in a south-north alignment from Geelong-Ballan Road to Anakie Road. A summary of general geometrical features of the existing roads is provided in Table 2.1.

Table 2.1: Existing Road Network Geometrical Features

Feature					
Road	Carriageway	Geometry	Posted Speed Limit	Drainage	Parking
Geelong-Ballan Road	Two-way single lane in each direction. Sealed traffic lanes and shoulders	Horizontal – generally straight with curve at Evans Road intersection. Vertical – flat with grades generally < 1%	100 km/h	Open table drains with culvert crossings at intersections and driveways	No formal parking permitted
Midland Highway	Two-way single lane in each direction. Sealed traffic lanes and shoulders	Horizontal – generally straight. Vertical – flat with grades generally < 1%	80 km/h	Open table drains with culvert crossings at intersections	No formal parking permitted
Creamery Road	Two-way single lane in each direction. Sealed traffic lanes and unsealed shoulders	Horizontal – generally straight with curves at eastern boundary crossing over Geelong Ring Road on approach to Rollins Road. Vertical – flat with grades generally < 1%	80 km/h	Open table drains with culvert crossings at intersections and driveways	No formal parking permitted
Evans Road	Two-way single lane in each direction. Sealed traffic lanes and unsealed shoulders. Evans Road changes from sealed to unsealed just north of Valleyside Drive through to Anakie Road (excluding Lovely Banks Road intersection).	Horizontal – straight. Vertical - flat with grades generally < 1% with the exception to Cowies Creek crossing where grades exceed 6%.	90 km/h	Open table drains with culvert crossings at intersections and driveways	No formal parking permitted

2.3 Site Walkover

A site inspection was undertaken on 22 December 2022 by representatives of the Stantec design team to inspect areas relating to the road, intersection, and culvert projects as part of the concept design development. The general observations from our inspection are summarised below. Further commentary is provided under the specific transport projects in the subsequent sections of this report where this is considered relevant to the concept design and opinion of probable costs.

2.3.1 CREAMERY ROAD

Generally straight road alignment with ample sight distances in flat terrain. Open areas of vacant land either side of the existing Creamery Road road reserve. It is noted that existing surface runoff appears to be largely contained within open drains and overland.

Site Photos	
Location	Photo
Photo 1 – Creamery Road at proposed CC 07 location (looking East) Photo 2 – Creamery Road at proposed CC 07 location (looking West)	 

2.3.2 GEELONG-BALLAN ROAD – MIDLAND HIGHWAY INTERSECTION

Flat road geometry with sealed existing road carriageway including minimal shoulders. Existing surface runoff appears to be generally contained within open drains and road culverts. Numerous existing services infrastructure was noted in the area including overhead electrical, underground communications (in particular communications pillar) and drainage.

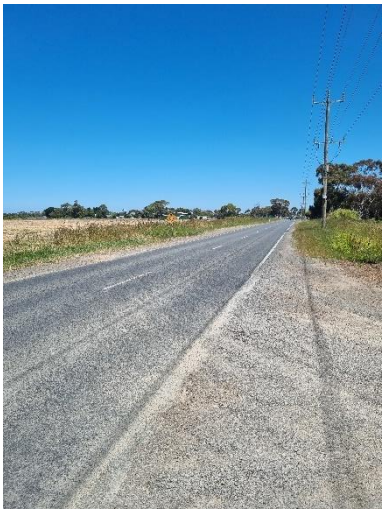
Existing hall and property fencing noted in close proximity to road and electrical infrastructure on western side of Geelong-Ballan Road.

Site Photos	
Location	Photo
Photo 3 – Creamery Road at proposed IN 05 location (looking East) Photo 4 – Creamery Road at proposed IN 05 location (looking West)	 

Photo 5 – Creamery Road at proposed IN 05 location (looking North)	

2.3.3 GEELONG-BALLAN ROAD

Flat road geometry with sealed existing road carriageway including minimal shoulders. Heavily vegetated road verges with earthen swales line each side of the existing Geelong-Ballan Road. Large trees noted on both sides of road in various sections, as well as property access driveways not easily identifiable.

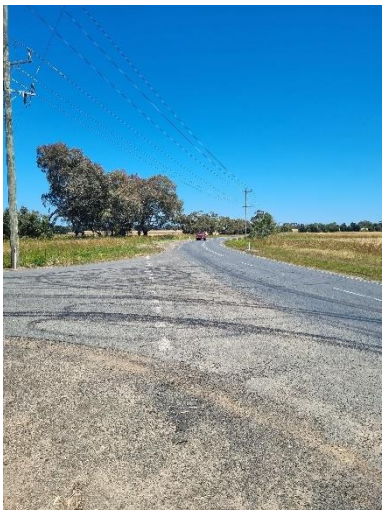
Site Photos	
Location	Photo
Photo 6 – Geelong-Ballan Road at proposed IN 04 location (looking North) Photo 7 - Geelong-Ballan Road at proposed IN 04 location (looking South)	 

2.3.4 GEELONG-BALLAN ROAD – EVANS ROAD INTERSECTION

Sealed existing road carriageway with unsealed shoulders. Minimal superelevation noted on Geelong-Ballan Road through intersection.

Two existing property accesses located within existing intersection extents, and short stub of Evans Road truncated adjacent to intersection. Minimal signage and linemarking noted on approach to and at intersection.

Existing overhead electrical, underground communications and drainage infrastructure observed within intersection extents.

Site Photos	
Location	Photo
Photo 8 – Southern side of Geelong-Ballan and Evans Road intersection (looking North) Photo 9 - Northern side of Geelong-Ballan and Evans Road intersection (looking South)	 

2.3.5 EVANS ROAD (SOUTH OF CC 12)

Sealed road carriageway without shoulders. Vegetated road verges and earthern swale drains lining either side of Evans Road.

Existing kerb and channel noted on either side of road carriageway from proposed CC 12 location to existing Cowies Creek crossing (at CU-02). Safety barrier also noted on either side of Creek crossing. Limitations to sight distance were observed along Evans Road, in particular between proposed CC 12 and existing railway crossing.

Site Photos	
Location	Photo
Photo 10 – Evans Road south of CC 12 (looking North) Photo 11 – Evans Road south of CC 12 (looking South)	 

2.3.6 EVANS ROAD (EXISTING WARNERS ROAD INTERSECTION)

Sealed existing road carriageway with minimal shoulders. As mentioned previously in Section 2.3.5, limitations to sight distance were observed from the existing Cowies Creek crossing to existing railway crossing, and beyond to Warners Road and Valleyside Drive.

Noted existing railway crossing is at grade, controlled by electronic lights and boom gates.

Numerous existing services infrastructure noted in the area including overhead electrical, underground communications and water.

Site Photos	
Location	Photo
Photo 12 – Evans and Warners Road intersection (looking South) Photo 13 – Evans and Warners Road intersection (looking North)	 

2.3.7 EVANS ROAD (EXISTING VALLEYSIDE DRIVE INTERSECTION)

Unsignalised intersection between Evans Road and Valleyside Drive. Sealed on southern and eastern approaches of intersection. Evans Road changes to unsealed carriageway just north of Valleyside Drive intersection through to southern approach at Lovely Banks Road intersection.

Site Photos	
Location	Photo
Photo 14 – Evans Road and Valleyside Drive intersection (looking South) Photo 15 – Evans Road and Valleyside Drive intersection (looking North)	 

2.3.8 EVANS ROAD (EXISTING LOVELY BANKS ROAD INTERSECTION)

Sealed intersection without shoulders. Densely vegetated roadside verge, particularly on western sides of Evans Road and western approach on Lovely Banks Road. Immediately north of intersection, Evans Road changes to unsealed carriageway through to Anakie Road.

Noted existing communications pillar located on south-western corner of intersection along Lovely Banks Road.

Site Photos	
Location	Photo
Photo 15 – Evans and Lovely Banks Road intersection (looking South) Photo 16 - Evans and Lovely Banks Road intersection (looking South)	 
Photo 17 - Evans and Lovely Banks Road intersection (looking North)	

3 Design Assumptions and Instructions

The following assumptions were made in the development of the Draft Concept Designs:

- Initial road centreline alignment, intersection and culvert locations based off FUS base plan provided to Stantec by the City
- Vertical geometry is designed based on LiDAR data supplied by the City. Concept design road levels and extent of earthworks cut and fill are therefore indicative only for the purposes of the opinion of probable costs and land take requirements. The concept designs and associated opinion of probable costs will be subject to detailed site survey, input from The City on flooding requirements and further design development beyond this current engagement.
- Locations of existing services obtained from Before-You-Dig-Australia (BYDA) enquiry data is indicative only for the purposes of approximate identification. Actual locations, levels and sizes will be subject to detailed site survey and underground services investigations completed during future design stages.
- The capacity and condition of the existing stormwater drainage system is assumed to be sufficient and satisfactory. The potential need for upgrade works to the existing stormwater drainage is considered under a separate investigation undertaken by the City's hydraulic consultant Alluvium with the exception of the culvert design for CU 01, CU 02 and CU 03 (refer Section 7.1 for explanation of naming conventions). The design for CU 01, CU 02 and CU 03 has been based on investigations completed by Alluvium but ultimately will be subject to further input from The City. Where sag points are identified along the road alignment, the concept design has considered the likely point of discharge to inform further design development that will be undertaken beyond this current engagement. Confirmation of actual points of stormwater discharge will be subject to finalisation and detailed design of both the road and drainage network following completion of activities such as feature and level survey, underground service proving and stakeholder/authority consultation. This would ultimately be completed during future project stages including that of the subdivisions. Details such as longitudinal sections, points of discharge, outfalls, hydraulic grade line, etc. are therefore not considered in this project.
- Existing rail level crossing on Evans Road at the Creamery Road PSP site boundary or existing bridge on Creamery Road over Geelong Ring Road is to remain unchanged.

Further assumptions made have been detailed in relevant sections of the Report.

Key instructions provided to Stantec by the City during the development of the Draft Concept Designs are:

- All road and intersection design extent (incl. earthworks batters) are not to impact on any proposed detention basins (incl. batters associated to the drainage assets) designed and located by Alluvium.
- Existing trees on the eastern side of Geelong-Ballan Road are not culturally significant and can be assumed as being able to be removed.
- All CCC alignments are to be kept as straight as possible (curves to be minimised).
- The Coolangatta Homestead building and trees nominated for protection are not to be impacted.

- The existing buildings adjacent to intersections IN 01 and IN 03 are not to be impacted and limit impact to new dwellings.
- Designs are to be developed generally in accordance with the Infrastructure Design Manual (IDM) and the City's Design Notes.
- The design of the Geelong-Ballan Road alignment and IN-01 to IN-05 is to be prepared so that land take is proportioned equally between the Creamery Road PSP and Batesford North PSP.
- On the basis of outcomes from the Framework Plan, priority to be made for pedestrians and cyclists which includes the following:
    - Improved turning and holding facilities are to be provided for cyclists at IN-01, IN-06 to CC-12.
    - Reducing chamfers at the corners of all intersections.
    - Inclusion of pedestrian operated signals (POS 01) on Evans Road CCC between CC-12 and ER-14.
- Pedestrian facilities at all intersections to align with likely desire lines.
- Inclusion of moderate, high and critical retention value tree information from the Creamery Road PSP Arboriculture Assessment, completed by ENSPEC and provided to Stantec by the City, into the existing conditions base plan to provide clarity on the impact of the concept design of intersections and roads.

4 Transport Modelling

4.1 Overview

Strategic transport modelling uses future population, employment and land use data projections to model the change in demands and impacts on the road and public transport networks. The Victorian Integrated Transport Model (VITM) is developed by the Department of Transport and Planning (DTP) to assist in the planning of road and public transport infrastructure and contains all public transport corridors, major freeways, main arterials and connector roads within Victoria.

The key inputs in undertaking strategic transport modelling to inform precinct planning activities are the following:

- Population, employment and land use projections
- Proposed road and public transport networks, including:
    - Capacity and speed of road links
    - Public transport service capacity, frequency and speed

Strategic transport modelling VITM has informed the development of the street and road network for Creamery Road PSP. VITM modelling was undertaken for 2051 and interpolated to 2041 (refer below section), factoring in development of other NWGGA PSPs not only Creamery Road PSP.

To align with the strategic directions in the Framework Plan and the City's overall objective for sustainable transport mode shift, the model reflects a future scenario with greater focus on active and public transport investment rather than road capacity expansion. This scenario indicates traffic volumes are approximately 10 per cent lower than the business-as-usual scenario.

4.2 Interim vs Ultimate Traffic Volumes

The relationship between the 2051 and 2041 "base case" forecasts have been used to determine the 2041 or interim traffic volumes for the assessment. The difference between interim (2041) and ultimate (2051) intersection volumes from the "base case" scenario ranged from 63% to 81%, and is dependent on the location of the network.

Accordingly, the ultimate (2051) intersection volumes were factored by 75% to determine the interim (2041) traffic volumes. The adoption of a 75% factor is consistent with other PSP modelling throughout Victoria.

Further detail on the traffic modelling, design years and analysis is provided in the SIDRA Modelling Report prepared by Stantec and included in Appendix A.

5 Roads Projects

5.1 Road Locations

Initial locations of each road alignment were referenced from GIS data provided to Stantec by the City. Deviations from the initial GIS alignments have been made on the basis of achieving compliance with Austroads Guide to Road Design (AGRD) Parts 3 and 4A and consistent with current industry practice, while meeting key instructions made by the City as stated previously in Section 3.

5.1.1 Road Naming Conventions

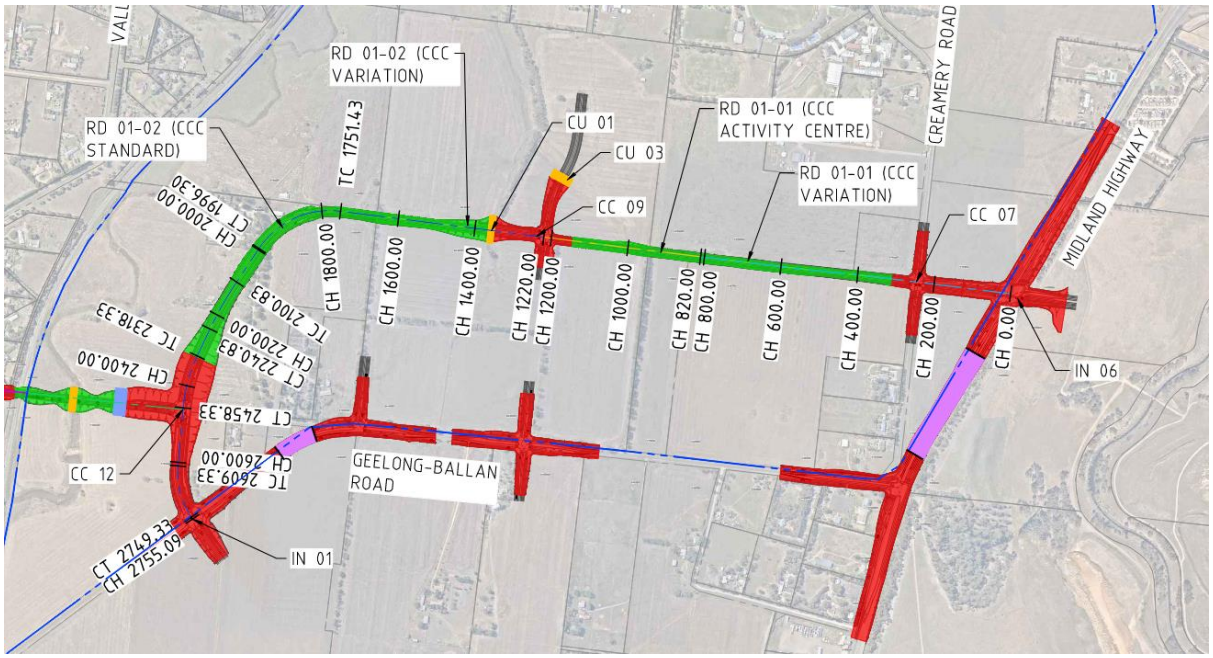
For simplicity, the concept road designs consist of two main control alignments on the centreline of the main carriageways: RD 01 and RD 02.

RD 01 consists of the following key sections along the CCC:

- The CCC from IN 06 through to CC 07 noted as CCC (Standard)*
- The CCC from CC 07 through to CH 945 noted as CCC (Variation)
- The CCC from CH 945 through to CC 09 noted as CCC (Activity Centre)
- The CCC from CC 09 through to CH 1840 noted as CCC (Variation)
- The CCC from CH 1845 to IN 01 noted as CCC (Standard)*

*Note – As highlighted in further Sections of this Report, due to insufficient distance between intersection projects to facilitate tapering to a standard road cross section, ultimate intersection arrangements have been carried through and no separate road section provided.

Figure 5.1: Key Sections of RD 01 (image sourced from image sourced from Final Concept Design Submission dated 16 February 2024 and modified by Stantec



RD 02 consists of the following along Evans Road:

- The CCC from CC 12 to the PSP site boundary at the interface with Evans Road noted as CCC (Evans Road)

- The CCC from the PSP site boundary at the interface with Evans Road through to a future connection point with the Evans Road / Anakie Road intersection noted as Evans Road.

Figure 5.2: Key Sections of RD 02 (image sourced from image sourced from Final Concept Design Submission dated 16 February 2024 and modified by Stantec

Refer to Section 0 for further details on road cross sections used for RD-01 and RD-02.

5.2 Cross Sections

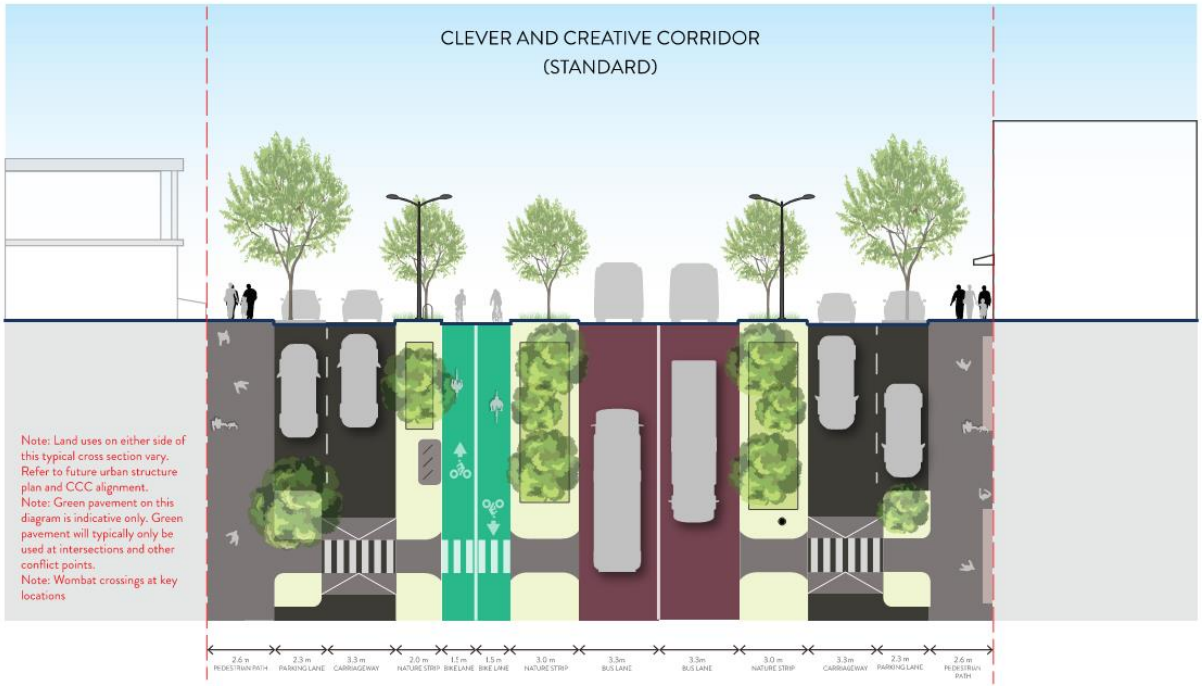
5.2.1 CCC - Standard

The cross-section profile for the CCC – Standard has been adopted from Cross Section 14 of the document *Appendix_Cross Sections V3 (2022.02.15).pdf* as provided by the City and is shown below in Figure 5.3. The purpose of the CCC is transit corridor that prioritises public transport and active travel between key areas within the proposed PSP.

To facilitate this purpose, the 34 m wide CCC cross section features a 6.6 m wide two lane, two-way main carriageway for bus movements, separated by nature strips on both sides. Further to the left-hand side of the cross section, a single lane, one way service road exists for general traffic with adjacent on-street car parking and pedestrian footpaths. A 3 m wide dedicated bicycle path is also located between the main carriageway and service road on the left-hand side of the cross section.

On the right-hand side, a one lane, one-way minor carriageway exists for general traffic as well as pedestrian footpaths.

Figure 5.3: CCC Standard Cross Section (image sourced from *2022.01.30 - Cross-Sections V10 (2).pdf*)

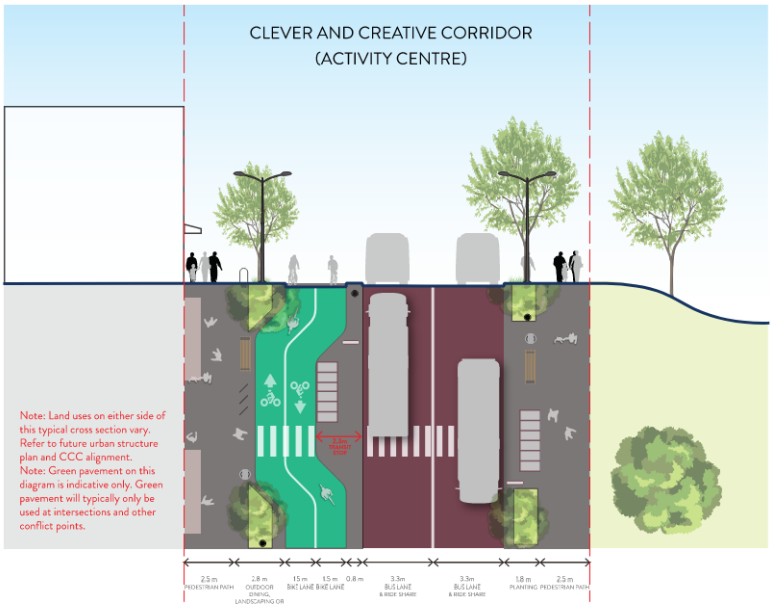


5.2.2 CCC – Activity Centre

The cross section for the CCC – Activity Centre has been adopted from Cross Section 16 of the document *Appendix_Cross Sections V3 (2022.02.15).pdf* as shown below in Figure 5.4.

The 20 m cross section features the 6.6 m wide two lane, two way main carriageway for bus movements and 3 m wide dedicated bicycle path consistent with the CCC – Standard cross section. Beyond this, the cross section differs with the removal of the service road, minor carriageway and adjacent on-street car parking and an increased pedestrian footpath width within the road verge.

Figure 5.4: CCC Activity Centre Cross Section (image sourced from *2022.01.30 - Cross-Sections V10 (2).pdf*)



5.2.3 CCC – VARIATION

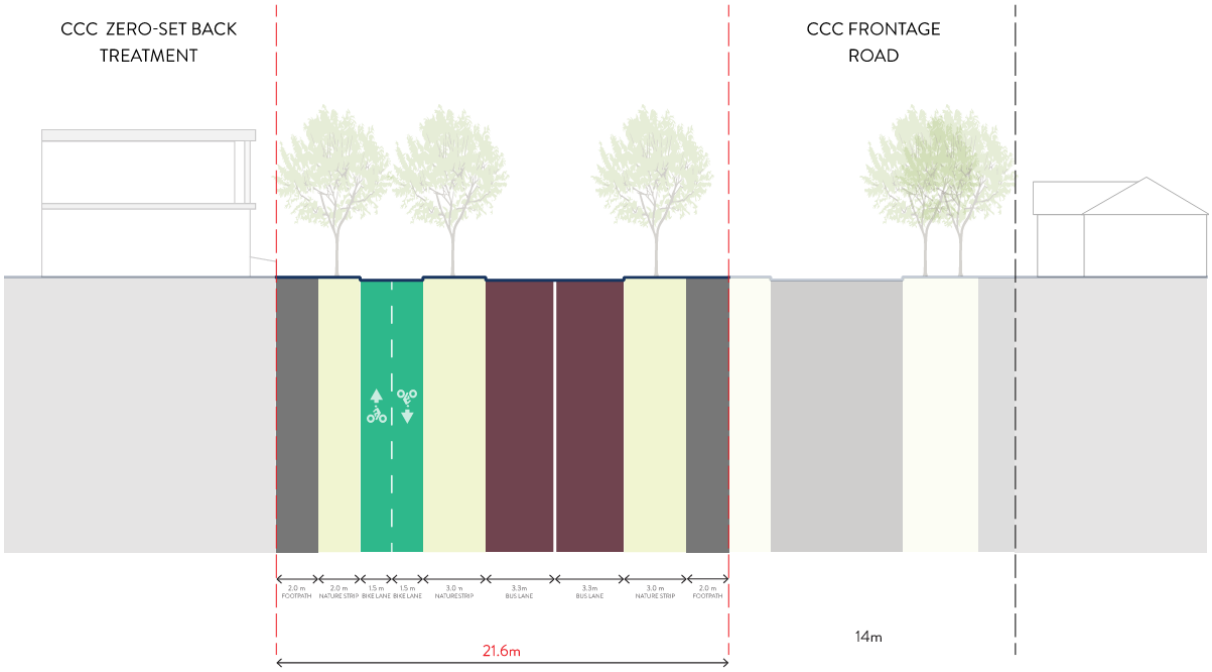
The cross section for the CCC – Variation has been adopted from the document *2023.09.07 - CCC Cross-Sections V2.pdf* as shown in Figure 5.5 and Figure 5.6.

The 21.6 m cross section features the 6.6 m wide two lane, two way main carriageway for bus movements and 3.0 m wide dedicated bicycle path consistent with the CCC – Standard cross section. Beyond this, the CCC - Variation cross section differs with the removal of the service road, minor carriageway and adjacent on-street car parking and provides an increased pedestrian footpath and nature strip width within the road verge.

There are two versions of the CCC – Variation cross section, differing in the side that the 14 m CCC Frontage Road cross section is situated on. The CCC Frontage Road locations will ultimately be up to the individual subdivision developers and decided in future project stages.

Figure 5.5: CCC Variation Cross Section with Frontage Road on LHS (image sourced from *2023.09.07 - CCC Cross-Sections V2.pdf*)

Figure 5.6: CCC Variation Cross Section with Frontage Road on RHS (image sourced from *2023.09.07 - CCC Cross-Sections V2.pdf*)

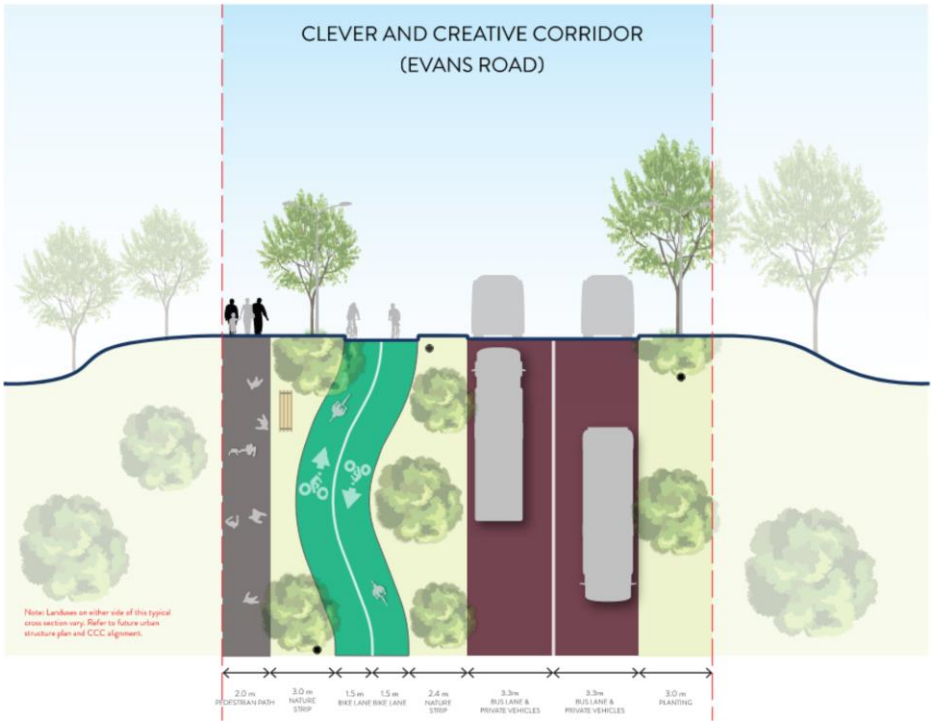


5.2.4 CCC – Evans Road

The cross section for CCC between intersection CC 12 and the PSP site boundary at Evans Road has been adopted from Cross Section 17 of the document *Appendix_Cross Sections V3 (2022.02.15).pdf* as shown below in Figure 5.7.

The 20 m wide cross section features the 6.6 m wide two lane, two way main carriageway for bus and vehicle movements and 3 m wide dedicated bicycle path consistent with the CCC – Standard cross section. Beyond this, the cross section differs with the removal of minor carriageways, adjacent on-street car parking and a pedestrian footpath on the right hand side which is replaced with verge space for planting.

Figure 5.7: CCC Evans Road Cross Section (image sourced from *Appendix_Cross Sections V3 (2022.02.15).pdf*)

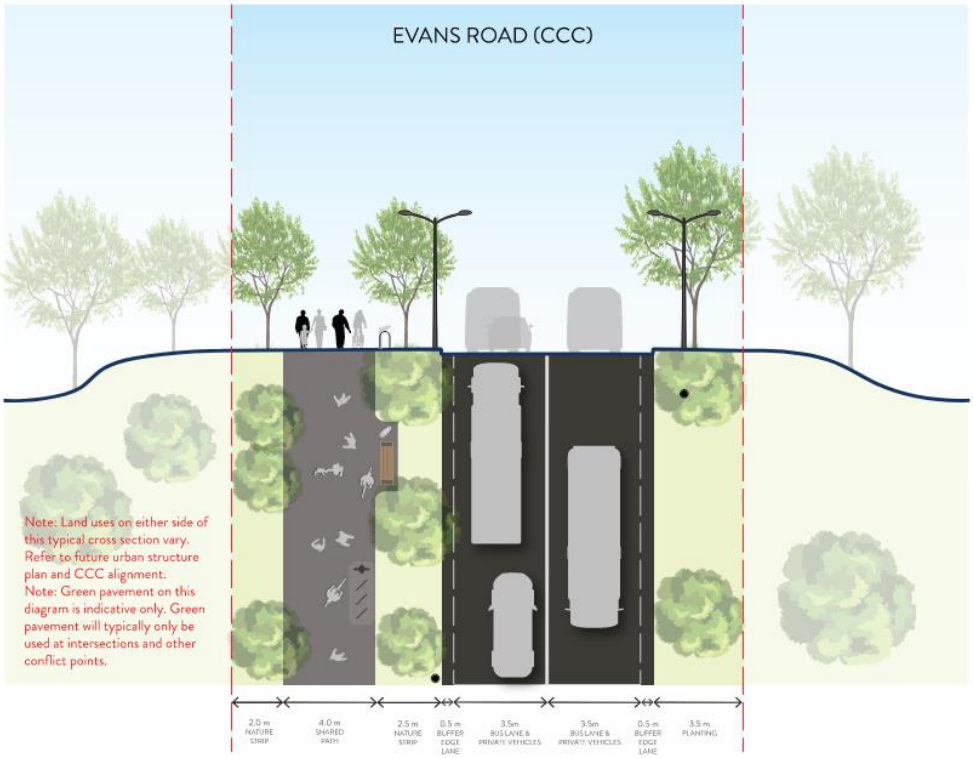


5.2.5 Evans Road

The cross section for Evans Road has been provided by the City for incorporation into the concept designs and is shown below in Figure 5.8.

The 20 m cross section features an 8 m wide two lane, two way main carriageway with 0.5m wide shoulders on each side along with a 4 m wide dedicated shared user path on the left hand side separated by verge space for planting.

Figure 5.8: Evans Road Cross Section (image sourced from *2022.01.30 - Cross-Sections V10 (2).pdf*)



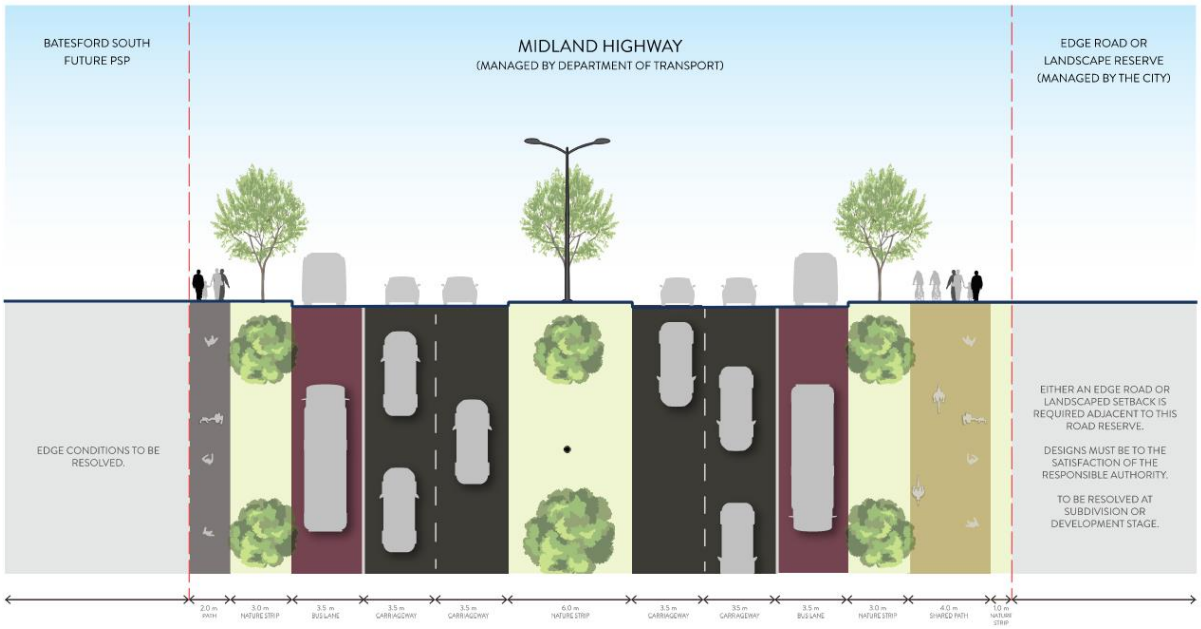
It is noted that Stantec provided guidance that 2m wide buffer zones between the edge of traffic lane and kerb should be adopted to make allowance for an emergency stopping area for vehicles, however this was reduced to 0.5m as instructed by The City in favour of enhancing active travel outcomes (i.e. increased shared user path width).

5.2.6 Midland Highway

The cross section for Midland Highway has been provided by the City for incorporation into the concept designs and is shown below in Figure 5.9.

The 40 m cross section features two carriageways consisting of two vehicle lanes and dedicated bus lane separated by 6 m central median, with a 4m Shared User Path on one side of the cross section and 2 m pedestrian path on the other.

Figure 5.9: Midland Highway Cross Section (image sourced from *2022.01.30 - Cross-Sections V10 (3).pdf*)



5.2.7 Geelong Ballan Road

The cross section for Midland Highway has been provided by the City for incorporation into the concept designs and is shown below in Figure 5.10.

The 34 m cross section features two carriageways consisting of two vehicle lanes separated by 6 m central median, with 3 m SUP on each side separated by a 4 m nature strip for planting.

Figure 5.10: Geelong Ballan Road Cross Section (image sourced from *2022.01.30 - Cross-Sections V10 (3).pdf*)

5.3 Design References

The IDM and the City's Design Notes have been referenced to inform the development of the concept designs.

Standard drawings referenced from the IDM are as follows:

- SD 100 – Typical Kerb Profiles 'B' Type, 'SM' Type and 'M' Type
- SD 205 – Typical Footpath Detail

In addition to information contained in the IDM and the City's Design Notes, the Victorian Planning Authority (VPA) Benchmark Infrastructure Costings Report has been referenced for the following:

- Table 3-3 – Pavement Makeup

5.4 Horizontal Geometry

Design of road geometry has been conducted in accordance with latest versions of AGRD Part 3 and the Infrastructure Design Manual (IDM).

Operating speeds have been specified and agreed by the City during earlier transport modelling stages (refer Section 4). Design speeds have been developed by adopting the nominated operating speeds plus 10 km/h in accordance with AGRD Part 3.

Horizontal design parameters used in the development of concept road layouts are summarised in the tables below for each distinct section of CCC and Evans Road.

It is noted that throughout this Report and on the Final Concept Design drawings, standard road design abbreviations are used including CH (Chainage), TC (Tangent to Circle i.e. Start of Curve), CT (Circle to Tangent i.e. End of Curve), L (Length) and R (Radius).

Table 5.1: Horizontal Design Criteria – RD 01 (CCC – Activity Centre)

Description	Value	Reference
Design Speed Operating Speed	50 km/h 40 km/h	As provided by the City based on PMP Urbanists' Technical Transport Access Report
Min. Horizontal Curve Length	70 m	AGRD03-16 Table 7.7
Min. Horizontal Curve Radius	76 m	AGRD03-16 Equation 5 – Based on e_{max} = 5% with Desirable Minimum f_{max} of 0.21 for Urban Roads
Friction Factor	0.30 (Cars) 0.21 (Trucks)	AGRD03-16 Table 7.5 – Desirable Maximum
Min. Radii with adverse crossfall	120 m	AGRD03-16 Table 7.12 – Based on Minimum radii for 3% adverse crossfall for New Roads
Min. Length between Reverse Curves	35 m	AGRD03-16 Section 7.5.3 – Based on Desirable Minimum length of 0.7(V) where V = Design Speed
Min. Length between Broken Back Curves	50 m	AGRD03-16 Section 7.5.3 – Based on Desirable Minimum length of V where V = Design Speed

Table 5.2: Horizontal Design Criteria – RD 01 (CC 07 to CH 945 and CC 09 to CH 1840) (CCC – Variation), RD 01 (IN 06 to CC 07, and CH 1840 to IN 01) and RD 02 to ER 14 (CCC - Standard)

Description	Value	Reference
Design Speed Operating Speed	70 km/h 60 km/h	As per Strategic Modelling Outcomes. Operating Speed of 60 km/h has been adopted in this instance for proposed Bus Speeds, however general traffic Operating Speeds will be 40 km/h.
Min. Horizontal Curve Length	140 m	AGRD03-16 Table 7.7
Min. Horizontal Curve Radius	203 m	AGRD03-16 Equation 5 – Based on e_{max} = 5% with Desirable Minimum f_{max} of 0.14 for Urban Roads
Friction Factor	0.19 (Cars) 0.14 (Trucks)	AGRD03-16 Table 7.5 – Desirable Maximum
Min. Radii with adverse crossfall	400 m	AGRD03-16 Table 7.12 – Based on Minimum radii for 3% adverse crossfall for New Roads

Min. Length between Reverse Curves	49 m	AGRD03-16 Section 7.5.3 – Based on Desirable Minimum length of 0.7(V) where V = Design Speed
Min. Length between Broken Back Curves	70 m	AGRD03-16 Section 7.5.3 – Based on Desirable Minimum length of V where V = Design Speed

Table 5.3: Horizontal Design Criteria – RD 02 (Evans Road north of ER 14)

Description	Value	Reference
Design Speed Operating Speed	90 km/h 80 km/h	As per Strategic Modelling Outcomes
Min. Horizontal Curve Length	230 m	AGRD03-16 Table 7.7
Min. Horizontal Curve Radius	375 m	AGRD03-16 Equation 5 – Based on e_{max} = 5% with Desirable Maximum f_{max} of 0.12 for Urban Roads for Trucks
Friction Factor	0.13 (Cars) 0.12 (Trucks)	AGRD03-16 Table 7.5 – Desirable Maximum
Min. Radii with adverse crossfall	1150 m	AGRD03-16 Table 7.12 – Based on Minimum radii for 3% adverse crossfall for New Roads
Min. Length between Reverse Curves	63 m	AGRD03-16 Section 7.5.3 – Based on Desirable Minimum length of 0.7(V) where V = Design Speed
Min. Length between Broken Back Curves	90 m	AGRD03-16 Section 7.5.3 – Based on Desirable Minimum length of V where V = Design Speed

5.5 Vertical Geometry

Vertical design parameters used in the development of concept road layouts are specified in the tables below.

A maximum vertical grade of 6% has been adopted for the road design in accordance with the requirement of the Austroads Guide to Road Design. The proposed maximum grade of 6% is consistent with the "limit of acceptable grade" for roads carrying buses identified in DTP's *Guidelines for Land Use Development*. Whilst not adopted in this instance, it is noted that this document does identify a "maximum grade (in limited circumstances where acceptable alternatives are not possible)" of 9% for roads carrying buses."

Table 5.4: Vertical Design Criteria – RD 01 (CCC – Activity Centre)

Description	Value	Reference
Max. Grade	6 %	AGRD03-16 Table 8.3 – Based on Operating Speed of 60 km/h for Flat Terrain
Min. Grade	0.5 %	AGRD03-16 Table 8.5 – Based on Minimum for Roads with Kerb and Channel
Min. Length of Vertical Curves for New Construction	30 m	AGRD03-16 Table 8.10 – Based on Single Carriageway Roads
Min. Length between Broken Back Curves	20 m	AGRD03-16 Section 8.6.6 – Based on 0.4(V) where V = Operating Speed
Min. Grade change without Vertical Curve	0.8 %	AGRD03-16 Table 8.12
Min. Sag K Value	3.9	AGRD03-16 Equation 20
Min. Crest K Value	6.8	AGRD03-16 Table 8.7 – Based on d = 0.36 and R_T = 2.0 for Desirable Minimum for most Urban and Rural Roads
Driver Reaction time (R_T)	2.0 s	AGRD03-16 Table 5.2 – For high speed roads in urban areas comprising numerous intersections
Coefficient of Deceleration (d)	0.36 (Car) 0.29 (Truck)	AGRD03-16 Table 5.3
Stopping Sight Distance (SSD)	55 m (Car)	AGRD03-16 Table 5.5 – Based on d = 0.36 and R_T = 2.0 s
Safe Intersection Sight Distance (SISD)	97 m	AGRD04A-17 Equation 2 – Based on R_T = 2.0

*Note – the values in Table 5.4 above are calculated based on a design speed of 50 km/h as specified in Table 5.1.

Table 5.5: Vertical Design Criteria – RD 01 (CC 07 to CH 945 and CC 09 to CH 1840) (CCC – Variation), RD 01 (IN 06 to CC 07, and CH 1840 to IN 01) and RD 02 to ER 14 (CCC - Standard)

Description	Value	Reference
Max. Grade	6 %	AGRD03-16 Table 8.3 – Based on Operating Speed of 60 km/h for Flat Terrain
Min. Grade	0.5 %	AGRD03-16 Table 8.5 – Based on Minimum for Roads with Kerb and Channel
Min. Length of Vertical Curves for New Construction	50 m	AGRD03-16 Table 8.10 – Based on Single Carriageway Roads
Min. Length between Broken Back Curves	28 m	AGRD03-16 Section 8.6.6 – Based on 0.4(V) where V = Operating Speed
Min. Grade change without Vertical Curve	0.7 %	AGRD03-16 Table 8.12
Min. Sag K Value	7.7	AGRD03-16 Equation 20
Min. Crest K Value	19.1	AGRD03-16 Table 8.7 – Based on d = 0.36 and R_T = 2.0 for Desirable Minimum for most Urban and Rural Roads
Driver Reaction time (R_T)	2.0 s	AGRD03-16 Table 5.2 – For high speed roads in urban areas comprising numerous intersections
Coefficient of Deceleration (d)	0.19 (Car) 0.14 (Truck)	AGRD03-16 Table 5.3
Stopping Sight Distance (SSD)	92 m (Car)	AGRD03-16 Table 5.5 – Based on d = 0.36 and R_T = 2.0 s
Safe Intersection Sight Distance (SISD)	151 m	AGRD04A-17 Equation 2 – Based on R_T = 2.0

*Note – the values in Table 5.5 above are calculated based on a design speed of 70 km/h as specified in Table 5.2

Table 5.6: Vertical Design Criteria – RD 02 (Evans Road north of ER 14)

Description	Value	Reference
Max. Grade	6 %	AGRD03-16 Table 8.3 – Based on Operating Speed of 80 km/h for Flat Terrain
Min. Grade	0.5 %	AGRD03-16 Table 8.5 – Based on Minimum for Roads with Kerb and Channel
Min. Vertical Curve Length	90 m	AGRD03-16 Table 8.10 – Based on Dual Carriageway Roads
Min. Length between Broken Back Curves	36 m	AGRD03-16 Section 8.6.6 – Based on 0.4(V) where V = Operating Speed
Min. Grade change without Vertical Curve	0.5 %	AGRD03-16 Table 8.12
Min. Sag K Value	12.7	AGRD03-16 Equation 20
Min. Crest K Value	42.9	AGRD03-16 Table 8.7 – Based on d = 0.36 and R_T = 2.0 for Desirable Minimum for most Urban and Rural Roads
Driver Reaction time (R_T)	2.0	AGRD03-16 Table 5.2 – For high speed roads in urban areas comprising numerous intersections
Coefficient of Deceleration (d)	0.36 (Car) 0.29 (Truck)	AGRD03-16 Table 5.3
Stopping Sight Distance (SSD)	139 m (Car)	AGRD03-16 Table 5.5 – Based on d = 0.36 and R_T = 2.0 s
Safe Intersection Sight Distance (SISD)	214 m	AGRD04A-17 Equation 2 – Based on R_T = 2.0

*Note – the values in Table 5.6 above are calculated based on a design speed of 90 km/h as specified in Table 5.3.

5.6 Earthworks

Slopes for cut and fill batters have been designed as 6H:1V in accordance with the IDM guidelines and consistent with DTP requirements. Final batter slopes used will be subject to confirmation following geotechnical investigation and assessment of site conditions.

The extent of earthworks was considered as the area between road batters (including the road reserve but minus the pavement boxing) for the length of road between intersection extents.

5.7 Road Project Extents

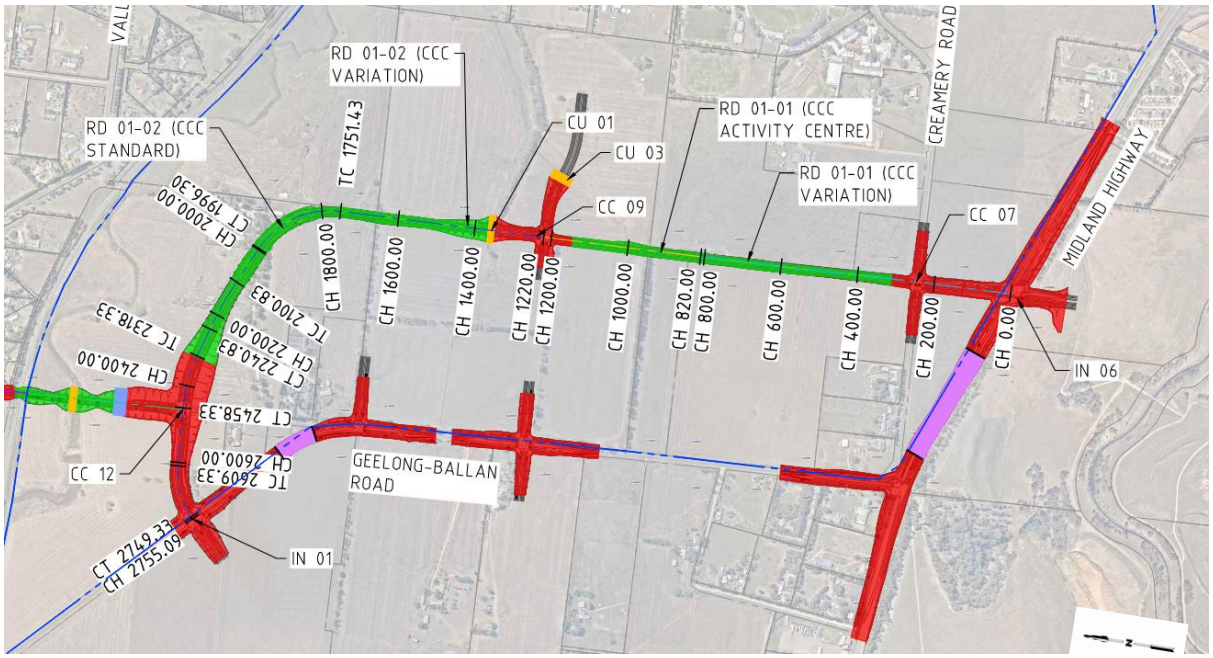
Individual segments of road were calculated between the extent of each intersection and culvert project. The calculation of intersection and culvert project extents is discussed in Section 6.4 and 7.3 respectively.

5.8 RD 01

Road RD 01 is the Clever and Creative Corridor running in a generally north-south alignment from the Midland Highway with a westward deviation to connect with Geelong-Ballan Road in the north-western corner of the PSP site. It is noted that RD 01 will not function as a Secondary Arterial Road but is nominated as such for assumptions made on pavement depth and makeup.

The road has a total control line length of 2,755 m consisting of two sections of 34 m wide road corridor (CCC Standard), two sections of 21.6 m wide road corridor (CCC Variation) and one section of 20 m wide road corridor (CCC Activity Centre).

Figure 5.11: RD 01 alignment (image sourced from Final Concept Design Submission dated 16 February 2024 and modified by Stantec)



There are five (5) intersections located along the length of RD 01 including IN 01, IN 06, CC 07, CC 09 and CC 12, as well as one (1) culvert CU 01. Individual lengths of road projects along RD 01 between intersections were as follows:

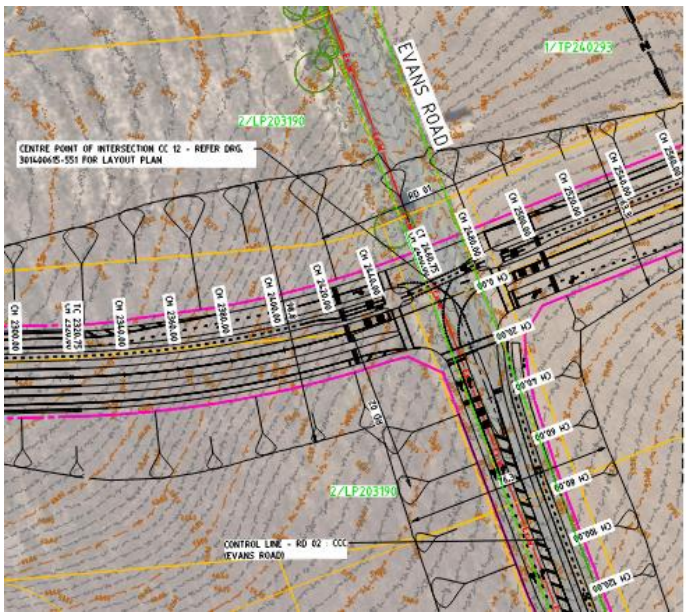
- RD 01-01 (between CC 07 and CC 09) = 839 m

- RD 01-02 (between CC 09 and CC 12) = 963 m

RD 01 follows a generally flat terrain from its southern connection point at the Midland Highway (IN 06) through to the intersection CC 07. North of intersection CC 07, RD 01 slopes gently downhill through the proposed Activity Centre and CC 09 to the culvert crossing CU 01 before rising uphill to CH 2120. Beyond CH 2120, RD 01 dips noticeably to CC 12 then rises through to its connection with Geelong-Ballan Road at intersection IN 01.

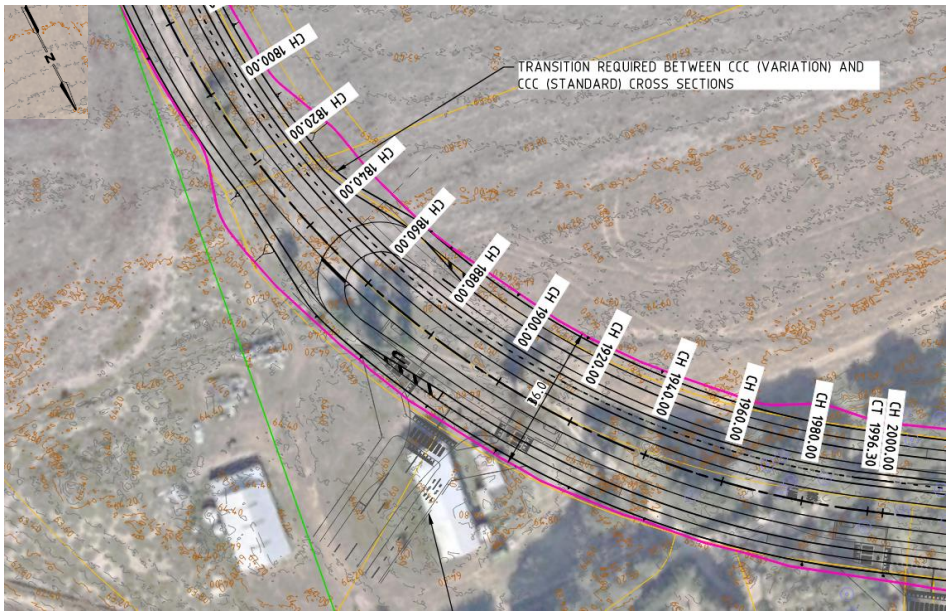
Extensive earthworks (i.e. cut) will be required from CH 2,180 to CH 2,680 to facilitate the construction of the intersection CC 12. This is due to several factors such as achieving compliant sight distances for the specified design speed and grades on approach to and departure from intersection CC 12, maintaining compliant vertical geometry without exceeding maximum gradients, as well as the influence of the vertical geometry required for RD 02, the locations of the culvert crossing CU 02, pedestrian operated signals (POS 01) and existing railway crossing. Further discussion on the earthworks and constraints that influence RD 01 and intersection CC 12 is made in Section 5.9, 6.12 and 6.20.

Figure 5.12: Approx. Earthworks at Intersection CC 12 (image sourced from Stantec's Final Concept Design Submission dated 16 February 2024)



A U-turn facility is located at approx. CH 1850, shown below in Figure 5-11, to enable vehicles travelling south on the side service lanes to turn northbound due to the termination of service lanes past this point.

Figure 5.13- U-Turn Facility (image sourced from Stantec's Final Concept Design Submission dated 16 February 2024)



A short section of fill batters will be required from CH 1300 to CH 1500 as RD 01 passes over CU 01 on the northern side of CC 09. This is required to provide adequate clearance over the culvert and maintain proposed drainage paths.

Indicative access points in the form of left in left out arrangements have been shown on the plans at CH 1900 and CH 2020. The costs for these arrangements have not been included in the OPC estimates as they will be delivered as part of the subdivision works.

Refer to DRG. 301400615-201 to 252 included in Appendix B for further details of RD 01.

5.9 RD 02

Road RD 02 is a Secondary Arterial Road running in a north-south alignment along the existing Evans Road from intersection CC 12 through to a connection point at a future intersection with Anakie Road.

The road has a total control line length of 3,404 m consisting of two sections of 20 m wide road corridors (CCC Evans Road and Evans Road).

Figure 5.14: RD 02 alignment (image sourced from Final Concept Design Submission dated 16 February 2024 and modified by Stantec)

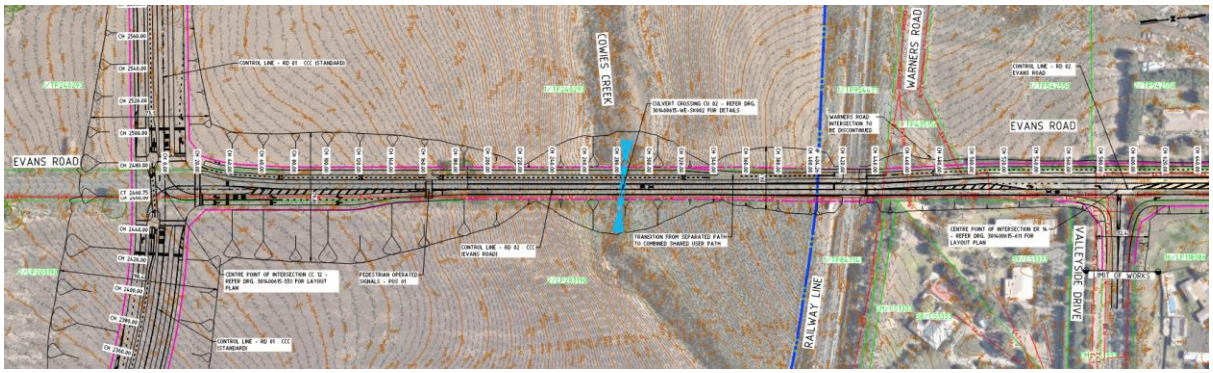
There are four (4) intersections located along the length of RD 02 including ER 14, ER 15, ER 16 and ER 17, as well as a pedestrian operated signal POS 01 and an at-grade level crossing over an existing railway line. Individual lengths of road projects along RD 02 were as follows:

- RD 02-01 (between CC 12 and CU 02) = 123 m
- RD 02-02 (between CU 02 and ER 14) = 154 m
- RD 02-03 (between ER 16 and ER 17) = 730 m
- RD 02-04 (between ER 17 and connection to future Anakie Road intersection) = 651 m

RD 02 commences at the intersection CC 12 with a downward gradient through POS 01 and over culvert crossing CU 02 before rising upward to match the existing railway corridor at the PSP site boundary. Beyond the PSP site boundary, the RD 02 alignment largely consists of minimum vertical grades with a gentle upward rise between intersection ER 16 at Lovely Banks Road and ER 17 at Edgerton Road.

As previously discussed in Section5.8, significant earthworks will be required for the construction of CC 12 in its proposed location. The level of RD 02 at CC 12 is constrained by multiple factors including the requirement to match existing levels at the railway crossing, compliant vertical geometry at the culvert crossing CU 02 and maximum allowable grades on approach to CC 12. The location of POS 01 also dictates the longitudinal grading between CC 12 and the pedestrian crossing point, designed to not exceed 2.5 % (max.), to meet future DDA requirements.

Figure 5.15: RD 02 from CC 12 to PSP Site Boundary (image sourced from Stantec's Final Concept Design Drawings dated 16 February 2024)

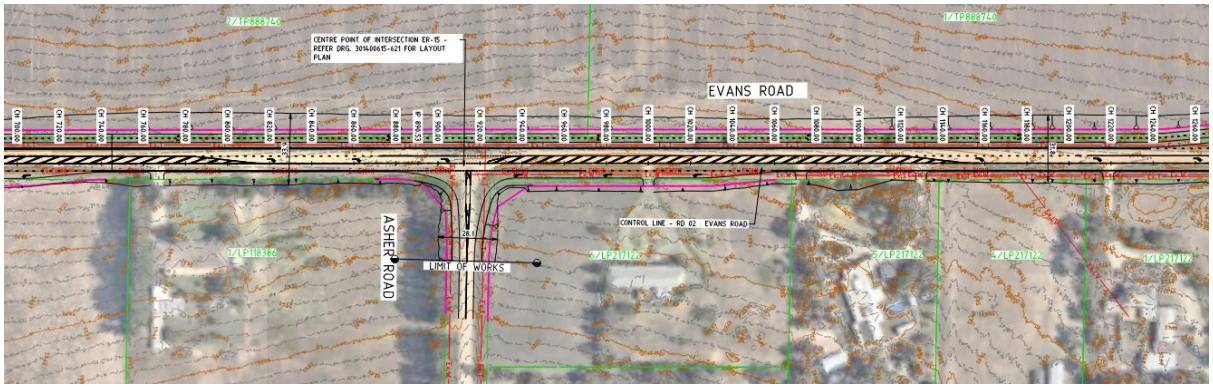


A section for transitioning between the CCC Evans Road and Evans Road proposed 20 m cross sections will be required on approach to the PSP site boundary. This will be required for merging of the separated shared user and pedestrian footpaths within the PSP site to a combined shared path, and a 1.6 m increase in carriageway width.

It is noted that a section of cut will be required on the southern approach to intersection ER 14 to achieve compliant sight distances. The cut batters will extend into adjacent properties on both the eastern and western sides of the road reserve.

Given the existing Evans Road alignment is very flat (grade < 0.5%) with minimal road cross fall, fill batters up to a height of 0.8 m and length of approx. 5 m will be required on the western side of the carriageway from intersection ER 14 to the northern side of ER 16 in order to achieve compliant minimum longitudinal grades along the road.

Figure 5.16: Earthworks batters on western side of RD 02 (image sourced from Stantec's Final Concept Design Drawings dated 16 February 2024)



Refer to DRG. 301400615-301 to 352 included in Appendix B for further details of RD 02.

6 Intersection Projects

6.1 Design Criteria

The Concept Designs for all intersection projects have been developed on the basis of layouts completed by PMP Urbanists (provided to Stantec by the City) and outcomes of transport analysis and modelling (refer Section 4) agreed with the City.

6.2 Design Parameters

The parameters used in the development of the intersection designs are specified in the following tables:

Table 6.1: Design Parameters – IN 01

Description	Value	Reference
Intersecting Roads	Geelong-Ballan Road RD 01	
Design Speed	Geelong-Ballan Road – 70km/h RD 01 – 40km/h	Geelong-Ballan Road – Declared main road speed plus 10 km/h RD 01 – As per transport modelling outcomes and as agreed with the City
Design Vehicle	12.5m Truck	Based on AGRD04-17 Table 5.1
Storage Length	Geelong-Ballan Road North (right turn lane) – 61 m Geelong-Ballan Road South (right turn lane) – 175 m RD 01 East (right turn lane) – 60 m RD 01 West (right turn lane) – 63 m	Based on AGRD04A-17 Section 5.2
Taper Length	Geelong-Ballan Road North (right turn lane) – 23 m Geelong-Ballan Road South (right turn lane) – 25 m RD 01 East (right turn lane) – 40 m RD 01 West (right turn lane) – 35 m	Based on AGRD04A-17 Table 5.1

Table 6.2: Design Parameters – IN 02

Description	Value	Reference
Intersecting Roads	Geelong-Ballan Road Proposed Connector Road	
Design Speed	Geelong-Ballan Road – 70km/h Proposed Connector Road – 50km/h	Geelong-Ballan Road – Declared main road speed plus 10 km/h Proposed Connector Road – As per transport modelling outcomes and as agreed with the City
Design Vehicle	12.5m Truck	Based on AGRD04-17 Table 5.1
Storage Length	Geelong-Ballan Road North (U-turn lane) – 52m Geelong-Ballan Road South (right turn lane) – 90m Proposed Connector Road (right turn lane) – 60m	Based on AGRD04A-17 Section 5.2
Taper Length	Geelong-Ballan Road North (U- turn lane) –23m Geelong-Ballan Road South (right turn lane) – 23m Proposed Connector Road (right turn lane) – 50m	Based on AGRD04A-17 Table 5.1

Table 6.3: Design Parameters – IN 03

Description	Value	Reference
Intersecting Roads	Geelong-Ballan Road Proposed Connector Road	
Design Speed	Geelong-Ballan Road – 70km/h Proposed Connector Road – 50km/h	Geelong-Ballan Road – Declared main road speed plus 10 km/h Proposed Connector Road – As per transport modelling outcomes and as agreed with the City
Design Vehicle	12.5m Truck	Based on AGRD04-17 Table 5.1
Storage Length	Geelong-Ballan Road North (right turn lane) – 69m Geelong-Ballan Road South (right turn lane) – 87m Proposed Connector Road East (right turn lane) – 60m Proposed Connector Road West (right turn lane) – 60m	Based on AGRD04A-17 Section 5.2
Taper Length	Geelong-Ballan Road North (right turn lane) – 23m Geelong-Ballan Road South (right turn lane) – 23m Proposed Connector Road East (right turn lane) – 50m Proposed Connector Road West (right turn lane) – 50m	Based on AGRD04A-17 Table 5.1

Table 6.4: Design Parameters – IN 05

Description	Value	Reference
Intersecting Roads	Midland Highway Geelong-Ballan Road	
Design Speed	Midland Highway – 90km/h Geelong-Ballan Road – 70km/h	Midland Highway – Declared main road speed plus 10 km/h Geelong-Ballan Road – Declared main road speed plus 10 km/h
Design Vehicle	19m Semi	Based on AGRD04-17 Table 5.1
Storage Length	Midland Highway East (right turn lane) – 190m Midland Highway West (U-turn lane) – 95m Geelong-Ballan Road North (right turn lane) –153m	Based on AGRD04A-17 Section 5.2
Taper Length	Midland Highway East (right turn lane) – 50m Midland Highway West (U-turn lane) – 30m Geelong-Ballan Road North (right turn lane) – 67m	Based on AGRD04A-17 Table 5.1

Table 6.5: Design Parameters – IN 06

Description	Value	Reference
Intersecting Roads	Midland Highway RD 01	
Design Speed	Midland Highway – 90km/h RD 01 – 40km/h	Midland Highway – Declared main road speed plus 10 km/h RD 01 – As per transport modelling outcomes and as agreed with the City
Design Vehicle	19m Semi	Based on AGRD04-17 Table 5.1
Storage Length	Midland Highway East (right turn lane) – 195m Midland Highway West (right turn lane) – 170m RD 01 North (right turn lanes) – 90m RD 01 South (right turn lane) – 60m	Based on AGRD04A-17 Section 5.2
Taper Length	Midland Highway East (right turn lane) – 30m Midland Highway West (right turn lane) – 30m RD 01 North (right turn lanes) – 40m RD 01 South (right turn lane) – 40m	Based on AGRD04A-17 Table 5.1

Table 6.6: Design Parameters – CC 07

Description	Value	Reference
Intersecting Roads	RD 01 Creamery Road	
Design Speed	RD 01 – 40km/h Creamery Road – 50km/h	RD 01 – As per transport modelling outcomes and as agreed with the City Creamery Road – As per transport modelling outcomes and as agreed with the City
Design Vehicle	12.5m Truck	Based on AGRD04-17 Table 5.1
Storage Length	RD 01 South (right turn lane) – 80m Creamery Road West (right turn lane) – 60m	Based on AGRD04A-17 Section 5.2
Taper Length	RD 01 South (right turn lane) – 30m Creamery Road West (right turn lane) – 50m	Based on AGRD04A-17 Table 5.1

Table 6.7: Design Parameters – CC 09

Description	Value	Reference
Intersecting Roads	RD 01 Proposed Connector Road	
Design Speed	RD 01 – 40km/h Proposed Connector Road - 50km/h	RD 01 – As per transport modelling outcomes and as agreed with the City. Proposed Connector Roads – As per transport modelling outcomes and as agreed with the City.
Design Vehicle	12.5m Truck	Based on AGRD04-17 Table 5.1
Storage Length	RD 01 North from Local Access Road (right turn lane) – 25m Proposed Connector Road East (right turn lane) – 60m	Based on AGRD04A-17 Section 5.2
Taper Length	RD 01 North from Local Access (right turn lane) – 15m Proposed Connector Road East (right turn lane) – 50m	Based on AGRD04A-17 Table 5.1

Table 6.8: Design Parameters - CC 12

Description	Value	Reference
Intersecting Roads	RD 01 RD 02	
Design Speed	RD 01 – 40km/h RD 02 – 70km/h	RD 01 – As per transport modelling outcomes and as agreed with the City RD-02 – As per transport modelling outcomes and as agreed with the City
Design Vehicle	12.5m Truck	Based on AGRD04-17 Table 5.1
Storage Length	RD 01 East (right turn lane) - 60m RD 02 (combined turn lane) – 95m	Based on AGRD04A-17 Section 5.2
Taper Length	RD 01 East (right turn lane) – 40m RD 02 (combined turn lane) – 23m	Based on AGRD04A-17 Table 5.1

Table 6.9: Design Parameters – ER 14

Description	Value	Reference
Intersecting Roads	Evans Road (RD 02) Valleyside Drive	
Design Speed	Evans Road (RD 02) North – 90 km/h Evans Road (RD 02) South – 70 km/h Valleyside Drive - 60km/h	Evans Road (RD-02)– As per transport modelling outcomes and as agreed with the City Valleyside Drive – As per the existing conditions
Design Vehicle	12.5m Truck	Based on AGRD04-17 Table 5.1
Storage Length	Evans Road (RD 02) South (right turn lane) - 52m	Based on AGRD04A-17 Section 5.2
Taper Length	Evans Road (RD 02) South (right turn lane) - 23m	Based on AGRD04A-17 Table 5.1

Table 6.10: Design Parameters – ER 15

Description	Value	Reference
Intersecting Roads	Evans Road (RD 02) Asher Road	
Design Speed	Evans Road (RD 02) – 90 km/h Asher Road – 60 km/h	Evans Road (RD 02) – As per transport modelling outcomes and as agreed with the City Asher Road – As per the existing conditions (assumed speed)
Design Vehicle	12.5m Truck	Based on AGRD04-17 Table 5.1
Storage Length	Evans Road (RD 02) South - 95m	Based on AGRD04A-17 Section 5.2
Taper Length	Evans Road (RD 02) South - 30m	Based on AGRD04A-17 Table 5.1

Table 6.11: Design Parameters – ER 16

Description	Value	Reference
Intersecting Roads	Evans Road (RD 02) Lovely Banks Road	
Design Speed	Evans Road (RD 02) – 90km/h Lovely Banks Road – 90km/h	Evans Road (RD 02) – As per transport modelling outcomes and as agreed with the City Lovely Banks Road – As per transport modelling outcomes and as agreed with the City
Design Vehicle	19m Semi	Based on AGRD04-17 Table 5.1
Storage Length	Evans Road (RD 02) North (right turn lane) – 143m Evans Road (RD 02) South (right turn lane) – 217m Lovely Banks Road East and West – 95m	Based on AGRD04A-17 Section 5.2
Taper Length	Evans Road (RD 02) North (right turn lane) – 90m Evans Road (RD 02) South (right turn lane) – 30m Lovely Banks Road East and West – 90m	Based on AGRD04A-17 Table 5.1

Table 6.12: Design Parameters – ER 17

Description	Value	Reference
Intersecting Roads	Evans Road (RD 02) Edgerton Road	
Design Speed	Evans Road (RD 02) – 90km/h Edgerton Road – 60 km/h	Evans Road (RD 02) – As per transport modelling outcomes and as agreed with the City Edgerton Road – As per the existing conditions (assumed speed)
Design Vehicle	12.5m Truck	Based on AGRD04-17 Table 5.1
Storage Length	Evans Road (RD 02) South – 95 m	Based on AGRD04A-17 Section 5.2
Taper Length	Evans Road (RD 02) South – 30 m	Based on AGRD04A-17 Table 5.1

6.3 Earthworks

Slopes for cut and fill batters have been designed as 6H:1V in accordance with the IDM guidelines and consistent with DTP requirements. Final batter slopes used will be subject to confirmation following geotechnical investigation and assessment of site conditions.

The extent of earthworks was considered as the area between earthworks batters (including the road reserve but minus the pavement boxing) for the entirety of the intersection project extents.

6.4 Intersection Project Extents

The extent of each intersection project was determined as either:

- Between the furthest carriageway taper on each approach or,
- Where in close proximity to (or overlapping with) tapers on an adjacent intersection project, the midpoint between hold lines on intersection approach legs.

6.5 IN 01

IN 01 is a four-leg signalised intersection located at the proposed intersection of Geelong-Ballan Road, the CCC (RD 01) into the Creamery Road PSP area, and the CCC into the Batesford North PSP area.

Noteworthy items identified during the concept design development were as follows:

- The alignment of IN 01 has been centrally located on the existing Geelong-Ballan Road carriageway with the aim of apportioning the road cross section equally between the Creamery Road PSP and neighbouring PSP sites.
- Existing property located on south-eastern corner adjacent to intersection. Existing access for this property currently interfaces directly at the intersection proper and will need to be relocated in the future to an alternative location which achieves compliant sight lines and provides adequate road safety considerations.
- Topography slopes from west to east, hence the CCC into the Batesford North PSP will need a sag point introduced to maintain and prioritize cross fall along Geelong-Ballan Road. This is evident by cut batters.
- The CCC (RD 01) requires flattening of approach leg to the intersection to achieve compliant cross falls on south-eastern lane and verge connecting with Geelong-Ballan Road.
- A number of existing trees within the eastern verge on Geelong-Ballan Road will require removal. Based on the GIS data provided to Stantec by the City, the trees were not identified as being of High or Critical retention value.
- IN 01 will be located on an uphill slope on Geelong-Ballan Road. The crest on the southern approach will need to be extended further south to provide for compliant sight distances to IN 01.
- Nominal 2% verge grade (incl. SUP/footpath) toward carriageway was applied with 1V:6H batter slopes.
- The concept design of IN 01 will require removal of majority of the existing Geelong-Ballan Road carriageway within the intersection extents under the interim scenario. This is due to the existing carriageway being located centrally beneath the proposed central median and would therefore need to be removed to make way for the median's construction.

Confirmation of this will be subject to further pavement investigation and detailed design in future project stages.

- Refer DRG. 301400615-401 in Appendix B for Intersection IN 01 Layout Plan.

6.6 IN 02

IN 02 is a three-leg signalised intersection located at the proposed intersection of Geelong-Ballan Road and a proposed Connector Road into the Creamery Road PSP.

Noteworthy items identified during the concept design development were as follows:

- The alignment of IN 02 has been centrally located on the existing Geelong-Ballan Road carriageway with the aim of apportioning the road cross section equally between the Creamery Road PSP and neighbouring PSP sites.
- Fill batters on the outside of the horizontal curve on the Geelong-Ballan Road northern approach are required to achieve superelevation compliant with Austroads Guidelines.
- Due to existing flat topography within property 109/PP3179, the eastern Connector Road will need to be lifted to achieve minimum longitudinal grades. Consideration will need to be made in future design stages for Connector Road levels on approach to the intersection given the close proximity of the Geelong-Ballan Road horizontal curve and superelevation requirements.
- A number of existing trees will require removal on both sides of Geelong-Ballan Road and within eastern and western properties impacted by the proposed intersection arrangement. Based on the GIS data provided to Stantec by the City, the trees requiring removal located at the north-eastern quadrant of the intersection in close proximity to the eastern Connector Road are of High and Critical retention value.
- Nominal 2% verge grade (incl. SUP/footpath) toward carriageway was applied with 1V:6H batter slopes.
- The concept design of IN 02 will require removal of majority of the existing Geelong-Ballan Road carriageway within the intersection extents under the interim scenario. This is due to the existing carriageway being located centrally beneath the proposed central median and would therefore need to be removed to make way for the median's construction. Confirmation of this will be subject to further pavement investigation and detailed design in future project stages.
- Refer DRG. 301400615-411 in Appendix B for Intersection IN 02 Layout Plan.

6.7 IN 03

IN 03 is a four-leg signalised intersection located at the proposed intersection of Geelong-Ballan Road, an eastern Connector Road into the Creamery Road PSP, and a western Connector Road into the Batesford North PSP.

Noteworthy items identified during the concept design development were as follows:

- The alignment of IN 03 has been centrally located on the existing Geelong-Ballan Road carriageway with the aim of apportioning the road cross section equally between the Creamery Road PSP and neighbouring PSP sites.
- IN 03 has been located such that the existing building on property 2/PS339867 is not impacted by the proposed intersection arrangement or batters.

- Topography slopes from west to east, hence the western Connector Road will need a sag point introduced to maintain and prioritize cross fall along Geelong-Ballan Road. This is evident by cut batters.
- Due to existing flat topography within property 109/PP3179, proposed eastern Connector Road will need to be lifted to achieve minimum longitudinal grades.
- An existing driveway access is located on the northern intersection leg on the western side of Geelong-Ballan Road to access the property 1/TP968649. This required integration into the northern departure lane on Geelong-Ballan Road.
- A number of existing trees will require removal on both sides of Geelong-Ballan Road. Based on the GIS data provided to Stantec by the City, trees of Moderate and High retention value were identified on the eastern side of Geelong-Ballan Road on both northern and southern approaches to the intersection.
- Nominal 2% verge grade (incl. SUP/footpath) toward carriageway was applied with 1V:6H batter slopes.
- The concept design of IN 03 will require removal of majority of the existing Geelong-Ballan Road carriageway within the intersection extents under the interim scenario. This is due to the existing carriageway being located centrally beneath the proposed central median and would therefore need to be removed to make way for the median's construction. Confirmation of this will be subject to further pavement investigation and detailed design in future project stages.
- Refer DRG. 301400615-421 in Appendix B for Intersection IN 03 Layout Plan.

6.8 IN 05

IN 05 is a three-leg signalised intersection located at the proposed intersection of Geelong-Ballan Road and the Midland Highway.

Noteworthy items identified during the concept design development were as follows:

- The alignment of IN 05 has been centrally located on the existing Geelong-Ballan Road and Midland Highway carriageways with the aim of apportioning the road cross section equally between the Creamery Road PSP and neighbouring PSP sites.
- On all approaches to IN 05, existing Geelong-Ballan Road and Midland Highway are noticeably flat (grade > 0.5%) and will require introduction of various sag and crest curves to achieve longitudinal grading while minimising earthworks and impact to adjacent properties.
- Multiple existing trees will require removal on the northern verge of Midland Highway and adjacent to the boundary within property 1/TP749472. Based on the GIS data provided to Stantec by the City, trees of High retention value were identified on the eastern side of Geelong-Ballan Road on the northern approach to the intersection, and Moderate on the Midland Highway eastern approach.
- Due to the proposed location of IN 05 on the curve of Midland Highway, superelevation will need to be applied to the outside carriageway and hence fill batters required on northern sides of the intersections to maintain the proposed cross fall on Midland Highway.
- Nominal 2% verge grade (incl. SUP/footpath) toward carriageway was applied with 1V:6H batter slopes.
- The concept design of IN 05 will require removal of majority of the existing Geelong-Ballan Road and Midland Highway carriageway within the intersection extents under the interim

scenario. This is largely due to the location of proposed central medians whereby their construction will require removal of the existing road pavement. Confirmation of this will be subject to further pavement investigation and detailed design in future project stages.

- Refer DRG. 301400615-441 in Appendix B for Intersection IN 05 Layout Plan.

6.9 IN 06

IN 06 is a four-leg signalised intersection located at the proposed intersection of the Midland Highway, the CCC (RD 01) into Creamery Road PSP area, and the CCC into the Batesford South PSP area.

Noteworthy items identified during the concept design development were as follows:

- The alignment of IN 06 has been centrally located on the existing Midland Highway carriageway with the aim of apportioning the road cross section equally between the Creamery Road PSP and neighbouring PSP sites.
- On eastern and western approaches to IN 06, existing Midland Highway is noticeably flat (grade > 0.5%) and will require introduction of various sag and crest curves to achieve longitudinal grading while minimising earthworks and impact to adjacent properties.
- Existing topography to south within property 6/PS332100 slopes downward significantly beyond 100 m of the southern approach to IN 06. To facilitate a straight alignment as per Draft Concept Design, the southern leg will need to be lifted extensively (> 15 m) to achieve compliant vertical geometry and sight distances. This is evident by the fill batters associated with the southern leg of the intersection. Further detailed investigation will be required to confirm this alignment.
- Existing topography is generally very flat within property 1/TP18622, hence fill batters are required within this property on the northern side of intersection.
- Nominal 2% verge grade (incl. SUP/footpath) toward carriageway was applied with 1V:6H batter slopes.
- A number of existing trees within the northern verge on Midland Highway will require removal. Based on the GIS data provided to Stantec by the City, the trees were identified as Moderate retention value.
- An existing Fibre Optic cable owned by Optus will be impacted by the intersection arrangement on the southern side of Midland Highway. This will likely require relocation outside of the carriageway
- The concept design of IN 06 will require removal of majority of the existing Midland Highway carriageway within the intersection extents under the interim scenario. It is expected that sections of road pavement falling within the central median islands will require removal. Confirmation of this will be subject to further investigation of pavement suitability in future design stages.
- Refer DRG. 301400615-451 in Appendix B for Intersection IN 06 Layout Plan.

6.10 CC 07

CC 07 is a four-leg signalised intersection located at the proposed intersection of the CCC (RD 01) and Creamery Road (proposed to be upgraded to a Connector Road).

Noteworthy items identified during the concept design development were as follows:

- Intersection is in close proximity to IN 06, approximately 250m apart. Therefore, the ultimate cross section profile has been carried through between intersections with no separate road section in between.
- Existing topography generally very flat within property 1/TP18622, hence CC 07 requires lifting to achieve minimum longitudinal grading and compliant sight distances. This similar applies to the Creamery Road connector approach legs.
- Nominal 2% verge grade (incl. SUP/footpath) toward carriageway was applied with 1V:6H batter slopes.
- Refer DRG. 301400615-501 in Appendix B for Intersection CC 07 Layout Plan.

6.11 CC 09

CC 09 is a four-leg signalised intersection located at the proposed intersection of the CCC (RD 01) and a proposed Connector Road.

Noteworthy items identified during the concept design development were as follows:

- A section of a proposed Local Access Street will connect into CC 09 from the north, adjacent to the CCC, based on The City's FUS plan to provide space for a Community Park.
- Existing topography in this part of the site slopes south to north toward an existing drainage path on the northern side of intersection. A sag point has been located on the western Connector Road to maintain and prioritize cross falls on the CCC, resulting in cut batters on either side of road reserve. The batters however avoid impact to the adjacent retarding basin WLRB2.
- Proposed western Connector Road and centre point of intersection has been located such that impacts to WLRB2 are avoided. The design also considers the connection to intersection IN 03 on Geelong-Ballan Road to ensure a straight alignment can be maintained as well as ensuring the intersection of roads is perpendicular.
- Proposed eastern Connector Road alignment has been adjusted from alignment provided to Stantec by the City and designed for compliant geometry for the required design speed.
- Culvert crossing CU 03 is located approx. 165 m east of CC 09. The proposed eastern Connector Road has been lifted at the crossing location to provide for compliant sight distances to CC 09 given the vertical geometry and sag point at the crossing. The lift also provides for minimum fill between the underside of the pavement and top of culvert and meets minimum freeboard requirements to indicative 1% AEP flood levels.
- A number of existing trees within the CCC corridor will require removal. Based on the GIS data provided to Stantec by the City, the trees were not identified as being of High or Critical retention value.
- Nominal 2% verge grade (incl. SUP/footpath) toward carriageway was applied with 1V:6H batter slopes.
- Refer DRG. 301400615-521 in Appendix B for Intersection CC 09 Layout Plan.

6.12 CC 12

CC 12 is a three-leg signalised intersection at the proposed intersection of the two adjoining CCC's (RD 01 and RD 02).

Noteworthy items identified during the concept design development were as follows:

- Extensive earthworks required to facilitate sight distances and considering constraints as mentioned previously in Section 5.85.7 and 5.9. It is noted that batters in excess of 40 m will be required on the eastern approach leg.
- Existing water main will require significant relocation works for new intersection.
- Superelevation required on horizontal curve on eastern approach leg.
- Nominal 2% verge grade (incl. SUP/footpath) toward carriageway was applied with 1V:6H batter slopes.
- Longitudinal grading on the northern approach has considered the introduction of POS 01 and allowable grades to meet DDA requirements at the crossing.
- Consideration will need to be given to sight distance requirements for future LILO intersection arrangements adjacent POS 01 and potential reduction in design speeds. This will be subject to further design development in future design stages.
- The concept design of CC 12 will require removal of majority of the existing Evans Road carriageway within the intersection extents under the interim scenario. Confirmation of this will be subject to further investigation of pavement suitability in future design stages.
- Refer DRG. 301400615-551 in Appendix B for Intersection CC 12 Layout Plan.

6.13 ER 14

Intersection ER 14 is a three leg unsignalized intersection at the proposed intersection of Evans Road (RD 02) and Valleyside Drive.

Noteworthy items identified during the concept design development were as follows:

- Existing Evans Road grading is very flat (grade > 0.5%) with minimal (if any) cross fall. General approach has been to provide for minimum longitudinal grades and nom. 3% cross fall on all intersection legs. As a result, a sag point has been introduced on Valleyside Drive approach that maintains and prioritizes cross fall on Evans Road and hence results in cut batters that extend beyond the property boundary.
- ER 14 is located within close proximity to existing railway crossing. Extension of lower design speed has been made to the northern approach on Evans Road to allow for compliant sight distances and vertical geometry along Evans Road (RD 02).
- Nominal 3.5 m wide verge at 2% toward the carriageway was applied with 1V:6H batter slopes. This is to allow for future underground services and above ground infrastructure and is consistent with Austroads Guidelines.
- The concept design of ER 14 will require removal of majority of the existing Evans Road and Valleyside Drive carriageways within the intersection extents under the interim scenario. Confirmation of this will be subject to further investigation of pavement suitability in future design stages.
- Refer DRG. 301400615-611 in Appendix B for Intersection ER 14 Layout Plan.

6.14 ER 15

Intersection ER 15 is a three leg unsignalized intersection at the proposed intersection of Evans Road (RD 02) and Asher Road.

Noteworthy items identified during the concept design development were as follows:

- Existing Evans Road grading is very flat (grade > 0.5%) with minimal (if any) cross fall. General approach has been to provide for minimum longitudinal gradings and nom. 3% cross fall on all intersection legs. As a result, a sag point has been introduced on Asher Road approach that maintains and prioritizes cross fall on Evans Road and hence results in cut batter. Noted that fill batter also required on western side of the intersection due to widening and providing for min. cross falls on verges.
- Nominal 3.5 m wide verge at 2% toward the carriageway was applied with 1V:6H batter slopes. This is to allow for future underground services and above ground infrastructure and is consistent with Austroads Guidelines.
- The concept design of ER 15 will require removal of majority of the existing Evans Road and Asher Drive carriageways within the intersection extents under the interim scenario. Confirmation of this will be subject to further investigation of pavement suitability in future design stages.
- Refer DRG. 301400615-621 in Appendix B for Intersection ER 15 Layout Plan.

6.15 ER 16

ER 16 is a four-leg signalised intersection at the proposed intersection of Lovely Banks Road and Evans Road.

Noteworthy items identified during the concept design development were as follows:

- Existing Evans Road grading is very flat (grade > 0.5%) with minimal (if any) cross fall. As a result, a sag point has been introduced on the eastern approach (Lovely Banks Road) that maintains and prioritizes cross fall on Evans Road and hence results in cut batter. General approach has been to provide for minimum longitudinal grades and nom. 3% cross fall on all intersection legs. Noted that fill batter also required on the western side of the intersection due to widening and providing for min. cross falls on verges.
- Large existing AusNet transmission lines running south-east to north-west alignment through intersection, but this is not impacted by the design.
- Nominal 2% verge grade (incl. SUP/footpath) toward carriageway was applied with 1V:6H batter slopes.
- The concept design of ER 16 will require removal of majority of the existing Evans Road and Lovely Banks Road carriageways within the intersection extents under the interim scenario. Confirmation of this will be subject to further investigation of pavement suitability in future design stages.
- Refer DRG. 301400615-631 in Appendix B for Intersection ER 16 Layout Plan.

6.16 ER 17

Intersection ER 17 is a three leg unsignalized intersection at the proposed intersection of Evans Road (RD 02) and Edgerton Road.

Noteworthy items identified during the concept design development were as follows:

- Existing Evans Road grading is very flat (grade > 0.5%) with minimal (if any) cross fall. General approach has been to provide for minimum longitudinal grades and nom. 3% cross fall on all intersection legs. As a result, a sag point has been introduced on Edgerton Road approach that maintains and prioritizes cross fall on Evans Road and hence results in cut batter.
- Nominal 3.5 m wide verge at 2% toward the carriageway was applied with 1V:6H batter slopes. This is to allow for future underground services and above ground infrastructure and is consistent with Austroads Guidelines.
- The concept design of ER 17 will require removal of majority of the existing Evans Road and Edgerton Road carriageways within the intersection extents under the interim scenario. Confirmation of this will be subject to further investigation of pavement suitability in future design stages.
- Refer DRG. 301400615-641 in Appendix B for Intersection ER 17 Layout Plan.

6.17 POS 01

Crossing POS 01 is a Pedestrian Operated Signalized crossing located on RD 02 approx. 165 m north of intersection CC 12.

Noteworthy items identified during the concept design development were as follows:

- POS 01 is located on RD 02 where compliant sight distances to the crossing (and future LILO intersections) from the north and south can be achieved with a reduction in design speed to 50 km/h.
- POS 01 is also located in a location where DDA requirements can be met (max. 2.5%).
- Shifting the POS location north will require increased earthworks due to steeper existing terrain and have a cross fall on crossing that will exceed DDA requirements (max. 2.5%) unless Evans Road is significantly raised at culvert crossing CU 02.
- Shifting the POS location south will impact CC 12 traffic lanes and reduce sight distances to crossing and future LILO intersections due to vertical curve located on RD 02.
- Longitudinal grading on approach to POS 01 can meet limits as specified in Austroads Guidelines (recommended max. 5%). Noting the existing terrain is steep, significant earthworks (cut) will be required.
- Design of intersection arrangements and approach roads at POS 01 will be subject to further design development as part of future land development projects.
- Refer DRG. 301400615-551 in Appendix B for POS 01 Layout Plan.

7 Culvert Projects

7.1 Background

The draft concept culvert designs have used the hydraulic design parameters and modelling completed by Alluvium and supplied to Stantec by the City as the basis of our design.

Naming of culvert structures has been allocated by Stantec in line with general naming conventions used for PSP projects. For simplicity, CU-01 crossing RD-01, CU-02 crossing RD-02 and CU-03 crossing the eastern leg of intersection CC 09.

Culvert arrangements have been developed by adopting VPA Benchmark Infrastructure Design Item 32 for the purposes of informing opinion of probable costs. It is noted that the arrangements may be adjusted/optimised following further investigation and design in future project stages by others.

The following general assumptions have been adopted for all culvert projects:

- Manning's n roughness value of 0.07 is assumed for channels upstream and downstream of proposed culverts to allow for future planting.
- The approx. culvert invert levels have been estimated from existing LiDAR data. Confirmation of the existing site stormwater outlet levels is required with survey to confirm existing channel base levels and proposed culvert levels.
- All culvert projects are subject to final input from authorities (incl. Barwon Water) and require further detailed design work to confirm final arrangements.
- A min. 1 m clearance has been provided from the top of culvert to the underside of proposed road pavement at each crossing location.
- Structural design has not been undertaken as part of this project. Confirmation of all structural elements in the culvert design projects are to be confirmed in further design stages.

7.2 Preliminary Assessment

High level modelling local to each culvert location has been undertaken using HECRAS software to ascertain the approximate 1% AEP flood level extents at each of the culvert crossing locations.

The following inputs were used in the development of the high level HECRAS model:

- Design flows as developed by Alluvium (2022)
- Cross sections extracted from existing LiDAR data (with the exception to assumed channel excavation on the upstream extent of culvert crossing CU 03)
- Manning's n roughness value of 0.07 (as mentioned previously in Section 7.1)

7.3 Culvert Project Extents

The extent of each culvert project has been calculated as the approximated trench width required across the relevant road cross section taken perpendicular to the centreline.

7.4 CU 01

Culvert crossing CU 01 is a 48.62 m long twin DN 1500 RCP arrangement located at CH 1,358 on RD 01 shown below in Figure 7.1.

Figure 7.1: Culvert Crossing CU 01 (image sourced from Stantec's Final Concept Design Submission dated 16 February 2024)

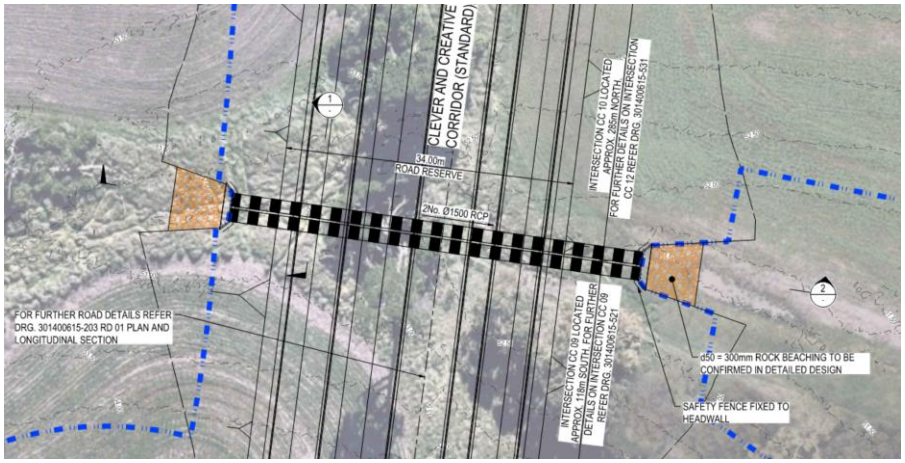


Table 7.1: Design Parameters – CU 01

Structure ID	1% AEP Flow Rate (m^3/s)	Comment
CU 01	7.84	1% AEP flow rate adopted from Alluvium (2022) based on RORB model at node *ww ds WLRB2 and 3a.*

Refer to DRG. 301400615-WE-SK001 included in Appendix B for further details on draft concept design for CU 01.

7.5 CU 02

Culvert crossing CU 02 is a 42.76 m long twin DN 1200 RCP arrangement located at CH 282 on RD 02 shown below in Figure 7.2.

Figure 7.2: Culvert Crossing CU 02 (image sourced from Stantec's Final Concept Design Submission dated 16 February 2024)

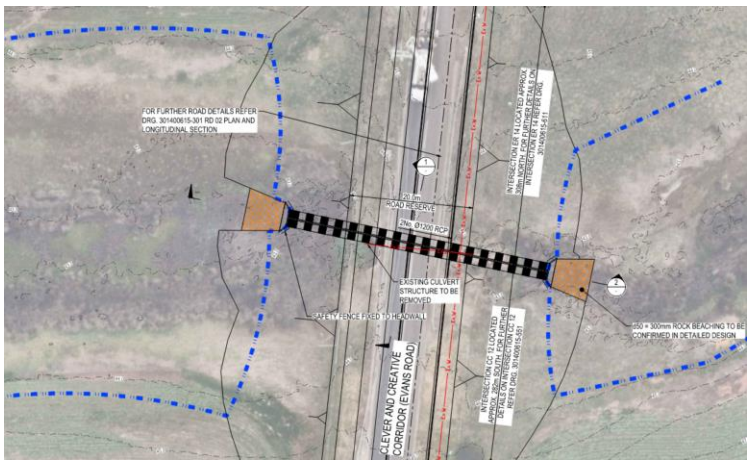


Table 7.2: Design Parameters – CU 02

Structure ID	1% AEP Flow Rate (m^3/s)	Comment
CU 02	4.46	1% AEP flow rate adopted from Alluvium (2022) based on RORB model at node *DS EX WGGA and WLRB8*

Refer to 301400615-WE-SK002 included in Appendix B for further details on concept design for CU 02.

7.6 CU 03

Culvert crossing CU 03 is a 47.58 m long twin DN 1200 RCP arrangement located approx. 165 m east of intersection CC 09 beneath a proposed Connector Road shown below in Figure 7.3.

Figure 7.3: Culvert Crossing CU 03 Final Concept Design Submission dated 16 February 2024)

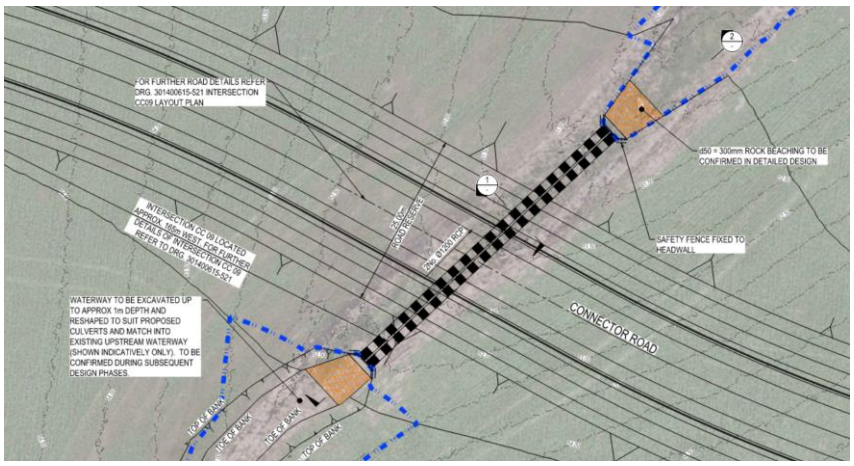


Table 7.3: Design Parameters – CU 03

Structure ID	1% AEP Flow Rate (m^3/s)	Comment
CU 03	3.84	1% AEP flow rate adopted from Alluvium (2022) based on RORB model at node *ww 2 US*

It is noted that channel excavation is assumed up to approx. 1 m on upstream side of the culvert to suit the ultimate arrangement. The ultimate proposed waterway cross-section and longitudinal grade is to be confirmed following future channel design.

Refer to 301400615-WE-SK003 included in Appendix B for further details on concept design for CU 03.

8 Utilities

8.1 Before-You-Dig-Australia

A BYDA enquiry was completed in August 2022 and March 2024 to understand existing utilities assets within the Site. Responses were received from the following authorities with assets in the vicinity:

- APA Group
- ARTC
- AusNet Services
- Barwon Water
- NBN Co
- Nextgen Group
- Optus
- Powercor
- Telstra
- TPG
- City of Greater Geelong (The City)

Refer Appendix E for responses from the March 2024 BYDA enquiry.

8.2 Identified Utilities

A preliminary review was undertaken of the BYDA information received from affected authorities and as part of the development of the concept road alignments and intersection designs. A summary of the possible impacts identified has been provided in the tables below.

Utilities identified in subsequent sections of this report as impacted by the transport projects are indicative only based on the results of BYDA current to the date of the enquiry only. The actual extent of impacts may vary and will be highly subject to further investigations such as underground service location and potholing completed during further design stages.

8.2.1 ROAD PROJECTS

A summary of the assets affected by the road projects including owner, type, size and location is provided in the tables below.

Table 8.1: Identified Utilities – RD 01

Asset Owner	Asset	Location
Telstra	Underground communications conduit (size unknown)	Within private property 2/LP203190.

Table 8.2: Identified Utilities – RD 02

Asset Owner	Asset	Location
Telstra	Underground communications conduits (size varies)	Western verge from Valleyside Drive through to northern side of Lovely Banks Road.

		Eastern verge from northern side of Lovely Banks Road through to Edgerton Road. Western verge from Edgerton Road to future Anakie Road intersection connection.
Powercor	Overhead electrical cable	Eastern verge on Evans Road from Warners Road to northern side of Edgerton Road intersection
Powercor	Underground low voltage electrical cable (size unknown)	Crossing Evans Road approx. 300 m north of Lovely Banks Road intersection. Eastern verge on Evans Road from pole at approx. CH 1180 to existing property (1/LP217122) located approx. 200 m south of Lovely Banks Road intersection.
Barwon Water	Underground water mains (150 mm PVC and DICL)	Eastern verge on Evans Road for entirety.

8.2.2 INTERSECTION PROJECTS

A summary of the assets possibly affected by the intersection projects including owner, type, size and location is provided in the tables below.

Table 8.3: Identified Utilities – IN 01

Asset Owner	Asset	Location
Telstra	Underground communications conduits (size varies)	Eastern verge of Geelong-Ballan Road
Powercor	Overhead electrical cable	Western verge of Geelong-Ballan Road
Powercor	Underground low voltage electrical	Western verge of Geelong-Ballan Road Crossing of Geelong-Ballan Road from properties 1/TP240293 and 2/TP668613

Table 8.4: Identified Utilities – IN 02

Asset Owner	Asset	Location
Telstra	Underground communications conduits (size varies)	Eastern verge of Geelong-Ballan Road Separately continuing north along the eastern verge on Evans Road
Powercor	Overhead electrical cable	Western verge of Geelong-Ballan Road Crossing Geelong-Ballan Road immediately north of Evans Road intersection
Powercor	Underground low voltage electrical	Northern side of Geelong-Ballan Road / Evans Road intersection within western verge side of Evans Road
Barwon Water	Underground water main (150mm PVC)	Eastern verge of Geelong-Ballan Road, continuing north along the eastern verge on Evans Road

Table 8.5: Identified Utilities – IN 03

Asset Owner	Asset	Location
Telstra	Underground communications conduits (size varies)	Eastern verge of Geelong-Ballan Road and further east in private property
Powercor	Overhead electrical cable	Western verge of Geelong Ballan Road

Table 8.6: Identified Utilities – IN 05

Asset Owner	Asset	Location
Telstra	Underground communications conduits (size varies)	Eastern verge of Geelong-Ballan Road, and northern and southern verges on Midland Highway. Conduits cross on northern and eastern sides of existing intersection
Optus	Underground fibre optic communications cable (size unknown)	Southern verge on Midland Highway
Powercor	Overhead electrical cable	Western verge of Geelong-Ballan Road, southern and southern verges on Midland Highway and northern verge of Creamery Road. Cables cross on northern side of existing intersection
Barwon Water	Underground water main (150mm AC)	Northern verge on Midland Highway crossing through middle of existing intersection
The City	Drainage culverts: 750 (W) x 300 (H) RCBC 600 (W) x 300 (H) RCBC RCP (size unknown)	East-west crossing Geelong-Ballan Road at intersection North-eastern corner of existing intersection crossing beneath Creamery Road on approach Crossing beneath existing footpath on eastern side of intersection Also a crossing on western leg of intersection as per screen shot below:

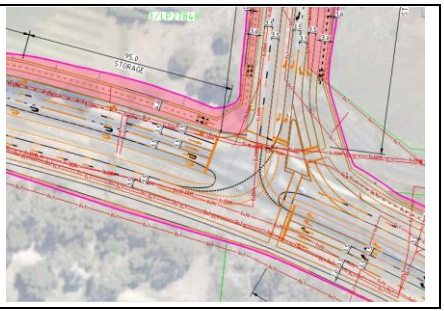
		

Table 8.7: Identified Utilities – IN 06

Asset Owner	Asset	Location
Telstra	Underground communications conduits (size varies)	Northern verge on Midland Highway
Optus	Underground fibre optic communications cable (size unknown)	Southern verge on Midland Highway
Barwon Water	Underground water main (150mm AC)	Northern verge on Midland Highway

Table 8.8: Identified Utilities – CC 07

Asset Owner	Asset	Location
Telstra	Underground communications conduits (size varies)	Southern verge on Creamery Road
Powercor	Overhead electrical cable	Northern verge on Creamery Road

Table 8.9: Identified Utilities – CC 12

Asset Owner	Asset	Location
Barwon Water	Underground water main (150mm PVC)	Eastern verge on Evans Road

Table 8.10: Identified Utilities – ER 14

Asset Owner	Asset	Location
Telstra	Underground communications conduits (size varies)	Western verge on Evans Road Northern and southern verges on Valleyside Drive
Powercor	Overhead electrical cable	Eastern verge on Evans Road
Barwon Water	Underground water mains (150mm PVC and 150mm DICL)	Northern verge of Warners Road crossing to eastern verge on Evans Road north of intersection Southern verge on Valleyside Drive connecting with main on Evans Road on south-eastern corner of intersection
The City	Drainage culvert (size unknown)	Beneath Valleyside Drive at intersection

Table 8.11: Identified Utilities – ER 15

Asset Owner	Asset	Location
Telstra	Underground communications conduits (size varies)	Northern verge on Asher Road. Western verge on Evans Road
Powercor	Overhead electrical cable	Eastern verge on Evans Road
Barwon Water	Underground water main (150mm PVC and PVC CL)	Southern verge on Asher Road crossing at intersection and continuing north on eastern verge on Evans Road

Table 8.12: Identified Utilities – ER 16

Asset Owner	Asset	Location
Optus	Underground optic fibre cable	Northern verge on Lovely Banks Road crossing to western verge on Evans Road. Cable crosses approx. 20m from the intersection centre point and continues through private property to east.

Telstra	Underground communications conduits (size varies)	Eastern and western verges on Evans Road south of intersection. Eastern verge on Evans Road north of intersection. Southern verge on Lovely Banks Road (east and west)
AusNet	Overhead high voltage transmission cables	South-east to north-west alignment crossing over intersection
Barwon Water	Underground water mains (150mm PVC and 150mm DICL)	Northern verge on Lovely Banks Road (east) and southern verge on Lovely Banks Road (west). Connects with main on eastern verge on Evans Road and continues north and south
The City	Drainage culvert (size unknown)	Crossing east-west on Evans Road at intersection on southern side

Table 8.13: Identified Utilities – ER 17

Asset Owner	Asset	Location
Telstra	Underground communications conduits (size varies)	Eastern verge on Evans Road south of intersection, crossing to western verge at intersection and continuing north. Southern verge on Edgerton Road connecting with Evans Road lines
Powercor	Overhead electrical cables	Eastern verge on Evans Road
Barwon Water	Underground water main (150mm DICL and 150mm PVC)	Eastern verge on Evans Road and northern verge on Edgerton Road

There are no identified utilities for intersection CC 09.

9 Opinion of Probable Costs

9.1 Background

Stantec engaged WT Partnership to undertake calculation of quantities and development of Opinion of Probable Costs (OPC) for transport infrastructure projects associated within the Creamery Road PSP and Evans Road. This consisted of ultimate designs for the CCC and interim designs for the Midland Highway and Geelong-Ballan Road as shown on the Final Concept Design Drawings.

To inform the OPC development, Stantec provided to WT Partnership earthworks volumes based on the Final Concept Designs as approved by the City, as well as electronic and PDF design documentation for the purposes of quantity calculation.

The Report developed by WT partnership is provided in Appendix D.

9.2 Earthworks Assumptions

Assumptions made by Stantec in the development of the earthworks volumes were as follows:

- Existing surface used for comparison in the development of the estimates was based on LiDAR data as supplied by the City to Stantec.
- Earthworks volumes have been calculated using civil design software Civil 3D Model comparing two elevation surfaces: the bulk earthworks surface (to pavement boxing depth) and existing surface stripped to an assumed 100 mm depth (allowing for nominal topsoil stripping).
- Where batters have been designed, cut and fill values have been added to volumes and areas used in the estimates.
- Cut and fill quantities are based on in-situ volumes. No bulking factor has been applied to excavated quantities.
- Quantities have been calculated based on Final Concept Design drawings dated 16 February 2024 (as included in Appendix B).

9.3 Project Extents

Stantec instructed WT Partnership to cost each project individually in accordance with road, intersection and culvert extents as outlined in earlier Sections of this Report.

9.4 Opinion of Probable Cost Summary

Brief summaries of the cost values developed by WT Partnership are provided in the tables below. For further details of the estimations, refer Report provided in Appendix D.

It is noted that the P90 cost values represent the estimate of costs such that there is a 90 per cent probability of the project being delivered within that cost estimate, while P50 represent the estimate of costs such that there is a 50 per cent probability of the project being delivered within that cost estimate.

Table 9.1: Road Projects

Project ID	Value (excl. GST) (incl. Delivery) – P50	Value (excl. GST) (incl. Delivery) – P90
RD 01-01	$ 6,749,000	$ 7,731,000
RD 01-02	$ 15,590,000	$ 17,895,000
RD 02-01	$ 2,442,000	$ 2,784,000
RD 02-02	$ 2,936,000	$ 3,339,000
RD 02-03	$ 7,355,000	$ 8,351,000
RD 02-04	$ 6,740,000	$ 7,654,000

Table 9.2: Intersection Projects

Project ID	Value (excl. GST) (incl. Delivery) – P50	Value (excl. GST) (incl. Delivery) – P90
IN-01	$ 17,113,000	$ 19,695,000
IN-02	$ 9,390,000	$ 10,820,000
IN-03	$ 10,983,000	$ 12,678,000
IN-05	$ 25,710,000	$ 29,503,000
IN-06	$ 27,912,000	$ 31,909,000
CC-07	$ 8,510,000	$ 9,798,000
CC-09	$ 7,638,000	$ 8,789,000
CC-12	$ 20,984,000	$ 24,543,000
ER-14	$ 7,753,000	$ 8,963,000
ER-15	$ 6,334,000	$ 7,329,000
ER-16	$ 13,905,000	$ 16,804,000
ER-17	$ 7,619,000	$ 8,799,000

Table 9.3: Culvert Projects

Project ID	Value (excl. GST) (incl. Delivery) – P50	Value (excl. GST) (incl. Delivery) – P90
CU-01	$ 783,000	$ 901,000
CU-02	$ 656,000	$ 754,000
CU-03	$ 723,000	$ 831,000

Table 9.4: Crossing Projects

Project ID	Value (excl. GST) (incl. Delivery) – P50	Value (excl. GST) (incl. Delivery) – P90
POS-01	$ 139,000	$ 163,000

A summary of the key factors contributing to the overall OPC for transport infrastructure items is provided below:

- Earthworks quantities which are a direct result of site-specific topography and design parameters specific to DTP (such as 1V:6H batter slopes and 2% approach to intersections) and AGRD requirements. As discussed in various Sections of this Report including Sections 5.8 and 5.9, the balance of competing requirements for provision of compliant road geometry for all transport modes (including active travel and public transport) within the existing topography required a high degree of earthworks. While it is recognised that resultant earthworks could be reduced by implementing retaining walls or other engineering solutions, it is expected that these would still add noteworthy costs to each project.

- Allowance has been made for potential existing service relocation based on those identified from BYDA enquiries, site inspections and photos. The relocation of underground and overhead services, in particular electrical and telecommunications, have contributed significantly to the costs. This is most evident in the overall estimated costs for IN 05 and IN 06.
- Allowance has been made for removal and replacement of existing road pavements to suit the expected higher classification of upgraded roads (e.g. from rural to secondary arterial and the need to accommodate higher future traffic volumes). This has had a direct influence on the area of new pavement and the cost for removal of existing.
- Of the intersections, four (4) have been estimated at approximately $20M or above due to a range of reasons as follows:
    - IN 01 is estimated to be $17,113,000 (P50 excl. GST) and $19,695,000 (P90 excl. GST). This is due to the number of lanes, required flaring and deceleration lengths contributing to the overall size of the intersection and new pavement required. In addition, large volume of earthworks due to specific topography of the site, various existing services requiring relocation and new drainage infrastructure have made noteworthy contribution to the overall cost.
    - IN 05 is estimated to be $25,710,000 (P50 excl. GST) and $29,503,000 (P90 excl. GST). This is due to the number of lanes, required flaring and deceleration lengths contributing to the overall size of the intersection and new pavement required. In addition, large volume of earthworks due to specific topography of the site, various existing services requiring relocation and new drainage infrastructure have made noteworthy contribution to the overall cost.
    - IN 06 is estimated to be $27,912,000 (P50 excl. GST) and $31,909,000 (P90 excl. GST). This is due to the number of lanes, required flaring and deceleration lengths contributing to the overall size of the intersection and new pavement required. In addition, large volume of earthworks due to specific topography of the site, various existing services requiring relocation and new drainage infrastructure have made noteworthy contribution to the overall cost.
    - CC 12 is estimated to be $20,984,000 (P50 excl. GST) and $24,543,000 (P90 excl. GST). This is most notably due to the significant level of earthworks required that is a direct result of competing constraints such as matching existing levels at Geelong Ballan Road and the railway crossing on Evans Road, minimising the amount of cover (fill) and corresponding batter widths over culvert CU 02, achieving compliant vertical geometry set out in Austroads Guide to Road Design and adopting 6H:1V batter slopes in accordance with DTP requirements.

APPENDICES

Appendix A Transport Modelling Report

Appendix B Final Concept Design Drawings

Appendix C Concept Design Comments Register

Appendix D Opinion of Probable Costs

Appendix E Before You Dig Australia Responses (March 2024)