EnergyCo

Central-West Orana Renewable Energy Zone Transmission project

Amendment Report

Appendix J: Traffic and Transport Impact Assessment Addendum

March 2024

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March 2024

Central-West Orana Renewable Energy Zone Transmission project

Traffic and transport impact assessment addendum

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Central-West Orana Renewable Energy Zone Transmission project
Traffic and transport impact assessment addendum

EnergyCo

WSP
Level 27, 680 George Street
Sydney NSW 2000
GPO Box 5394
Sydney NSW 2001

Tel: +61 2 9272 5100
Fax: +61 2 9272 5101
wsp.com

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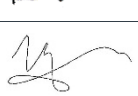
	Name	Date	Signature
Prepared by:	William Zhou	05/03/2024	
Reviewed by:	Ben Groth	05/03/2024	
Approved by:	Paul Greenhalgh	05/03/2024	

WSP acknowledges that every project we work on takes place on First Peoples lands.
We recognise Aboriginal and Torres Strait Islander Peoples as the first scientists and engineers and pay our respects to Elders past and present.

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Summary

The potential traffic and transport impacts of the project during construction and operation were assessed in Technical Paper 13 of the Environmental Impact Statement (EIS). The key findings of this assessment was summarised in Chapter 17 (Traffic and transport) of the EIS. Additional assessment has been undertaken to identify changes to potential traffic and transport impacts associated with the amended project. The findings of the additional assessment are reported in this section.

Assessment approach

A desktop assessment was carried out to assess the proposed amendments. The same assessment approach methodology detailed in Section 3 of Technical Paper 13 was applied for the assessment of traffic and transport impacts for the amended project. The assessment of the proposed amendments and refinements included:

- revised assessment of the potential traffic and transport impacts to sensitive receivers as a result of updates to the proposed construction and operational study area
- additional construction and operational scenarios not previously assessed in Technical Paper 13, including changes to construction traffic generation/distribution, two newly assessed intersections with updated traffic survey counts, updates to background traffic assumptions, updates to traffic data, additional microwave repeater sites, local road upgrades.

Existing environment

The existing environment in relation to traffic and transport as assessed in Technical Paper 13 remains relevant to assess the impacts of the amended project, with the exception of:

- an increase to the study area to include the proposed microwave repeater sites
- two newly assessed intersections with updated traffic survey counts
- updates to available crash-related traffic data.

Assessment of potential impacts

Construction

The results of intersection analysis found that construction traffic associated with the amended project would have only minor impacts, with intersections operating at acceptable levels.

The results of turn warrant assessments found that most locations had adequate turn treatments to provide safe intersection operation and to accommodate additional increases in traffic demand during construction associated with the amended project. Three intersections and two typical access gate locations were found to not meet adequate turn treatment requirements have been identified, with mitigation measures recommended.

The results of Safe Intersection Sight Distance assessments found that five intersections and five access gate locations along Castlereagh Highway, Golden Highway, Merotherie Road, Ulan-Wollar Road, Cope Road, Ulan Road and Spring Ridge Road would not comply with SISD requirements during construction. Traffic controls in the form of temporary speed limits would be implemented at these intersections and access gates, to ensure sufficient sight distance for road users during construction, subject to engagement with the relevant road authority.

Operation

Potential traffic and transport impacts of the amended project during operation would be consistent with the impacts identified in the EIS.

Updated or additional mitigation measures

There is a potential need for intersection turning upgrades to provide safer intersection operation and to accommodate additional increases in traffic demand during construction. The volume of construction vehicle movements using these intersections during the peak hour period will be restricted, with proportionate reductions also occurring during other times as applicable. This applies to the following locations:

- Intersection of Ulan Road/Neeleys Lane, where further investigation is needed to confirm that short channelised right turn and/or auxiliary left turn treatments (or suitable alternatives) are required for safe access to the workforce accommodation camp.
- Intersection of Golden Highway/ Ulan Road, where further investigation is needed to confirm that a new short channelised right turn treatment (or suitable alternative) is required.
- Intersection of Golden Highway / Blue Springs Road, where further investigation is needed to confirm that a new short channelised right turn treatment (or suitable alternative) is required.
- Typical access gate locations off Cope Road where further investigation is needed to confirm if short channelised right turn (CHRs) treatments (or suitable alternatives) is required.
- Typical access gate locations off Ulan Road (near Ulan township), where further investigation is needed to confirm that new channelised right turn treatments for a north/west access gate and short auxiliary left turn treatments for a south/east access gate (or suitable alternatives) are required.
- Typical access gate locations off Ulan Road (north of Ulan-Wollar Road), where further investigation is needed to confirm that new short channelised right turn treatments and short auxiliary left turn treatments (or suitable alternatives) are required.

Updates to mitigation measure T1 have been made to this effect.

An additional mitigation measure (T13) has been also proposed to provide greater clarity and guidance for the establishment of new construction access points.

Other minor updates have also been made to the management and mitigation measures originally proposed in Technical paper 9 however these changes to not have a material affect the intent of the measures. Otherwise, the proposed management and mitigation measures remain unchanged from Technical Paper 13. The revised mitigation measures are identified in section 6.

1 Introduction

1.1 Background

The Energy Corporation of NSW (EnergyCo) is seeking approval for the construction and operation of new electricity transmission infrastructure and new energy hubs and switching stations that are required to connect energy generation and storage projects within the Central West Orana REZ to the existing electricity network.

The original Central-West Orana REZ declaration provided for an initial intended network capacity of three gigawatts. The NSW Government amended the REZ declaration in December 2023 to increase the intended network capacity to six gigawatts, which would allow for more renewable energy from solar, wind and storage projects to be distributed through the NSW transmission network.

As the existing transmission network in the Central-West Orana region is not capable of transferring the amount of electricity expected to be generated from new renewable energy generation and storage projects in the Central-West Orana REZ, the development of new transmission infrastructure is required to provide additional electricity transfer capacity in the region to connect these projects to the National Energy Market (NEM).

1.2 The project (as exhibited)

The project as described in the publicly exhibited EIS (hereafter referred to as the 'exhibited project') included the following features:

- a new switching station (the New Wollar Switching Station), located at Wollar to connect the project to the existing 500 kilovolts (kV) transmission network
- around 90 kilometres of twin double circuit 500 kV transmission lines and associated infrastructure to connect the two energy hubs to the existing NSW transmission network via the New Wollar Switching Station
- energy hubs at Merotherie and Elong Elong (including a potential battery storage option at the Merotherie Energy Hub) to connect renewable energy generation projects within the Central West Orana REZ to the 500 kV network infrastructure
- around 150 kilometres of single circuit, double circuit and twin double circuit 330 kV transmission lines, to connect renewable energy generation projects within the Central-West Orana REZ to the two energy hubs
- thirteen switching stations along the 330 kV network infrastructure at Cassilis, Coolah, Leadville, Merotherie, Tallawang, Dunedoo, Cobbora and Goolma, to transfer the energy generated from the renewable energy generation projects within the Central-West Orana REZ onto the project's 330 kV network infrastructure
- underground fibre optic communication cables along the 330 kV and 500 kV transmission lines between the energy hubs and switching stations
- construction of microwave repeater sites at locations along the alignment, as well as off the alignment at Botobolar, to provide a communications link between the project and the existing electricity transmission and distribution network
- a maintenance facility within the Merotherie Energy Hub to support the operational requirements of the project
- establishment of new, and upgrade of existing access tracks for transmission lines, energy hubs, switching stations and other ancillary works areas within the construction area (such as temporary waterway crossings, laydown and staging areas, earthwork material sites with crushing, grinding and screening plants, concrete batching plants, brake/winch sites, site offices and workforce accommodation camps)

- property adjustment works to facilitate access to the transmission lines and switching stations. These works include the relocation of existing infrastructure on properties that are impacted by the project
- utility adjustments required for the construction of the transmission network infrastructure, along with other adjustments to existing communications, water and wastewater utilities. This would include adjustments to existing Transgrid and Essential Energy transmission infrastructure. This includes adjustments to Transgrid's 500 kV transmission lines 5A3 (Bayswater to Mount Piper) and 5A5 (Wollar to Mount Piper) to provide a connection to the existing NSW transmission network, including new transmission line towers along the Transgrid network along the frontage of the New Wollar Switching Station, and other locations where there is an interface with Transgrid's network.

1.3 The project (as amended)

In response to community, government and stakeholder engagement, consideration of submissions received during EIS exhibition, and ongoing development of the design and construction methodology for the project, EnergyCo is proposing a number of amendments and refinements to the exhibited project. The amendments and refinements to the exhibited project also confirm certain elements of the project that were highlighted as options or opportunities in the EIS.

The proposed amendments to the project as described in the EIS (inclusive of the proposed alignment and other refinements and clarification to the exhibited project) are collectively referred to in this traffic and transport impact assessment addendum as the 'amended project'.

The key proposed amendments and refinements of the amended project in comparison to the exhibited project are summarised in Table 1-1. It is noted that the table only includes features of the exhibited project that are subject to amendment or refinement as part of the Amendment Report.

Further information about the proposed amendments and refinements is provided in Chapter 3 of the Amendment Report. A detailed description and updated maps of the amended project are provided in Appendix A (Updated Project description) and Appendix B (Updated project description mapping) of the Amendment Report respectively.

Table 1-1 Summary of key amendments and refinements to the exhibited project

Project feature	Summary of exhibited project	Summary of amendment/refinement
Construction area	The area identified in the exhibited project that would be directly impacted by the construction of the project, including (but not limited to) transmission towers and lines, brake and winch sites, access roads to the switching stations and energy hubs, access tracks, energy hubs, switching stations, communications infrastructure, workforce accommodation camps, construction compounds, laydown and staging areas.	Changes to the construction area are proposed due to changes to the exhibited project alignment, and the provision of additional project components, including a 330 kV switching station and associated transmission line, microwave repeater sites, access tracks and brake and winch sites.
Operation area	The area identified for the exhibited project that would be occupied by permanent components of the project and/or maintained, including transmission line easements, transmission lines and towers, energy hubs, switching stations, communications infrastructure, access roads to the switching stations and energy hubs, maintenance facilities and permanent access tracks to the easements.	Changes to the operation area are proposed due to changes to the exhibited project alignment, and the provision of additional project components, including a 330 kV switching station and associated transmission line, microwave repeater sites and access tracks.

Project feature	Summary of exhibited project	Summary of amendment/refinement
500 kV and 330 kV transmission line alignments	— A new switching station (the New Wollar Switching Station), located at Wollar to connect the project to the existing 500 kV transmission network. — Around 90 kilometres of twin double circuit 500 kV transmission lines and associated infrastructure to connect two energy hubs to the existing NSW transmission network via the New Wollar Switching Station. — Energy hubs at Merotherie and Elong Elong (including a potential battery storage option at the Merotherie Energy Hub) to connect renewable energy generation projects within the Central-West Orana REZ to the 500 kV network infrastructure. — Around 150 kilometres of single circuit, double circuit and twin double circuit 330 kV transmission lines, to connect renewable energy generation projects within the Central-West Orana REZ to the two energy hubs.	As per the exhibited project with the following changes: — changes to the 500 kV and 330 kV transmission line alignments (as detailed in the Amendment Report) — removal of potential battery storage option at the Merotherie Energy Hub.
Switching stations	Thirteen switching stations along the 330 kV network infrastructure.	Fourteen switching along the 330 kV network infrastructure, which includes relocation five 330 kV switching stations and provision of an additional 330 kV switching station.
Communication cables	Underground fibre optic communication cables along the 330 kV and 500 kV transmission lines between the energy hubs and switching stations.	Underground fibre optic communication cables along the amended alignments for the 330 kV and 500 kV transmission lines between the energy hubs and switching stations.
Microwave repeater sites	Construction of microwave repeater sites at locations along the alignment, as well as off the alignment at Botobolar, to provide a communications link between the project and the existing electricity transmission and distribution network.	— A new antenna pole or tower would be established at an existing microwave repeater site at Botobolar, as described in the exhibited project. — The new microwave repeater site along the 500 kV New Wollar Switching Station—Merotherie Energy Hub connection, as described in the exhibited project, would be provided along the southern side of the 500 kV transmission line easement, just east of Blue Springs Road, Cope. — Additional communications microwave equipment (microwave antennas) is also proposed at two existing microwave repeater sites outside of the operation area, at Baldy Peak in Kandos and Magpie Hill in Galambine.

Project feature	Summary of exhibited project	Summary of amendment/refinement
Construction methods and facilities	Construction compounds to support the construction of the project would be located at: — New Wollar Switching Station — Merotherie Energy Hub — Elong Elong Energy Hub.	— It is proposed to provide a satellite construction compound at the Neeleys Lane workforce accommodation camp, within the construction area of the exhibited project. The construction compound would include materials storage and laydown facilities. — An additional crushing, grinding and screening plant is proposed at switching station M1.
Access roads and access tracks	Establishment of new, and upgrade of existing access tracks for transmission lines, energy hubs, switching stations and other ancillary works areas within the construction area (such as temporary waterway crossings, laydown and staging areas, earthwork material sites with crushing, grinding and screening plants, concrete batching plants, brake/winch sites, site offices and workforce accommodation camps).	— Minor changes are proposed to the alignment of access roads to the energy hubs, New Wollar Switching Station and switching station E2. — Minor changes to the alignments of access tracks and additional access tracks (some of which are existing access tracks) are proposed at various locations.
Property adjustments	Property adjustment works to facilitate access to the transmission lines and switching stations. These works include the relocation of existing infrastructure on properties that are impacted by the project.	Property adjustment works to facilitate access to the transmission lines and switching stations due to changes to the exhibited project alignment. These works include the relocation of existing infrastructure on properties that are impacted by the amended project.
Local road and intersection upgrades	The following road and intersection upgrades are required to ensure safe access to construction sites and the movement of oversize and overmass (OSOM) equipment for the project: — Merotherie Road — Spring Ridge Road — Spring Ridge Road/Dapper Road intersection — Golden Highway/Spring Ridge Road intersection — Neeleys Lane/Ulan Road intersection — Golden Highway/Ulan Road intersection — Merotherie Energy Hub Access Road/Merotherie Road intersection — Merotherie Road/Golden Highway intersection. The EIS further noted that EnergyCo may assess and determine the above local road, bridge and intersection upgrades under Division 5.1 of the EP&A Act to allow these time critical works to be determined and commence construction prior to the determination of the CSSI application	Refinements to the local road, bridge and intersection upgrades, including: — Minor changes to the extent and/or alignment of the local road, bridge and intersection upgrades, including (but not limited to): — installing a new bridge on Merotherie Road at its crossing of the Talbragar River to replace the existing crossing — installing a new bridge on Spring Ridge Road at its crossing of Laheys Creek to replace the existing causeway — upgrading drainage infrastructure. — Additional works, including: — upgrading Neeleys Lane from the Neeleys Lane / Ulan Road intersection to the entrance of the Neeleys Lane workforce accommodation camp. EnergyCo no longer intends to assess and determine these local road, bridge and intersection works under Division 5.1 of the EP&A Act, and would determine these works as part of the CSSI application

1.4 Statutory context

Environmental planning approval for the project is required in accordance with the *Environmental Planning and Assessment Act 1979* (EP&A Act). The project is also a controlled action and would therefore requires Commonwealth assessment and approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Sections 5.12 and 5.13 of the EP&A Act provide for the declaration of State significant infrastructure (SSI) and Critical State significant infrastructure (CSSI). On 23 November 2020, the Minister for Planning made the Environmental Planning and Assessment Amendment (Central-West Orana Renewable Energy Zone Transmission Order) 2020. The Order declares the whole Central-West Orana REZ Transmission project to be CSSI.

This section describes the legislation and policy relevant to the assessment of traffic and transport impacts.

1.4.1 Legislation

1.4.1.1 Environmental Planning and Assessment Act 1979

The project was declared as Critical State significant infrastructure (CSSI) under section 5.13 of the (NSW) EP&A Act and by amendment to Schedule 5 of the NSW State Environmental Planning Policy (Planning Systems) 2021 (Planning Systems SEPP) with the addition of clause 23. As a CSSI project, the project requires approval from the NSW Minister for Planning and Public Spaces under Division 5.2, Part 5 of the EP&A Act.

An EIS was prepared to support EnergyCo's application for approval of the project in accordance with the requirements of Division 5.2 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The EIS was placed on public exhibition by the NSW Department of Planning, Housing and Infrastructure and Environment (DPHI – formerly Department of Planning (DPE)) for a period of 42 days, commencing 28 September 2023 and concluding on 8 November 2023. In accordance with clause 179(2) of the EP&A Regulation, an application may, with the approval of the Planning Secretary, be amended at any time before the application is determined.

1.4.1.2 Environment Protection and Biodiversity Conservation Act 1999

A referral under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) was also submitted on 2 February 2023, with the project subsequently declared to be a controlled action on 2 March 2023 requiring approval from the Australian Minister for the Environment and Water under the EPBC Act. The project would therefore be assessed in accordance with the NSW Assessment Bilateral Agreement under Part 9 of the EPBC Act.

In accordance with Section 156A of the EPBC Act, a person may submit an application requesting a variation of the proposal described in the original EPBC referral.

1.4.1.3 Roads Act 1993

The *Roads Act 1993* (Roads Act) aims to establish the rights of members of the public to pass along public roads, rights of persons who own land adjoining a public road to have access to the public road, and to establish the procedures for the opening and closing of a public road. The Roads Act also aims to provide a structure for the classification of roads, empower public agencies such as Transport for NSW as the road authorities and regulate the carrying out of various activities on public roads, including the transportation of construction materials with heavy vehicles.

This project is consistent with the EP&A Act and Roads Act by ensuring that the appropriate processes, approvals and measures are in place to manage the impacts to users of the public roads, property owners and the opening/closing of public roads.

Part 9 of the Roads Act nominates the requirements for undertaking works within a public road, including the requirement to obtain consent under section 138 for carrying out works in, on or over a public road (this includes the erection of structures), and the digging up or disturbance of the surface of a public road. In relation to section 138 consents, Section 5.24 of the EP&A Act lists the approvals or authorisations that cannot be refused if they are necessary for carrying out approved CSSI and are substantially consistent with the CSSI approval. A consent under section 138 of the Roads Act is one of the approvals listed under section 5.24 of the EP&A Act.

1.4.1.4 NSW Road Rules, 2014

The NSW Road Rules 2014 are a framework for safe and efficient movement of traffic on NSW roads. The NSW Road Rules are a legislative instrument with the following objectives:

- to consolidate in a single instrument the road rules that are applicable in New South Wales
- to provide for road rules that are based on the Australian Road Rules so as to ensure that the road rules applicable in this State are substantially uniform with road rules applicable elsewhere in Australia
- to provide for other road rules to be observed in this State in relation to matters that are not otherwise dealt with in the Australian Road Rules.

The project would support the objectives of the legislation by ensuring recommended mitigation measures are aligned with the Road Rules.

1.4.2 Policies standards and guidelines

The proposal is Critical State significant infrastructure and is subject to approval by the NSW Minister for Planning and Public Spaces under the EP&A Act.

The Planning Secretary's Environmental Assessment Requirements (SEARs) have been issued for the project. As relevant to traffic and transport impacts, these require:

- *an assessment of the potential transport impacts for all stages of the project on the capacity, condition, safety and efficiency of the local and State road network and the rail network*
- *a cumulative impact assessment of traffic from nearby developments*
- *details of the ongoing maintenance works required to service assets, outlining the measures to maintain the road*
- *provide details of measures to mitigate and/or manage potential impacts including a schedule of all required road upgrades and any other traffic control measures, developed in consultation with the relevant road and/or rail authority.*

The assessment of traffic and transport impacts for the amended project has been undertaken with reference to relevant standards and guidelines. Impacts on traffic and transport from construction and operation of the amended project have been assessed in accordance with the relevant legislation and guidelines as they apply to these parameters. Key guidelines considered as part of this assessment included:

- Guide to Traffic Management Part 3: Transport Study and Analysis Methods (Austroads, 2020)
- Guide to Road Design Part 4A: Unsignalised and Signalised Intersections (Austroads, 2023)
- Guide to Traffic Management Part 6: Intersections. Interchanges and Crossings (Austroads, 2019)
- Guide to Traffic Generating Developments (Transport for NSW, 2001).

1.5 Purpose and structure of this addendum assessment

The purpose of this traffic and transport impact assessment addendum is to assess the potential impacts of the project amendments and refinements for the amended project. This report considers whether the proposed amendments and refinements would result in any changes to the predicted traffic and transport impacts described in the EIS for the exhibited project, and whether any changes to the mitigation measures are required.

This report is to be read in conjunction with the EIS for the exhibited project and specifically Technical Paper 13 –Traffic and Transport (Technical paper 13).

This traffic and transport impact assessment addendum assesses the potential impacts to traffic and transport associated with the proposed amendments and refinements to support and inform the Amendment Report.

The structure and content of this traffic and transport impact assessment addendum is as follows:

- Chapter 1 – Introduction: Provides an introduction to this traffic and transport impact assessment addendum and a brief overview of the statutory context that apply to the amended project (this chapter).
- Chapter 2 – Methodology: Outlines the methodology adopted for this traffic and transport impact assessment addendum, as well as background information of Transport for NSW's feedback on Technical Paper 13.
- Chapter 3 – Proposed amendments with potential traffic impact: Describes the proposed amendments which may have potential traffic and transport impacts during construction and operation of the project.
- Chapter 4 – Updated existing conditions analysis: Details the updated analysis of the existing traffic and transport condition at newly assessed locations and with updated traffic data.
- Chapter 5 – Updated construction analysis: Details the updated analysis of the construction traffic and transport impacts.
- Chapter 6 – Updated management and mitigation measures: Details recommended mitigation and management measures to minimise the traffic and transport impacts (including any updated or new mitigation and management measures) as a result of the amended project.

2 Methodology

2.1 Overview

The methodology for assessing the potential traffic and transport impacts of the amended project is generally consistent with that undertaken for the exhibited project with minor changes as follows:

- Identification of changes to construction routes used by heavy and light vehicles as a result of the proposed amendments and refinements.
- Updated analysis of existing conditions of the construction routes, including:
  - consideration of additional intersection surveys completed on 30 November 2023 to gain greater clarity of current traffic demands, conditions and travel patterns
  - updated analysis of crash data for highway, main, regional and local roads using updated Transport for NSW crash data between 2018 and 2022
  - turn warrant assessment of key intersections used by construction vehicles, in accordance with Austroads' Guide to Road Design, Part 4A: Unsignalised and Signalised Intersections (Austroads, 2023), to assess whether the existing layout of each intersection is suitable to provide safe access for the existing traffic demand during the AM and PM peak.
- Assessment of the potential traffic and transport impacts to key construction routes within the study area, associated with the expected construction traffic volumes, including:
  - assessment of the operational performance of key intersections used by construction vehicles using the SIDRA intersection modelling program, to determine if the intersections can safely accommodate construction vehicles during the AM and PM peak. The assessment involved comparing traffic performance indicators, including the Level of Service (LoS) and average delay, for the following two scenarios:
    - the existing intersection performance with existing background traffic volumes (i.e. base case without project construction traffic). Existing traffic volumes at these intersections were determined using survey data or estimated from intersection counts, and traffic lane capacity of the roads determined in accordance with Guide to Traffic Management (refer to sections 3.7 and 4.1.5 of Technical paper 13 for further information)
    - the performance of the same intersection layout with increased background traffic volumes (using a growth value of 1.6%) and the predicted construction traffic volumes.
- Updated assessment of the layout of key intersections used by construction vehicles, to determine if the intersections can safely accommodate construction vehicles during the AM and PM peak based on the design speed according to Guide to Traffic Management, or the turn treatments required to ensure the safe operation of the intersections.
- Assessment of Safe Intersection Sight Distance (SISD) compliance for the 2.5 second reaction time for the 100km/hr+10km/hr design speed (which equates to a requirement for 300 metres of SISD in each direction), at the key intersections used by construction vehicles.

2.2 Screening assessment

An initial screening assessment of the proposed amendments and refinements was undertaken to identify those changes with the potential to affect the outcomes of the traffic and transport assessment contained in Technical paper 13, and therefore requiring additional assessment. Those amendments and refinements identified as having the potential to result in material traffic impacts are provided in Table 2-1.

Table 2-1 Summary of proposed amendments and potential need to assess traffic impacts

Amendment	Traffic Impact Assessment
Orana Wind Farm Connection – Elong Elong	Refer to section 3.1
Orana Wind Farm Connection – Merotherie	Refer to section 3.2
Merotherie Road Upgrade	Refer to section 3.3
Spring Ridge Road Upgrade	Refer to section 3.4
Additional or modified access track west of M8 Switching Station	Refer to section 3.5.1
Additional access track off Highett Road.	Refer to section 3.5.2
Modification to access track to use established track to existing transmission line easement. Location is approximately 1.5km west of Cope town centre	Refer to section 3.5.3
Additional access track from Main Street (Cope) into the 500kV alignment	Refer to section 3.5.4
Additional access track off Ulan-Wollar Road to 500 kV corridor	Refer to section 3.5.5
Additional new access track east of Ulan Mine	Refer to section 3.5.6
Modification access track immediately north-east of Wilpinjong Mine	Refer to section 3.5.7
Additional access track and new access route off Ulan-Wollar Road via Wilpinjong Mine	Refer to section 3.5.9
Microwave repeater sites at — Botobolar — Magpie Hill — Cope — Baldy Peak	Refer to section 3.6
Neeley Lane Accommodation Camp – addition of a construction compound	Refer to section 3.7

2.3 Transport for NSW Feedback

A submission was provided by Transport for NSW in response the public exhibition of the EIS, with feedback primarily relating to the assessment undertaken in Technical paper 13 as summarised and clarified in the following sections.

2.3.1 Infrastructure approval for all road upgrades

TfNSW require clarification if the OSOM upgrades at the intersections with State Classified Roads were reliant on the separate Part 5.1 environmental assessment underpinning the Port to REZ OSOM road infrastructure upgrades or an additional Part 5.1 environmental approval to be prepared and determined by EnergyCo.

The upgrades required as part of this project are not reliant on works required as part of Port to Renewable Energy Zone Oversized Overmass (OSOM) road infrastructure upgrades. The Environmental Impact Assessment has identified the upgrades, in terms of configurations, required to minimise impact resulting from this project through quantitative assessments undertaken in the Traffic and Transport Impact Assessment. This includes upgrades to:

- Merotherie Road to provide access to the Merotherie Energy Hub and site compound.
- Spring Ridge Road to provide access to the Elong Elong Energy Hub, including the upgrade of Spring Ridge Road and Dapper Road intersection.
- Intersection upgrades at the following locations:
  - Neeleys Lane and Ulan Road
  - Merotherie Road and Golden Highway
  - Golden Highway and Ulan Road.

Upgrade works identified as part of this project would go through a separate concept and detailed design process to ensure the geometric functionality of the upgrade suitable for the proposed design vehicles.

2.3.2 Estimation of project traffic generation

Transport for NSW requires further information on the assumptions regarding traffic generation of the project, broken down into delivery trucks required for water, excavation, fill, concrete, crushing, delivery of workforce accommodation, equipment, workforce (at the peak of construction), and workforce prior to the erection of workforce accommodation.

The traffic generation numbers summarised in the TTIA presents the hourly traffic volumes presented in the peak hours of the day during the peak periods of construction (mid-2025 to mid-2026). These present the worst-case scenario for the project.

Whilst there may be variation in construction traffic demand in various stages of construction, the assessed traffic generation volumes present the maximum and most conservative construction traffic volume that would be on the road network during the extent of the project. As such, any identified upgrade works based on traffic impacts have been based on the worst-case scenario to ensure they are suitable to manage variations in traffic demand during construction.

2.3.3 Background traffic volumes

The CWO REZ Transmission line project will occur within the declared CWO REZ and there is a significant volume of Major Projects that are being approved and will have coinciding timeframes for construction. Therefore, the assumption of land use growth is not accurate and the coinciding project timing and traffic volumes for the construction periods must be included to provide an accurate representation of the background traffic at the peak of the construction period for the CWO REZ Transmission lines, at the key intersections with the state classified road network.

In addition, the annual growth of the Castlereagh Highway (1.6%), Mitchell Highway (1.5%) and Golden Highway (1.6%) applied linearly to the year of peak of construction is required to accurately reflect the background traffic volumes occurring on the network.

The assessment to consider the impacts from other Major Projects has been included in the Cumulative Impact Assessment chapter of the EIS.

The aggregate traffic growth patterns in the Central West region have been reviewed using Transport for NSW's permanent traffic counters located near the project site and within the Central West region. These counts are publicly available and displayed in the *TfNSW's Traffic Volume Viewer* website.

The traffic counter locations that have been selected to review traffic growth patterns in the Central West region include those that consistently collect traffic data since 2015, to account for their patterns pre-COVID pandemic. The locations are listed below, with the data and location depicted in Figure 2-1:

- Station ID 6163: Golden Highway east of Merriwa town
- Station ID 6364: Golden Highway west of Sandy Hollow
- Station ID 6145: Newell Highway north of Dubbo
- Station ID 6149: Newell Highway south of Dubbo.

Based on this assessment, it was found that:

- travel restrictions introduced due to COVID-19 pandemic in 2020 and 2021 affected travel demand in Central West with traffic volumes visibly decline from the demand observed in 2019
- all sites recorded no growth in years preceding the COVID-19 pandemic with a decline in traffic volumes observed for three years prior (between 2017 to 2019)
- traffic volumes in 2022 were returning to pre-COVID-19 levels and shows minimal downtrend growth since.

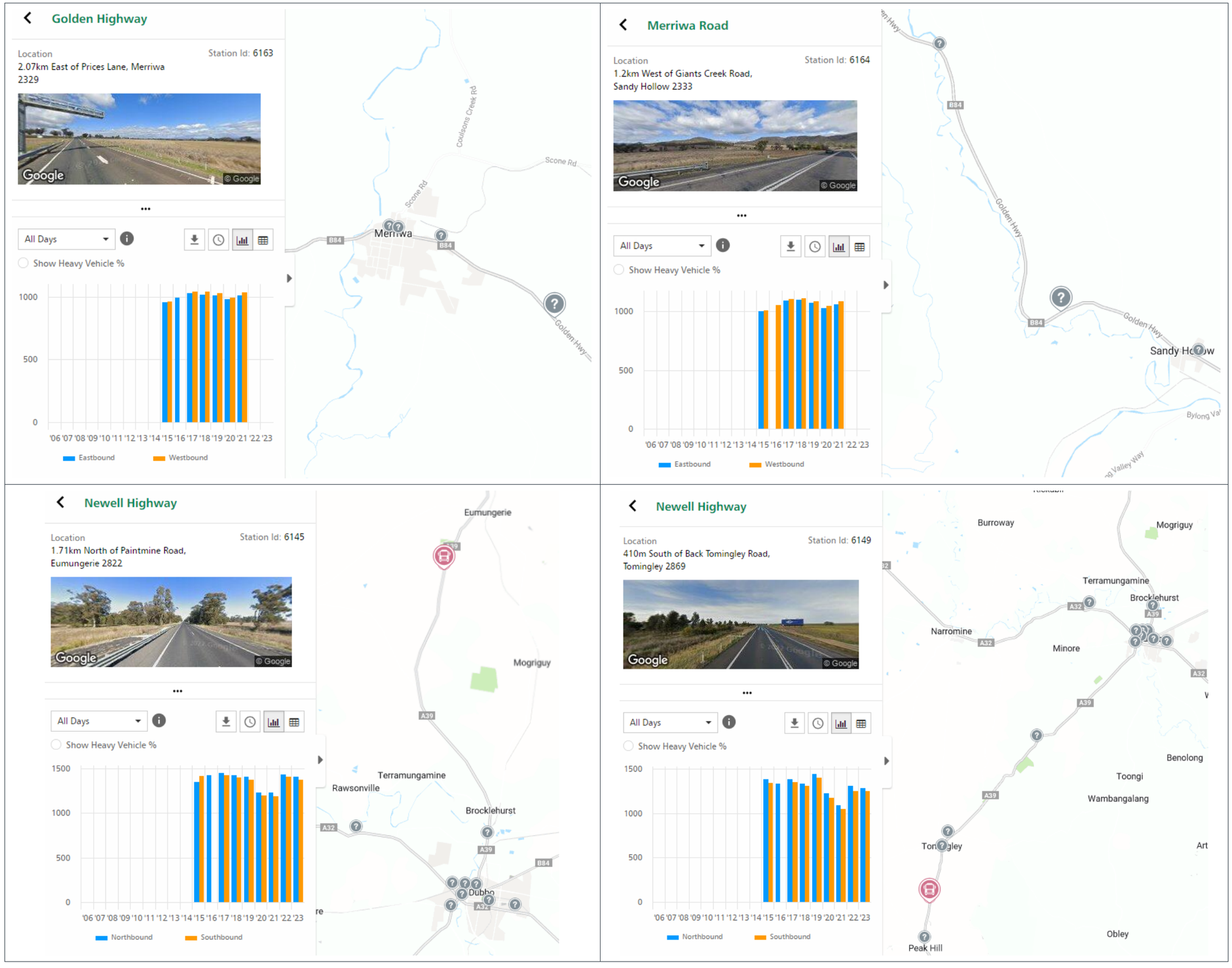


Figure 2-1 Traffic Volume Viewer locations and patterns (TfNSW Traffic Volume Viewer)

The source of Transport for NSW's rate of 1.5 per cent and 1.6 per cent annual growth rates on the State Road network is unclear, although may relate to the Corridor Strategy for the respective highways, with the *Golden Highway Corridor Study* released in October 2016 reporting a 1.6 per cent traffic growth trends preceding its publication.

Notwithstanding the above, an analysis has been completed applying a 1.6 per cent growth annually to the base traffic volume on the Golden Highway and Castlereagh Highway (refer to Table 2-2). This demonstrates that the background traffic growth would not significantly add to the base traffic volume to impact mid-block road capacity, with an increase of up to four vehicles per hour in each direction of travel on the State Road network in the year 2026, noting a peak construction period between mid-2025 and mid-2026. A sensitivity analysis has been included at key intersections in Chapter 5 to ensure that the intersections would perform adequately given a conservative growth rate estimate.

Table 2-2 Traffic growth calculation on State Road network

No.	Location	Weekday Daily Volume				November 2022				2024				2025				2026			
						AM peak hour		PM peak hour		AM peak hour		PM peak hour		AM peak hour		PM peak hour		AM peak hour		PM peak hour	
		ADT	AWT	NB/ WB	SB/ EB	NB/ WB	SB/ EB	NB/ WB	SB/ EB	NB/ WB	SB/ EB	NB/ WB	SB/ EB	NB/ WB	SB/ EB	NB/ WB	SB/ EB	NB/ WB	SB/ EB	NB/ WB	SB/ EB
M-2	Golden Highway (near Spring Ridge Road, west of Dunedoo)	1,282	1,341	694	647	57	52	51	61	59	54	53	63	60	55	53	64	61	55	54	65
									Δ	*2*	*2*	*2*	*2*	*3*	*3*	*2*	*3*	*4*	*3*	*3*	*4*
M-3	Golden Highway (between Ulan Road and Merotherie Road)	930	918	488	430	54	35	39	42	56	36	40	43	57	37	41	44	58	37	42	45
									Δ	*2*	*1*	*1*	*1*	*3*	*2*	*2*	*2*	*4*	*2*	*3*	*3*
M-4	Castlereagh Highway (between Golden Highway and Tucklan Road)	725	781	353	428	29	41	38	34	30	42	39	35	30	43	40	36	31	44	40	36
									Δ	*1*	*1*	*1*	*1*	*1*	*2*	*2*	*2*	*2*	*3*	*2*	*2*
M-13	Castlereagh Highway (north of Laheys Creek Road)	1,000	1,048	514	534	31	46	44	45	32	47	45	46	33	48	46	47	33	49	47	48
									Δ	*1*	*1*	*1*	*1*	*2*	*2*	*2*	*2*	*2*	*3*	*3*	*3*

2.3.4 Data collection

In terms of data collection, Transport for NSW has highlighted the points below:

a	*Intersection counts have not been undertaken at each key intersection with the state classified road network that will be utilised as a part of the construction route for the Central West Orana REZ.*

The surveys completed for this project were extensive and covered the intersections impacted by the construction routes of the project. Transport for NSW's recommended list has been reviewed and as a result, additional traffic surveys at the following intersections have been included:

- Cassilis Road and Golden Highway
- Golden Highway and Castlereagh Highway.

b	*Mid-block counts have been undertaken on certain sections of the state classified road network instead of intersection counts. Transport for NSW notes that midblock counts do not identify the existing turning volumes at the key intersections therefore requests intersection counts with the state classified road network that previously relied on the midblock counts. The traffic count survey is required to be undertaken for a minimum of 1 full day (preferably 7 days for improved accuracy).*

The use of midblock counts to survey the main road where an access point is required for the proposed construction is justified. The project requires access to tracks and local roads that are remote or currently only service several rural properties which have minimal traffic generation.

The mid-block counts provide substantial traffic data of the major road across a 7-day period, providing more accurate peak periods, thus ensure that the project considers the worst-case scenario.

c	*The surveys undertaken for the TTIA were completed for a period between 6am-10am and 3pm-7pm. Transport for NSW requests that all counts are to represent a minimum period of 1 full day (preferably 7 days for improved accuracy).*

The survey times selected (6am-10am and 3pm-7pm) are typical for traffic surveys as these are the periods where journeys are made by typical households to/from work/school/other activities.

These periods are also the peak times where construction workers of the project would travel between camp sites and work sites, thus represent the worst-case impact by the project.

While it can be useful to have more data in the off-peak periods, it is not essential for the purpose of reporting the project's impacts given the project's peak travel needs would be within the typical peak periods of the road network.

d	*Every section with the TIA relying on the intersection traffic counts for the classified road network is required to be updated based on the outcome of the further traffic count surveys at each intersection with the state classified road network.*

Relevant additional assessments have been undertaken and detailed further in Chapter 5.

e	*The raw data underpinning the revised intersection counts (i.e. tube counts) is required to be provided as part of an appendix to the revised TIA.*

Copies of the survey data used in the TTIA are included as an attachment to this report.

2.3.5 Crash analysis

The crash data identified within the Technical paper 3 – Transport and Traffic is representative of a 5-year period between 2016 and 2020 based on available data from Transport for NSW Open Data platform. The Transport for NSW Open Data platform provides crash data sets for an updated period between 2018-2022, the crash data is required to be updated based on the current data set.

The crash analysis was completed using the five-year crash data available at the time of the assessment, a period between 2016 and 2020. Additional analysis of crash data has been completed using the updated data available, between 2018 and 2022 and are summarised in Section 4.2 of this report.

2.3.6 Construction assessment – Elong Elong Energy Hub

Transport for NSW requested updates to the traffic assessment to identify the additional workforce accommodation camp at the Elong Elong Energy Hub which would be accessed via Spring Ridge Road and the Golden Highway.

A workforce accommodation camp is not proposed at Elong Elong Energy Hub. Workforce accommodation camps are only proposed at Merotherie Energy Hub and Neeleys Lane in Turrill which have been assessed as part of the submitted TTIA.

2.3.7 Construction assessment – workforce accommodation camps

Transport for NSW requested traffic assessment to be undertaken relating to the construction impacts of the workforce accommodation camps at Merotherie Energy Hub and Neeleys Lane.

The construction of workforce accommodation camps is not envisaged to generate traffic movements higher than those experienced during the construction of the transmission lines, energy hubs, switching stations and associated infrastructure which the TTIA has based its assessment on. Recommendations to upgrade road infrastructure has therefore been based on the worst-case scenario of the project.

2.3.8 Construction assessment – intersections

Transport for NSW requested the reassessment of intersections with the State classified road network that form part of the construction routes to address its detailed comments provided in Attachment 2 of its submission. Transport for NSW comments associated with Section 5.2.2 of the TTIA, and associated responses are summarised in Table 2-3.

Table 2-3 Construction impact intersection assessment

TfNSW items	Responses
Section 5.2.2 does not accurately reflect the current road environment or existing intersection treatments.	The current road environments are described as part of *Chapter 4 – Existing environment* of the TTIA. Section 5.2.2 reports on the project's impact during construction.
To include an assessment of the cumulative traffic volumes or the capacity of the intersection treatments.	The assessment of cumulative traffic volumes for part of a separate chapter (Chapter 20) in the EIS main report. Updated cumulative impact assessments will be reported in *Appendix L* of the *Amendment Report* which includes an additional eight projects for consideration and assessment.
To include an assessment of the SISD compliance for the 2.5 second reaction time for the 100km/hr+10km/hr design speed which equates to a requirement for 300 metres of SISD in each direction.	SISD compliance check are included in Section 5.2.3 of this report.

TfNSW items	Responses
Include a turn warrant assessment applying the base case existing background traffic and assessing the worst case during the morning and afternoon peak at each intersection during peak of construction at each state classified road network that forms part of a construction route in Figure 5-2 of the EIS.	Turn warrant assessment forms part of *Chapter 4 – Existing environment* and *Chapter 5 – Construction assessment* of the TTIA reporting the intersection capacity in the respective scenario. Turn warrant assessment to include cumulative impact assessments will be reported in *Appendix L* of the *Amendment Report*.
Consider all the key intersections with the state classified road network (inclusive of the access gates).	Key intersections forming part of the construction route have been assessed using traffic data collected on-site.
Supported by intersection traffic counts for each intersection with the state classified road network that forms part of a construction route in Figure 5-2 of the EIS.	
Review the adequacy of the existing intersection treatments (where applicable) for the proposed design vehicle (heavy vehicle and OSOM) through swept path analysis.	OSOM assessments have been undertaken as part of the Port to REZ assessment, which is separate to this project. Upgrades identified in the assessments for OSOM movements are subject to a separate design process.
Include the strategic designs for key state classified road intersections that forms part of the construction route where the: — Design vehicle and throat of the existing intersection does not permit simultaneous passing of the design vehicle in and out of the intersections in all directions. — Where the design vehicle cannot turn wholly from the existing intersection treatments. — Where the capacity assessment warrants a further intersection upgrade to a higher order treatment (based on the worst-case scenario and outcome of the warrants assessment. — Where the SISD does not comply with the 300-metre requirement for the design speed — Strategic designs must be provided in the Submissions Report for any intersection with the state classified road network	The Merotherie Road upgrade includes an upgrade of the Merotherie Road / Golden Highway intersection. The design of this intersection will be provided to TfNSW during the detailed design stage of the project.
Include a swept path analysis for the design vehicle (largest vehicle) for each key intersection requiring infrastructure road upgrades. The swept path analysis is to identify that the largest vehicle can turn wholly within the proposed intersection treatments and turn simultaneously in all directions from the proposed treatments.	A swept path analysis for each key intersection will be undertaken in the detailed design stage.

3 Proposed amendments with potential traffic impact

This chapter discusses the proposed amendments and refinements which may have potential traffic and transport impacts during construction and operation of the project.

3.1 Orana Wind Farm Connection – Elong Elong

The amendment proposes an additional 330kV network infrastructure from the Elong Elong energy hub for the purpose of providing a connection to the proposed Orana Wind Farm project. As depicted in Figure 3-1, this includes a 330Kv transmission line which would run parallel to the 500kV transmission line alignment and switching station named E5.

In terms of traffic and transport impacts, the amendment would make use of the access road via Spring Ridge Road and Dapper Road, which are part of the existing construction route and are planned for future upgrades to ensure its suitability to provide access to the Elong Elong Energy Hub.

Energy Co has confirmed that the proposed works would not generate additional traffic movements during the peak periods which have been considered in the EIS. As such, the impact of the amendment is considered minor.

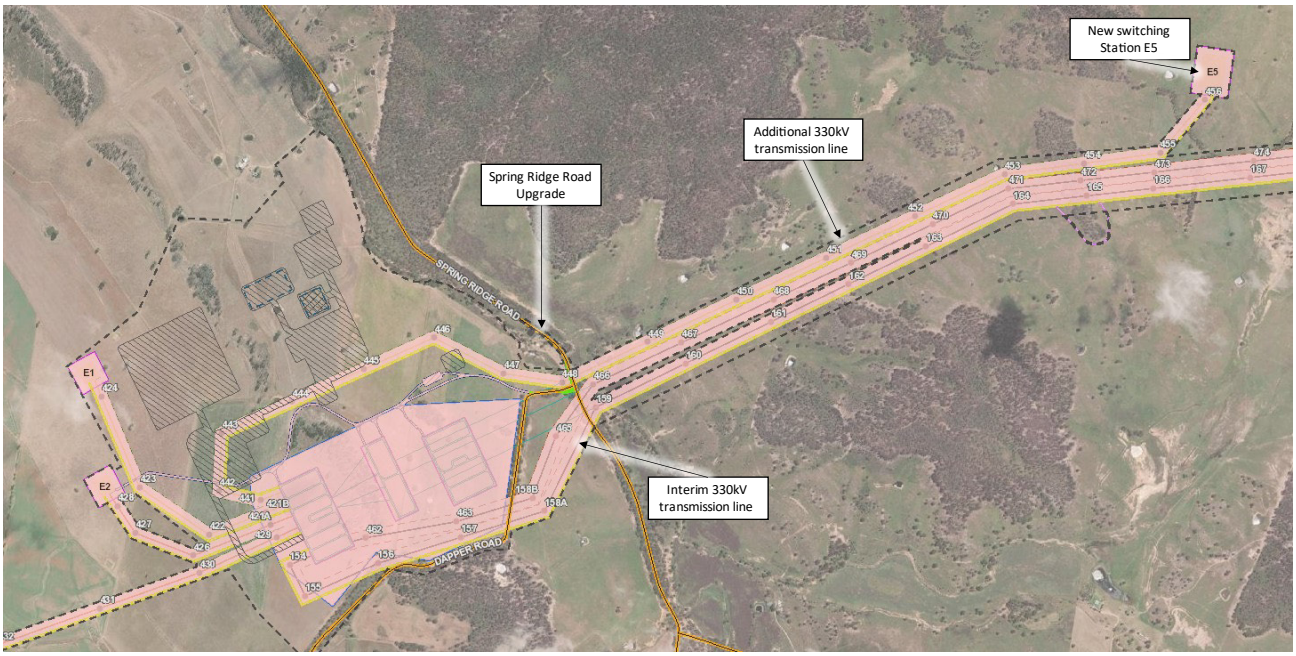


Figure 3-1 Orana Wind Farm Connection – Elong Elong

3.2 Orana Wind Farm Connection – Merotherie

The amendment proposes a relocation of the 330kV network infrastructure (transmission line and M7 switching station) from the Merotherie Energy Hub for connection to the proposed Orana Wind Farm project. The new location of the M7 switching station and revised 330kV alignment is depicted in Figure 3-2.

In terms of traffic and transport impacts, the amendment would maintain access via Spir Road and Tucklan Road, which are part of existing construction route to provide access track to the transmission lines. Both roads are unsealed roads, which will be maintained to a safe standard during and post construction.

Energy Co has confirmed that the proposed works would not generate additional traffic movements during the peak periods which have been considered in the EIS. As such, the impact of the amendment is considered minor.

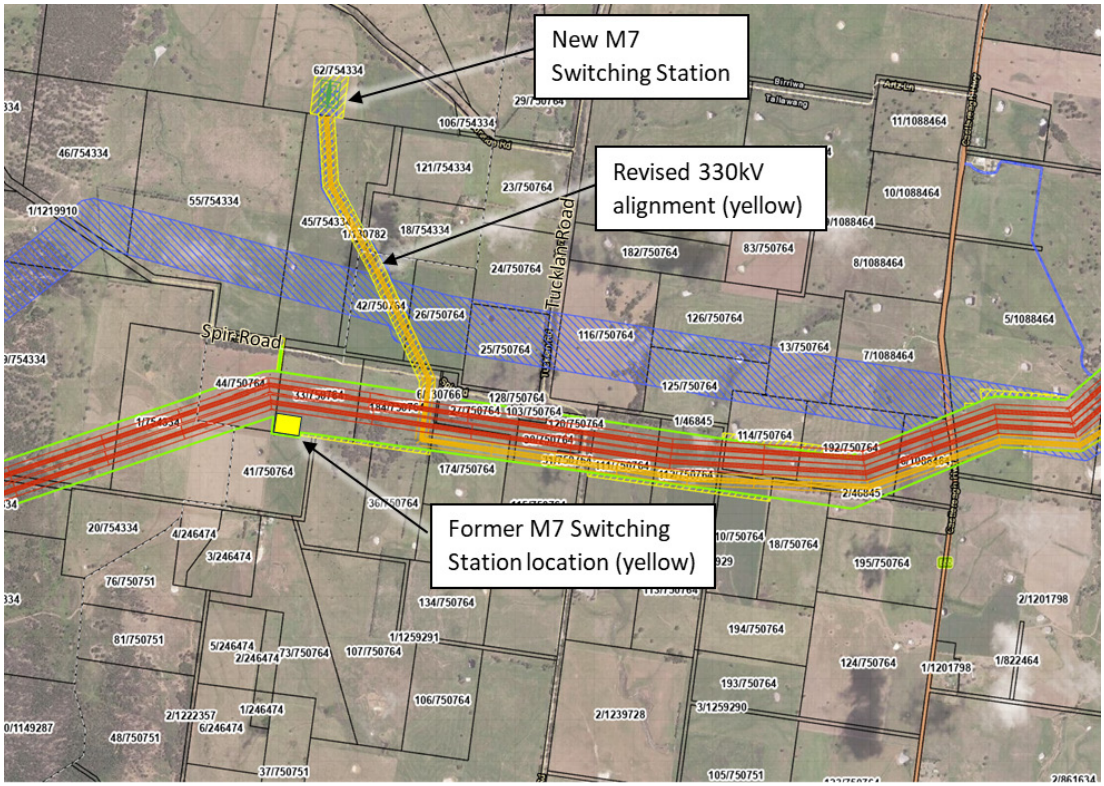


Figure 3-2 Orana Wind Farm Connection – Merotherie

3.3 Merotherie Road Upgrade

This amendment includes a local road upgrade of Merotherie Road, including the construction of a new bridge immediately to the south-east of the existing crossing as depicted in Figure 3-3.

In terms of traffic and transport impacts, construction traffic movements generated by the upgrade have been considered and assessed as part of the EIS. EnergyCo has confirmed that the proposed works would not generate additional traffic movements during the peak periods. As such, the amendment to include this work under the CSSI does not have any further impact than what has been considered in the EIS.

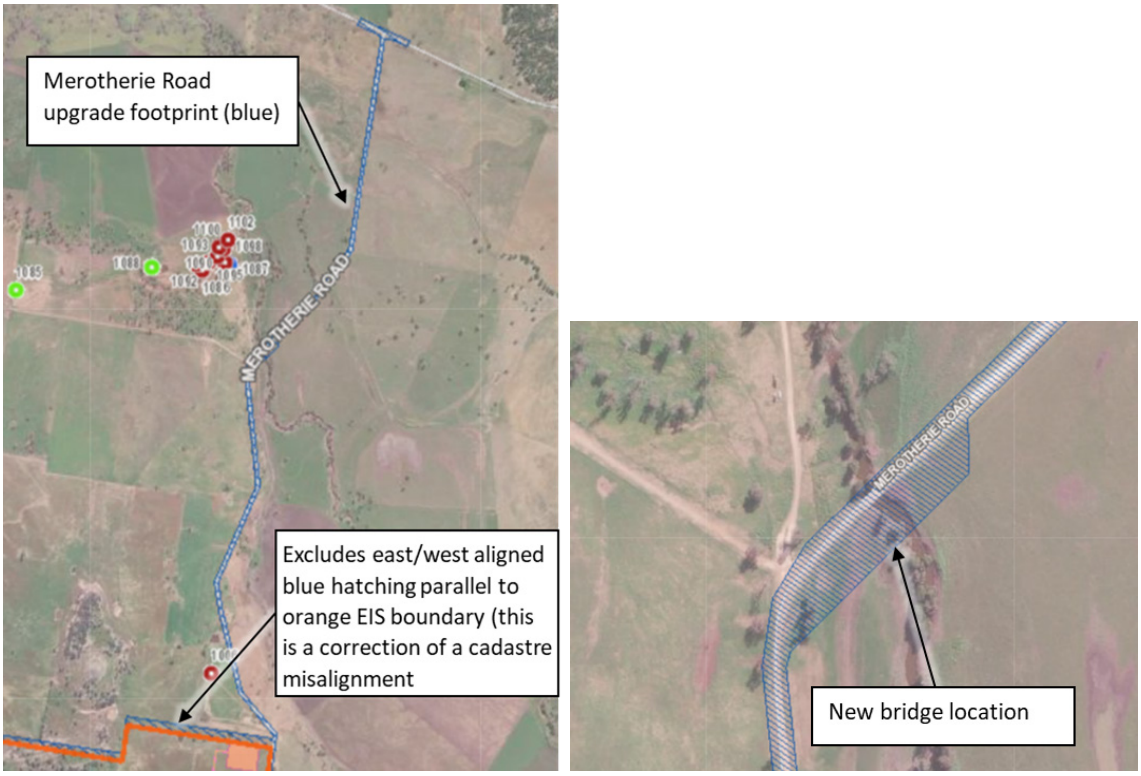


Figure 3-3 Merotherie Road Upgrade footprint

3.4 Spring Ridge Road Upgrade

This amendment includes a local road upgrade of Spring Ridge Road as depicted in Figure 3-4. This includes an upgrade of a short section of Spring Ridge Road north of Dapper Road.

In terms of traffic and transport impacts, construction traffic movements generated by the upgrade have been considered and assessed as part of the EIS. EnergyCo has confirmed that the proposed works would not generate additional traffic movements during the peak periods. As such, the amendment to include this work under the CSSI does not have any further impact than what has been considered in the EIS.

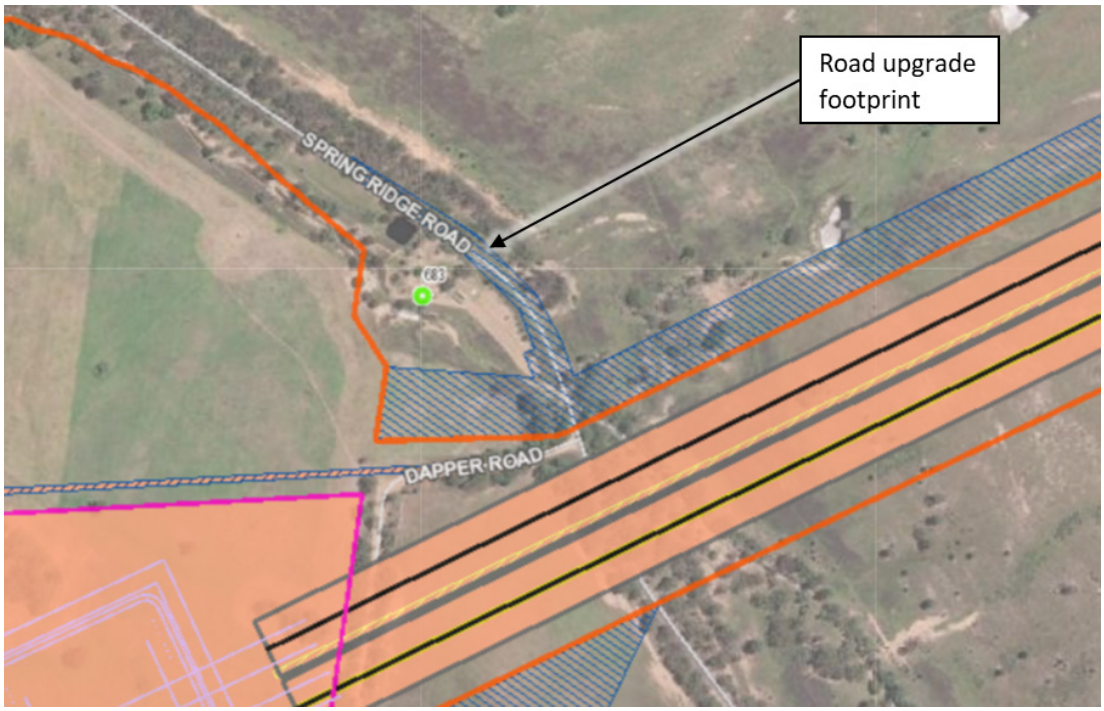


Figure 3-4 Spring Ridge Road Upgrade footprint

3.5 Additional or modified access tracks

3.5.1 Modified access track west of M8 Switching Station

The amendment includes a modification of the access track east of Whistons Lane, Tallawang to access the M8 switching station as depicted in Figure 3-5. The revised alignment reduces the use of the existing property access driveway previously nominated.

In terms of traffic and transport impacts, this change would not generate additional traffic movements and it would maintain the use of Whistons Lane/ Castlereagh Highway to access M8 switching station which are part of the existing construction route.

The proposed modification does not have any material impact to the traffic and transport network.

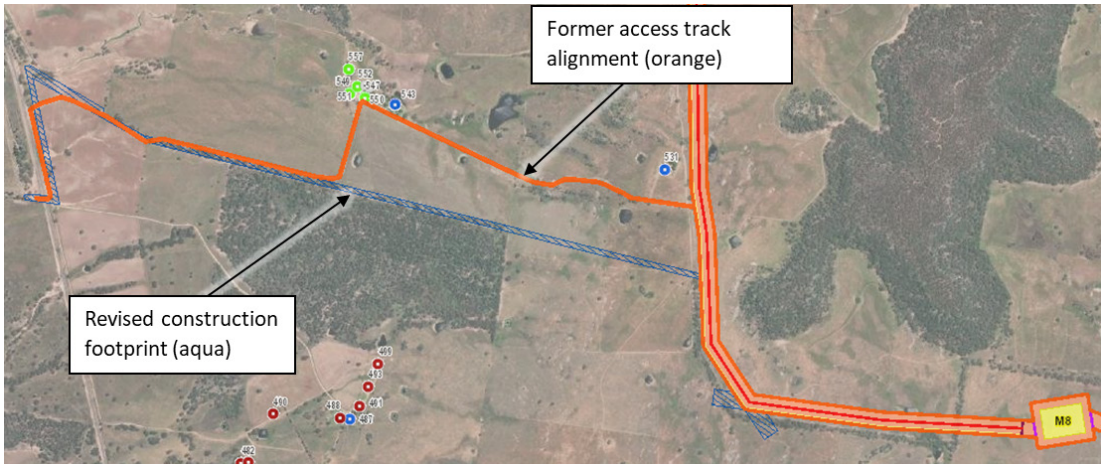


Figure 3-5 Modification of access track to M8 switching station

3.5.2 *Additional access track off Highett Road*

The amendment includes the use of an existing access track off Highett Road, Cope as depicted in Figure 3-6. The new track would be on an established unsealed access road of the existing single circuit transmission line at this location.

In terms of traffic and transport impacts, this change would not generate additional traffic movements and it would maintain the use of Highett Road/ Cope Road as an access point to the transmission line construction area.

Therefore, the proposed modification does not have any material impact to the traffic and transport network.

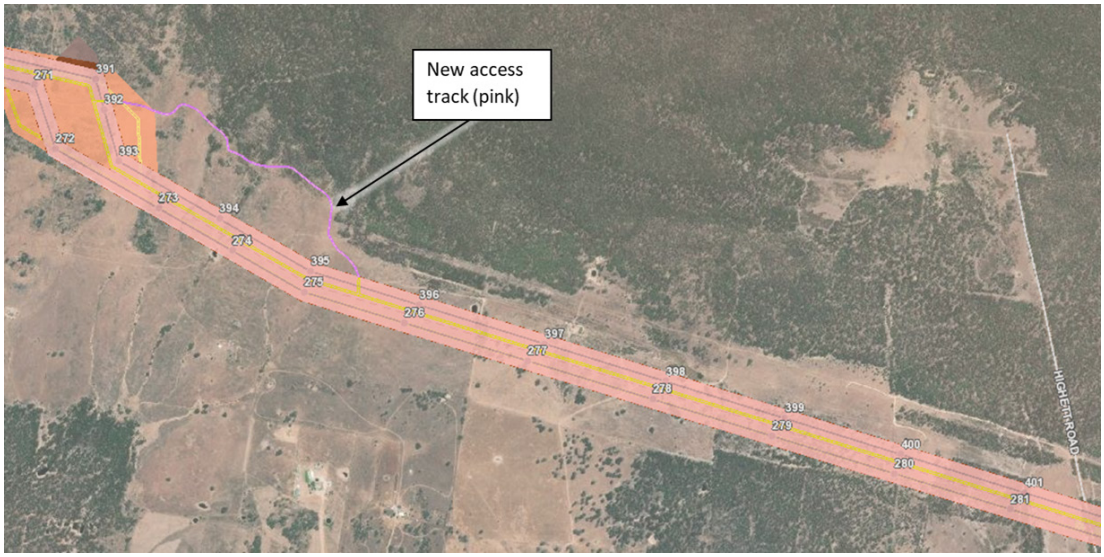


Figure 3-6 Modification of access track off Highett Road

3.5.3 *Additional access track west of Cope town centre*

The amendment includes the use of an existing access track off Cope Road, Cope as depicted in Figure 3-7. The new track would be on an established unsealed access road of the existing single circuit transmission line at this location.

In terms of traffic and transport impacts, this change would not generate additional traffic movements and it would maintain the use of Cope Road as an access point to the transmission line construction area.

Therefore, the proposed modification does not have any material impact to the traffic and transport network.

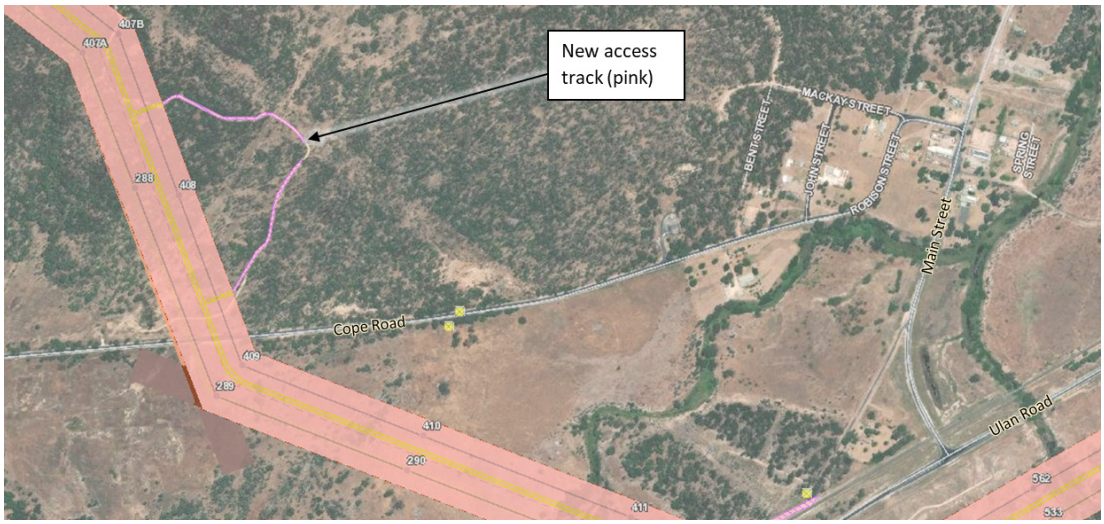


Figure 3-7 New access track off Cope Road, west of Cope town centre

3.5.4 Additional access track from Main Street (Cope)

The amendment includes a new access track off Main Street, Cope to access the alignment north-west of Ulan Road as depicted in Figure 3-8. The new track would be on an existing clearing to connect to a sealed access road off Main Street.

In terms of traffic and transport impacts, this change would not generate additional traffic movements and it would maintain the use of Main Street as an access point to the transmission line construction area.

Therefore, the proposed modification does not have any material impact to the traffic and transport network.

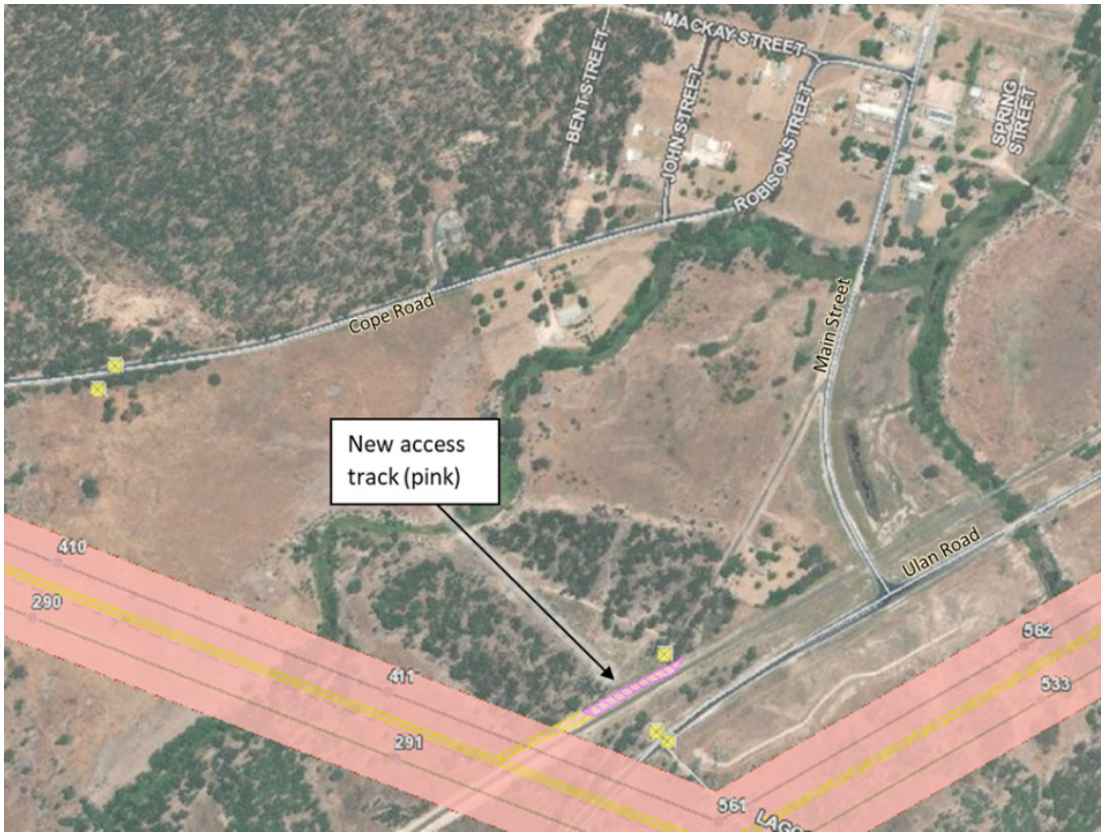


Figure 3-8 Additional access track from Main Street, Cope

3.5.5 Additional access track off Ulan-Wollar Road to 500 kV corridor

The amendment includes the use of an existing access track off Ulan-Wollar Road, Ulan to access the 500kV corridor, as depicted in Figure 3-9. This is in addition to the original location of the access track further east of the alignment. The new track would be on an established unsealed access track which has a passive rail crossing (stop sign) across the railway line as shown in Figure 3-10.

In terms of traffic and transport impacts, this change would not generate additional traffic movements and it would maintain the use of Ulan-Wollar Road as an access point to the transmission line construction area.

Coordination with the rail line operator (ARTC) would be required to ensure the rail crossing is suitable for construction vehicle access. The site entry will be managed through traffic control during construction.

Therefore, the proposed modification does not have any material impact to the traffic and transport network.

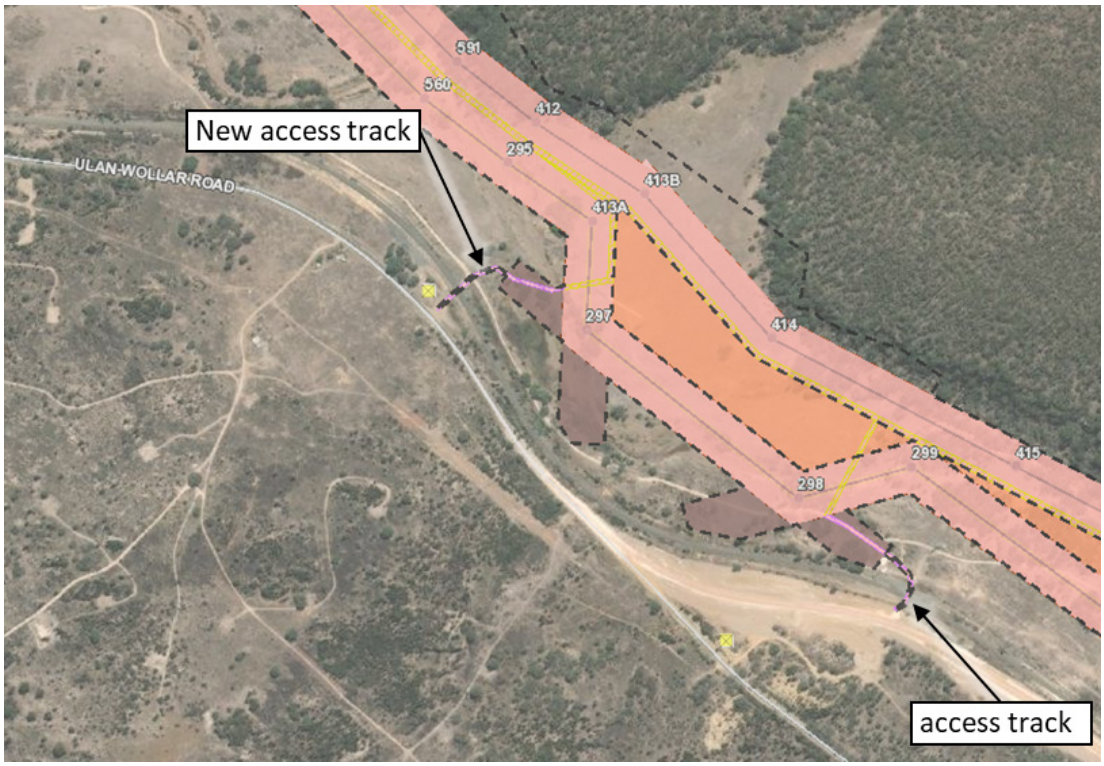


Figure 3-9 Additional access track off Ulan-Wollar Road to 500kV corridor

Figure 3-10 Existing passive control rail crossing (Google Street View, August 2023)

3.5.6 *Additional access track east of Ulan Mine*

The amendment includes the use of an existing access track off Ulan-Wollar Road, Ulan to access the 500kV corridor, tower 586, 584, 583, 553 and surrounds as depicted in Figure 3-11. The track would be on an established unsealed access track and would cross the railway line at an existing passive rail crossing (stop sign) across the railway line as shown in Figure 3-12.

In terms of traffic and transport impacts, this change would not generate additional traffic movements and it would maintain the use of Ulan-Wollar Road as an access point to the transmission line construction area.

Coordination with the rail line operator (ARTC) would be required to ensure the rail crossing is suitable for construction vehicle access. The site entry would be managed through traffic control during construction.

Therefore, the proposed modification does not have any material impact to the traffic and transport network.

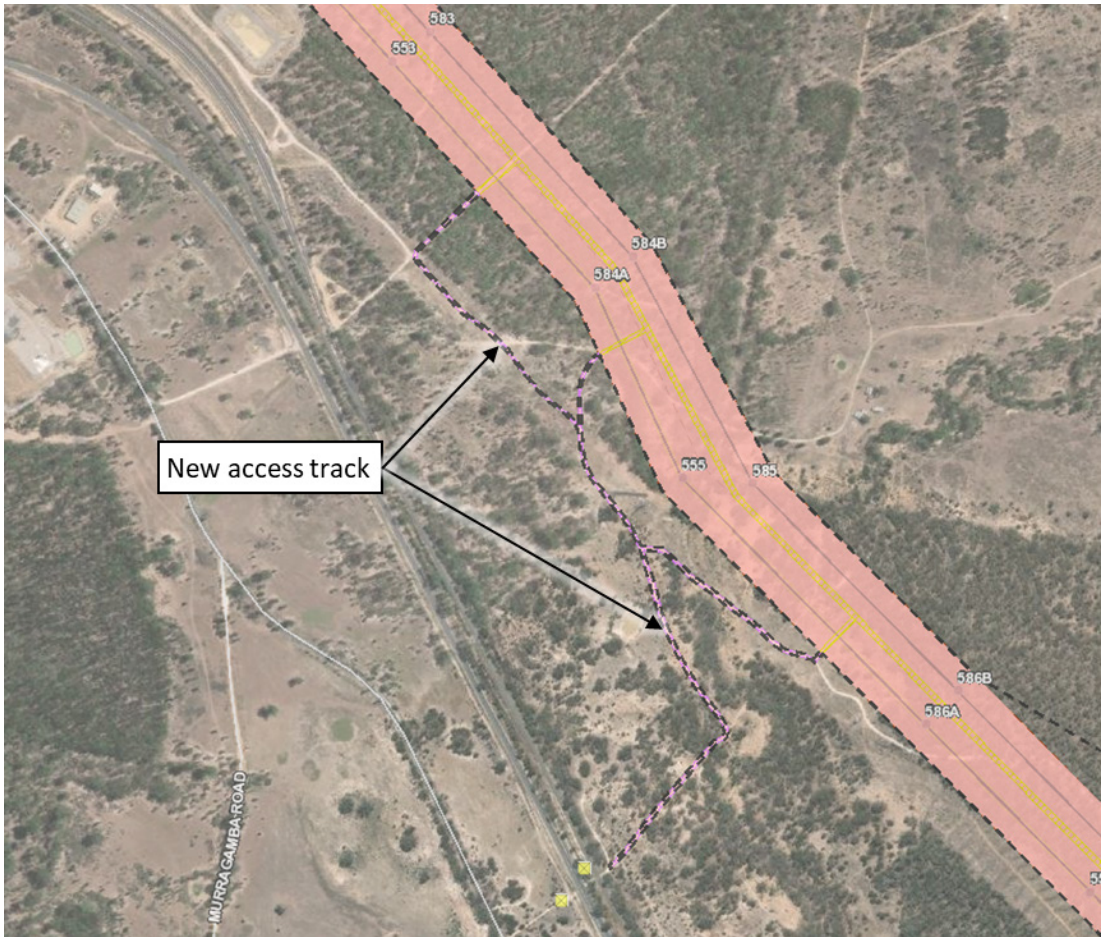


Figure 3-11 Additional access track east of Ulan Mine

Figure 3-12 Existing passive control rail crossing to Tower 555 (Google Street View, August 2023)

3.5.7 *Additional access track immediately north-east of Wilpinjong Mine*

The amendment includes the use of an existing access track off Ulan-Wollar Road, Wilpinjong to access the 500kV corridor south of Ulan-Wollar Road, as depicted in Figure 3-13. The track would be on an established track adjacent to the railway corridor which intersects at Ulan-Wollar Road, south of the existing passive rail crossing (stop sign) as shown in Figure 3-14.

In terms of traffic and transport impacts, this change would not generate additional traffic movements and it would maintain the use of Ulan-Wollar Road as an access point to the transmission line construction area.

Therefore, the proposed modification does not have any material impact to the traffic and transport network.

Figure 3-13 Additional access track north-east of Wilpinjong Mine

Figure 3-14 Existing access track intersection with Ulan-Wollar Road (Nearmap, May 2015)

3.5.8 Additional access track and new access route via Upper Cumbo Road

The proposed addition of an access track via Upper Cumbo Road would require construction trips to travel on Upper Cumbo Road from its intersection with Wollar Road.

Wollar Road (between the transmission line alignment and Wollar town) have been identified as a construction route with an upper-threshold traffic movement of up to 50 vehicle movements per hour which is rounded up from 32 vehicle trips per hour required to service the transmission line access gate.

Upper Cumbo Road is currently a gated unsealed local road as depicted in Figure 3-16. Given that access is currently restricted, this road is not regularly travelled and not likely to have significant traffic generation. To safely manage construction vehicle access, traffic management and two-way radio are to be used during construction to enable communications between work personnel. Access to Upper Cumbo Road is to be restricted to the public during construction, as per the existing condition.

Overall, the addition of Upper Cumbo Road as a construction route to access the transmission line construction site would have no material impact to the road network.

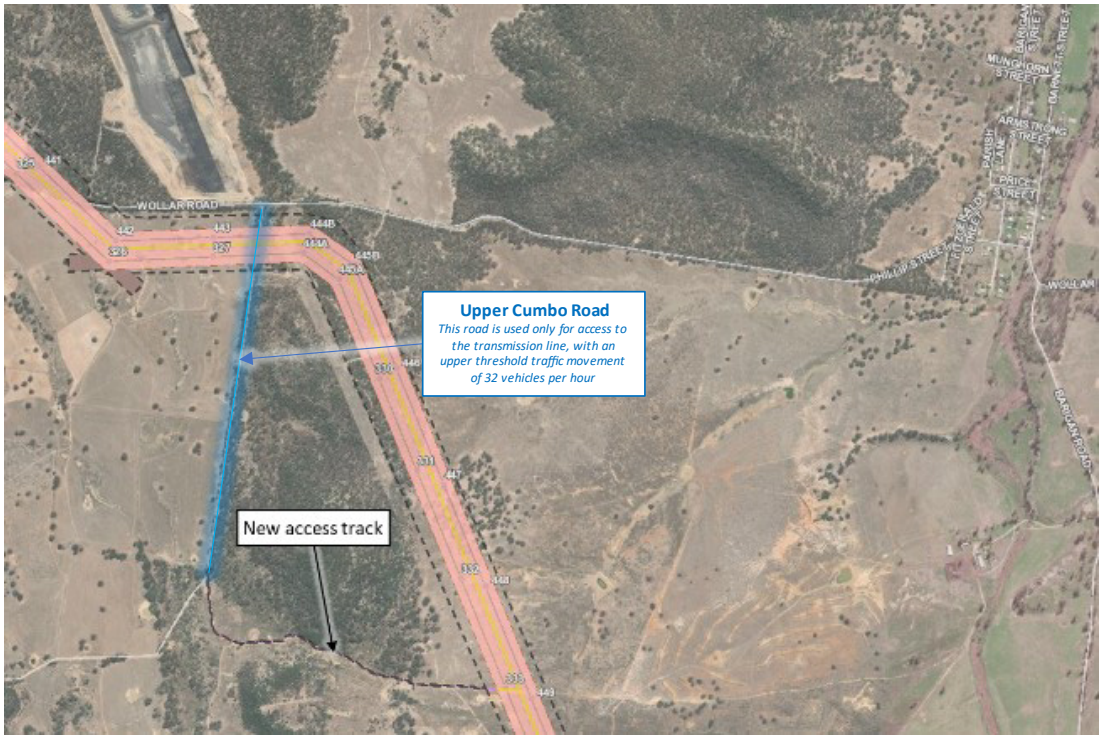


Figure 3-15 Additional access track and new access route via Upper Cumbo Road

Figure 3-16 Gated Upper Cumbo Road viewed from Wollar Road (Google Street View, August 2023)

3.5.9 *Additional access track and new access route off Ulan-Wollar Road via Wilpinjong Mine*

The amendment includes the use of an existing access track off Ulan-Wollar Road, Ulan to access the 500kV corridor, as depicted in Figure 3-17. The new route would be on an established unsealed access track which has a passive rail crossing (stop sign) across the railway line, as shown in Figure 3-18.

In terms of traffic and transport impacts, this change would not generate additional traffic movements and it would maintain the use of Ulan-Wollar Road as an access point to the transmission line construction area.

Coordination with the rail line operator (ARTC) would be required to ensure the rail crossing is suitable for construction vehicle access. The site entry will be managed through traffic control during construction.

Therefore, the proposed modification does not have any material impact to the traffic and transport network.

Figure 3-17 Extension of access track and route off Ulan-Wollar Road via Wilpinjong Mine

Figure 3-18 Existing passive control rail crossing (Google Street View, August 2023)

3.6 Microwave repeater sites

3.6.1 Botobolar

Construction works at his location would involve the installation of new microwave communications tower approximately 16 metres in height. The site is located off Botobolar Road east of MacArthur Park Road as depicted in Figure 3-19. It is noted that the site has an existing communications tower operated by the NSW Telco Authority. The installation of the microwave repeater tower is isolated from the remainder of transmission line construction activities.

The most direct route from the nearest camp and compound (Neeleys Lane) to the Botobolar microwave repeater site can be achieved via Ulan Road, Wollar Road and Botobolar Road, with an estimated travel time of one hour.

Both Ulan Road and Wollar Road are sealed, and line marked two-way two-lane roads. According to the Transport for NSW's Speed Zone data, both roads have a posted speed limit of 100 km/h.

Botobolar Road, between Wollar Road and the microwave repeater site, is approximately 17 km long which are partially sealed with minimal signs and linemarking. According to Transport for NSW's Speed Zone data, it has a posted speed limit of 100 km/h.

It is envisaged that up to 20 vehicles per day (40 movements daily) and approximately 2 vehicles during a peak hour would be needed to construct the tower. These movements would be spread out across the day based on the needs of the proposed construction. The installation is anticipated to take around 6 months to complete, which will be confirmed in the detailed design phase.

In terms of traffic and transport impact, the limited number of vehicles required for the construction would not be likely to result in adverse impact to road capacity.

For safety considerations, construction vehicles are to follow the NSW road rules at all times and to travel at a speed suitable to the road conditions.

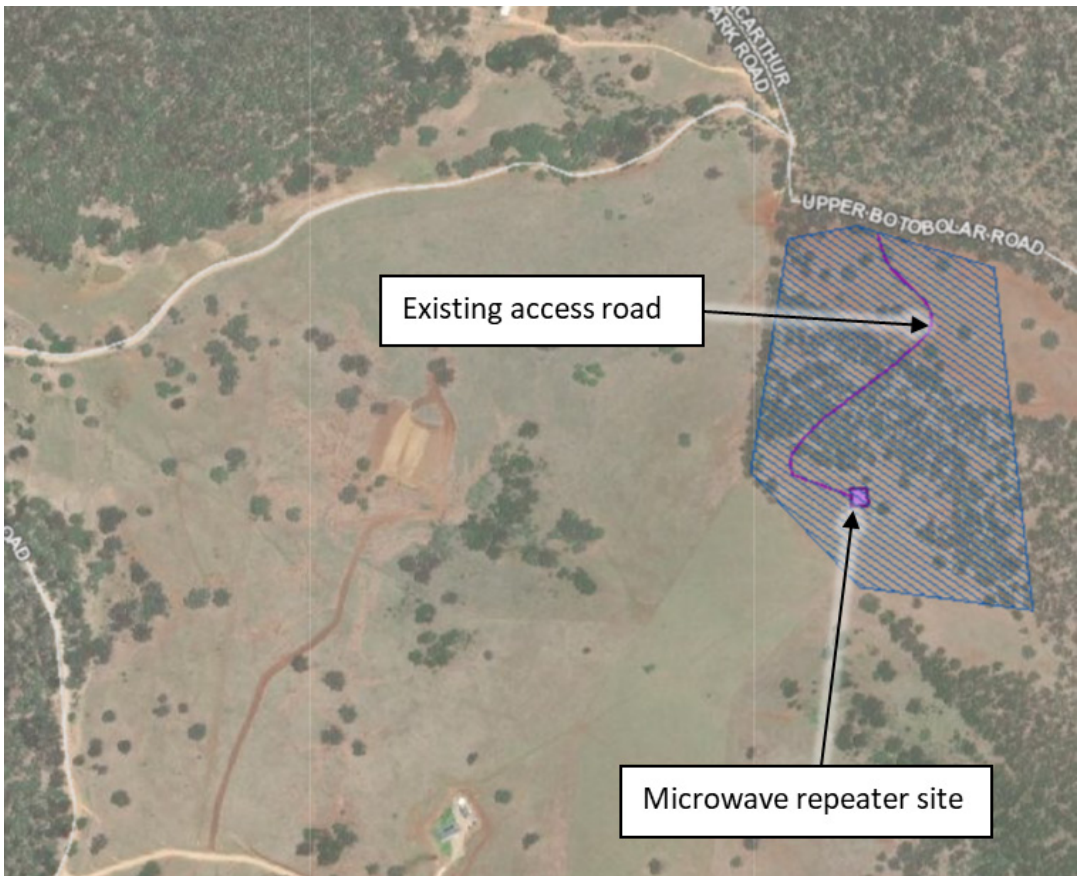


Figure 3-19 Botobolar Road microwave repeater site

3.6.2 Magpie Hill

Construction works at his location would include the installation of additional communications infrastructure (sending and receiving dishes) to the existing tower at Magpie Hill. The Magpie Hill site is located approximately 4.2 kilometres to the east of Castlereagh Highway as depicted in Figure 3-20 and is currently operated by the NSW Telco Authority. The installation of the additional communications infrastructure is isolated from the remainder of transmission line construction activities.

The most direct route from the nearest camp and compound (Neeleys Lane) to the Magpie Hill microwave repeater site can be achieved via Ulan Road (sealed road with posted speed limit of 100 km/h), Cope Road (sealed road with posted speed limit of 100 km/h), Castlereagh Highway (sealed road with posted speed limit of 100 km/h) and an unsealed existing access track (of approximately 5 kilometres in length) can be used to reach the site. The route would also pass through the town of Gulgong, which will have urban roads with a speed limit of 50 km/h. This has a total estimated travel time of one hour.

It is envisaged that up to 20 vehicles per day (40 movements daily) would be needed to for the installation of additional communication infrastructure. These movements would be spread out across the day based on the needs of the proposed construction activity. The installation is anticipated to take around 3 months to complete, though this would be confirmed in the detailed design phase.

In terms of traffic and transport impact, the limited number of vehicles required for the construction would not be likely to result in adverse impact to road capacity.

For safety considerations, construction vehicles are to follow the NSW road rules at all times and to travel at a speed suitable to the road conditions.

Figure 3-20 Magpie Hill microwave repeater site

3.6.3 Cope

Construction works at his location comprise the installation of new microwave communications tower of approximately 16 metres in height. The site is located off approximately 1.6 kilometres to the east of Blue Springs Road. The installation of the microwave repeater tower is almost entirely within the construction footprint of the project. As such, it is proposed to use access points which are already proposed for the project.

It is anticipated that works on the microwave tower would be completed in around 3 to 6 months.

Construction would be likely to occur outside of the peak construction stage of the project, and It is envisaged that up to 20 vehicles per day (40 movements daily) would be needed to for the installation of additional communication infrastructure. This would not exceed the number of movements anticipated during peak construction, and hence not result in any additional impact to road capacity.

3.6.4 Baldy Peak

Construction works at his location comprise the installation of additional communications infrastructure (sending and receiving dishes) to the existing tower at Baldy Peak. The Baldy Peak site is located approximately 2.3 kilometres to the southeast of the town of Kandos as depicted in Figure 3-21 and is currently operated by the NSW Telco Authority. The installation of the additional communications infrastructure is isolated from the remainder of transmission line construction activities.

The most direct route from the nearest camp and compound (Neeleys Lane) to the Baldy Peak microwave repeater site is approximately 140 kilometres. It can be achieved via Ulan Road (sealed road with posted speed limit of 100 km/h), Lue Road (sealed road with posted speed limit of 100 km/h), Bylong Valley Way (sealed road with posted speed limit of 100 km/h) and Cooper Drive (sealed road with posted speed limit of 80 km/h) to Charbon. Then from Charbon, the sealed roads of Cement Avenue, Charbon Road and an unsealed existing access track can be used to reach the site. This has a total estimated travel time of two hours.

It is envisaged that up to 20 vehicles per day (40 movements daily) would be needed to for the installation of additional communication infrastructure. These movements would be spread out across the day based on the needs of the proposed construction activity. The installation is anticipated to take around 3 months to complete, though this would be confirmed during the detailed design stage.

In terms of traffic and transport impact, the limited number of vehicles required for the construction would not be likely to result in adverse impact to road capacity.

For safety considerations, construction vehicles are to follow the NSW road rules at all times and to travel at a speed suitable to the road conditions.

Figure 3-21 Baldy Park microwave repeater site

3.7 Neeleys Lane Accommodation Camp change of use

This modification proposes additional uses to be included at Neeleys Lane accommodation camp to include the addition of a construction compound, resulting in an increase in traffic movements to and from the site.

This change would improve access to the eastern section of the construction area, including the switching station east of the study area (New Wollar, M1-M3) and transmission line construction off Ulan Road, Ulan-Wollar Road, and Cope Road. However, not necessarily alter the construction traffic demand estimated along the nominated construction routes in the study area. This is because workers and construction vehicles that would otherwise travel from the main camp (Merotherie) site, would have to travel via the same route to reach the eastern section of the construction area.

This would, however, change the number of vehicles entering and exiting Neeleys Lane from Ulan Road.

Neeleys Lane camp was previously forecasted to generate 32 light vehicle and 24 heavy vehicle movements hourly (56 combined) in both the AM and PM peak periods. As depicted in Figure 3-22, the introduction of a compound would maintain the previous forecast in the AM peak, however increase the traffic generation in the PM peak to 32 light and 34 heavy vehicle movements (66 combined vehicle movements per hour) an increase of 10 combined vehicle movements per hour.

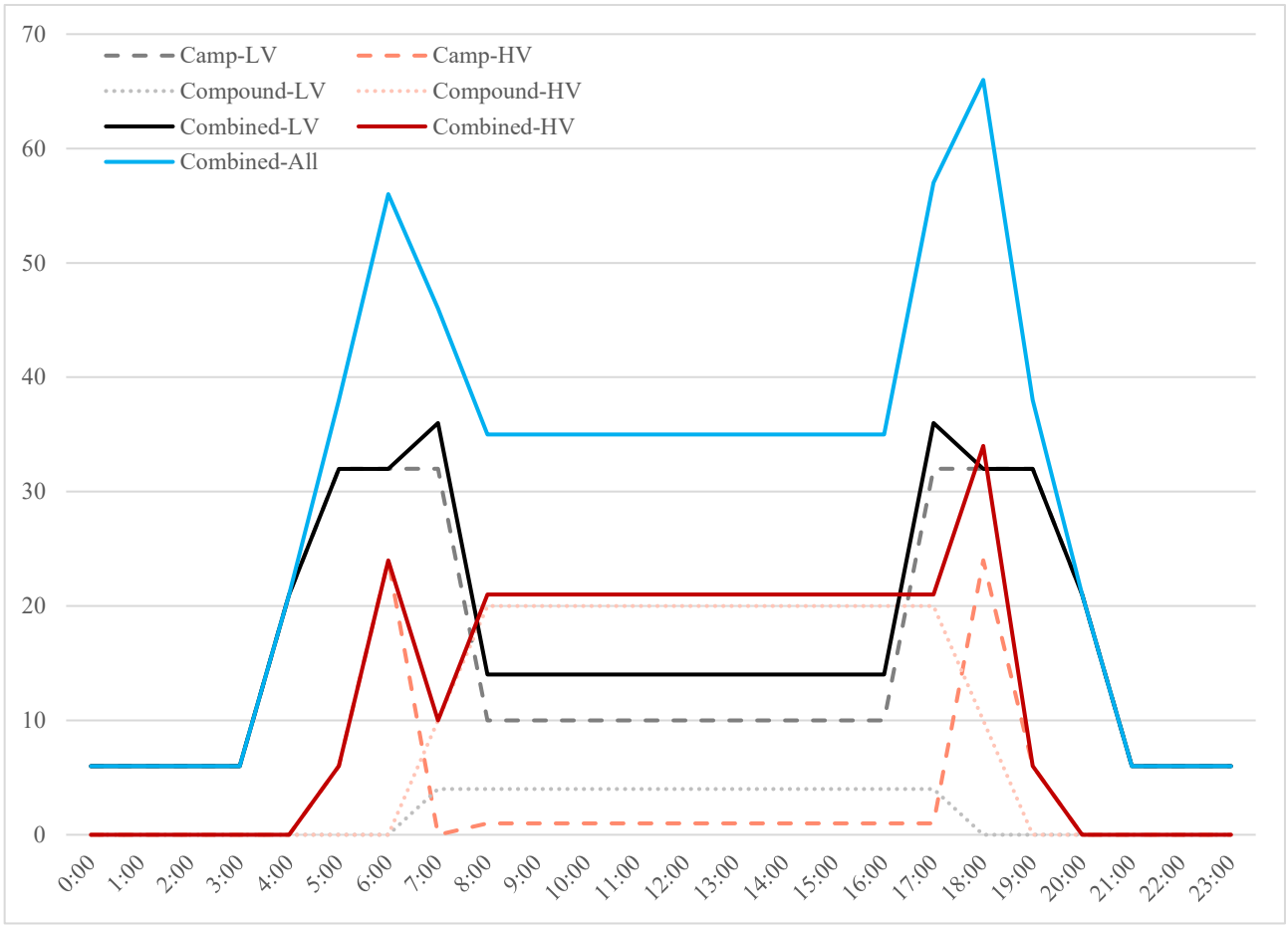


Figure 3-22 Traffic generation Neeleys Lane camp and site compound

The turning warrant assessment at the intersection of Neeleys Lane and Ulan Road would be reassessed with the revised trip generation in the PM peak.

4 Updated existing conditions analysis

4.1 Updated intersection counts

This chapter captures the key intersection layout, volumes and warrant assessment against Austroads' turn treatment warrant for the two newly assessed intersections within the construction haulage routes. The warrant assessment is used to understand if the current intersection layouts are currently suitable to provide safe operations to accommodate the existing peak hour demand at the intersection.

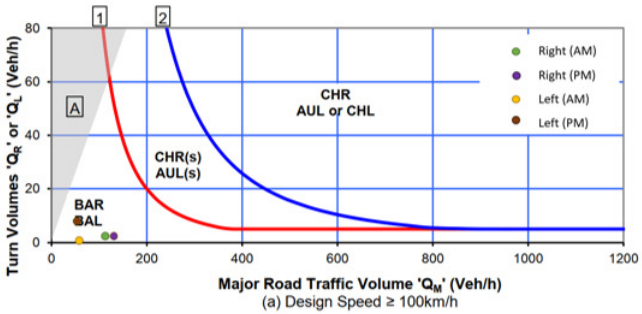
Cassilis Road / Golden Highway intersection is T-intersection with priority given to the Golden Highway in the east-west direction.

Both Cassilis Road and Golden Highway are sealed, and line marked.

The speed limit of both roads is 100 km/h. On the Golden Highway, only a right turn treatment into Cassilis Road is provided via a Channelised Right-turn (CHR) treatments.

Based on the count survey data collected at the intersection, there was minimal traffic entering/exiting Cassilis Road, with a maximum of 6 left-turn movements and 0 right-turn movements occurring during the PM peak.

As such, the demand requires the intersection to have a basic left and basic right turn layout. The intersection layout is therefore considered sufficient for its existing demand.



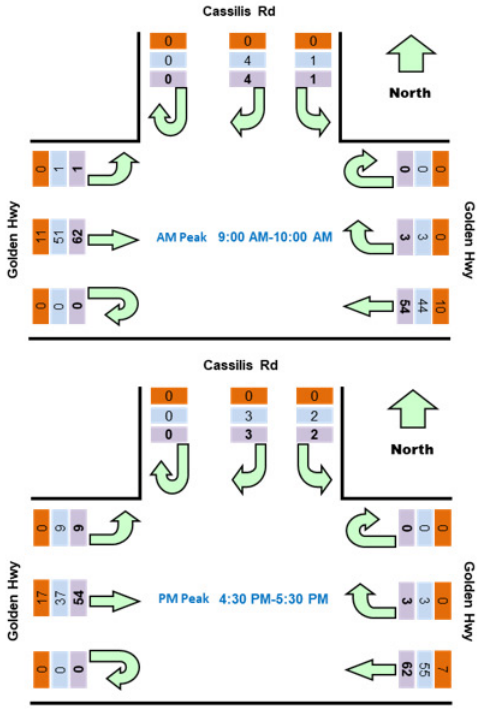


Figure 4-1 Cassilis Road/Golden Highway – layout, volumes and turn treatment assessment

Castlereagh Highway/Golden Highway intersection is T-intersection with priority given to the Golden Highway in the east-west direction.

Both Castlereagh Highway and Golden Highway is sealed, and line marked.

The speed limit of both roads is 100 km/h. On the Golden Highway, left and right turn treatments into Castlereagh Highway are provided through a Channelised Right-turn (CHR) treatment and Auxiliary Left-turn treatment (AUL)

Based on the count survey data collected at the intersection, there was low traffic entering/exiting Castlereagh Highway with up to 25 vehicles turning left-in and 19 vehicles turning right-in.

As such, the demand requires the intersection to have a basic left and basic right turn layout. The intersection layout is considered sufficient for its existing demand.

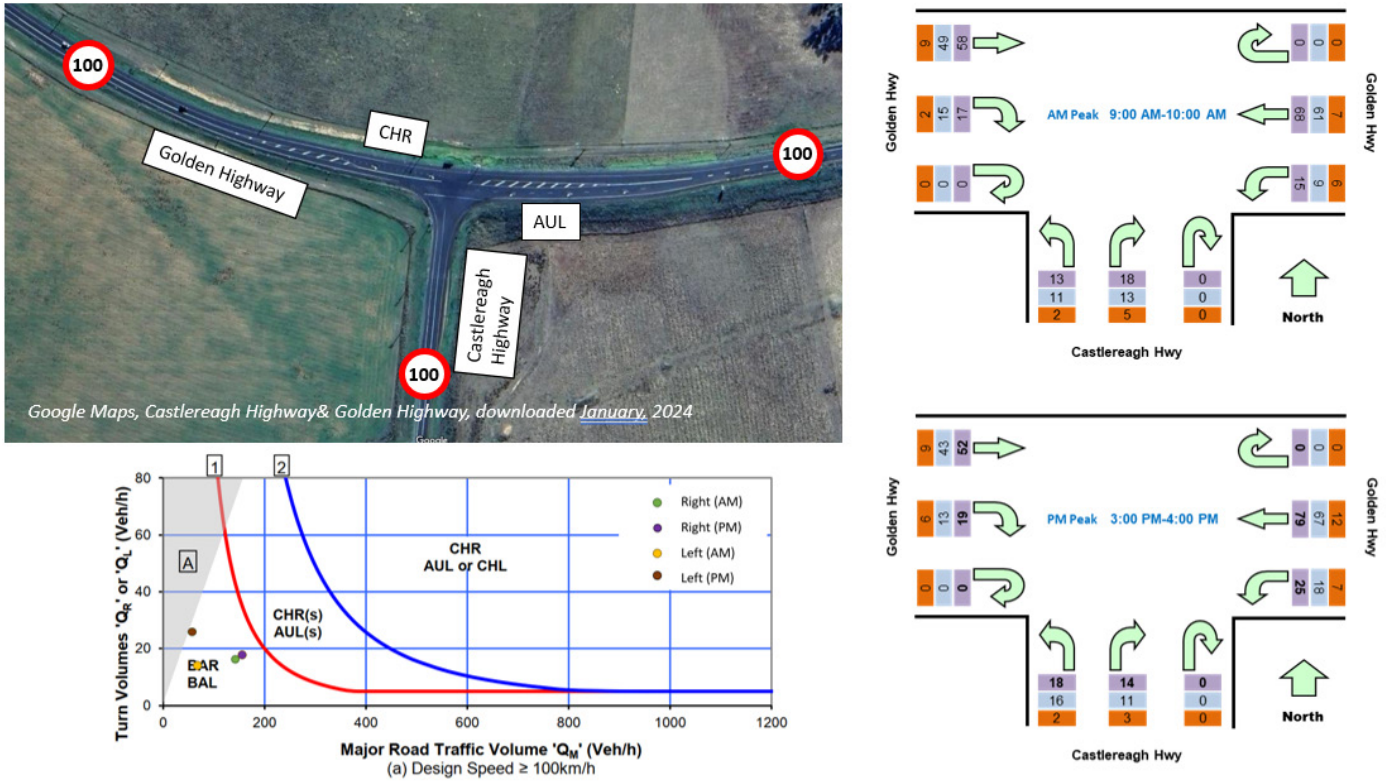


Figure 4-2 Castlereagh Highway/Golden Highway – layout, volumes and turn treatment assessment

4.2 Crash data update

Crash data has been updated and sourced from NSW Crash Data accessible from Transport for NSW's Open Data platform. The 5-year crash data for this assessment has been updated to include data from 2018 to 2022.

Crash data was grouped by NSW Road Classifications which include Highway (Golden Highway and Castlereagh Highway), Main Road (Cope Road and Ulan Road), Regional (Wollar Road) and Local roads given the large study area extents and importance/heavy usage of these roads by the public.

There was a total of 64 crashes, between 2018 and 2022, along the proposed construction routes that are proposed to be used for construction vehicles.

Figure 4-3 shows the recorded crashes along the proposed construction routes within the study area, where the crashes were recorded for the 5-year period between 2018 to 2022.

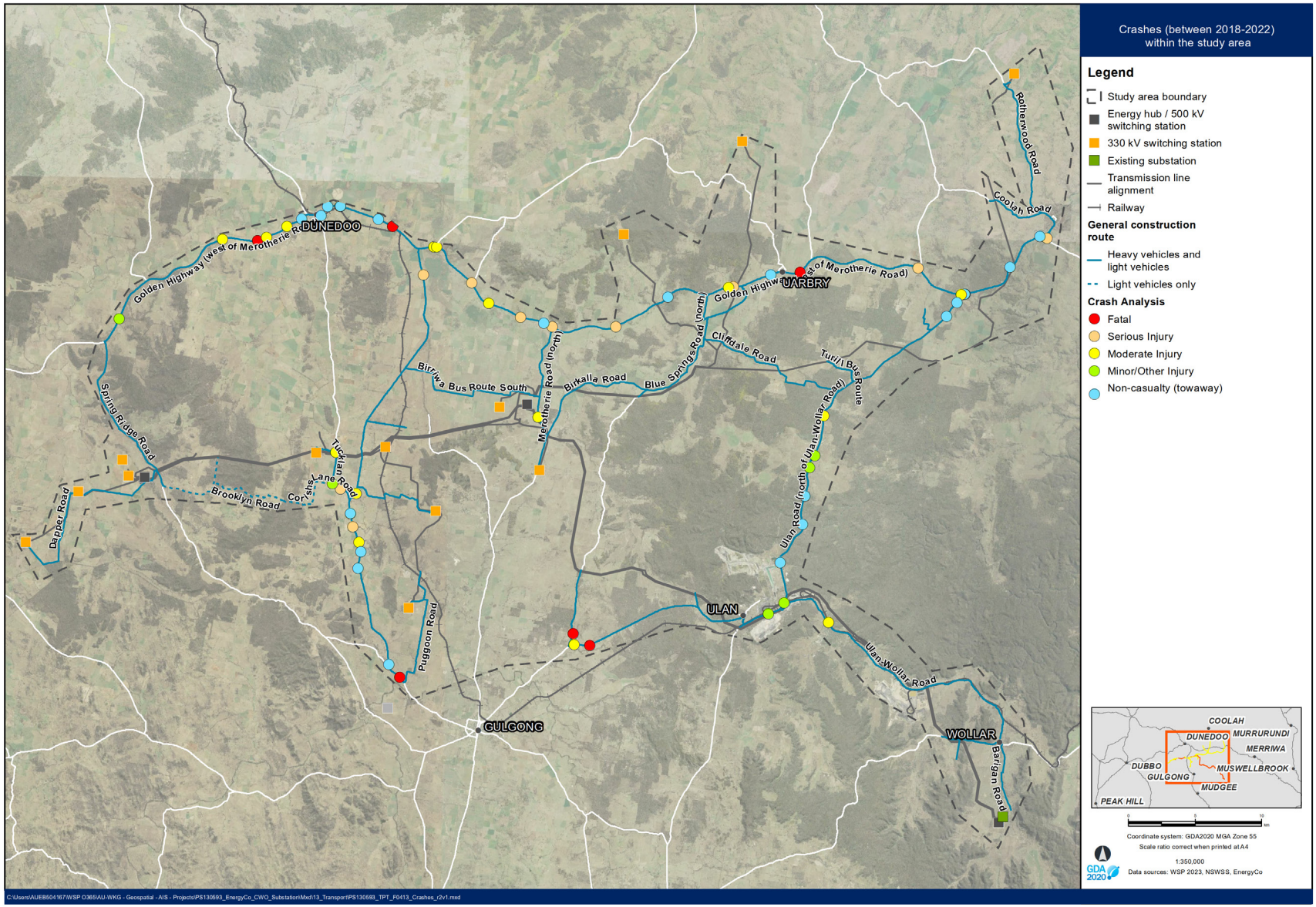


Figure 4-3 Crashes along the proposed construction routes within the study area (updated for crash data between 2018 – 2022)

Table 4-1and Table 4-2 show the crashes which occurred in the study area on Golden Highway and Castlereagh Highway respectively of the proposed construction routes.

Golden Highway recorded 36 crashes with 11 crashes (31 per cent) classified as Fatal and Serious Injury (FSI) crashes, with the majority having occurred mid-block (78 per cent). The most common crash types recorded were off-path. In high-speed environment, these types of crashes tend to result in fatality and serious injury.

Table 4-1 Crash summary along the proposed Golden Highway construction route by degree of severity and location

Severity	Total	Pedestrian	Intersection	Head-on	Rear-ends	U-turn/ Parking	Overtaking	On-path	Off-path on straight	Off-path on curve	Others
Fatal	3	0	0	1	1	0	0	0	0	1	0
Serious injury	8	0	0	2	1	0	0	0	2	3	0
Moderate injury	10	0	2	1	0	0	0	2	2	3	0
Minor injury/other injury	1	0	0	0	0	0	1	0	0	0	0
No casualty	14	0	0	0	0	0	0	2	3	8	1
Total	**36**	**0**	**2**	**4**	**2**	**0**	**1**	**4**	**7**	**15**	**1**

Castlereagh Highway recorded 10 crashes with 3 crashes (30 per cent) classified as FSI crashes, with most of the crashes recorded mid-block. All the crashes were off-path.

Table 4-2 Crash summary along the proposed Castlereagh Highway construction route by degree of severity and location

Severity	Total	Pedestrian	Intersection	Head-on	Rear-ends	U-turn/ Parking	Overtaking	On-path	Off-path on straight	Off-path on curve	Others
Fatal	1	0	0	0	0	0	0	0	1	0	0
Serious injury	2	0	0	0	0	0	0	0	1	1	0
Moderate injury	3	0	0	0	0	0	0	0	2	1	0
Minor injury/other injury	0	0	0	0	0	0	0	0	0	0	0
No casualty	4	0	0	0	0	0	0	0	3	1	0
Total	**10**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**7**	**3**	**0**

Table 4-3 and Table 4-4 show the crashes upon Cope Road and Ulan Road (main roads) along the proposed construction routes.

Cope Road recorded 2 crashes with 1 of them being classified as FSI crashes. These crashes recorded were associated with run-off crashes.

Ulan Road recorded 10 crashes with no FSI crashes. The most common type of crashes recorded were associated with run-off crashes and loss of control on-path.

Main roads along the proposed construction routes have comparatively much lower proportions of FSI crashes when compared to the highway road network. The majority of crashes on the main roads occurred at mid-block locations (83 per cent).

Table 4-3 Crash summary along the proposed Cope Road construction route by degree of severity and location

Severity	Total	Pedestrian	Intersection	Head-on	Rear-ends	U-turn/ Parking	Overtaking	On-path	Off-path on straight	Off-path on curve	Others
Fatal	1	0	0	0	0	0	0	0	1	0	0
Serious injury	0	0	0	0	0	0	0	0	0	0	0
Moderate injury	1	0	0	0	0	0	0	0	0	1	0
Minor injury/other injury	0	0	0	0	0	0	0	0	0	0	0
No casualty	0	0	0	0	0	0	0	0	0	0	0
Total	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**

Table 4-4 Crash summary along the proposed Ulan Road construction route by degree of severity and location

Severity	Total	Pedestrian	Intersection	Head-on	Rear-ends	U-turn/ Parking	Overtaking	On-path	Off-path on straight	Off-path on curve	Others
Fatal	0	0	0	0	0	0	0	0	0	0	0
Serious injury	0	0	0	0	0	0	0	0	0	0	0
Moderate injury	1	0	0	0	0	0	0	0	1	0	0
Minor injury/other injury	4	0	0	0	0	0	0	3	0	0	1
No casualty	5	0	0	0	1	0	1	1	1	1	0
Total	**10**	**0**	**0**	**0**	**1**	**0**	**1**	**4**	**2**	**1**	**1**

Wollar Road (regional road) had no crashes between the period of 2018-2022.

Table 4-5 show the crashes upon the local roads along the proposed construction routes which includes Merotherie Road, Tucklan Road and Blue Springs Road. These accounted for 6 crashes, with 2 crashes (33 per cent) classified as FSI crashes. The majority of crashes recorded were associated with run-off crashes, with one crash involving a head-on collision.

Table 4-5 Crash summary along the proposed construction routes using Local Roads by degree of severity and location

Severity	Total	Pedestrian	Intersection	Head-on	Rear-ends	U-turn/ Parking	Overtaking	On-path	Off-path on straight	Off-path on curve	Others
Fatal	1	0	0	0	0	0	0	0	0	1	0
Serious injury	1	0	0	1	0	0	0	0	0	0	0
Moderate injury	3	0	0	0	0	0	0	0	1	2	0
Minor injury/other injury	1	0	0	0	0	0	0	0	1	0	0
No casualty	0	0	0	0	0	0	0	0	0	0	0
Total	**6**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**2**	**3**	**0**

5 Updated construction analysis

5.1 Construction overview

5.1.1 Construction routes

As noted in Section 2.3.4 above, minimal changes are proposed to the proposed construction route resulting from the construction of transmission line, switching stations and energy hubs given that their location would be largely maintained. These changes are mainly associated with refinements to the alignment from further consultation with stakeholders. In terms of construction route, the change is generally limited to the inclusion of Upper Cumbo Road as part of the construction route.

As described in Section 3.6, the addition of microwave repeater sites would require construction vehicles to travel on roads which are not currently part of the current construction route. The construction activities at these sites are generally limited to minor works including the erection of a telecommunications tower (16m high) to be assembled on-site and installation of a satellite dish. Access and transporting needs for the sites will be limited to a minor increase in traffic volumes and with the use of general access vehicles only (i.e., maximum a 19 metre semi-trailer).

5.1.2 Traffic generation and distribution

The addition of a construction compound at the Neeleys Lane accommodation camp site would change the traffic movements generated by the site particularly impacting the intersection of Neeleys Lane and Ulan Road.

These traffic movements are discussed in Section 5.2.1, under the Turn Warrant Assessment section of Neeleys Lane and Ulan Road.

5.2 Construction impact assessment

5.2.1 Intersection analysis

Intersection analysis of applicable locations was performed using the SIDRA Intersection modelling program, to comparatively assess the traffic performance of road intersections associated with the construction of the transmission line. This was done by comparing the performance of the intersections for both AM Peak and PM peak periods for the following scenarios:

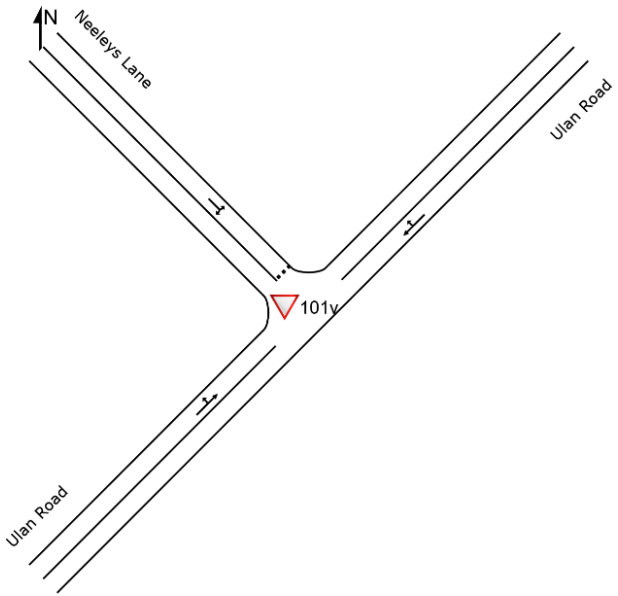
- existing intersection performance with existing background traffic volumes from traffic surveys and estimates (i.e. base case without project construction traffic)
- the performance of the same intersection layout with increased background traffic volumes (growth value of 1.6%) and the predicted construction traffic volumes.

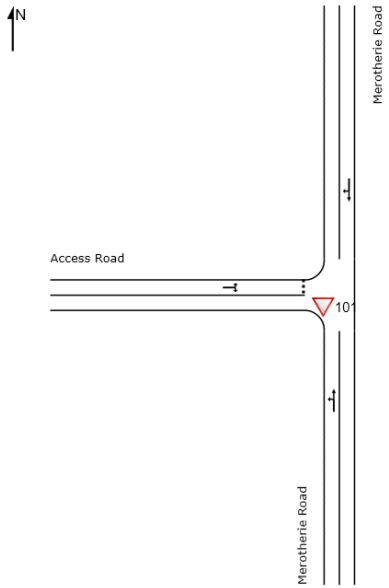
The comparative assessment involved the evaluation of the Level of Service (LoS) traffic performance indicator, which provides a qualitative indication of an intersection's operating condition, based upon quantitative measurements such as average delay experienced by each driver, queue length and Degree of Saturation. The LoS indicator provides intersection performance ratings from LoS A (free flowing intersection conditions) through to LoS F (heavily congested intersection conditions), which are described as follows:

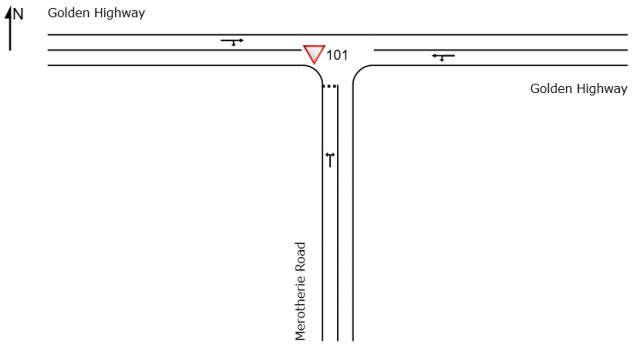
- Level of Service A indicates the intersection operates at free-flow, with minimal delays and queueing at the intersection.
- Level of Service B indicates the intersection is operating reasonably unimpeded, albeit with insignificant delays and queueing experienced by drivers at the intersection. The general level of physical and psychological comfort provided to drivers is still high.
- Level of Service C indicates the intersection is operating stably, with some noticeably minor delays and queuing experienced by drivers at the intersection. Navigating the intersection require more care and vigilance on the part of the drivers.
- Level of Service D indicates the intersection is experiencing is experiencing increasing delays, with higher degree of saturation. Freedom to manoeuvre is seriously limited and the drivers experience reduced physical and psychological comfort levels. Performance up to Level of Service D are considered typically acceptable by Transport for NSW
- Level of Service E indicates the intersection is operating at or near capacity. Operations at this level are highly volatile with virtually no usable gaps in traffic, leaving little room to navigate the intersection. The physical and psychological comfort for drivers is poor.
- Level of Service F indicates the intersection is operating unstably.

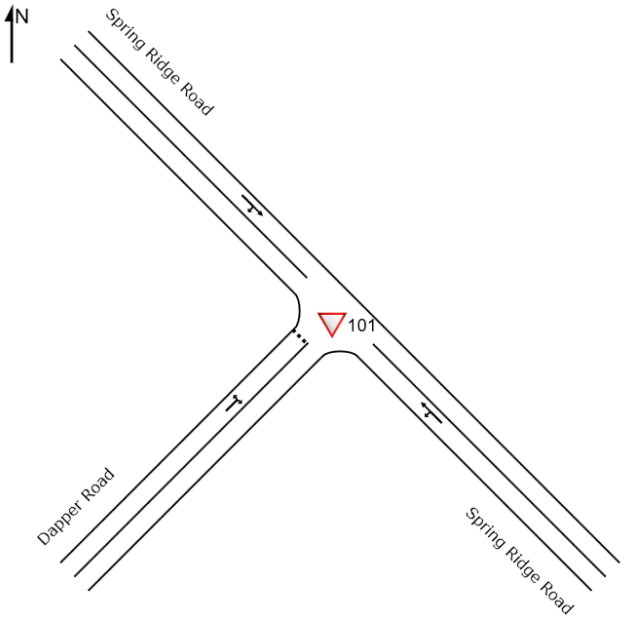
Results of the intersection analysis are detailed in Table 5-1.

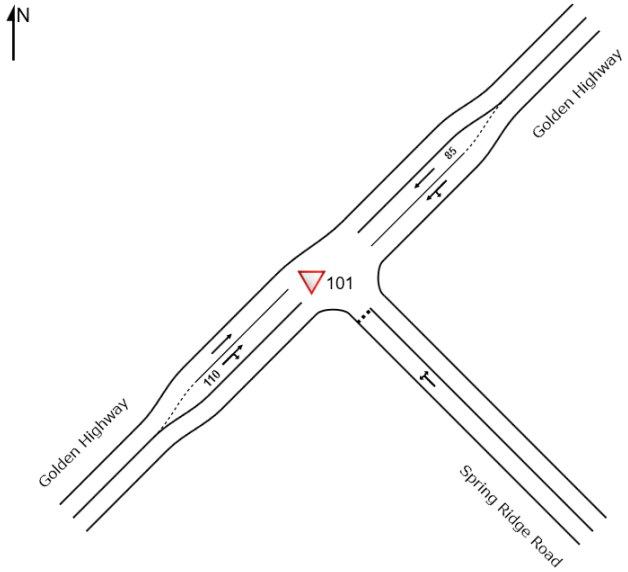
Table 5-1 SIDRA summary results

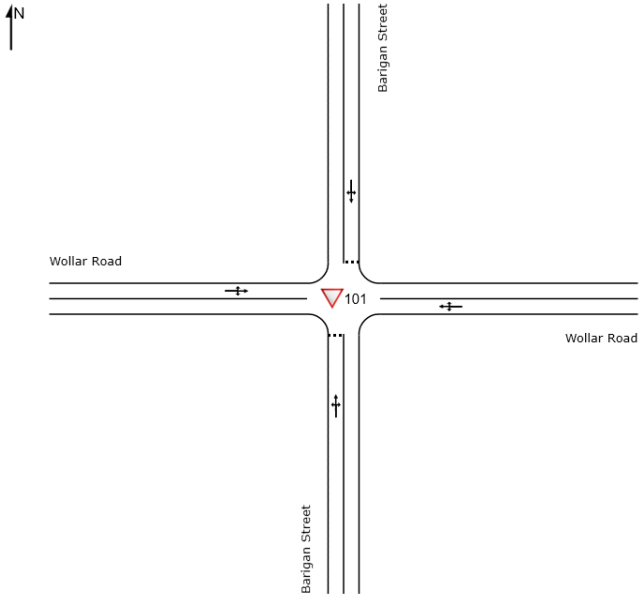
Intersection Name and Layout	Scenario	Peak Period	Intersection Approach: Road Name	Level of Service	Average Delay (seconds per vehicle)	Back of Queue (metres)	Degree of Saturation
Neeleys Lane and Ulan Road 	Existing Condition (current intersection configuration)	AM	Northeast: Ulan Road	LoS A	0.1	0.1	0.061
			Northwest: Neeleys Lane	LoS A	8.4	0.0	0.002
			Southwest: Ulan Road	LoS A	7.8	0.0	0.087
		PM	Northeast: Ulan Road	LoS A	0.1	0.0	0.046
			Northwest: Neeleys Lane	LoS A	8.0	0.0	0.002
			Southwest: Ulan Road	LoS A	7.8	0.0	0.042
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	Northeast: Ulan Road	LoS B	12.1	4.1	0.115
			Northwest: Neeleys Lane	LoS A	8.7	0.0	0.002
			Southwest: Ulan Road	LoS B	10.5	0.0	0.124
		PM	Northeast: Ulan Road	LoS A	7.6	0.0	0.049
			Northwest: Neeleys Lane	LoS A	8.1	1.4	0.054
			Southwest: Ulan Road	LoS A	7.8	0.0	0.045

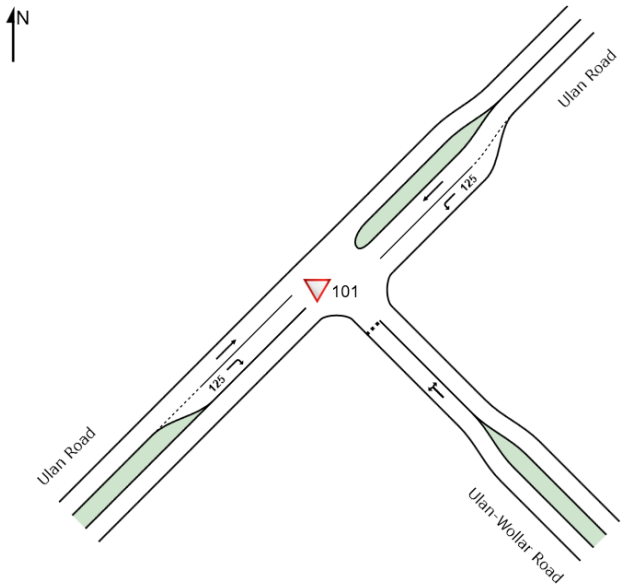
Intersection Name and Layout	Scenario	Peak Period	Intersection Approach: Road Name	Level of Service	Average Delay (seconds per vehicle)	Back of Queue (metres)	Degree of Saturation
Merotherie Energy Hub access road and Merotherie Road 	Existing Condition (current intersection configuration)	AM	North: Merotherie Road	LoS A	7.4	0.0	0.001
			South: Merotherie Road	LoS A	7.8	0.0	0.001
			West: Access Road	LoS A	7.8	0.0	0.001
		PM	North: Merotherie Road	LoS A	7.4	0.0	0.001
			South: Merotherie Road	LoS A	7.8	0.0	0.001
			West: Access Road	LoS A	7.8	0.0	0.001
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	North: Merotherie Road	LoS B	10.3	0.0	0.131
			South: Merotherie Road	LoS A	7.8	7.5	0.008
			West: Access Road	LoS A	8.2	0.0	0.002
		PM	North: Merotherie Road	LoS A	7.7	0.1	0.007
			South: Merotherie Road	LoS A	11.2	0.0	0.060
			West: Access Road	LoS B	7.9	4.6	0.086

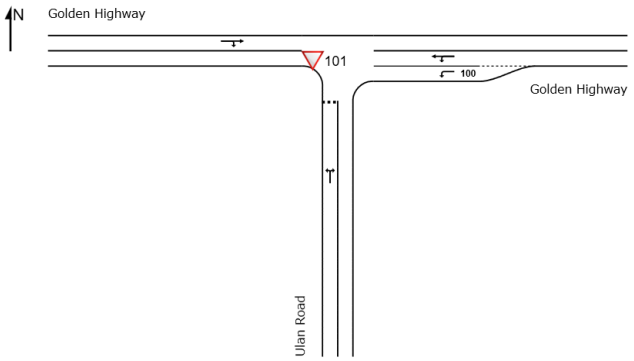
Intersection Name and Layout	Scenario	Peak Period	Intersection Approach: Road Name	Level of Service	Average Delay (seconds per vehicle)	Back of Queue (metres)	Degree of Saturation
Golden Highway and Merotherie Road  	Existing Condition (current intersection configuration)	AM	South: Merotherie Road	LoS A	7.9	0.0	0.002
			East: Golden Highway	LoS A	7.8	0.0	0.021
			West: Golden Highway	LoS A	7.5	0.0	0.026
		PM	South: Merotherie Road	LoS A	7.9	0.0	0.002
			East: Golden Highway	LoS A	7.8	0.0	0.021
			West: Golden Highway	LoS A	7.5	0.1	0.025
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	South: Merotherie Road	LoS A	8.4	0.0	0.002
			East: Golden Highway	LoS B	10.5	0.0	0.106
			West: Golden Highway	LoS B	11.6	5.2	0.098
		PM	South: Merotherie Road	LoS A	8.2	1.6	0.066
			East: Golden Highway	LoS A	7.8	0.0	0.025
			West: Golden Highway	LoS A	7.6	0.1	0.089

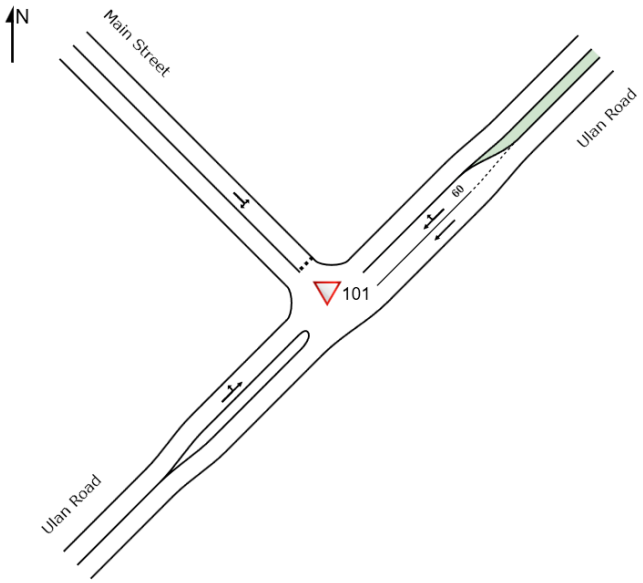
Intersection Name and Layout	Scenario	Peak Period	Intersection Approach: Road Name	Level of Service	Average Delay (seconds per vehicle)	Back of Queue (metres)	Degree of Saturation
Spring Ridge Road and Dapper Road 	Existing Condition (current intersection configuration)	AM	Southeast: Spring Ridge Road	LoS A	7.8	0.0	0.005
			Northwest: Spring Ridge Road	LoS A	7.4	0.0	0.003
			Southwest: Dapper Road	LoS A	7.9	0.0	0.001
		PM	Southeast: Spring Ridge Road	LoS A	7.8	0.0	0.003
			Northwest: Spring Ridge Road	LoS A	7.4	0.0	0.003
			Southwest: Dapper Road	LoS A	7.8	0.0	0.001
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	Southeast: Spring Ridge Road	LoS A	7.8	0.0	0.006
			Northwest: Spring Ridge Road	LoS B	10.2	4.3	0.075
			Southwest: Dapper Road	LoS A	7.9	0.0	0.002
		PM	Southeast: Spring Ridge Road	LoS A	7.8	0.0	0.003
			Northwest: Spring Ridge Road	LoS A	7.4	0.0	0.004
			Southwest: Dapper Road	LoS B	10.5	0.0	0.069

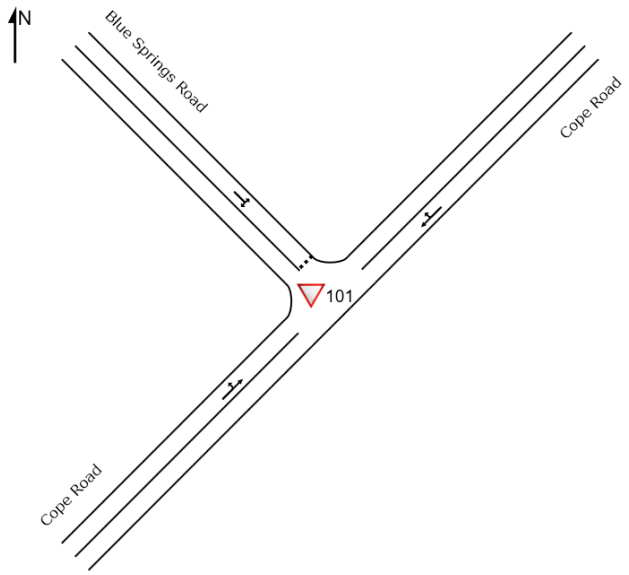
Intersection Name and Layout	Scenario	Peak Period	Intersection Approach: Road Name	Level of Service	Average Delay (seconds per vehicle)	Back of Queue (metres)	Degree of Saturation
Golden Highway and Spring Ridge Road 	Existing Condition (current intersection configuration)	AM	Southeast: Spring Ridge Road	LoS A	9.9	0.3	0.009
			Northeast: Golden Highway	LoS A	7.8	0.0	0.026
			Southwest: Golden Highway	LoS A	7.6	0.1	0.035
		PM	Southeast: Spring Ridge Road	LoS A	9.7	0.2	0.005
			Northeast: Golden Highway	LoS A	7.8	0.0	0.032
			Southwest: Golden Highway	LoS A	9.2	0.3	0.034
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	Southeast: Spring Ridge Road	LoS B	12.4	0.4	0.015
			Northeast: Golden Highway	LoS B	10.4	0.0	0.111
			Southwest: Golden Highway	LoS A	9.0	0.2	0.047
		PM	Southeast: Spring Ridge Road	LoS C	17.0	15.3	0.272
			Northeast: Golden Highway	LoS A	7.8	0.0	0.043
			Southwest: Golden Highway	LoS A	9.1	0.5	0.103

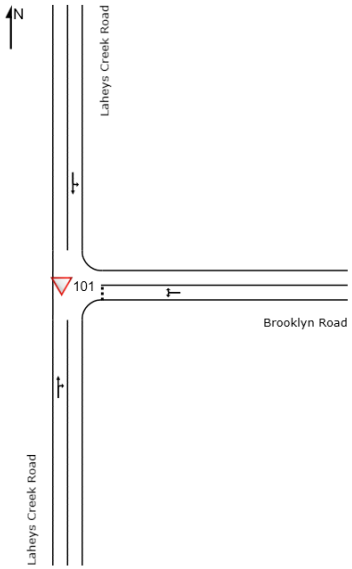
Intersection Name and Layout	Scenario	Peak Period	Intersection Approach: Road Name	Level of Service	Average Delay (seconds per vehicle)	Back of Queue (metres)	Degree of Saturation
Wollar Road, Barigan Street and Phillip Street 	Existing Condition (current intersection configuration) Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	South: Barigan Street	LoS A	5.6	0.1	0.002
			East: Wollar Road	LoS A	5.6	0.2	0.009
			North: Barigan Street	LoS A	5.6	0.1	0.004
			West: Wollar Road	LoS A	5.6	0.0	0.004
		PM	South: Barigan Street	LoS A	5.6	0.1	0.002
			East: Wollar Road	LoS A	5.6	0.4	0.011
			North: Barigan Street	LoS A	5.6	0.1	0.004
			West: Wollar Road	LoS A	5.5	0.1	0.004
	Project Case (with background traffic growth and construction traffic)	AM	South: Barigan Street	LoS A	5.8	0.1	0.002
			East: Wollar Road	LoS A	5.6	0.3	0.011
			North: Barigan Street	LoS A	6.8	3.3	0.071
			West: Wollar Road	LoS A	5.6	0.1	0.005
		PM	South: Barigan Street	LoS A	5.8	0.1	0.003
			East: Wollar Road	LoS A	6.3	2.4	0.046
			North: Barigan Street	LoS A	5.9	0.1	0.006
			West: Wollar Road	LoS A	6.6	0.1	0.029

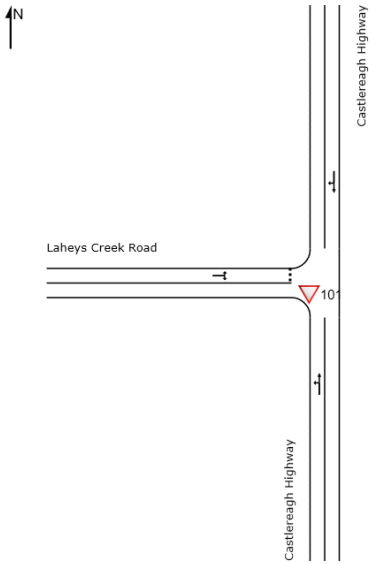
Intersection Name and Layout	Scenario	Peak Period	Intersection Approach: Road Name	Level of Service	Average Delay (seconds per vehicle)	Back of Queue (metres)	Degree of Saturation
Ulan Road and Ulan-Wollar Road 	Existing Condition (current intersection configuration)	AM	Southeast: Ulan-Wollar Road	LoS B	10.3	1.5	0.058
			Northeast: Ulan Road	LoS A	7.9	0.0	0.014
			Southwest: Ulan Road	LoS A	8.1	8.7	0.251
		PM	Southeast: Ulan-Wollar Road	LoS A	6.9	3.0	0.113
			Northeast: Ulan Road	LoS A	7.8	0.0	0.042
			Southwest: Ulan Road	LoS A	7.8	2.6	0.088
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	Southeast: Ulan-Wollar Road	LoS C	19.3	3.3	0.116
			Northeast: Ulan Road	LoS A	9.5	0.0	0.110
			Southwest: Ulan Road	LoS A	9.8	15.1	0.364
		PM	Southeast: Ulan-Wollar Road	LoS B	13.9	11.5	0.297
			Northeast: Ulan Road	LoS A	9.1	0.0	0.052
			Southwest: Ulan Road	LoS A	8.0	3.0	0.101

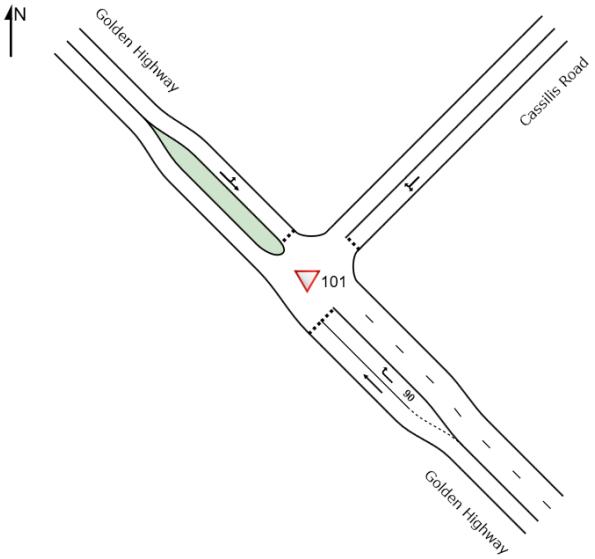
Intersection Name and Layout	Scenario	Peak Period	Intersection Approach: Road Name	Level of Service	Average Delay (seconds per vehicle)	Back of Queue (metres)	Degree of Saturation
Golden Highway and Ulan Road 	Existing Condition (current intersection configuration)	AM	South: Ulan Road	LoS A	8.7	2.0	0.066
			East: Golden Highway	LoS A	8.3	0.0	0.025
			West: Golden Highway	LoS A	8.2	0.3	0.031
		PM	South: Ulan Road	LoS A	8.4	1.7	0.058
			East: Golden Highway	LoS A	8.2	0.0	0.035
			West: Golden Highway	LoS A	7.7	0.4	0.035
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	South: Ulan Road	LoS B	10.5	2.8	0.092
			East: Golden Highway	LoS A	9.3	0.0	0.098
			West: Golden Highway	LoS B	11.9	6.4	0.125
		PM	South: Ulan Road	LoS B	11.7	8.7	0.196
			East: Golden Highway	LoS A	8.2	0.0	0.043
			West: Golden Highway	LoS A	7.8	0.6	0.098

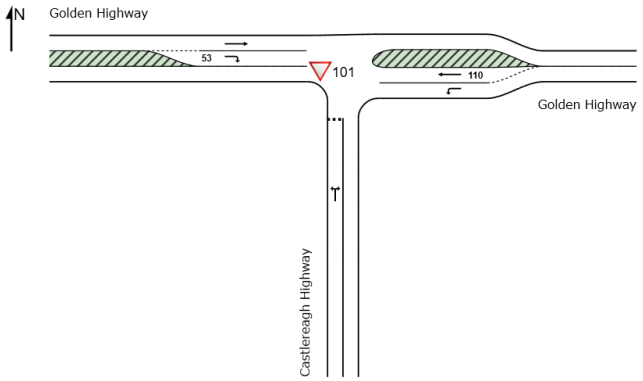
Intersection Name and Layout	Scenario	Peak Period	Intersection Approach: Road Name	Level of Service	Average Delay (seconds per vehicle)	Back of Queue (metres)	Degree of Saturation
Ulan Road and Cope Road (Main Street)  	Existing Condition (current intersection configuration)	AM	Northeast: Ulan Road	LoS A	9.0	2.2	0.069
			Northwest: Main Street	LoS B	13.7	4.0	0.131
			Southwest: Ulan Road	LoS A	7.8	0.0	0.202
		PM	Northeast: Ulan Road	LoS A	7.9	2.7	0.108
			Northwest: Main Street	LoS B	10.0	1.8	0.063
			Southwest: Ulan Road	LoS A	7.8	0.0	0.058
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	Northeast: Ulan Road	LoS B	11.4	6.6	0.153
			Northwest: Main Street	LoS C	22.5	5.8	0.188
			Southwest: Ulan Road	LoS B	10.1	0.0	0.271
		PM	Northeast: Ulan Road	LoS A	8.5	3.5	0.128
			Northwest: Main Street	LoS C	18.4	10.3	0.256
			Southwest: Ulan Road	Los A	9.0	0.0	0.128

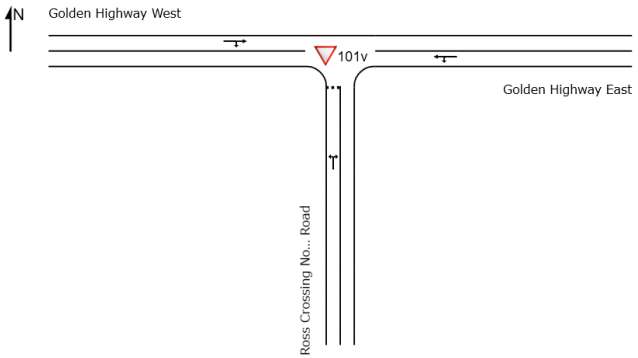
Intersection Name and Layout	Scenario	Peak Period	Intersection Approach: Road Name	Level of Service	Average Delay (seconds per vehicle)	Back of Queue (metres)	Degree of Saturation
Cope Road and Blue Springs Road 	Existing Condition (current intersection configuration)	AM	Northeast: Cope Road	LoS A	7.6	0.0	0.017
			Northwest: Blue Springs Road	LoS A	4.4	0.1	0.002
			Southwest: Cope Road	LoS A	7.8	0.0	0.045
		PM	Northeast: Cope Road	LoS A	7.6	0.0	0.031
			Northwest: Blue Springs Road	LoS A	4.3	0.1	0.005
			Southwest: Cope Road	LoS A	7.8	0.0	0.036
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	Northeast: Cope Road	LoS B	10.8	3.6	0.069
			Northwest: Blue Springs Road	LoS A	4.7	0.3	0.008
			Southwest: Cope Road	LoS A	7.8	0.0	0.049
		PM	Northeast: Cope Road	LoS A	9.7	0.5	0.041
			Northwest: Blue Springs Road	LoS A	6.3	2.7	0.057
			Southwest: Cope Road	LoS A	7.8	0.0	0.039

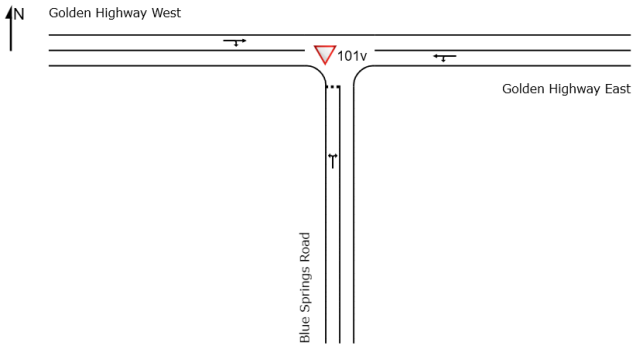
Intersection Name and Layout	Scenario	Peak Period	Intersection Approach: Road Name	Level of Service	Average Delay (seconds per vehicle)	Back of Queue (metres)	Degree of Saturation
Brooklyn Road and Laheys Creek Road 	Existing Condition (current intersection configuration)	AM	South: Laheys Creek Road	LoS A	7.4	0.0	0.001
			East: Brooklyn Road	LoS A	7.8	0.1	0.003
			North: Laheys Creek Road	LoS A	7.8	0.0	0.001
		PM	South: Laheys Creek Road	LoS A	7.4	0.0	0.001
			East: Brooklyn Road	LoS A	7.8	0.0	0.001
			North: Laheys Creek Road	LoS A	7.8	0.0	0.001
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	South: Laheys Creek Road	LoS B	7.4	1.0	0.030
			East: Brooklyn Road	LoS A	7.8	0.1	0.004
			North: Laheys Creek Road	LoS A	7.8	0.0	0.001
		PM	South: Laheys Creek Road	LoS A	7.4	0.0	0.002
			East: Brooklyn Road	LoS A	7.8	1.0	0.034
			North: Laheys Creek Road	LoS A	7.8	0.0	0.002

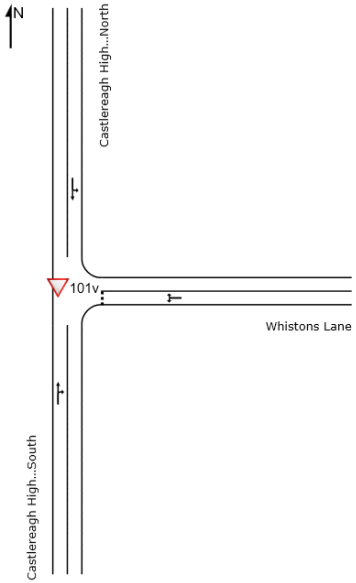
Intersection Name and Layout	Scenario	Peak Period	Intersection Approach: Road Name	Level of Service	Average Delay (seconds per vehicle)	Back of Queue (metres)	Degree of Saturation
Castlereagh Highway and Laheys Creek Road 	Existing Condition (current intersection configuration)	AM	South: Castlereagh Highway	LoS A	7.8	0.0	0.026
			North: Castlereagh Highway	LoS A	7.5	0.0	0.032
			West: Laheys Creek Road	LoS A	8.0	0.4	0.017
		PM	South: Castlereagh Highway	LoS A	8.1	0.0	0.032
			North: Castlereagh Highway	LoS A	7.6	0.1	0.028
			West: Laheys Creek Road	LoS A	8.0	0.1	0.003
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	South: Castlereagh Highway	LoS A	7.8	0.0	0.033
			North: Castlereagh Highway	LoS A	7.6	0.1	0.074
			West: Laheys Creek Road	LoS A	8.1	0.4	0.020
		PM	South: Castlereagh Highway	LoS A	8.1	0.0	0.075
			North: Castlereagh Highway	LoS A	7.8	0.1	0.035
			West: Laheys Creek Road	LoS A	8.2	0.1	0.005

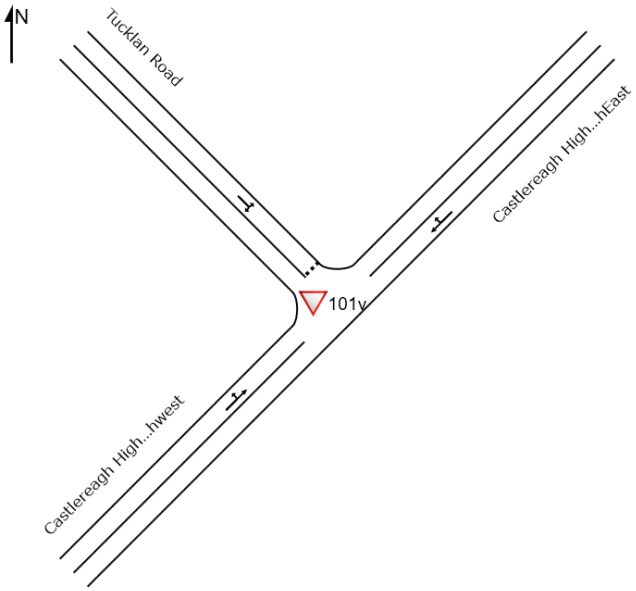
Intersection Name and Layout	Scenario	Peak Period	Intersection Approach: Road Name	Level of Service	Average Delay (seconds per vehicle)	Back of Queue (metres)	Degree of Saturation
Golden Highway and Cassilis Road 	Existing Condition (current intersection configuration)	AM	Southeast: Golden Highway	LoS A	8.0	0.1	0.033
			Northeast: Cassilis Road	LoS A	8.0	0.1	0.005
			Northwest: Golden Highway	LoS A	7.8	0.0	0.038
		PM	Southeast: Golden Highway	LoS A	8.0	0.1	0.036
			Northeast: Cassilis Road	LoS A	8.0	0.1	0.005
			Northwest: Golden Highway	LoS A	7.8	0.0	0.040
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	Southeast: Golden Highway	LoS A	8.4	0.1	0.095
			Northeast: Cassilis Road	LoS B	13.0	4.3	0.102
			Northwest: Golden Highway	LoS A	8.0	0.0	0.050
		PM	Southeast: Golden Highway	LoS A	8.9	0.1	0.044
			Northeast: Cassilis Road	LoS B	11.5	0.6	0.018
			Northwest: Golden Highway	LoS A	10.0	0.0	0.148

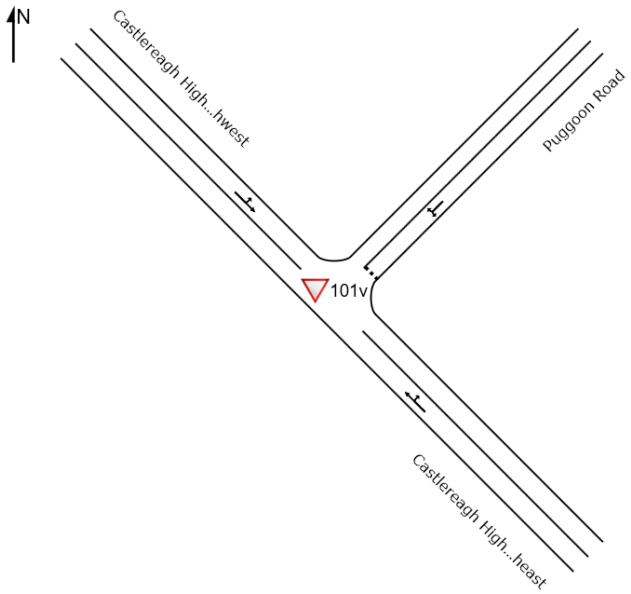
Intersection Name and Layout	Scenario	Peak Period	Intersection Approach: Road Name	Level of Service	Average Delay (seconds per vehicle)	Back of Queue (metres)	Degree of Saturation
Golden Highway and Castlereagh Highway  	Existing Condition (current intersection configuration)	AM	South: Castlereagh Highway	LoS A	9.8	1.1	0.037
			East: Golden Highway	LoS A	9.0	0.0	0.039
			West: Golden Highway	LoS A	8.1	0.4	0.035
		PM	South: Castlereagh Highway	LoS A	9.7	1.0	0.035
			East: Golden Highway	LoS A	8.6	0.0	0.047
			West: Golden Highway	LoS A	8.8	0.6	0.031
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	South: Castlereagh Highway	LoS B	12.4	2.0	0.061
			East: Golden Highway	LoS A	9.8	0.0	0.102
			West: Golden Highway	LoS B	10.8	2.2	0.053
		PM	South: Castlereagh Highway	LoS B	14.3	5.5	0.132
			East: Golden Highway	LoS A	8.7	0.0	0.056
			West: Golden Highway	LoS A	8.3	0.6	0.094

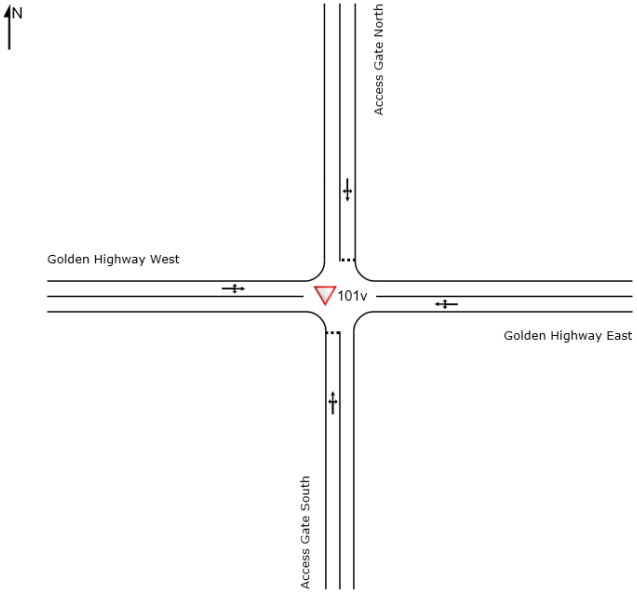
Intersection Name and Layout	Scenario	Peak Period	Intersection Approach: Road Name	Level of Service	Average Delay (seconds per vehicle)	Back of Queue (metres)	Degree of Saturation
Ross Crossing North and Golden Highway 	Existing Condition (current intersection configuration)	AM	South: Ross Crossing North Road	LoS A	5.8	0.0	0.002
			East: Golden Highway	LoS A	5.5	0.0	0.036
			West: Golden Highway	LoS A	5.6	0.1	0.023
		PM	South: Ross Crossing North Road	LoS A	5.7	0.0	0.002
			East: Golden Highway	LoS A	5.5	0.0	0.026
			West: Golden Highway	LoS A	5.6	0.1	0.028
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	South: Ross Crossing North Road	LoS A	6.5	0.0	0.002
			East: Golden Highway	LoS A	6.7	0.0	0.115
			West: Golden Highway	LoS A	8.2	3.8	0.075
		PM	South: Ross Crossing North Road	LoS A	8.7	3.3	0.072
			East: Golden Highway	LoS A	5.5	0.0	0.033
			West: Golden Highway	LoS A	5.6	0.1	0.092

Intersection Name and Layout	Scenario	Peak Period	Intersection Approach: Road Name	Level of Service	Average Delay (seconds per vehicle)	Back of Queue (metres)	Degree of Saturation
Golden Highway and Blue Springs Road (North)  	Existing Condition (current intersection configuration)	AM	South: Blue Springs Road	LoS A	5.8	0.0	0.002
			East: Golden Highway	LoS A	5.5	0.0	0.036
			West: Golden Highway	LoS A	5.6	0.1	0.023
		PM	South: Blue Springs Road	LoS A	5.7	0.0	0.002
			East: Golden Highway	LoS A	5.5	0.0	0.026
			West: Golden Highway	LoS A	5.6	0.1	0.028
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	South: Blue Springs Road	LoS A	6.5	0.0	0.002
			East: Golden Highway	LoS A	6.7	0.0	0.115
			West: Golden Highway	LoS A	8.2	3.8	0.075
		PM	South: Blue Springs Road	LoS A	8.6	3.0	0.062
			East: Golden Highway	LoS A	5.5	0.0	0.033
			West: Golden Highway	LoS A	5.6	0.1	0.092

Intersection Name and Layout	Scenario	Peak Period	Intersection Approach: Road Name	Level of Service	Average Delay (seconds per vehicle)	Back of Queue (metres)	Degree of Saturation
Whistons Lane and Castlereagh Highway 	Existing Condition (current intersection configuration)	AM	South: Castlereagh Highway	LoS A	5.6	0.0	0.026
			East: Whistons Lane	LoS A	5.7	0.2	0.008
			North: Castlereagh Highway	LoS A	5.5	0.0	0.018
		PM	South: Castlereagh Highway	LoS A	7.0	0.5	0.030
			East: Whistons Lane	LoS A	5.8	0.0	0.002
			North: Castlereagh Highway	LoS A	6.7	0.0	0.026
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	South: Castlereagh Highway	LoS A	8.1	0.6	0.031
			East: Whistons Lane	LoS A	6.2	0.2	0.010
			North: Castlereagh Highway	LoS A	6.7	0.0	0.111
		PM	South: Castlereagh Highway	LoS A	6.8	0.6	0.072
			East: Whistons Lane	LoS A	8.2	3.3	0.075
			North: Castlereagh Highway	LoS A	6.5	0.0	0.032

Intersection Name and Layout	Scenario	Peak Period	Intersection Approach: Road Name	Level of Service	Average Delay (seconds per vehicle)	Back of Queue (metres)	Degree of Saturation
Tucklan Road and Castlereagh Highway 	Existing Condition (current intersection configuration)	AM	Northeast: Castlereagh Highway	LoS A	5.5	0.2	0.027
			Northwest: Tucklan Road	LoS A	5.7	0.2	0.007
			Southwest: Castlereagh Highway	LoS A	5.5	0.0	0.019
		PM	Northeast: Castlereagh Highway	LoS A	5.6	0.2	0.024
			Northwest: Tucklan Road	LoS A	5.7	0.1	0.003
			Southwest: Castlereagh Highway	LoS A	5.5	0.0	0.026
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	Northeast: Castlereagh Highway	LoS A	6.9	5.0	0.118
			Northwest: Tucklan Road	LoS A	6.3	0.2	0.009
			Southwest: Castlereagh Highway	LoS A	6.2	0.0	0.030
		PM	Northeast: Castlereagh Highway	LoS A	5.8	0.3	0.033
			Northwest: Tucklan Road	LoS A	7.4	3.1	0.063
			Southwest: Castlereagh Highway	LoS A	5.6	0.0	0.066

Intersection Name and Layout	Scenario	Peak Period	Intersection Approach: Road Name	Level of Service	Average Delay (seconds per vehicle)	Back of Queue (metres)	Degree of Saturation
Puggoon Road and Castlereagh Highway 	Existing Condition (current intersection configuration)	AM	Southeast: Castlereagh Highway	LoS A	5.6	0.0	0.019
			Northeast: Puggoon Road	LoS A	5.7	0.0	0.002
			Northwest: Castlereagh Highway	LoS A	5.5	0.0	0.030
		PM	Southeast: Castlereagh Highway	LoS A	5.6	0.0	0.030
			Northeast: Puggoon Road	LoS A	5.8	0.0	0.002
			Northwest: Castlereagh Highway	LoS A	5.5	0.0	0.031
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	Southeast: Castlereagh Highway	LoS A	5.9	0.1	0.021
			Northeast: Puggoon Road	LoS A	5.9	0.1	0.003
			Northwest: Castlereagh Highway	LoS A	6.7	0.0	0.081
		PM	Southeast: Castlereagh Highway	LoS A	5.6	0.1	0.033
			Northeast: Puggoon Road	LoS A	7.7	3.1	0.073
			Northwest: Castlereagh Highway	LoS A	5.5	0.0	0.033

Intersection Name and Layout	Scenario	Peak Period	Intersection Approach: Road Name	Level of Service	Average Delay (seconds per vehicle)	Back of Queue (metres)	Degree of Saturation
Typical access gates on the most potentially impacted section of State Roads (Golden Highway east of Merotherie Road)  	Existing Condition (current intersection configuration)	AM	South: Access Gate	LoS A	5.9	0.1	0.003
			East: Golden Highway	LoS A	5.6	0.1	0.036
			North: Access Gate	LoS A	4.59	0.1	0.003
			West: Golden Highway	LoS A	5.6	0.1	0.024
		PM	South: Access Gate	LoS A	5.9	0.1	0.003
			East: Golden Highway	LoS A	5.6	0.1	0.026
			North: Access Gate	LoS A	5.9	0.1	0.003
			West: Golden Highway	LoS A	5.6	0.1	0.029
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	South: Access Gate	LoS A	6.8	0.1	0.003
			East: Golden Highway	LoS A	7.3	1.7	0.121
			North: Access Gate	LoS A	6.9	0.1	0.003
			West: Golden Highway	LoS A	8.2	3.4	0.079
		PM	South: Access Gate	LoS B	9.8	2.2	0.046
			East: Golden Highway	LoS A	5.9	0.1	0.033
			North: Access Gate	LoS B	9.8	2.3	0.049
			West: Golden Highway	LoS A	5.6	0.1	0.092

As detailed in Table 5-1, the Existing Condition analysis demonstrates that most of the legs of the assessed intersections currently operate at LoS A, with some legs operating at Los B. The Project Case analysis shows that, for the majority of these intersections, traffic movements would continue to operate at LoS A with some intersection legs expected to experience a slight decrease in LoS (from A to B, from A to C or from B to C). The minor decrease in LoS is only during the construction period and only temporary in nature, as the original LoS performance of these intersections will return at the end of this project. The decrease in LoS for the Project Case are as follows:

- Ulan Road and Neeleys Lane (AM peak only on both legs of Ulan Road)
- Merotherie Road and Merotherie Energy Hub access road (AM and PM peaks)
- Golden Highway and Merotherie Road (AM peak only)
- Spring Ridge Road and Dapper Road (AM and PM peaks)
- Golden Highway and Spring Ridge Road (AM and PM peaks)
- Ulan Road and Ulan-Wollar Road (AM and PM peaks)
- Golden Highway and Ulan Road (AM and PM peaks)
- Ulan Road and Cope Road (AM and PM peaks)
- Cope Road and Blue Springs Road (AM peak only)
- Brooklyn Road and Laheys Creek Road (AM peak only)
- Golden Highway and Cassilis Road (AM and PM peaks)
- Golden Highway and Castlereagh Highway (AM and PM peaks)
- Typical access gates on the most potentially impacted section of State Roads (Golden Highway east of Merotherie Road) (PM peak only).

At the intersection of Golden Highway and Spring Ridge Road, traffic turning from Spring Ridge Road onto Golden Highway is predicted to decrease from LoS A to LoS C as a result of the additional construction traffic using this intersection. This is the only turning movement that would be affected by greater than one LoS step change. Notwithstanding, the SIDRA modelling results identify that all intersections would operate during construction at a LoS C or better, representative of flow conditions with speeds near the free-flow speed. Accordingly, construction traffic associated with the amended project would have only minor impacts, with intersections operating at acceptable levels.

5.2.2 Turn warrant assessment

5.2.2.1 Neeleys Lane and Ulan Road

The Neeleys Lane satellite workforce accommodation camp would generate 66 traffic movements (32 light vehicles and 34 heavy vehicles) at its peak. Construction traffic would enter/exit Neeleys Lane assuming 50:50 (north:south) traffic distribution corresponding to the location of the work area. It is assumed that:

- during the AM peak:
  - 100% of construction vehicles would travel towards the worksites
  - 0% of construction vehicles would travel away from the worksites
- during the PM peak:
  - 0% of construction vehicles would travel towards the worksites
  - 100% of construction vehicles would travel away from the worksites.

As a result, during the AM peak, construction traffic would generate up to 33 vehicles per hour for both right-turn and left-turn movements into Neeleys Lane from Ulan Road. During the PM peak, no turning movements are anticipated into Neeleys Lane from Ulan Road.

Using the results from the traffic surveys undertaken in 2022, the intersection of Neeleys Lane and Ulan Road is anticipated to be moderately trafficked with a total of:

- 264 vehicle movements in both north and south directions during the AM peak period
- 155 vehicle movements in both north and south directions during the PM peak period.

Assuming near 100% of turning movements at the intersection are comprising only construction vehicle movements, the turn volumes 'Q_R' and 'Q_L' (as a combination of construction and existing traffic) are respectively considered as approximately:

- 33 vehicles per hour in both directions during the AM peak
- 0 vehicles per hour in either direction during the PM peak.

As the traffic volumes along Ulan Road are critical during the AM peak and there are no turning vehicles anticipated during the PM peak, only the AM peak has been assessed. The anticipated Q_M (as a combination of construction and existing traffic) by 2026 on the intersection Neeleys Lane and Ulan Road would also therefore account for approximately 297 vehicles for the right turn and 155 for the left turn calculations.

Currently, this intersection configuration is comprised of a Basic Left Turn (BAL) and a Basic Right Turn (BAR). The capacity assessment of this intersection indicate that it would need to have at least an Auxiliary Left-turn (AUL) and a short Channelised Right-turn (CHRs) treatment. Therefore, the intersection may require an upgrade to provide a safe access for workers travelling through the construction routes. This recommendation would be reviewed in the detailed construction planning stage, subject to the determination of finalised workforce numbers.

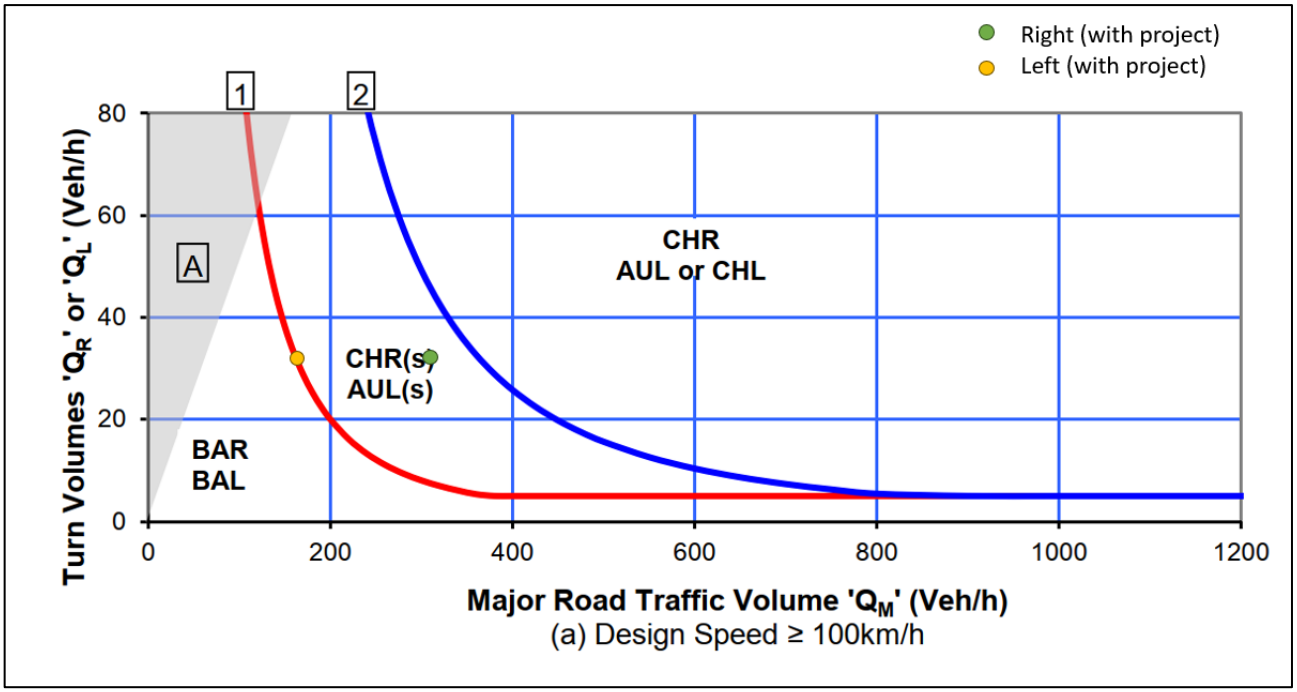


Figure 5-1 Turn warrant assessment of Neeleys Lane and Ulan Road

5.2.2.2 Cassilis Road and Golden Highway

The previous assessment undertaken in Technical Paper 13 for project traffic generation during the construction period determined that the intersection of Cassilis Road and Golden Highway is anticipated to experience 75 traffic movements along Golden Highway and 50 traffic movements turning in/out of Cassilis during each peak hour. It is assumed that:

- during the AM peak:
  - 90% of construction vehicles would travel towards the worksites
  - 10% of construction vehicles would travel away from the worksites
- During the PM peak:
  - 10% of construction vehicles would travel towards the worksites
  - 90% of construction vehicles would travel away from the worksites.

Under the proposed haulage route layout, 100% of northbound vehicles along Cassilis Road have conservatively been considered to have originated from the southwest along Golden Highway and as a result, the turn movements along Golden Highway into Cassilis Road are to increase by approximately:

- 0 right-turn movements and 5 left-turn movements during the AM peak
- 0 right-turn movements and 45 left-turn movements during the PM peak.

Combining the results from the traffic surveys undertaken in 2023 and application of 1.6% growth rate on Golden Highway, the intersection of Cassilis and Golden Highway is anticipated to be moderately trafficked with a total of:

- 134 vehicle movements in all directions (including 4 right-turns and 2 left-turns from Golden Highway) during the AM peak period
- 142 vehicle movements in all directions (including 4 right-turns and 10 left-turns from Golden Highway) during the PM peak period.

Based on the above, the turn volumes 'Q_R' and 'Q_L' (as a combination of construction and existing traffic) are respectively considered as approximately:

- 4 vehicles per hour Q_R and 7 vehicles per hour Q_L during the AM peak
- 4 vehicles per hour Q_R and 55 vehicles per hour Q_L during the PM peak.

The anticipated Q_M (as a combination of construction and existing traffic) by 2026 on the intersection Cassilis Road and Golden Highway would also therefore account for approximately:

- 205 vehicles for the right turn and 73 for the left turn calculations during the AM peak
- 135 vehicles for the right turn and 134 for the left-turn calculations during the PM peak.

Currently, this intersection configuration is comprised of a Basic Left Turn (BAL) and a Channelised Right Turn (CHR). The preferred treatment option was found to be a Basic Right-turn (BAR) and a short Auxiliary Left-Turn (AULs). Therefore, the intersection of Cassilis Road and Golden Highway may need to be upgraded with a short Auxiliary Left-Turn treatment to provide a safe access for worker travelling in/out of the construction routes. This recommendation would be reviewed in the detailed construction planning stage, subject to the determination of finalised workforce numbers.

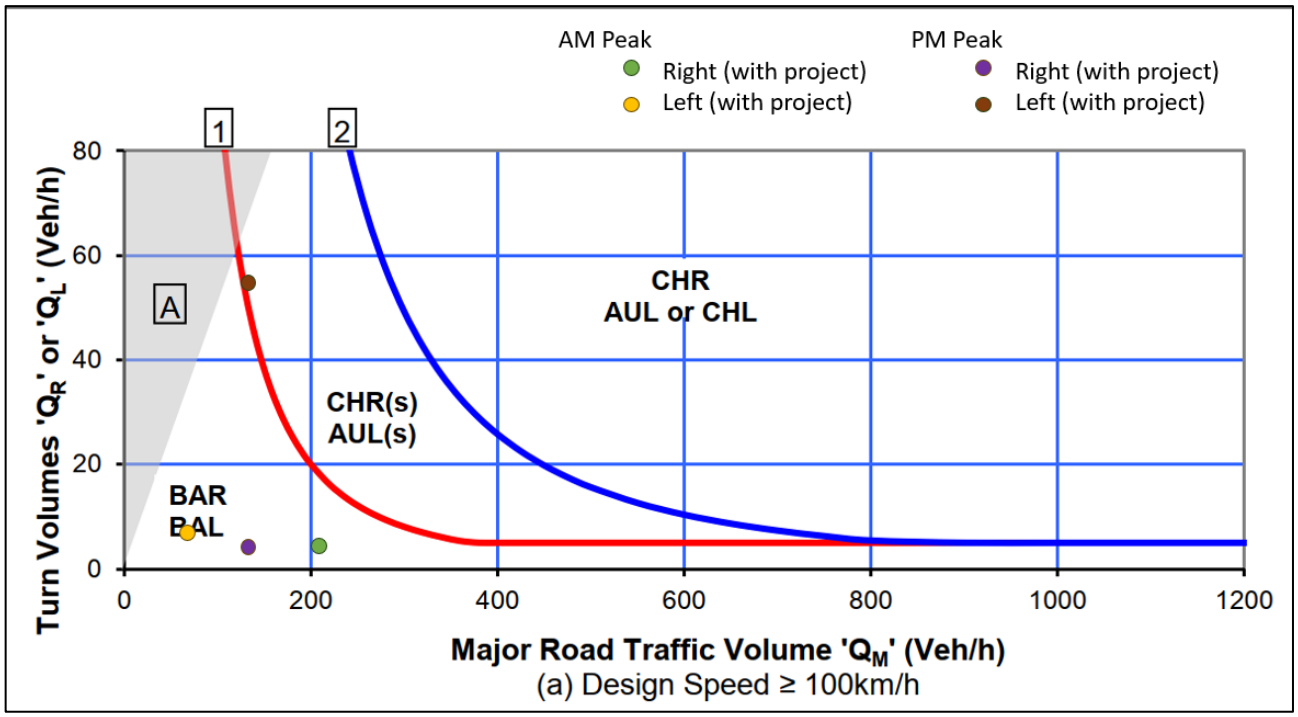


Figure 5-2 Turn warrant assessment of Cassilis Road and Golden Highway

5.2.2.3 Castlereagh Highway and Golden Highway

The previous assessment undertaken in Technical paper 13 for project traffic generation during the construction period determined that the intersection of Castlereagh Highway and Golden Highway is conservatively anticipated to experience 75 traffic movements along Golden Highway and 50 traffic movements turning in/out of Castlereagh Highway during each peak hour. It is assumed that:

- during the AM peak:
  - 90% of construction vehicles would travel towards the worksites
  - 10% of construction vehicles would travel away from the worksites
- during the PM peak:
  - 0% of construction vehicles would travel towards the worksites
  - 100% of construction vehicles would travel away from the worksites.

Under the proposed haulage route layout, a 50:50 distribution split has been assumed corresponding to the location of the work are and as a result, the turn movements along Golden Highway into Castlereagh Highway are to increase by approximately:

- 23 vehicles per hour for both right-turn and left-turn movements during the AM peak
- 3 vehicles per hour for both right-turn and left-turn movements during the PM peak.

Combining the results from the traffic surveys undertaken in 2023 and application of 1.6% growth rate for both roads, the intersection of Castlereagh and Golden Highway is anticipated to be moderately trafficked with a total of:

- 200 vehicle movements in all directions (including 18 right-turns and 16 left-turns from Golden Highway) during the AM peak period
- 219 vehicle movements in all directions (including 20 right-turns and 27 left-turns from Golden Highway) during the PM peak period.

Based on the above, the turn volumes 'Q_R' and 'Q_L' (as a combination of construction and existing traffic) are respectively considered as approximately:

- 41 vehicles per hour and 39 vehicles per hour during the AM peak
- 23 vehicles per hour and 30 vehicles per hour during the PM peak.

The anticipated Q_M (as a combination of construction and existing traffic) by 2026 on the intersection Castlereagh Highway and Golden Highway would also therefore account for approximately:

- 247 vehicles for the right turn and 140 for the left turn calculations during the AM peak
- 243 vehicles for the right turn and 90 for the left-turn calculations during the PM peak.

Currently, this intersection configuration is comprised of an Auxiliary Left Turn (AUL) and a short Channelised Right Turn (CHRs). The capacity assessment of this intersection indicate that it would need to have at least an Auxiliary Left-turn and a short Channelised Right-turn (CHRs) treatment. Therefore, this intersection would not need to be upgraded to provide a safe access for workers travelling through the construction routes. This recommendation would be reviewed in the detailed construction planning stage, subject to the determination of finalised workforce numbers.

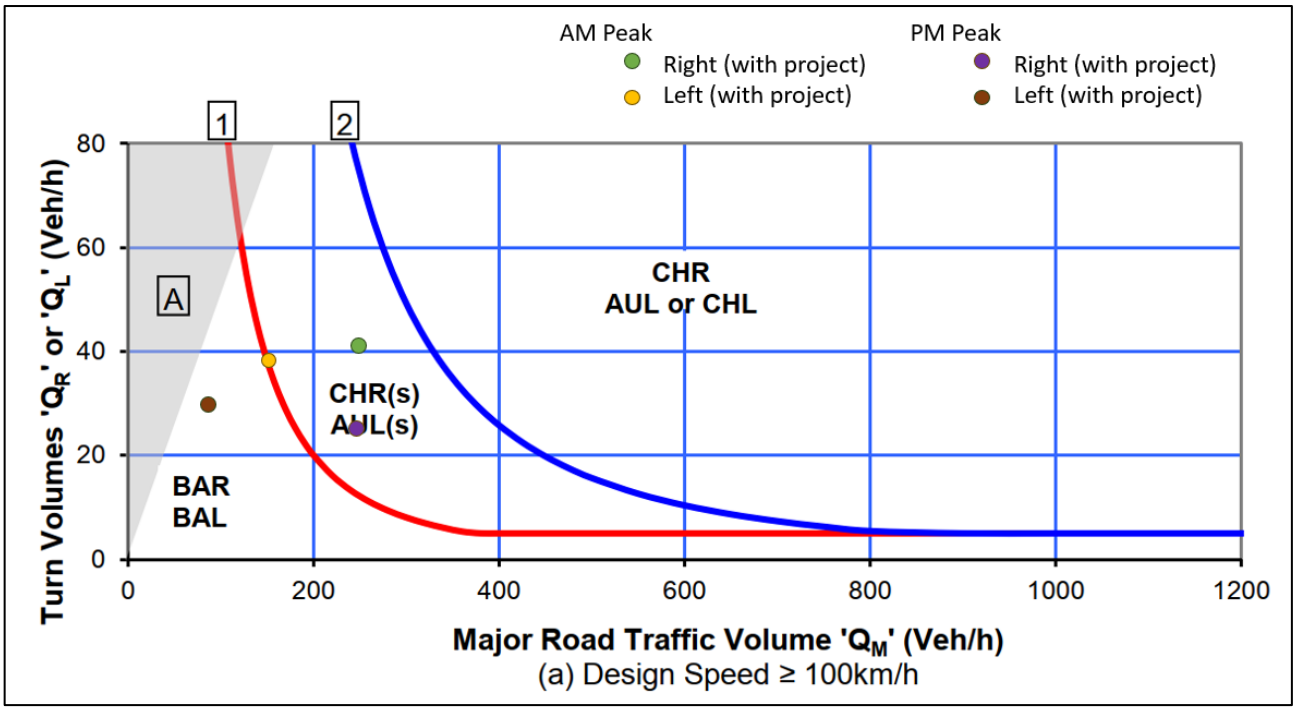


Figure 5-3 Turn warrant assessment of Castlereagh Highway and Golden Highway

5.2.2.4 Golden Highway and Spring Ridge Road

Elong Elong Energy Hub would generate 24 traffic movements (4 light vehicles and 20 heavy vehicles) at its peak. Additional 32 traffic movements (30 light vehicles and 2 heavy vehicles) and 13 traffic movements (12 light and 1 heavy vehicles) are needed for access to the transmission lines and switching station work sites respectively. As a result, it is conservatively estimated that 100 construction-associated vehicles would travel along Spring Ridge Road to and from Golden Highway during each peak hour. It is assumed that:

- during the AM peak, 100% of construction vehicles would travel towards the worksites (0% from the west and 100% from the east)
- during the PM peak, 100% of construction vehicles would travel away from the worksites (0% to the west and 100% to the east).

As a result, during the AM peak, right turn movements into Spring Ridge Road (Q_R) are estimated to increase by 0 vehicles per hour, and the left turn (Q_L) would increase by 100 vehicles per hour due to construction associated works. No increase in turning movements due to construction is anticipated during the PM peak. Within close proximity, Golden Highway is also to increase by 100 vehicles per hour during the construction period as previously assessed in Technical paper 13.

Using the results from the traffic surveys undertaken in 2022 and application of 1.6% growth rate to Golden Highway, the intersection of Spring Ridge Road and Golden Highway is anticipated to be moderately trafficked with a total of:

- 138 vehicle movements in all directions (including 2 right-turns and 5 left-turns from Golden Highway) during the AM peak period
- 139 vehicle movements in all directions (including 5 right-turns and 2 left-turns from Golden Highway) during the PM peak period.

Based on the above, the turn volumes 'Q_R' and 'Q_L' (as a combination of construction and existing traffic) are respectively considered as approximately:

- Q_R is 2 vehicles per hour and Q_L is 105 vehicles per hour during the AM peak
- Q_R is 5 vehicles per hour and Q_L is 0 vehicles per hour during the PM peak.

The anticipated Q_M (as a combination of construction and existing traffic) by 2026 on the intersection of Spring Ridge Road and Golden Highway would also therefore account for approximately:

- 329 vehicles for the right turn and 50 for the left turn calculations during the AM peak
- 229 vehicles for the right turn and 67 for the left-turn calculations during the PM peak.

Currently, this intersection configuration is comprised of a short Auxiliary Left Turn (AULs) and a Basic Right Turn (BAR). The capacity assessment of this intersection indicate that it would need to have a basic left turn (BAL) and basic right turn (BAR). Therefore, no intersection upgrades would be required.

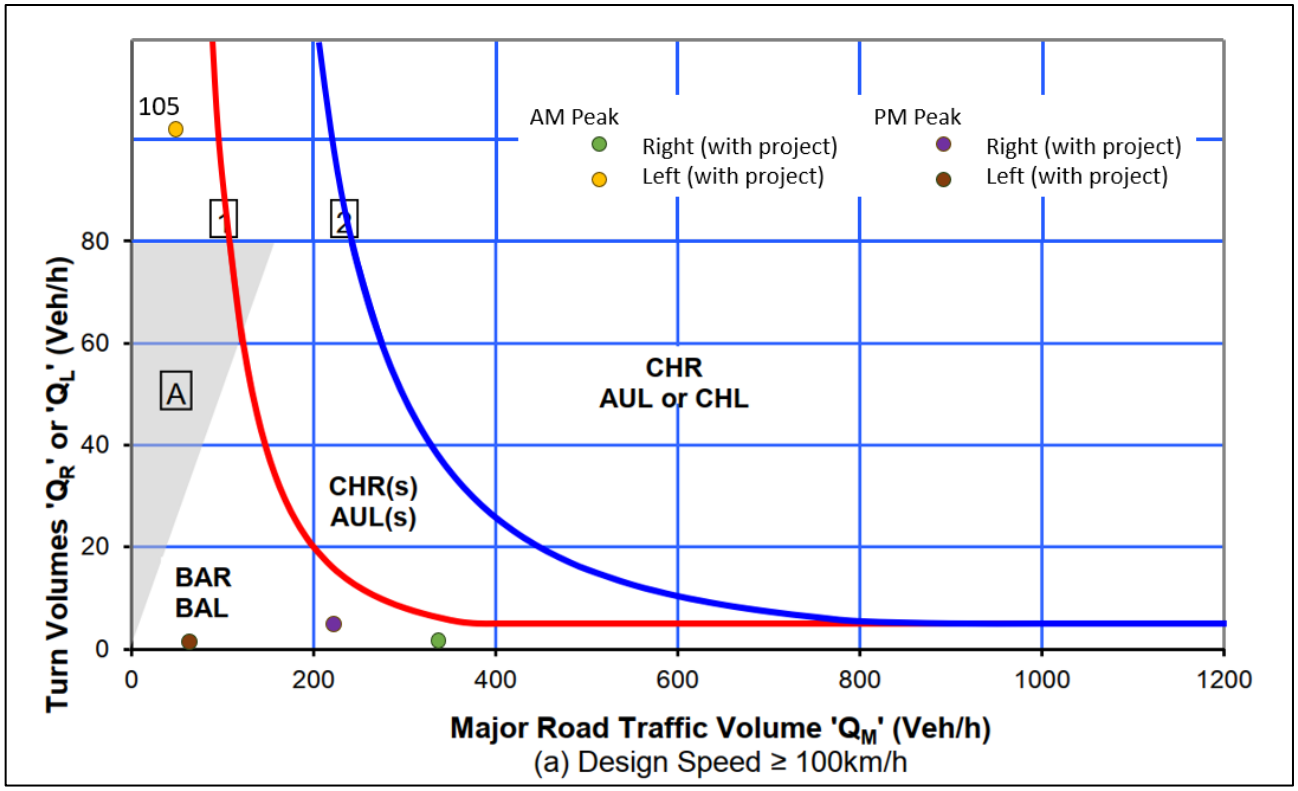


Figure 5-4 Turn warrant assessment of Golden Highway and Spring Ridge Road

5.2.2.5 Merotherie Road and Golden Highway

The Merotherie Energy Hub and the main construction camp would generate approximately 75 traffic movements which includes traffic demand into/out of transmission lines and switching stations work sites. It is assumed that:

- during the AM peak, 100% of construction vehicles would travel towards the worksites (67% from the west and 33% from the east)
- during the PM peak, 100% of construction vehicles would travel away from the worksites (67% to the west and 33% to the east).

As a result, during the AM peak, right turn movements into Merotherie Road (Q_R) are estimated to increase by 50 vehicles per hour, and the left turn (Q_L) would increase by 25 vehicles per hour due to construction associated works. No increase in turning movements due to construction is anticipated during the PM peak. Golden Highway is also to increase by 75 vehicles per hour during the construction period as previously assessed in Technical paper 13.

Combining the results from the traffic surveys undertaken in 2022 and application of 1.6% growth rate on Golden Highway, the intersection of Merotherie Road and Golden Highway is anticipated to be moderately trafficked with a total of:

- 77 vehicle movements in all directions (including 0 right-turns and 0 left-turns from Golden Highway) during the AM peak period
- 78 vehicle movements in all directions (including 2 right-turns and 0 left-turns from Golden Highway) during the PM peak period.

Based on the above, the turn volumes 'Q_R' and 'Q_L' (as a combination of construction and existing traffic) are respectively considered as approximately:

- Q_R is 50 vehicles per hour and Q_L is 25 vehicles per hour during the AM peak
- Q_R is 2 vehicles per hour and Q_L is 0 vehicles per hour during the PM peak.

The anticipated Q_M (as a combination of construction and existing traffic) by 2026 on the intersection of Merotherie Road and Golden Highway would also therefore account for approximately:

- 175 vehicles for the right turn and 98 for the left turn calculations during the AM peak
- 151 vehicles for the right turn and 43 for the left-turn calculations during the PM peak.

Currently, this intersection configuration is comprised of a Basic Left Turn (BAL) and a Basic Right Turn (BAR). The capacity assessment of this intersection indicates that it may need to have at least a basic left turn (BAL) and a short Channelised Right Turn (CHRs)

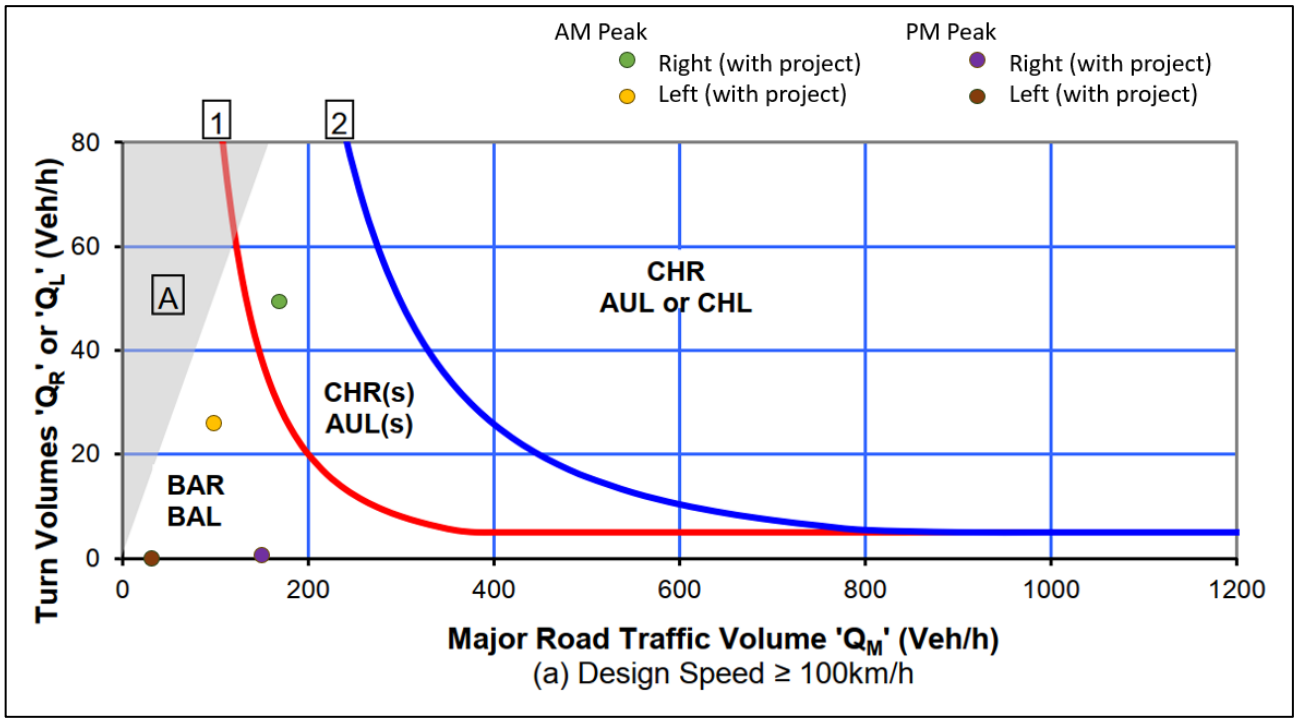


Figure 5-5 Turn warrant assessment of Merotherie Road and Golden Highway

5.2.2.6 Golden Highway and Ulan Road

Construction vehicle movements at this intersection would largely be associated with movements to and from the Neeleys Lane workforce accommodation camp (however at the time of writing this document, the updated traffic data associated with Neeleys Lane accommodation camp at this intersection is still pending), new Wollar switching station, and access gates along the transmission line in the south-eastern section of the construction area. The intersection is anticipated to experience an addition of up to 75 vehicle movements on the Golden Highway and 75 vehicle movements turning into/out of Ulan Road in the peak hours during construction as previously assessed in Technical paper 13 which includes traffic demand into/out of transmission lines and switching stations work sites. It is assumed that:

- during the AM peak, 100% of construction vehicles would travel towards the worksites (67% from the west and 33% from the east)
- during the PM peak, 100% of construction vehicles would travel away from the worksites (67% to the west and 33% to the east).

As a result, during the AM peak, right turn movements into Ulan Road (Q_R) are estimated to increase by 50 vehicles per hour, and the left turn (Q_L) would increase by 25 vehicles per hour due to construction associated works. No increase in turning movements due to construction is anticipated during the PM peak.

Combining the results from the traffic surveys undertaken in 2022 and application of 1.6% growth rate on Golden Highway, the intersection of Ulan Road and Golden Highway is anticipated to be moderately trafficked with a total of:

- 176 vehicle movements in all directions (including 6 right-turns and 31 left-turns from Golden Highway) during the AM peak period
- 191 vehicle movements in all directions (including 7 right-turns and 37 left-turns from Golden Highway) during the PM peak period.

Based on the above, the turn volumes 'Q_R' and 'Q_L' (as a combination of construction and existing traffic) are respectively considered as approximately:

- 56 vehicles per hour and 56 vehicles per hour during the AM peak
- 7 vehicles per hour and 37 vehicles per hour during the PM peak.

The anticipated Q_M (as a combination of construction and existing traffic) by 2026 on the intersection of Ulan Road and Golden Highway would also therefore account for approximately:

- 200 vehicles for the right turn and 87 for the left turn calculations during the AM peak
- 198 vehicles for the right turn and 43 for the left-turn calculations during the PM peak.

Currently, this intersection configuration is comprised of an Auxiliary Left Turn (AUL) and a Basic Right Turn (BAR). The capacity assessment of this intersection indicate that it would need to have at least a basic left turn (BAL) and short Channelised Right Turn (CHRs) treatments to support safe operations of the intersection.

Therefore, although the left turn treatment is satisfactorily, the need for a short Channelised Right Turn (CHRs) treatment may require an upgrade to the intersection from its currently layout of a Basic Right Turn (BAR) treatment. This would be reviewed in the detailed construction planning stage, subject to the determination of finalised workforce numbers.

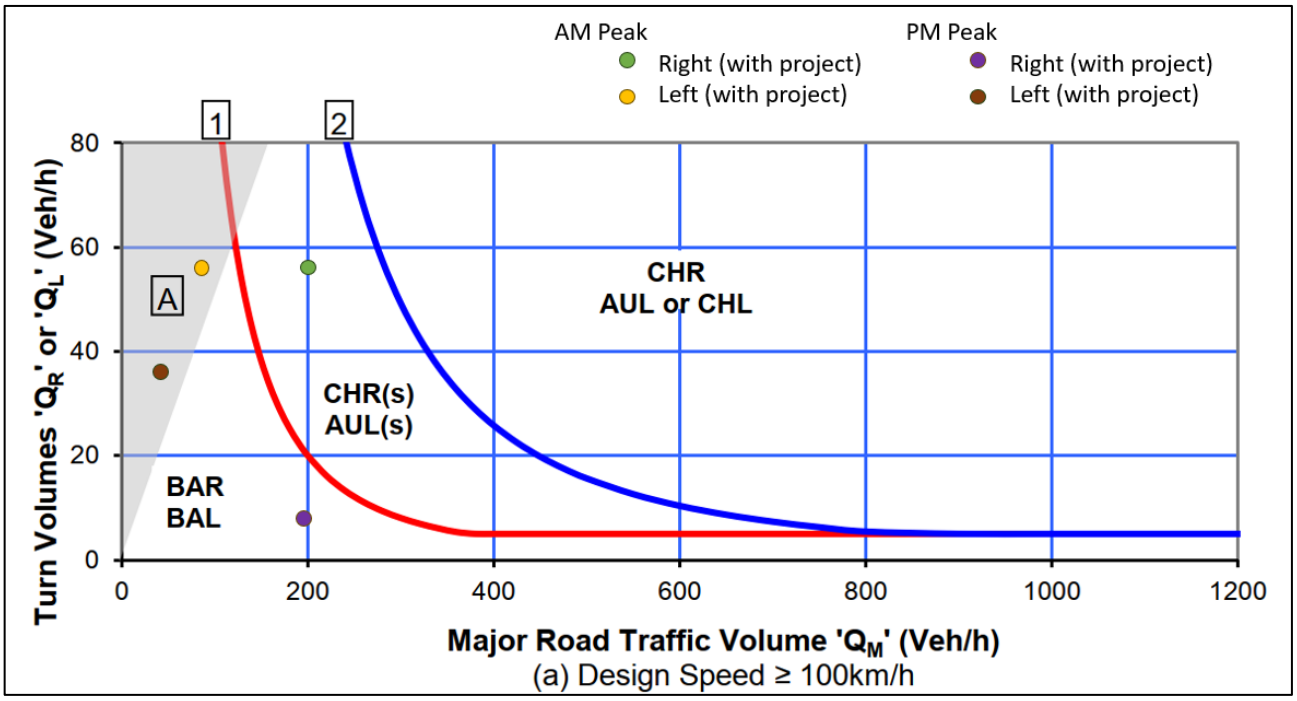


Figure 5-6 Turn warrant assessment of Golden Highway and Ulan Road

5.2.2.7 Castlereagh Highway and Laheys Creek Road

Construction vehicle movements at this intersection would largely be associated with light vehicle movements on Castlereagh Highway to access the gates off Puggoon Road to enter/exit M9 Switching Station. Access gates typically require up to 50 vehicles per hour at the peak periods of construction. The intersection is anticipated to experience an addition of up to 50 vehicle movements on the Castlereagh Highway in the peak hours during construction as previously assessed in Technical paper 13. It is assumed that:

- during the AM peak, 100% of construction vehicles would travel south along Castlereagh Highway towards the gates off Puggoon Road
- during the PM peak, 100% of construction vehicles would travel north along Castlereagh Highway from the gates off Puggoon Road.

As a result, there is no anticipated increase in turning movements due to construction during both peak hour periods.

Using the results from the traffic surveys undertaken in 2022 and application of 1.6% growth rate on Castlereagh Highway, the intersection of Castlereagh Highway and Laheys Creek Road is anticipated to be moderately trafficked with a total of:

- 111 vehicle movements in all directions (including 0 right-turns and 6 left-turns from Castlereagh Highway) during the AM peak period
- 109 vehicle movements in all directions (including 2 right-turns and 12 left-turns from Castlereagh Highway) during the PM peak period.

Based on the above, the turn volumes 'Q_R' and 'Q_L' (as a combination of construction and existing traffic) are respectively considered as approximately:

- 0 vehicles per hour and 6 vehicles per hour during the AM peak
- 2 vehicles per hour and 12 vehicles per hour during the PM peak.

The anticipated Q_M (as a combination of construction and existing traffic) by 2026 on the intersection of Castlereagh Highway and Laheys Creek Road would also therefore account for approximately:

- 158 vehicles for the right turn and 48 for the left turn calculations during the AM peak
- 154 vehicles for the right turn and 89 for the left-turn calculations during the PM peak.

Currently, this intersection configuration is comprised of a Basic Left Turn (BAL) and a Basic Right Turn (BAR). The increase of traffic movements due to construction would result in the intersection requiring Basic Left Turn (BAL) and a Basic Right Turn (BAR) treatments, which currently exist at the intersection. Therefore, the existing intersection configuration is adequate and does not require an upgrade for the project.

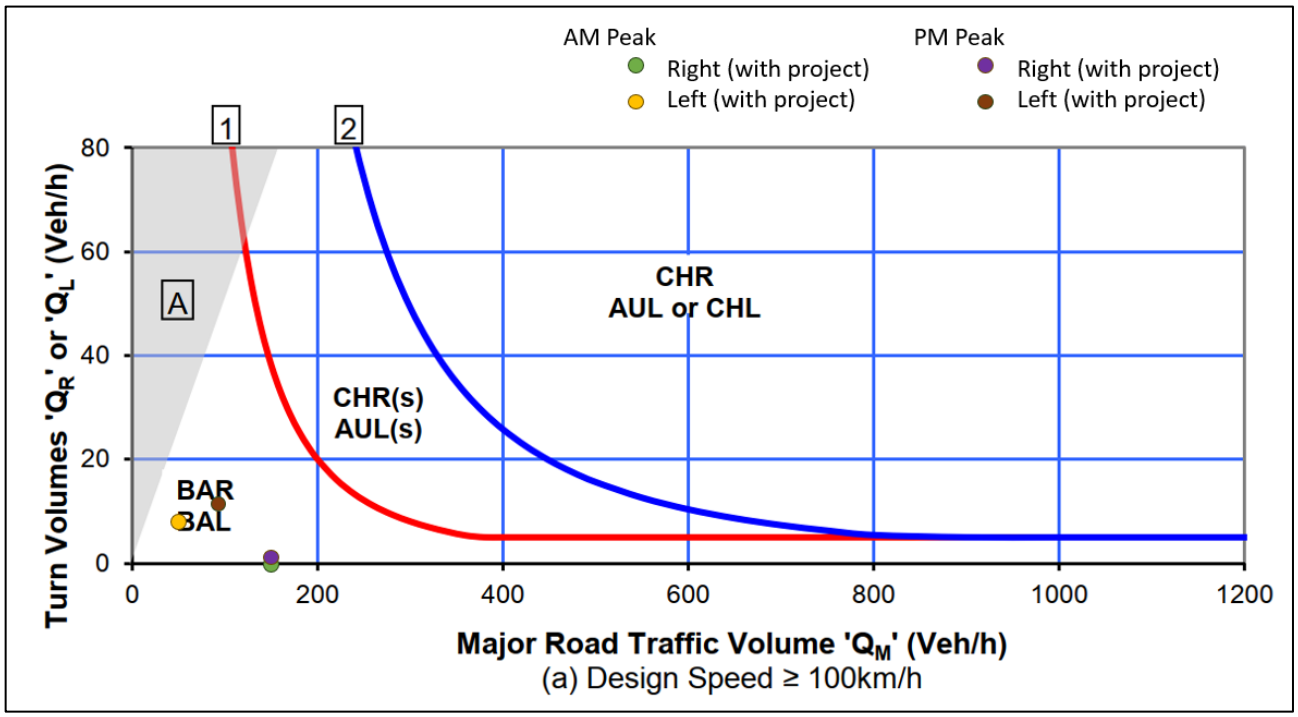


Figure 5-7 Turn warrant assessment of Castlereagh Highway and Laheys Creek Road

5.2.2.8 Golden Highway and Ross Crossing North Road

This intersection is not being used as a construction traffic route, other than through movements on Golden Highway. Therefore, there is no need to assess for Turn Warrant/intersection analysis.

5.2.2.9 Golden Highway and Blue Springs Road

During construction, the intersection of Golden Highway and Blue Springs Road is anticipated to experience up to 75 traffic movements along Golden Highway and 50 traffic movements turning in/out of Blue Springs Road during each peak hour as determined from the previous traffic generation assessment undertaken in Technical paper 13 . This includes traffic demand into/out of transmission lines, access gates and switching stations work sites. Based on the previous assessment, it is assumed that:

- during the AM peak, 100% of construction vehicles would travel towards the worksites (67% from the west, 33% from the east)
- during the PM peak, 100% of construction vehicles would travel from the worksites (67% to the west, 33% to the east).

As a result, during the AM peak, the right turn (Q_R) would increase by 33 vehicles per hour and the left turn (Q_L) would increase by 17 vehicles per hour due to construction associated works. No construction-associated turning movements into Blue Springs Road are expected during the PM peak.

As the intersection is outside of the traffic survey scope, 50% of the traffic movements turning in/out of the Merotherie Road, at the intersection of Golden Highway and Merotherie Road, has conservatively adopted for the traffic movements turning in/out of Blue Springs Road during any peak hours. Combining the results from the traffic count surveys undertaken in 2022 and application of 1.6% growth rate on Golden Highway, the intersection of Golden Highway and Blue Springs Road is anticipated to be moderately trafficked with a total of:

- 96 vehicle movements in all directions (including 0 right-turns and 0 left-turns from Golden Highway) during the AM peak period
- 89 vehicle movements in all directions (including 2 right-turns and 0 left-turns from Castlereagh Highway) during the PM peak period.

Based on the above, the turn volumes 'Q_R' and 'Q_L' (as a combination of construction and existing traffic) are respectively considered as approximately:

- 33 vehicles per hour and 17 vehicles per hour during the AM peak
- 2 vehicles per hour and 0 vehicles per hour during the PM peak.

The anticipated Q_M (as a combination of construction and existing traffic) by 2026 on the intersection of Golden Highway and Blue Springs Road would also therefore account for approximately:

- 188 vehicles for the right-turn and 126 for the left-turn calculations during the AM peak
- 162 vehicles for the right-turn and 49 for the left-turn calculations during the PM peak.

Currently, this intersection configuration is comprised of a Basic Left Turn (BAL) and a Basic Right Turn (BAR). The increase of traffic movements due to construction would result in the intersection requiring a Basic Left Turn (BAL) and short Channelised Right Turn (CHRs) treatments. Therefore, the right turn treatment may need to be upgraded to a short Channelised Right Turn (CHRs) from its currently layout of a Basic Right Turn (BAR). The construction vehicle movements, during the peak hour period, at this intersection are expected to marginally trigger the requirement for an intersection upgrade. Therefore, the volume of construction vehicle movements using this intersection during the peak hour period would be marginally restricted. If this vehicle movement volume cannot be achieved, then the required turning treatment upgrades would be constructed

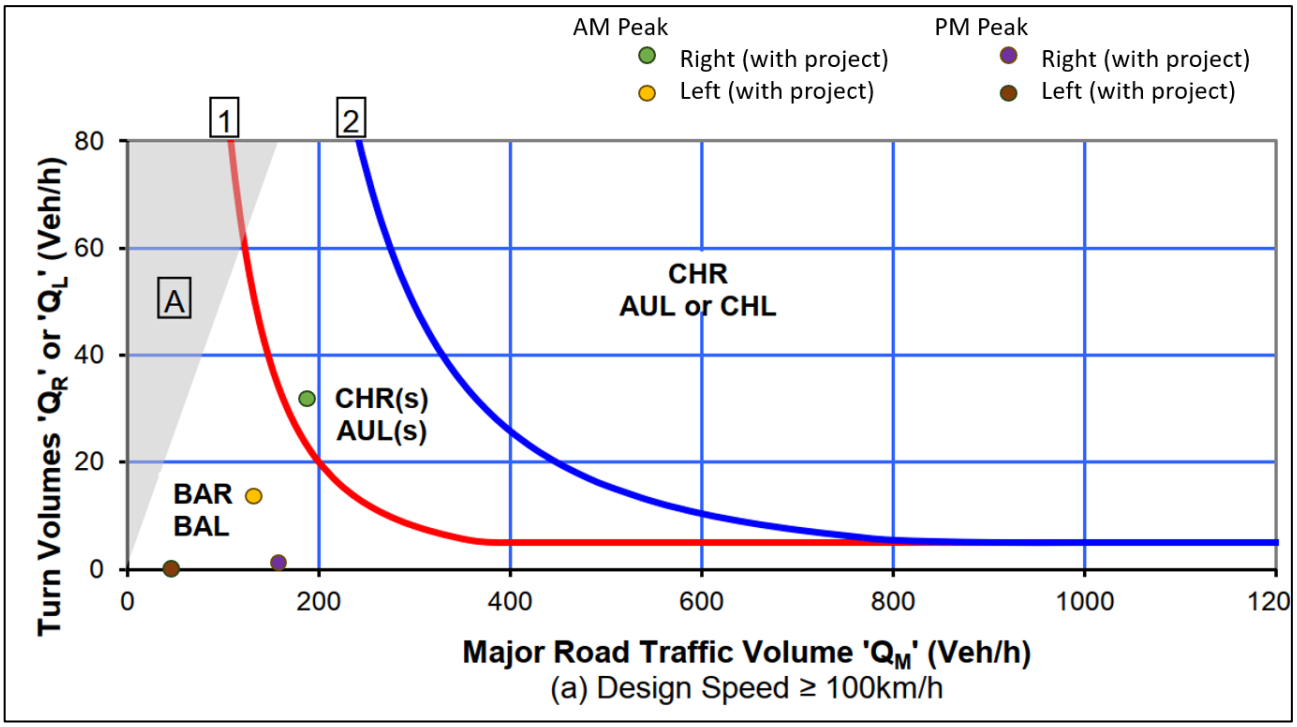


Figure 5-8 Turn warrant assessment of Golden Highway and Blue Springs Road

5.2.2.10 Whistons Lane and Castlereagh Highway

During construction, the intersection of Whistons Lane and Castlereagh Highway is anticipated to experience up to 50 traffic movements along Castlereagh Highway and 50 traffic movements turning in/out of Whistons Lane during each peak hour as determined from the previous assessment undertaken in Technical paper 13 for project traffic generation. This includes traffic demand into/out of transmission lines and switching stations work sites. On the basis of the previous assessment, it is assumed that:

- during the AM peak, 100% of construction vehicles would travel towards the worksites (90% from the north, 10% from the south)
- during the PM peak, 100% of construction vehicles would travel from the worksites (90% to the north, 10% to the south).

As a result, during the AM peak, the right turn (Q_R) would increase by 5 vehicles per hour and the left turn (Q_L) would increase by 45 vehicles per hour due to construction associated works. No construction-associated turning movements into Whistons Lane are expected during the PM peak.

It is observed that Whistons Lane serves up to two (2) existing developments. Accordingly, a rate of 10 vehicle movements per hour has been conservatively adopted for the traffic volumes along Whiston Lane during any peak hours with 100% exiting Whistons Lane during the AM peak and entering Whistons Lane during the PM peak. Combining the results from the traffic count surveys undertaken in 2022 and application of 1.6% growth rate on Castlereagh Highway, the intersection of Whistons Lane and Castlereagh Highway is anticipated to be moderately trafficked with a total of:

- 85 vehicle movements in all directions (including 0 right-turns and 0 left-turns from Castlereagh Highway) during the AM peak period
- 90 vehicle movements in all directions (including 6 right-turns and 6 left-turns from Castlereagh Highway) during the PM peak period.

Based on the above, the turn volumes 'Q_R' and 'Q_L' (as a combination of construction and existing traffic) are respectively considered as approximately:

- 5 vehicles per hour and 45 vehicles per hour during the AM peak
- 6 vehicles per hour and 6 vehicles per hour during the PM peak.

The anticipated Q_M (as a combination of construction and existing traffic) by 2026 on the intersection of Whistons Lane and Castlereagh Highway would also therefore account for approximately:

- 170 vehicles for the right-turn and 89 for the left-turn calculations during the AM peak
- 134 vehicles for the right-turn and 42 for the left-turn calculations during the PM peak.

Currently, this intersection configuration is comprised of a Basic Left Turn (BAL) and a Basic Right Turn (BAR). The increase of traffic movements due to construction would result in the intersection requiring a basic right-turn (BAR) and basic left-turn (BAL) treatments. Therefore, the current intersection configuration is adequate, and no upgrades are required to this intersection.

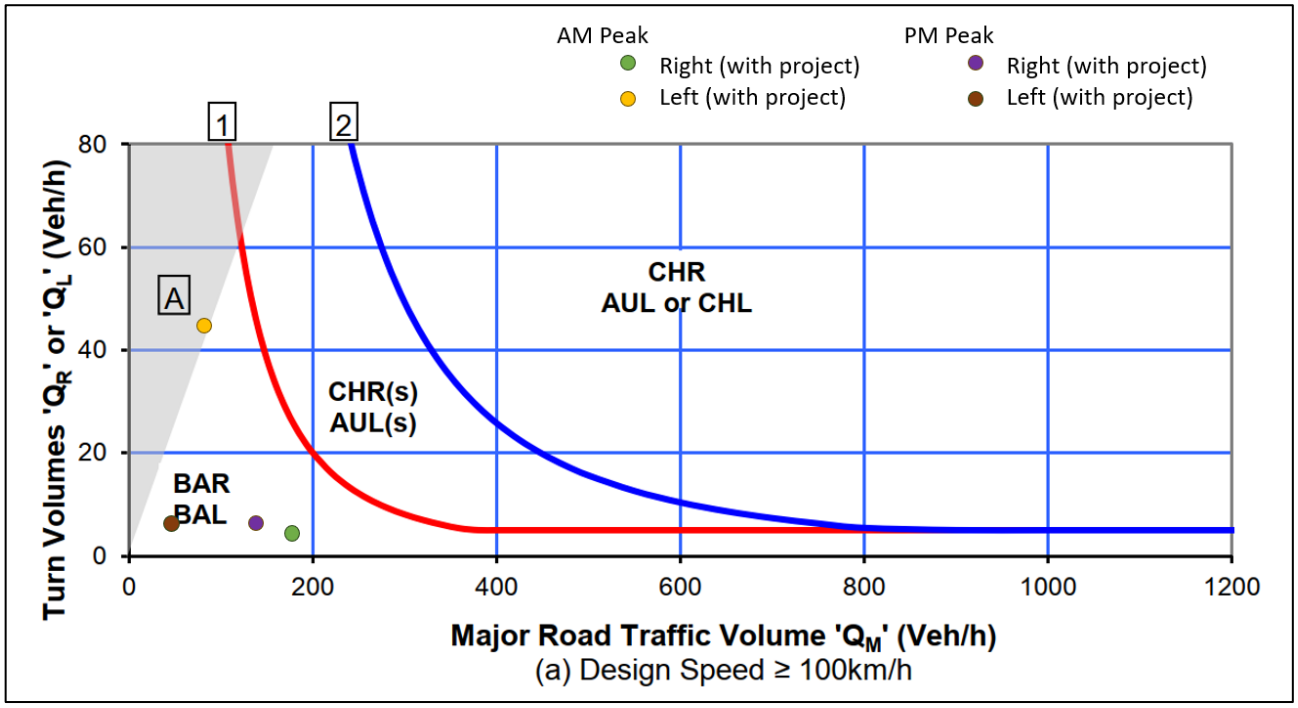


Figure 5-9 Turn warrant assessment of Whistons Lane and Castlereagh Highway

5.2.2.11 Tucklan Road and Castlereagh Highway

During construction, the intersection of Tucklan Road and Castlereagh Highway is anticipated to experience up to 50 traffic movements along Castlereagh Highway and 50 traffic movements turning in/out of Tucklan Road each peak hour as determined from the previous assessment undertaken in Technical paper 13 for project traffic generation. This includes traffic demand into/out of transmission lines and switching stations work sites. On the basis of the previous assessment, it is assumed that:

- during the AM peak, 100% of construction vehicles would travel towards the worksites (90% from the north, 10% from the south)
- during the PM peak, 100% of construction vehicles would travel from the worksites (90% to the north, 10% to the south).

As a result, during the AM peak, the right turn (Q_R) would increase by 45 vehicles per hour and the left turn (Q_L) would increase by 5 vehicles per hour due to construction associated works. No construction-associated turning movements into Tucklan Road are expected during the PM peak.

Combining the results from the automatic traffic count surveys undertaken in 2022 and application of 1.6% growth rate on Castlereagh Highway, the intersection of Tucklan Road and Castlereagh Highway is anticipated to be moderately trafficked with a total of:

- 93 vehicle movements in all directions (including 5 right-turns and 4 left-turns from Castlereagh Highway) during the AM peak period
- 94 vehicle movements in all directions (including 6 right-turns and 6 left-turns from Castlereagh Highway) during the PM peak period.

Based on the above, the turn volumes 'Q_R' and 'Q_L' (as a combination of construction and existing traffic) are respectively considered as approximately:

- 50 vehicles per hour and 9 vehicles per hour during the AM peak
- 6 vehicles per hour and 6 vehicles per hour during the PM peak.

The anticipated Q_M (as a combination of construction and existing traffic) by 2026 on the intersection of Tucklan Road and Castlereagh Highway would also therefore account for approximately:

- 134 vehicles for the right turn and 36 for the left turn calculations during the AM peak
- 134 vehicles for the right turn and 82 for the left-turn calculations during the PM peak.

Currently, this intersection configuration is comprised of a Basic Left Turn (BAL) and a Basic Right Turn (BAR). The increase of traffic movements due to construction would result in the intersection requiring a basic right-turn (BAR) and basic left-turn (BAL) treatments. Therefore, the current intersection configuration is adequate, and no upgrades are required to this intersection.

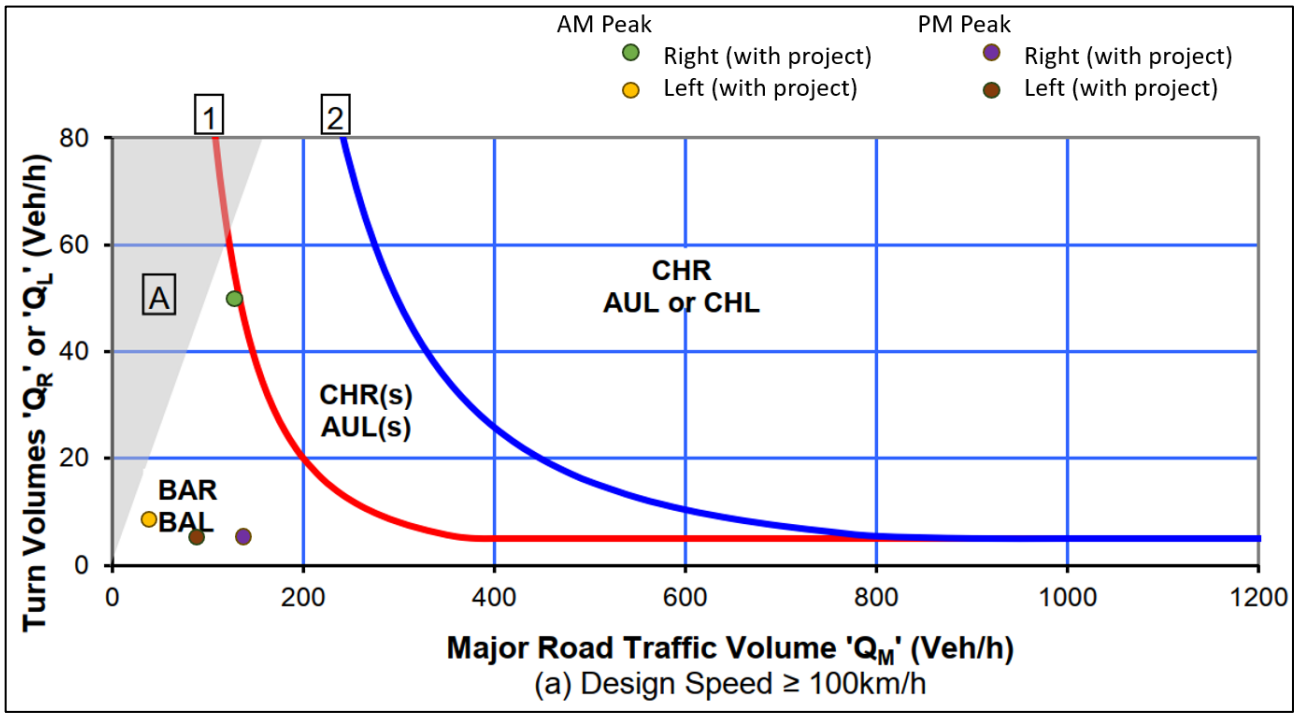


Figure 5-10 Turn warrant assessment of Tucklan Road and Castlereagh Highway

5.2.2.12 Puggoon Road and Castlereagh Highway

Construction vehicle movements at this intersection would largely be associated with light vehicle movements on Castlereagh Highway to access the gates off Puggoon Road to enter/exit M9 Switching Station. The intersection is anticipated to experience an addition of up to 50 vehicle movements turning between Castlereagh Highway and Puggoon Road in the peak hours during construction based on the previous assessment in Technical paper 13. It is assumed that:

- during the AM peak, 100% of construction vehicles would travel towards the gates off Puggoon Road from Castlereagh Highway
- during the PM peak, 100% of construction vehicles would travel from the gates off Puggoon Road to Castlereagh Highway.

As a result, during the AM peak, the left turn (Q_L) would increase by 32 vehicles per hour due to construction associated works. No increase in turning movements into Puggoon Road due to construction are anticipated during the PM peak.

Combining the results from the traffic surveys undertaken in 2022 as sourced from the *Bellambil Heights Traffic Impact Assessment Report* and application of 1.6% growth rate on Castlereagh Highway, the intersection of Castlereagh Highway and Puggoon Road is anticipated to be moderately trafficked with a total of:

- 95 vehicle movements in all directions (including 0 right-turns and 2 left-turns from Castlereagh Highway) during the AM peak period
- 115 vehicle movements in all directions (including 2 right-turns and 0 left-turns from Castlereagh Highway) during the PM peak period.

Based on the above, the turn volumes 'Q_R' and 'Q_L' (as a combination of construction and existing traffic) are respectively considered as approximately:

- 0 vehicles per hour and 52 vehicles per hour during the AM peak
- 2 vehicles per hour and 0 vehicles per hour during the PM peak.

The anticipated Q_M (as a combination of construction and existing traffic) by 2026 on the intersection of Castlereagh Highway and Puggoon Road would also therefore account for approximately:

- 144 vehicles for the right turn and 57 for the left turn calculations during the AM peak
- 113 vehicles for the right turn and 58 for the left-turn calculations during the PM peak.

Currently, this intersection configuration is comprised of a Basic Left Turn (BAL) and a Basic Right Turn (BAR). The increase of traffic movements due to construction would result in the intersection requiring a basic right-turn (BAR) and basic left-turn (BAL) treatments. Therefore, the current intersection configuration is adequate, and no upgrades are required to this intersection.

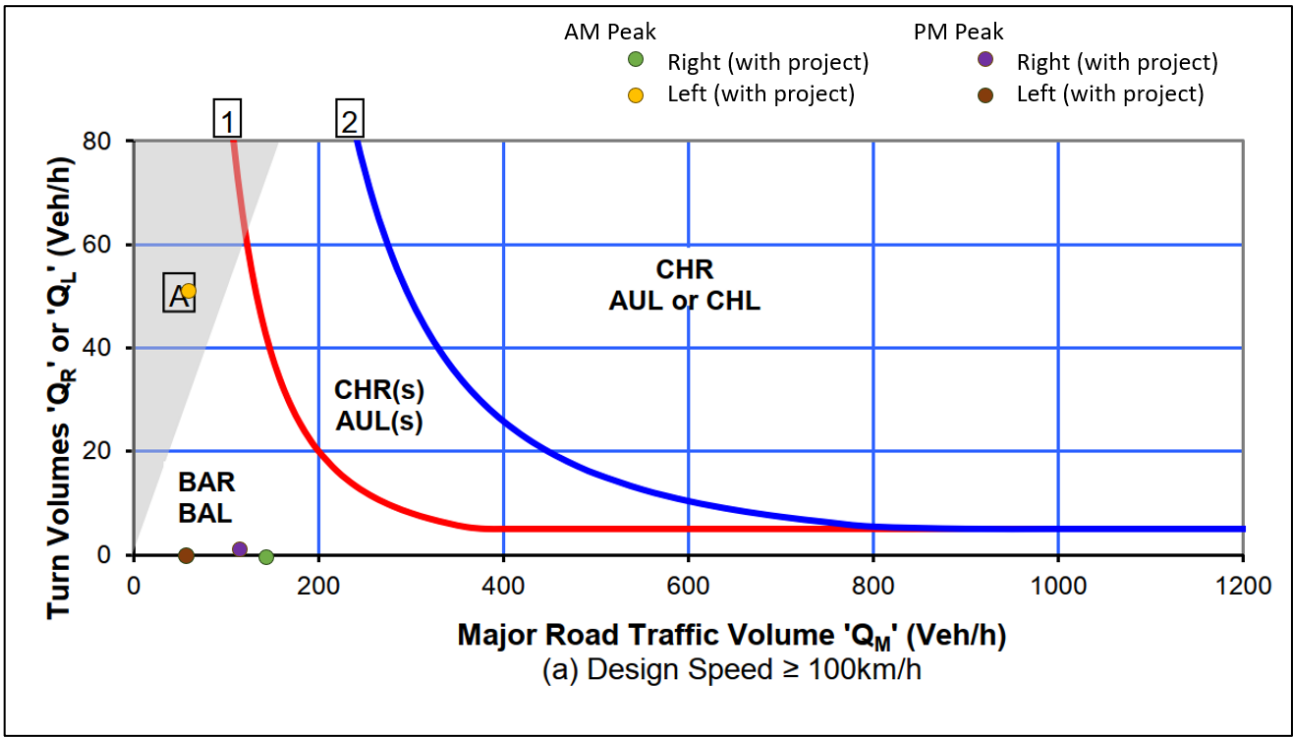


Figure 5-11 Turn warrant assessment of Puggoon Road and Castlereagh Highway

5.2.2.13 Golden Highway (East of Merotherie Road) access gates

Access gates typically require up to 32 vehicles per hour at the peak periods of construction. In addition, Golden Highway is anticipated to experience up 75 bi-directional traffic in the peak hours during construction as previously assessed in Technical paper 13. It is assumed that:

- during the AM peak, 100% of construction vehicles would travel towards the worksites (67% from the west and 33% from the east)
- during the PM peak, 100% of construction vehicles would travel away from the worksites (67% to the west and 33% to the east).

As there are access gates proposed on both sides along Golden Highway, the turn treatment warrant assessment has been undertaken separately for each side.

Access gates along the northern side of Golden Highway

- during the AM peak, right-turn (Q_R) movements into the access gate is estimated to be 11 vehicles per hour, and the left-turn (Q_L) movements would be 21 vehicles per hour.

Access gates along the southern side of Golden Highway

- during the AM peak, right-turn (Q_R) movements into the access gate is estimated to be 21 vehicles per hour, and the left-turn (Q_L) movements would be 11 vehicles per hour.

No construction-associated turning movements are anticipated from Golden Highway into the access gates during the PM peak.

Combining the results from the traffic count surveys undertaken in 2022 and application of 1.6% growth rate, Golden Highway is anticipated to be moderately trafficked with a total of:

- 58 vehicle movements per hour in the westbound direction during the AM peak period
- 38 vehicle movements per hour in the eastbound direction during the AM peak period.

The anticipated Q_M (as a combination of construction and existing traffic) by 2026 on the Golden Highway would also therefore account for approximately:

- 192 vehicles for the right turn and 45 for the left turn calculations for the north access gate during the AM peak
- 182 vehicles for the right turn and 126 for the left-turn calculations for the south access gate during the AM peak.

Currently, there are no intersection turning treatments this location. Therefore, the increase of traffic movements and implementation of the access gates due to construction would result in Golden Highway requiring the following upgrades:

- basic right turn (BAR) and basic left turn (BAL) treatments to access the north access gate
- basic right turn (BAR) and basic left turn (BAL) treatments to access the south access gate.

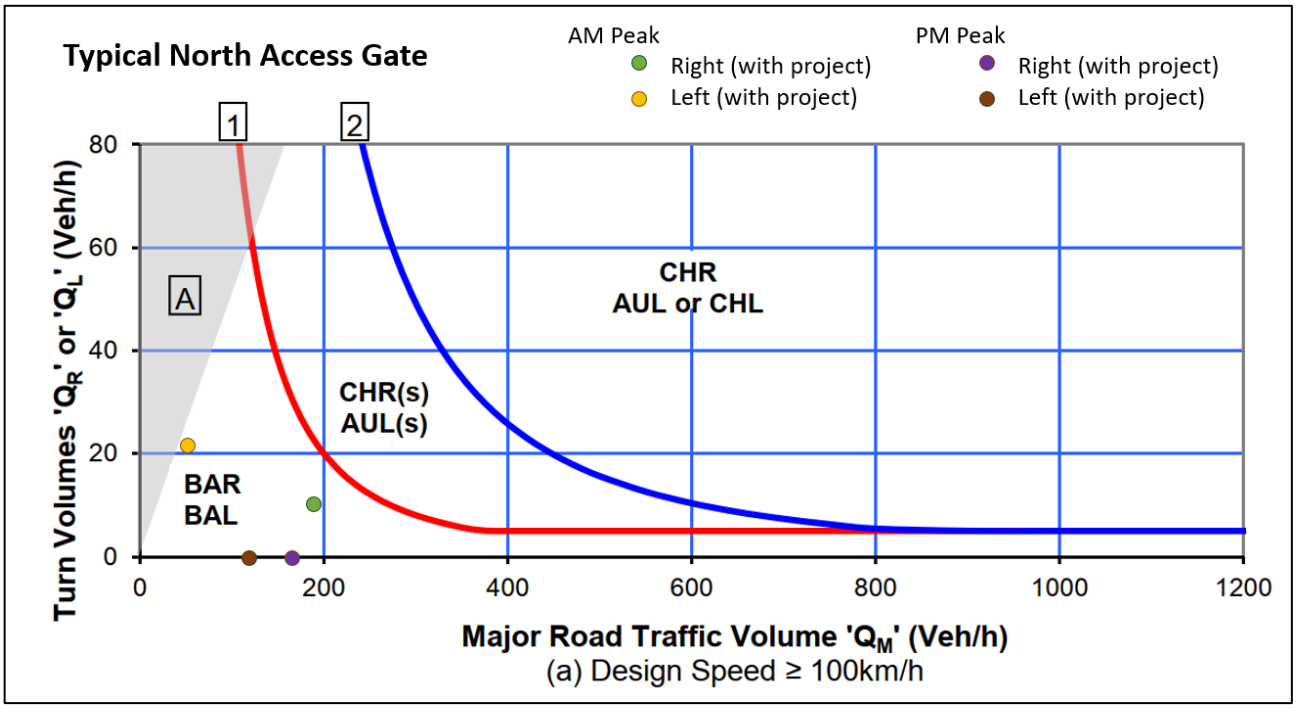


Figure 5-12 Turn warrant assessment of typical north Golden Highway (East of Merotherie Road) access gates

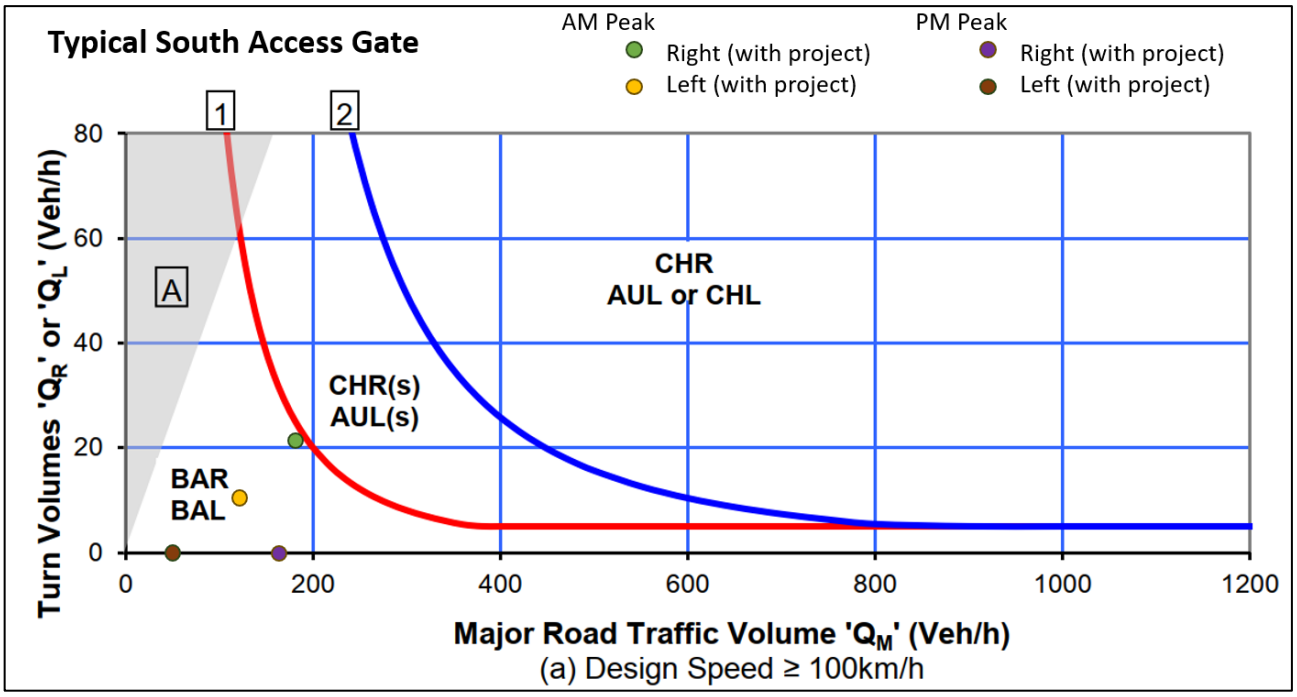


Figure 5-13 Turn warrant assessment of typical south Golden Highway (East of Merotherie Road) access gates

5.2.2.14 Castlereagh Highway access gates

Access gates typically require up to 32 vehicles per hour at the peak periods of construction. In addition, Castlereagh Highway is anticipated to experience up 50 bi-directional traffic in the peak hours during construction as previously assessed in Technical paper 13. It is assumed that:

- during the AM peak, 100% of construction vehicles would travel towards the worksites (90% from the north and 10% from the south)
- during the PM peak, 100% of construction vehicles would travel away from the worksites (90% to the north and 10% to the south).

As there are access gates proposed on both sides along Castlereagh Highway, the turn treatment warrant assessment has been undertaken separately for each side.

Access gates along the western side of Castlereagh Highway

- during the AM peak, right-turn (Q_R) movements into the access gate is estimated to be 29 vehicles per hour, and the left-turn (Q_L) movements would be 3 vehicles per hour.

Access gates along the eastern side of Castlereagh Highway

- during the AM peak, right-turn (Q_R) movements into the access gate is estimated to be 3 vehicles per hour, and the left-turn (Q_L) movements would be 29 vehicles per hour.

No construction-associated turning movements are anticipated from Castlereagh Highway into the access gates during the PM peak.

Combining the results from the traffic count surveys undertaken in 2022 and application of 1.6% growth rate, Castlereagh Highway is anticipated to be moderately trafficked with a total of:

- 44 vehicle movements per hour in the southbound direction during the AM peak period
- 31 vehicle movements per hour in the northbound direction during the AM peak period.

The anticipated Q_M (as a combination of construction and existing traffic) by 2026 on the Castlereagh Highway would also therefore account for approximately:

- 128 vehicles for the right turn and 36 for the left turn calculations for the north access gate during the AM peak
- 154 vehicles for the right turn and 89 for the left-turn calculations for the south access gate during the AM peak.

Currently, there are no intersection turning treatments this location. Therefore, the increase of traffic movements and implementation of the access gates due to construction would result in Castlereagh Highway requiring the following upgrades:

- basic right turn (BAR) and basic left turn (BAL) treatments to access the north access gate
- basic right turn (BAR) and basic left turn (BAL) treatments to access the south access gate.

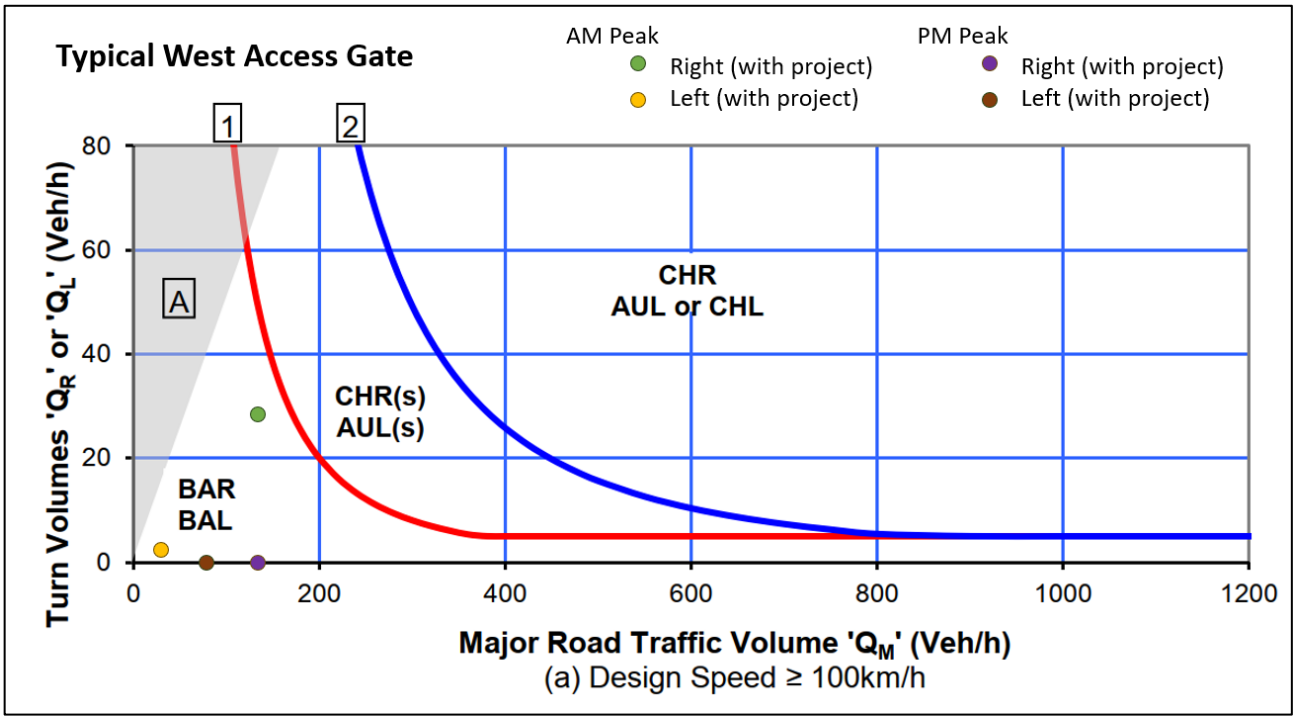


Figure 5-14 Turn warrant assessment of typical west Castlereagh Highway access gates

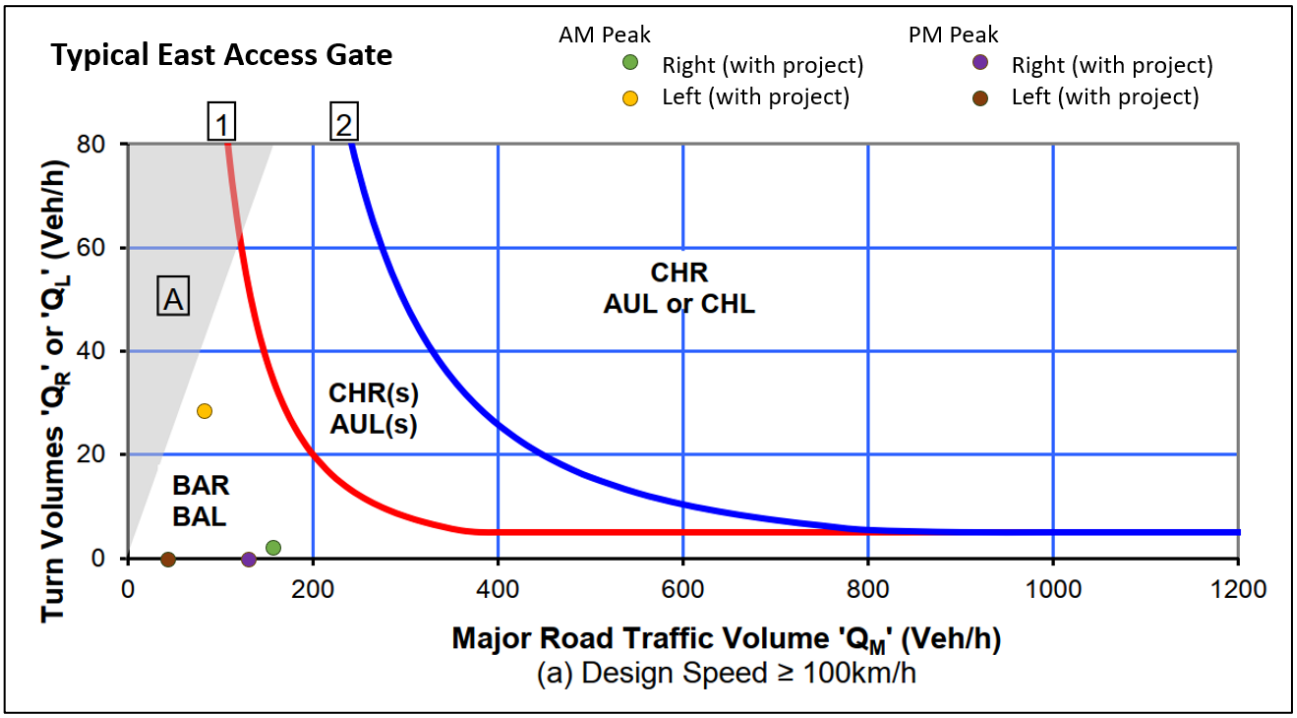


Figure 5-15 Turn warrant assessment of typical east Castlereagh Highway access gates

5.2.2.15 Ulan Road (near Ulan township) access gates

Access gates typically require up to 32 vehicles per hour at the peak periods of construction. In addition, Ulan Road (near Ulan township) is anticipated to experience up 75 bi-directional traffic in the peak hours during construction as previously assessed in Technical paper 13. It is assumed that:

- during the AM peak, 100% of construction vehicles would travel towards the worksites (100% from the north and 0% from the south)
- during the PM peak, 100% of construction vehicles would travel away from the worksites (100% to the north and 0% to the south).

As there are access gates proposed on both sides along Ulan Road (near Ulan township), the turn treatment warrant assessment has been undertaken separately for each side.

Access gates along the western side of Ulan Road (near Ulan township)

- during the AM peak, right-turn (Q_R) movements into the access gate is estimated to be 32 vehicles per hour, and the left-turn (Q_L) movements would be 0 vehicles per hour.

Access gates along the eastern side of Ulan Road (near Ulan township)

- during the AM peak, right-turn (Q_R) movements into the access gate is estimated to be 0 vehicles per hour, and the left-turn (Q_L) movements would be 32 vehicles per hour.

No construction-associated turning movements are anticipated from Ulan Road (near Ulan township) into the access gates during the PM peak.

Combining the results from the traffic count surveys undertaken in 2022, Ulan Road is anticipated to be moderately trafficked with a total of:

- 130 vehicle movements per hour in the southbound direction during the AM peak period
- 447 vehicle movements per hour in the northbound direction during the AM peak period.

The anticipated Q_M (as a combination of construction and existing traffic) by 2026 on the Ulan Road would also therefore account for approximately:

- 652 vehicles for the right turn and 455 for the left turn calculations for the north access gate during the AM peak
- 440 vehicles for the right turn and 241 for the left-turn calculations for the south access gate during the AM peak.

Currently, there are no intersection turning treatments this location. Therefore, the increase of traffic movements and implementation of the access gates due to construction would result in Ulan Road (near Ulan township) requiring:

- channelised right turn (CHR) and basic left turn (BAL) treatments to access the north/west access gate
- short auxiliary left turn (AULs) and basic right turn (BAR) treatments to access the south/east access gate.

It is expected that around four transmission towers would be constructed within the amended construction area serviced by these access gates. Accordingly, the construction traffic demand at this location would be less than that of other typical access gates. It is therefore proposed to limit construction vehicle movements turning into the northwest and southeast access gates at this location to 5 vehicles per hour during the AM peak hour period, with proportionate reductions also occurring during other times as applicable. This is to ensure safe and efficient traffic movements compatible with a Basic right turn (BAR) and Basic left turn (BAL) treatment at this location. If higher construction vehicle movement volumes are required and are incompatible with BAR / BAL treatments, then the required turning treatment upgrades would be implemented.

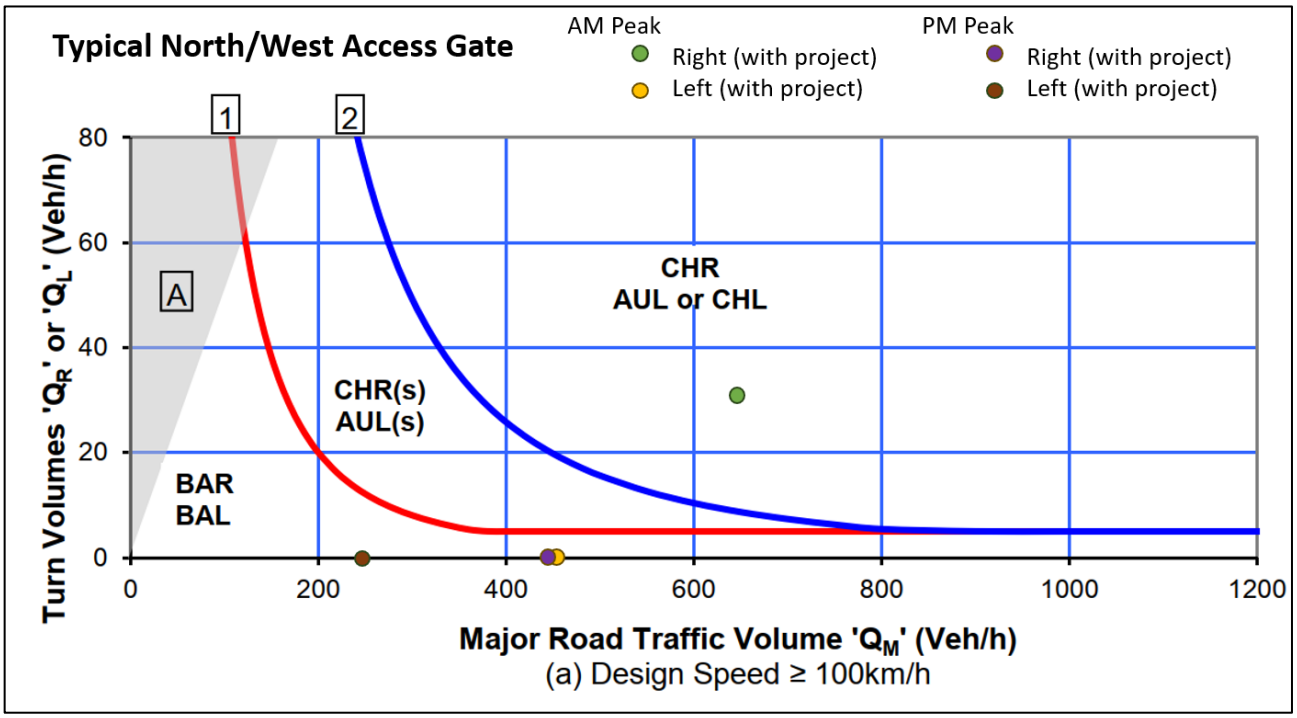


Figure 5-16 Turn warrant assessment of typical north/west Ulan Road (near Ulan township) access gates

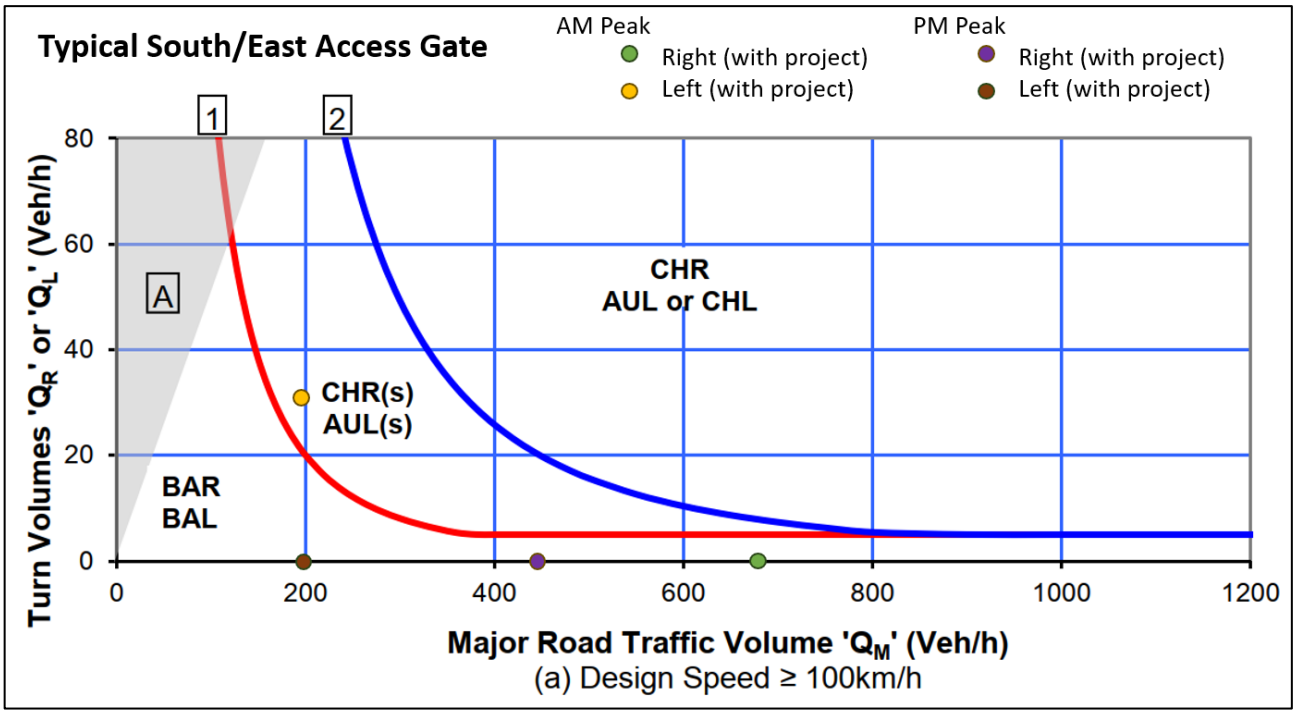


Figure 5-17 Turn warrant assessment of typical south/east Ulan Road (near Ulan township) access gates

5.2.2.16 Ulan Road (north of Ulan-Wollar Road) access gates

Access gates typically require up to 32 vehicles per hour at the peak periods of construction. In addition, Ulan Road (north of Ulan-Wollar Road) is anticipated to experience up 75 bi-directional traffic in the peak hours during construction as previously assessed in Technical paper 13. It is assumed that:

- during the AM peak, 100% of construction vehicles would travel towards the worksites (90% from the north and 10% from the south)
- during the PM peak, 100% of construction vehicles would travel away from the worksites (90% to the north and 10% to the south).

As there are access gates proposed on both sides along Ulan Road (north of Ulan-Wollar Road), the turn treatment warrant assessment has been undertaken separately for each side.

Access gates along the western side of Ulan Road (north of Ulan-Wollar Road)

- during the AM peak, right-turn (Q_R) movements into the access gate is estimated to be 29 vehicles per hour, and the left-turn (Q_L) movements would be 3 vehicles per hour.

Access gates along the eastern side of Ulan Road (north of Ulan-Wollar Road)

- during the AM peak, right-turn (Q_R) movements into the access gate is estimated to be 3 vehicles per hour, and the left-turn (Q_L) movements would be 29 vehicles per hour.

No construction-associated turning movements are anticipated from Ulan Road (north of Ulan-Wollar Road) into the access gates during the PM peak.

Using the results from the traffic count surveys undertaken in 2022, Ulan Road is anticipated to be moderately trafficked with a total of:

- 109 vehicle movements per hour in the southbound direction during the AM peak period
- 152 vehicle movements per hour in the northbound direction during the AM peak period.

The anticipated Q_M (as a combination of construction and existing traffic) by 2026 on the Ulan Road would also therefore account for approximately:

- 339 vehicles for the right turn and 160 for the left turn calculations for the typical west access gate during the AM peak
- 365 vehicles for the right turn and 176 for the left-turn calculations for the typical east access gate during the AM peak.

Currently, there are no intersection turning treatments this location. Therefore, the increase of traffic movements and implementation of the access gates due to construction would result in Ulan Road (north of Ulan-Wollar Road) requiring:

- short channelised right turn (CHRs) and basic left turn (BAL) treatments to access the typical west access gate
- basic right turn and short Auxiliary left turn (AULs) treatments to access the typical east access gate.

It is proposed to limit the volume of construction vehicle movements turning into a typical access gate location off Ulan Road (north of Ulan-Wollar Road) to 5 vehicles per hour during the AM peak hour period, with proportionate reductions also occurring during other times as applicable. This is to ensure safe and efficient traffic movements compatible with Basic right turn (BAR) and Basic left turn (BAL) treatment for access gates along this section of Ulan Road. If higher construction vehicle movement volumes are required and are incompatible with BAR / BAL treatments, then the required turning treatment upgrades would be implemented at applicable locations.

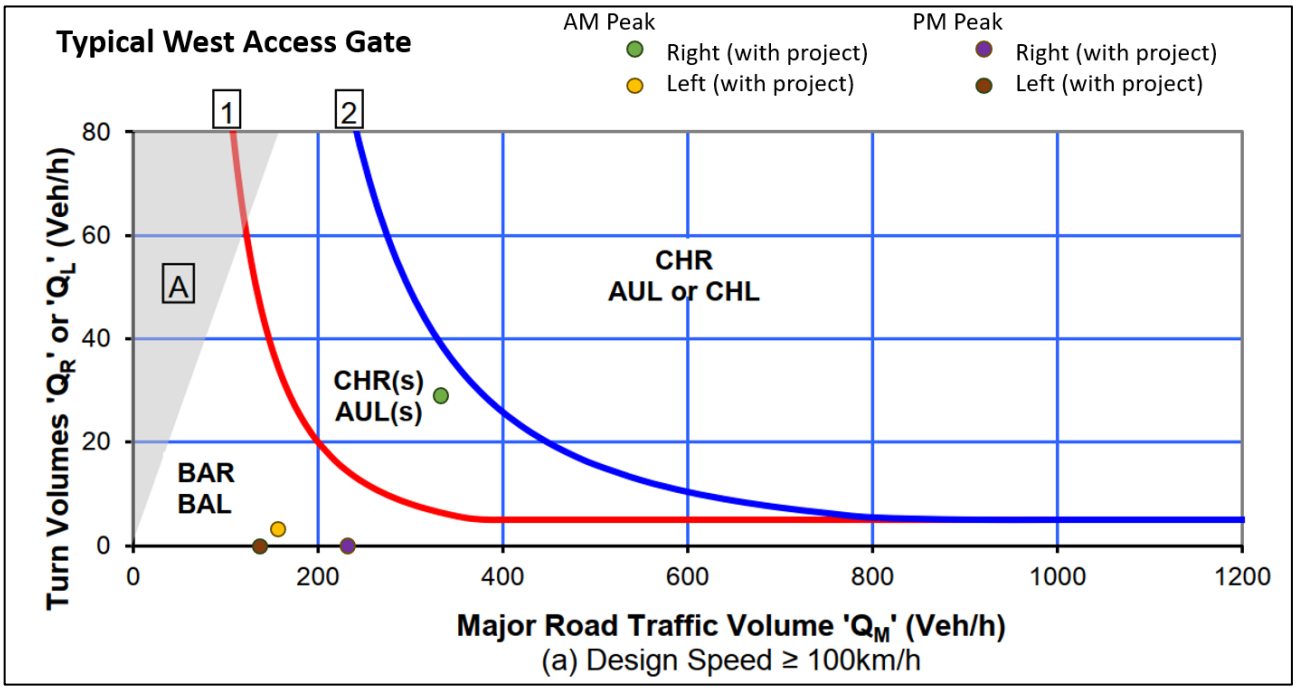


Figure 5-18 Turn warrant assessment of typical west Ulan Road (north of Ulan-Wollar Road) access gates

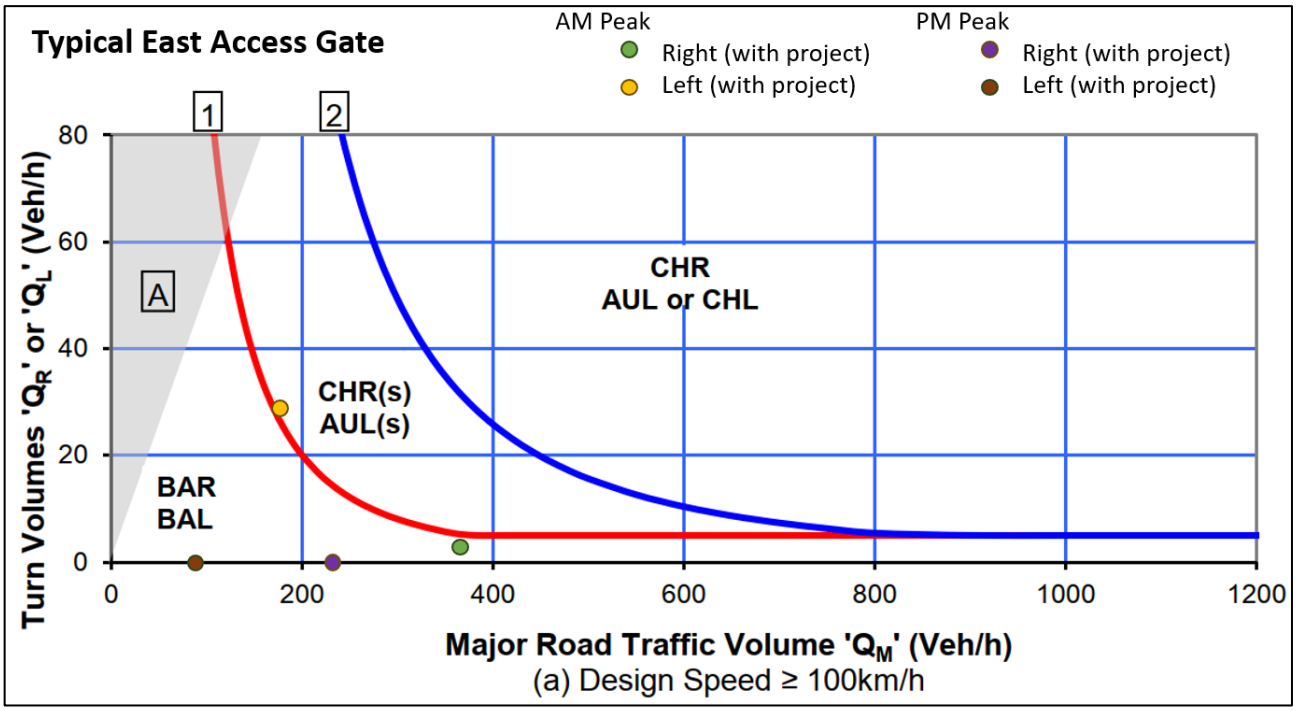


Figure 5-19 Turn warrant assessment of typical east Ulan Road (north of Ulan-Wollar Road) access gates

5.2.2.17 Wollar Road access gates

Access gates typically require up to 32 vehicles per hour at the peak periods of construction. In addition, Wollar Road is anticipated to experience up 50 bi-directional traffic in the peak hours during construction as previously assessed in Technical paper 13. It is assumed that:

- during the AM peak, 100% of construction vehicles would travel towards the worksites (0% from the west and 100% from the east)
- during the PM peak, 100% of construction vehicles would travel away from the worksites (0% to the west and 100% to the east).

As there are access gates proposed on both sides along Wollar Road, the turn treatment warrant assessment has been undertaken separately for each side.

Access gates along the northern side of Wollar Road

- during the AM peak, right-turn (Q_R) movements into the access gate is estimated to be 32 vehicles per hour, and the left-turn (Q_L) movements would be 0 vehicles per hour.

Access gates along the southern side of Wollar Road

- during the AM peak, right-turn (Q_R) movements into the access gate is estimated to be 0 vehicles per hour, and the left-turn (Q_L) movements would be 32 vehicles per hour.

No construction-associated turning movements are anticipated from Wollar Road into the access gates during the PM peak.

Using the results from the traffic surveys undertaken in 2022, Wollar Road is anticipated to be moderately trafficked with a total of:

- 11 vehicle movements per hour in the westbound direction during the AM peak period
- 7 vehicle movements per hour in the eastbound direction during the AM peak period.

The anticipated Q_M (as a combination of construction and existing traffic) by 2026 on the Wollar Road would also therefore account for approximately:

- 67 vehicles for the right turn and 11 for the left turn calculations for the north access gate during the AM peak
- 99 vehicles for the right turn and 56 for the left-turn calculations for the south access gate during the AM peak.

Currently, there are no intersection turning treatments this location. Therefore, the increase of traffic movements and implementation of the access gates due to construction would result in Wollar Road requiring:

- basic right turn (BAR) and basic left turn (BAL) treatments to access the north access gate
- basic right turn (BAR) and basic left turn (BAL) treatments to access the south access gate.

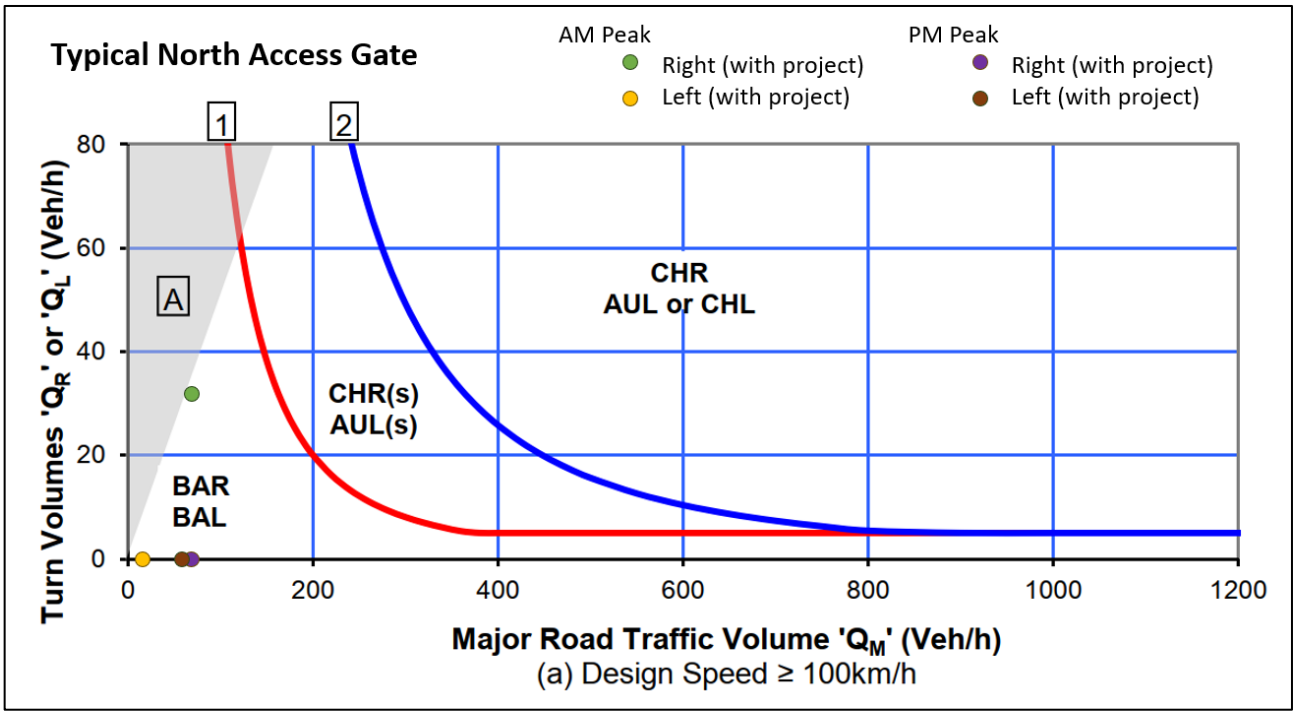


Figure 5-20 Turn warrant assessment of typical north Wollar Road access gates

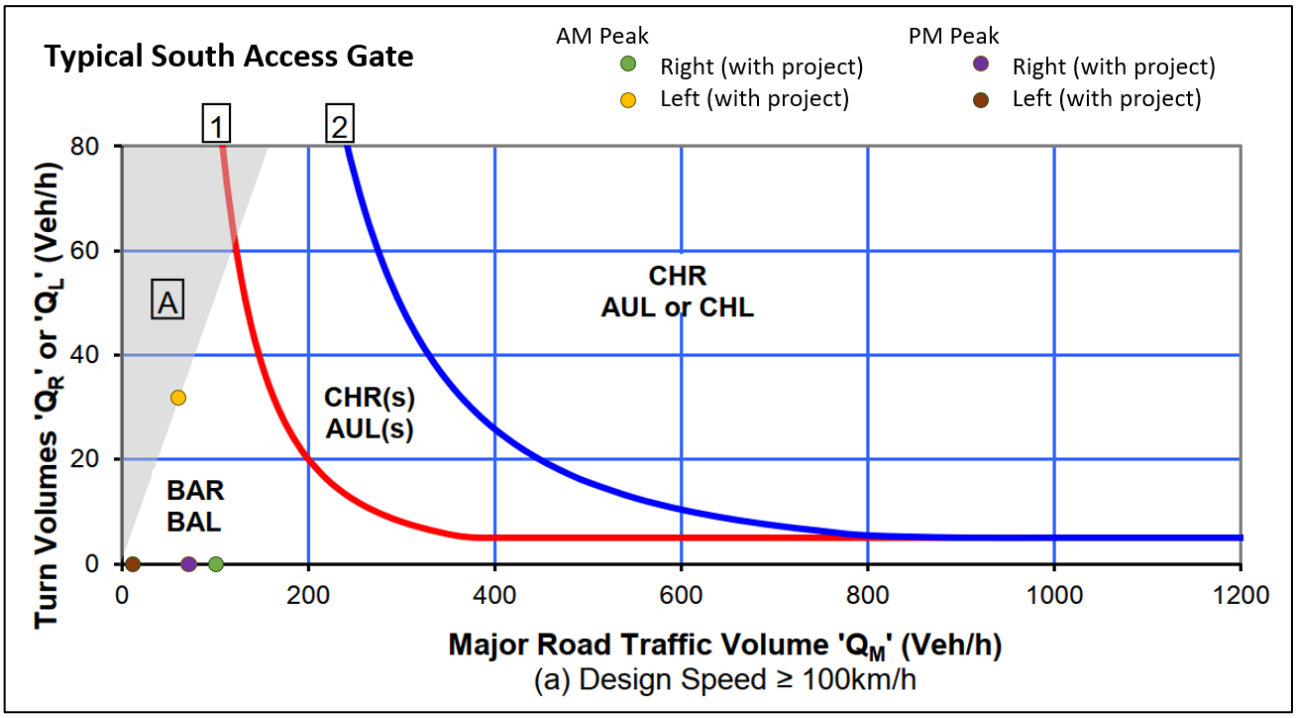


Figure 5-21 Turn warrant assessment of typical south Wollar Road access gates

5.2.2.18 Cope Road access gates

Access gates typically require up to 32 vehicles per hour at the peak periods of construction. In addition, Cope Road is anticipated to experience up 50 bi-directional traffic in the peak hours during construction as previously assessed in Technical paper 13. It is assumed that:

- during the AM peak, 100% of construction vehicles would travel towards the worksites (0% from the west and 100% from the east)
- during the PM peak, 100% of construction vehicles would travel away from the worksites (0% to the west and 100% to the east).

As there are access gates proposed on both sides along Cope Road, the turn treatment warrant assessment has been undertaken separately for each side.

Access gates along the northern side of Cope Road

- during the AM peak, right-turn (Q_R) movements into the access gate is estimated to be 32 vehicles per hour, and the left-turn (Q_L) movements would be 0 vehicles per hour.

Access gates along the southern side of Cope Road

- during the AM peak, right-turn (Q_R) movements into the access gate is estimated to be 0 vehicles per hour, and the left-turn (Q_L) movements would be 32 vehicles per hour.

No construction-associated turning movements are anticipated from Cope Road into the access gates during the PM peak.

Using the results from the traffic surveys undertaken in 2022, Cope Road is anticipated to be moderately trafficked with a total of:

- 16 vehicle movements per hour in the westbound direction during the AM peak period
- 106 vehicle movements per hour in the eastbound direction during the AM peak period.

The anticipated Q_M (as a combination of construction and existing traffic) by 2026 on the Cope Road would also therefore account for approximately:

- 172 vehicles for the right turn and 111 for the left turn calculations for the north access gate during the AM peak
- 204 vehicles for the right turn and 61 for the left-turn calculations for the south access gate during the AM peak.

Currently, there are no intersection turning treatments this location. Therefore, the increase of traffic movements and implementation of the access gates due to construction would result in Cope Road requiring:

- short channelised right turn (CHRs) and basic left turn (BAL) treatments to access the north access gate
- basic right turn (BAR) and basic left turn (BAL) treatments to access the south access gates.

There may be a need for short channelised right turn (CHRs) treatments for typical north access gates. Construction vehicle movements turning right into these access gates on the northern side of Cope Road will be limited to vehicles 25 per hour during the AM peak hour period to ensure safe and efficient traffic movements compatible with a Basic right turn (BAR) treatment. If higher construction vehicle movements are required and are incompatible with a BAR treatment, the required turning treatment upgrades will be implemented.

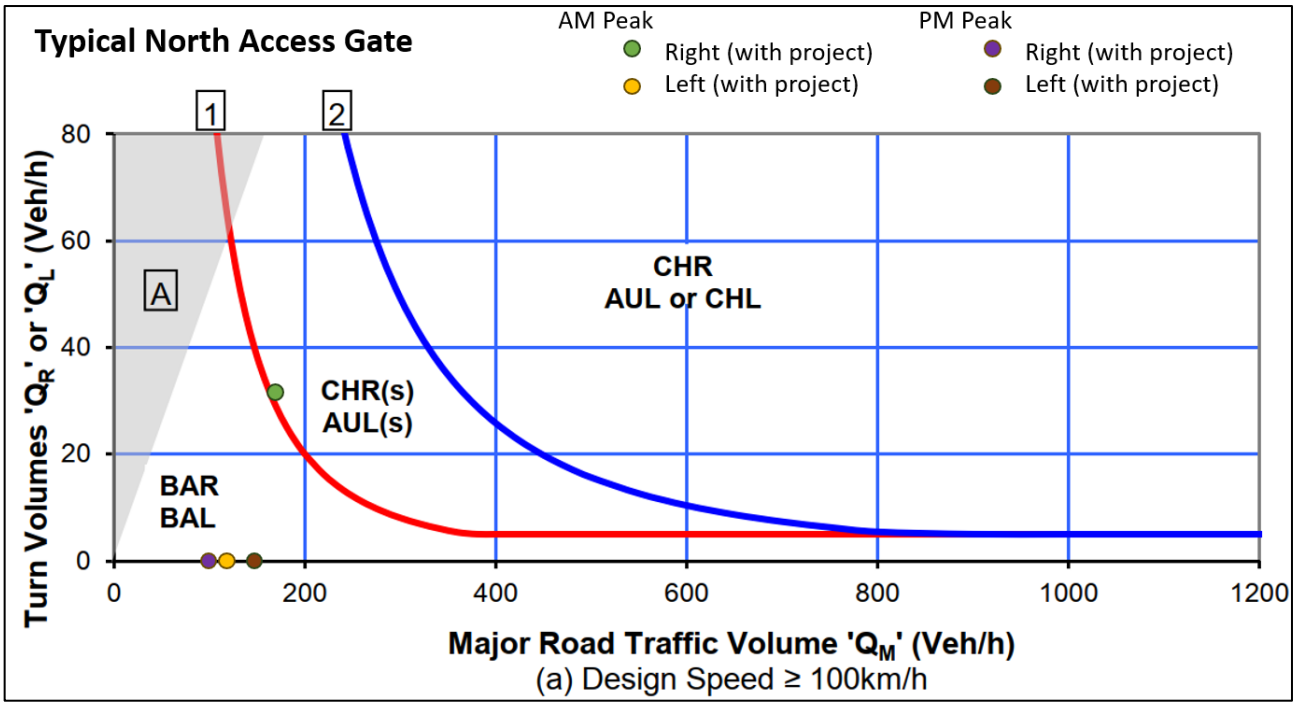


Figure 5-22 Turn warrant assessment of typical north Cope Road access gates

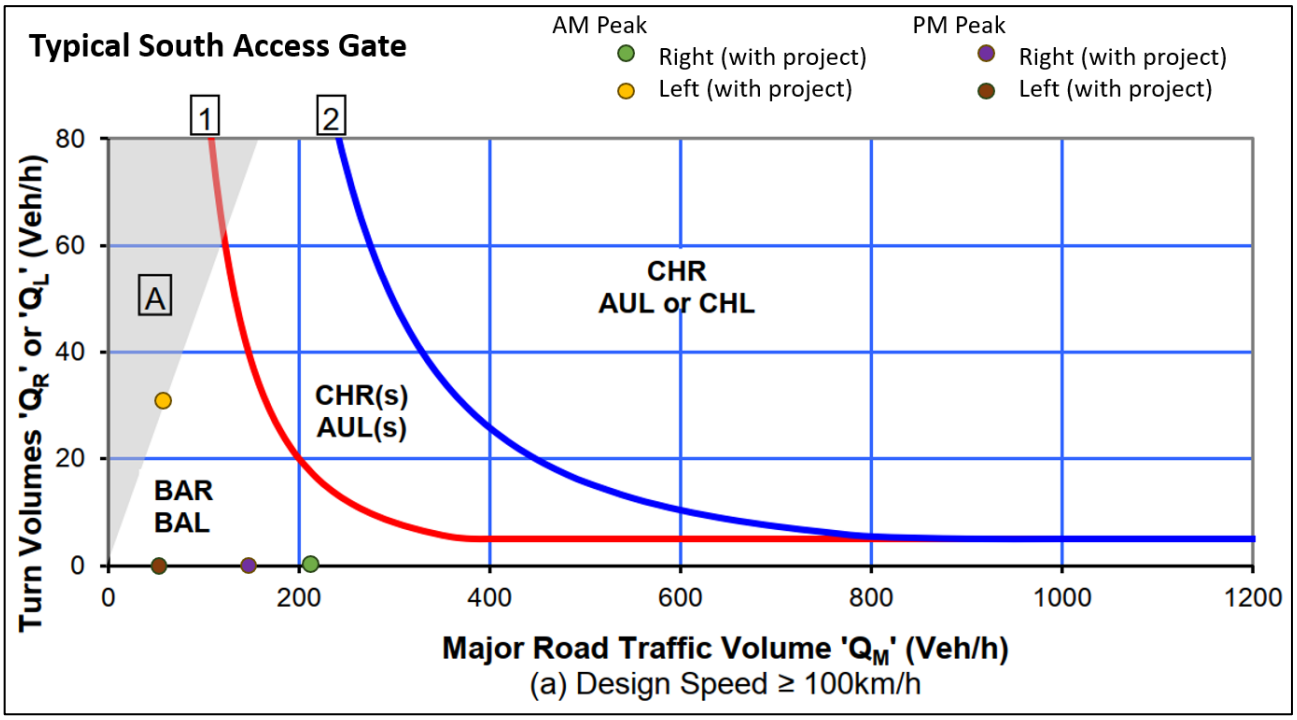
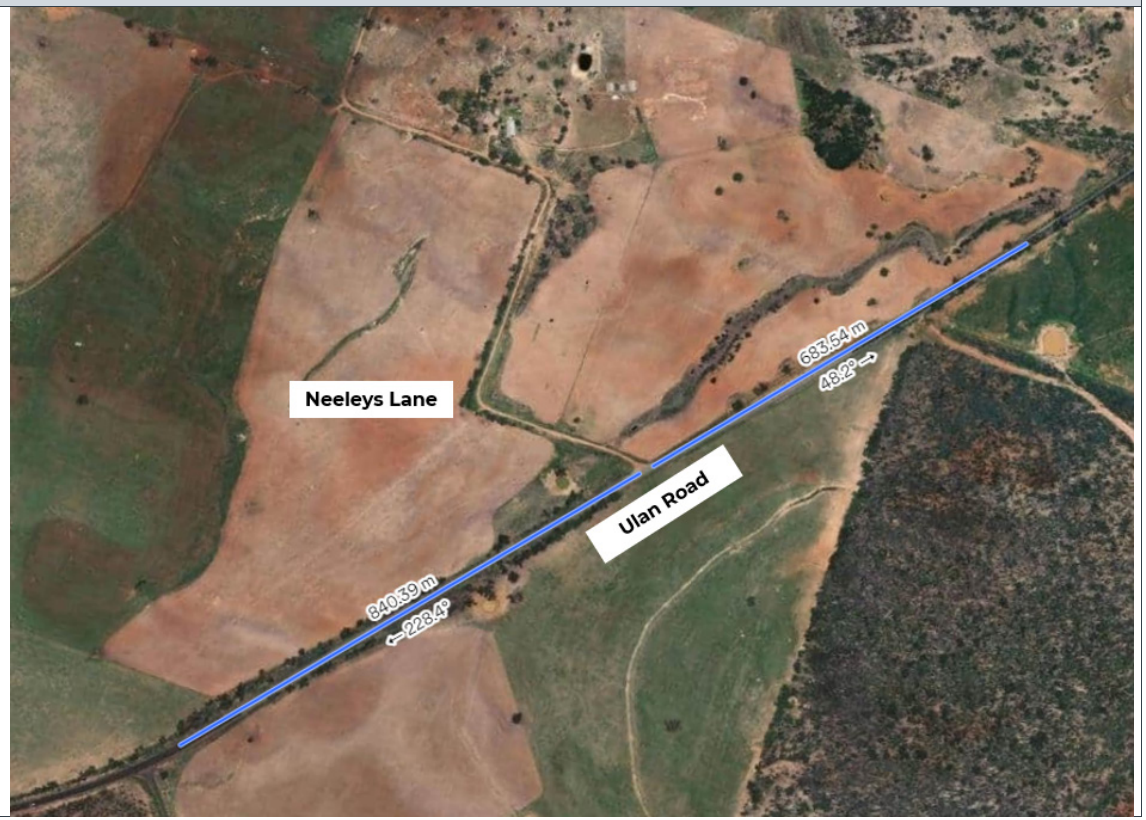


Figure 5-23 Turn warrant assessment of typical south Cope Road access gates

5.2.3 Safe intersection sight distance (SISD)

Safe Intersection Sight Distance (SISD) is the minimum sight distance which should be provided on the major road at any intersection. The calculation method for SISD is detailed in *Austroads Guide to Road Design Part 4A Unsignalised and Signalised Intersections*. This has been completed by desktop analyses.

Neeleys Lane and Ulan Road	
Requirement: an SISD of 300m is required assuming 3.0 seconds observation time and 2.5 seconds reaction on a 100km/h design speed. This assumes no grade correction is applied. **Compliance check.** Satisfactory SISD and no adjustments required.	

Merotherie Energy Hub access road and Merotherie Road	
Requirement: an SISD of 300m is required assuming 3.0 seconds observation time and 2.5 seconds reaction on a 100km/h design speed. **Compliance check** Northern Access Point – Satisfactory SISD and no adjustments required. Southern Access Point – Satisfactory SISD on the northern end of Merotherie Road whereas the southern end requires an additional 65m of road to meet SISD requirements for 100km/h/ Given the road type and condition, an 80km/h design speed appears more appropriate. Applying this would mean the southern end would only require 181 metres (assuming 3 second observation time and 2 second reaction with a design speed of 80 km/h) which is adequately provided by the available 232 metres of sight distance. Note, this temporary speed reduction would be removed after construction.	 (Left: Northern Access Point; Right: Southern Access Point)

Merotherie Road and Golden Highway	
Requirement: an SISD of 300m is required assuming 3.0 seconds observation time and 2.5 seconds reaction on a 100km/h design speed. **Compliance check** Satisfactory SISD and no adjustments required.	

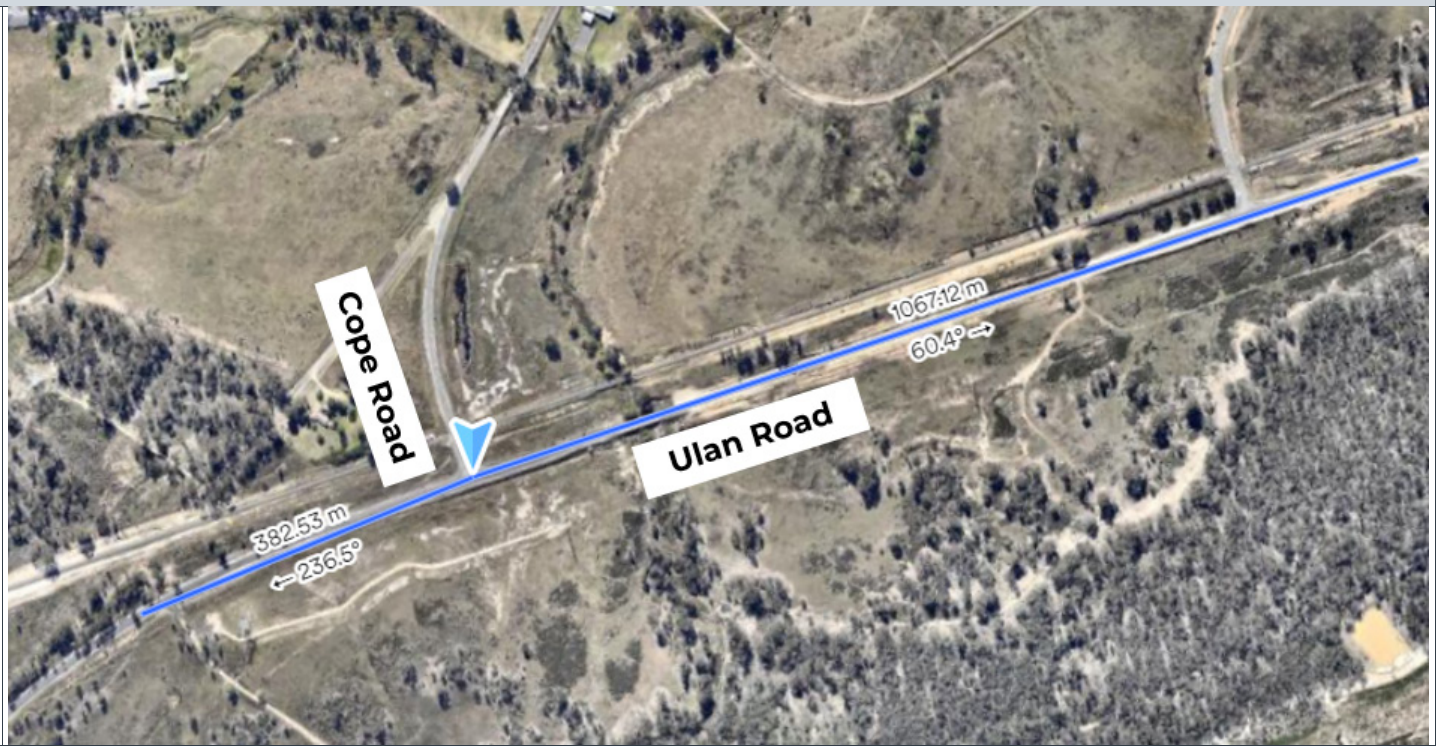
Spring Ridge Road and Dapper Road	
Requirement: an SISD of 300m is required assuming 3.0 seconds observation time and 2.5 seconds reaction on a 100km/h design speed. **Compliance check:** Insufficient sight distance is observed along Spring Ridge Road for either side of intersection with Dapper Road. A reduced speed limit is proposed on Spring Ridge Road to comply with SISD compliancy requirements. Applying a reduced speed limit of 60km/h on Spring Ridge Road only requires 123 metres sight distance (assuming 3 second observation time and 2 second reaction), which is adequately provided by the available 128 metres of sight distance to the north and 165 metres to the south. In addition, this recommended speed reduction would improve safety, particularly with the crossing of Laheys Creek with Spring Ridge Road. Note, this temporary speed reduction would be removed after construction.	

Golden Highway and Spring Ridge Road	
Requirement: an SISD of 300m is required assuming 3.0 seconds observation time and 2.5 seconds reaction on a 100km/h design speed. **Compliance check** Satisfactory SISD and no adjustments required.	

Wollar Road/ Barigan Street/ Phillip Street	
Requirement: an SISD of 97m is required assuming 3.0 seconds observation time and 2.0 seconds reaction on a 50km/h design speed. **Compliance check** Satisfactory SISD and no adjustments required.	

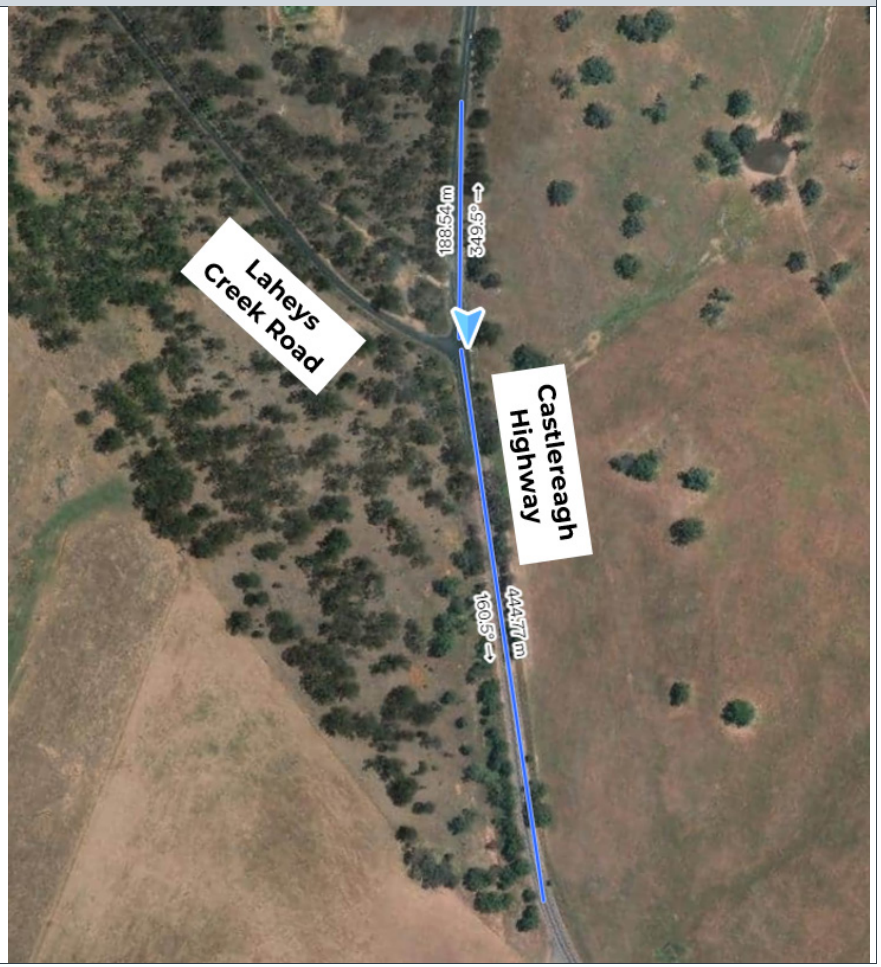
Ulan Road and Ulan-Wollar Road	
Requirement: an SISD of 300m is required assuming 3.0 seconds observation time and 2.5 seconds reaction on a 100km/h design speed. **Compliance check** The Ulan Road and Ulan-Wollar Road intersection does not satisfy the SISD requirements. The 10-40m shortfall can be targeted with tree clearance along Ulan Road on either side to remove visibility obstruction or a temporary speed reduction. This intersection has been redesigned a few years back and a reduced sight distance deemed satisfactory by road agencies.	

Golden Highway and Ulan Road	
Requirement: an SISD of 300m is required assuming 3.0 seconds observation time and 2.5 seconds reaction on a 100km/h design speed. **Compliance check** Satisfactory SISD and no adjustments required.	

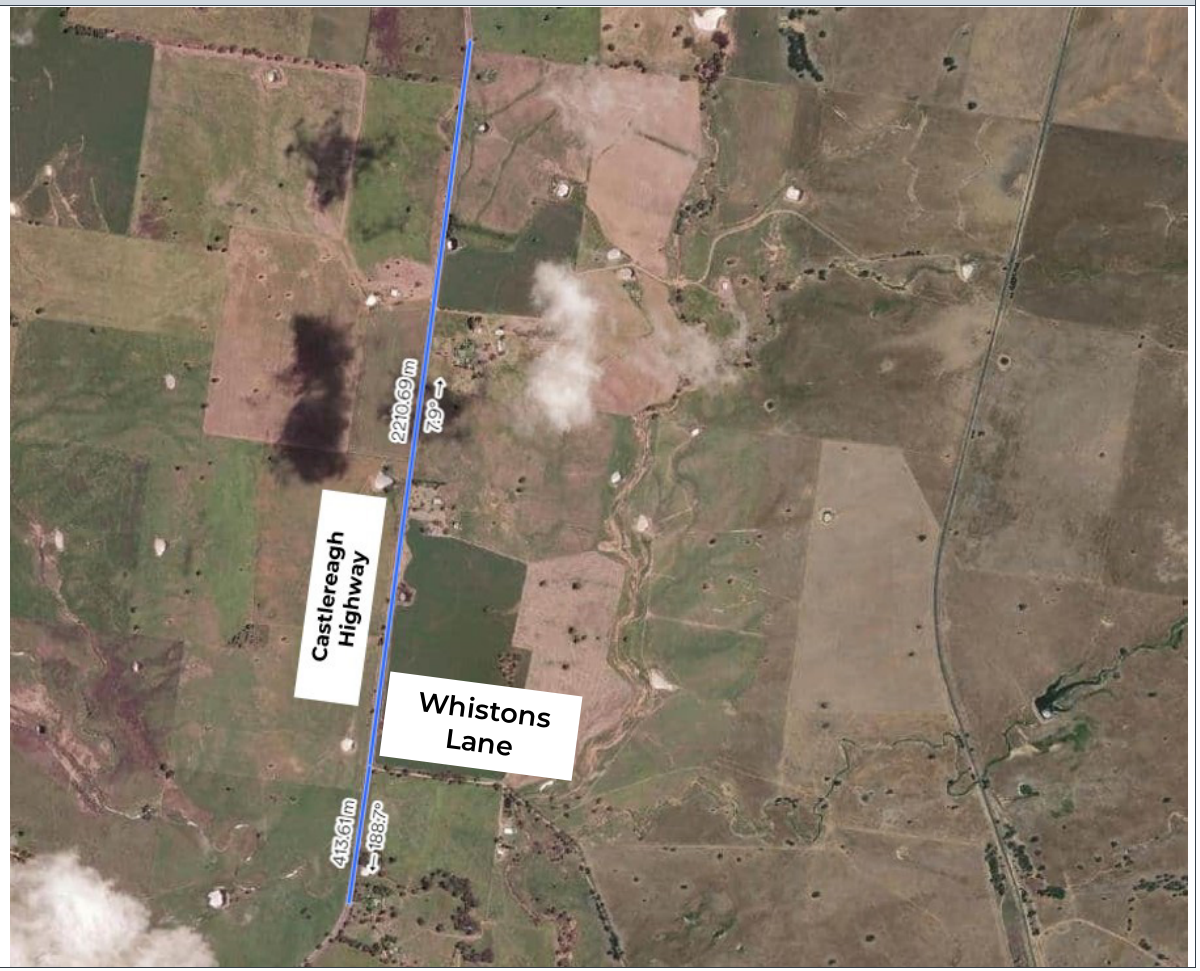
Ulan Road and Cope Road	
Requirement: an SISD of 300m is required assuming 3.0 seconds observation time and 2.5 seconds reaction on a 100km/h design speed. **Compliance check** Satisfactory SISD and no adjustments required.	

Cope Road and Blue Springs Road	
Requirement: an SISD of 300m is required assuming 3.0 seconds observation time and 2.5 seconds reaction on a 100km/h design speed. **Compliance check** Satisfactory SISD and no adjustments required.	

Brooklyn Road and Laheys Creek Road	
Requirement: an SISD of 300m is required assuming 3.0 seconds observation time and 2.5 seconds reaction on a 100km/h design speed. **Compliance check** Satisfactory SISD and no adjustments required.	

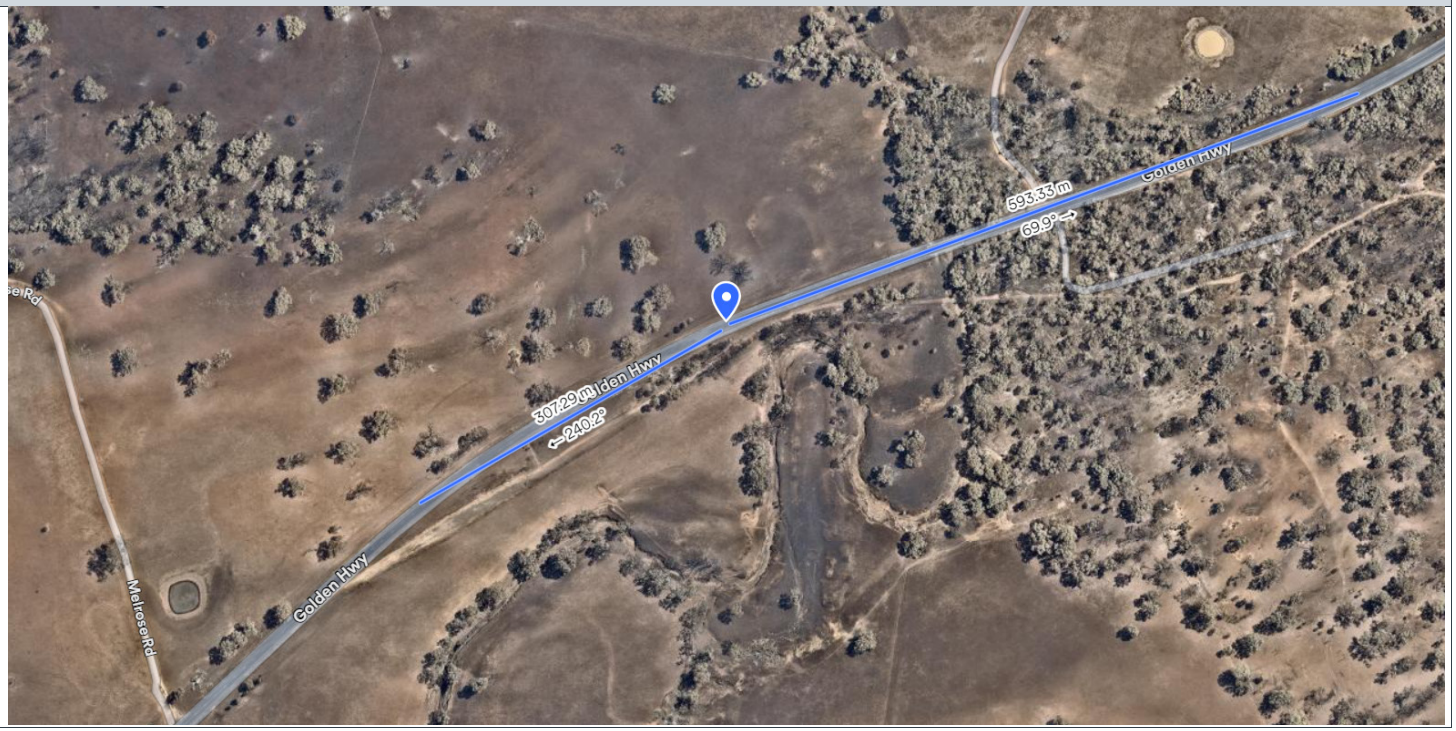
Castlereagh Highway and Laheys Creek Road	
Requirement: an SISD of 300m is required assuming 3.0 seconds observation time and 2.5 seconds reaction on a 100km/h design speed. **Compliance check** SISD requirements are satisfied on the southern end of the intersection noting a crest in the road may temporarily obstruct the driver's view of the intersection. SISD requirements are satisfied on the northern end of the intersection.	

Blue Springs Road (North) and Golden Highway	
Requirement: an SISD of 300m is required assuming 3.0 seconds observation time and 2.5 seconds reaction on a 100km/h design speed. **Compliance check** Satisfactory SISD and no adjustments required.	

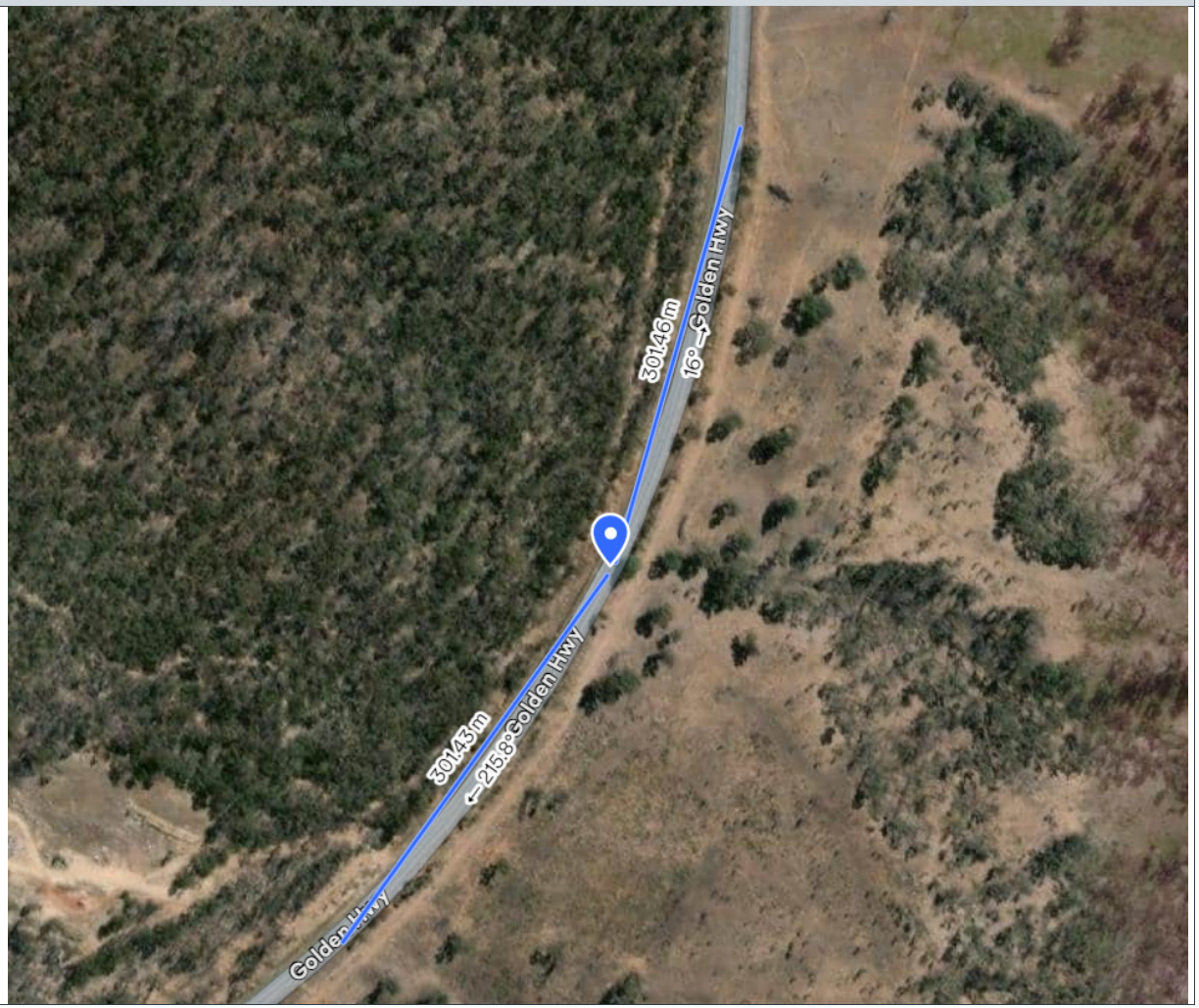
Whistons Lane and Castlereagh Highway	
Requirement: an SISD of 300m is required assuming 3.0 seconds observation time and 2.5 seconds reaction on a 100km/h design speed. **Compliance check** Satisfactory SISD and no adjustments required.	

Tucklan Road and Castlereagh Highway	
Requirement: an SISD of 300m is required assuming 3.0 seconds observation time and 2.5 seconds reaction on a 100km/h design speed. **Compliance check** Southern end of the Tucklan Road and Castlereagh Highway intersection is obstructed by vegetation and road curvature with SISD short by at least 50m. Applying a temporary reduced speed limit of 90km/h on Castlereagh Highway only requires 226 metres sight distance (assuming 3 second observation time and 2.5 second reaction), which is adequately provided by the available 254 metres of sight distance to the south. Note, this temporary speed reduction would be removed after construction. The northern end is satisfactory for SISD noting some road crests may temporarily obstruct the driver's view of the intersection.	

Puggoon Road and Castlereagh Highway	
Requirement: an SISD of 300m is required assuming 3.0 seconds observation time and 2.5 seconds reaction on a 100km/h design speed. **Compliance check** Northerly side of Castlereagh Highway relative to Puggoon Road satisfies the SISD requirements. Conversely, this is not the case on the southern end of the intersection with an approximate SISD shortfall of 120 metres, where there is obstruction by vegetation. Applying a temporary reduced speed limit of 80km/h on Castlereagh Highway only requires 181 metres sight distance (assuming 3 second observation time and 2 second reaction time), which is adequately provided by the available 188 metres of sight distance to the south. Note, this temporary speed reduction would be removed after construction.	

Proposed access gates on Golden Highway	
Requirement: an SISD of 300m is required assuming 3.0 seconds observation time and 2.5 seconds reaction on a 100km/h design speed. **Compliance check:** L2.19: Satisfactory SISD and no adjustments required.	

Proposed access gates on Golden Highway	
Requirement: an SISD of 300m is required assuming 3.0 seconds observation time and 2.5 seconds reaction on a 100km/h design speed. **Compliance check.** L2.14 and L2.15: satisfies SISD requirements.	

Proposed access gates on Golden Highway	
Requirement: an SISD of 300m is required assuming 3.0 seconds observation time and 2.5 seconds reaction on a 100km/h design speed. **Compliance check.** L2.31: Satisfies SISD requirements.	

Proposed access gates on Golden Highway	
Requirement: an SISD of 300m is required assuming 3.0 seconds observation time and 2.5 seconds reaction on a 100km/h design speed. **Compliance check.** L2.32 and L2.33: Northern section of Golden Highway has a SISD shortfall. Applying a temporary reduction of the speed limit to 90 km/h, would mean the northern end would only require 226 metres (assuming 3 second observation time and 2.5 second reaction with a design speed of 90 km/h) which is adequately provided by the available 237 metres of sight distance. Note, this temporary speed reduction would be removed after construction.	

Proposed access gates on Castlereagh Highway	
Requirement: an SISD of 300m is required assuming 3.0 seconds observation time and 2.5 seconds reaction on a 100km/h design speed. **Compliance check:** L3.3 and L3.4: satisfies SISD requirements.	

Access gates along Ulan-Wollar Road	
Requirement: an SISD of 300m is required assuming 3.0 seconds observation time and 2.5 seconds reaction on a 100km/h design speed. **Compliance check:** L1.7 and L1.8: satisfies SISD requirements.	

Access gates along Ulan-Wollar Road	
Requirement: an SISD of 300m is required assuming 3.0 seconds observation time and 2.5 seconds reaction on a 100km/h design speed. **Compliance check.** L1.6: Both sides of Ulan-Wollar Road has SISD shortfalls, where there is obstruction due to vegetation and road curvature. Applying a temporary reduced speed limit of 70km/h on Ulan-Wollar Road only requires 151 metres sight distance (assuming 3 second observation time and 2 second reaction time), which is adequately provided by the available 190 metres of sight distance to the north and 165 metres of sight distance to the south. Note, this temporary speed reduction would be removed after construction.	

Access gates along Ulan-Wollar Road	
Requirement: an SISD of 300m is required assuming 3.0 seconds observation time and 2.5 seconds reaction on a 100km/h design speed. **Compliance check.** L1.4F: satisfies SISD requirements.	

Access gates along Ulan-Wollar Road	
Requirement: an SISD of 300m is required assuming 3.0 seconds observation time and 2.5 seconds reaction on a 100km/h design speed. **Compliance check.** L1.4E: satisfies SISD requirements.	

Access gates along Ulan-Wollar Road	
Requirement: an SISD of 300m is required assuming 3.0 seconds observation time and 2.5 seconds reaction on a 100km/h design speed. **Compliance check.** L1.4D: satisfies SISD requirements.	

Access gates along Ulan-Wollar Road	
Requirement: an SISD of 300m is required assuming 3.0 seconds observation time and 2.5 seconds reaction on a 100km/h design speed. **Compliance check.** L1.4C: has a SISD shortfall on the western section of Ulan-Wollar Road, where there is obstruction due to vegetation and road curvature. Applying a temporary reduced speed limit of 80km/h on Ulan-Wollar Road only requires 181 metres sight distance (assuming 3 second observation time and 2 second reaction time), which is adequately provided by the available 201 metres of sight distance to the west. Note, this temporary speed reduction would be removed after construction.	

Access gates along Ulan-Wollar Road	
Requirement: an SISD of 300m is required assuming 3.0 seconds observation time and 2.5 seconds reaction on a 100km/h design speed. **Compliance check.** L1.4A: satisfies SISD requirements.	

Access gates along Ulan-Wollar Road	
Requirement: an SISD of 300m is required assuming 3.0 seconds observation time and 2.5 seconds reaction on a 100km/h design speed. **Compliance check.** L1.4B: satisfies SISD requirements.	

Access gates along Cope Road	
Requirement: an SISD of 300m is required assuming 3.0 seconds observation time and 2.5 seconds reaction on a 100km/h design speed. **Compliance check:** L1.13C: has a SISD shortfall on the northern section of Cope Road. SISD is satisfactory for the southerly side of Cope Road. Conversely, the northern side presents approximately 135 metre SISD shortfall, with visual obstruction by vegetation and road curvature. Given the road type and condition, a 70km/h temporary speed limit appears more appropriate. Applying this would mean the northern end would only require 151 metres (assuming 3 second observation time and 2 second reaction with a design speed of 70 km/h) which is adequately provided by the available 165 metres of sight distance. Note, this temporary speed reduction would be removed after construction.	

Access gates along Cope Road	
Requirement: an SISD of 300m is required assuming 3.0 seconds observation time and 2.5 seconds reaction on a 100km/h design speed. **Compliance check.** L1.13B: satisfies SISD requirements.	

Access gates along Cope Road	
Requirement: an SISD of 300m is required assuming 3.0 seconds observation time and 2.5 seconds reaction on a 100km/h design speed. **Compliance check.** L1.12 and L1.13: has a SISD shortfall on the eastern section of Cope Road. SISD is satisfactory for the western side of Cope Road. Conversely, the eastern side presents an approximate 70 metre SISD shortfall, with visual obstruction by vegetation and road curvature. Applying a temporary reduction of the speed limit to 90 km/h, would mean the eastern end would only require 226 metres (assuming 3 second observation time and 2.5 second reaction with a design speed of 90 km/h) which is adequately provided by the available 232 metres of sight distance. Note, this temporary speed reduction would be removed after construction.	

6 Updated management and mitigation measures

There is a potential need for intersection turning upgrades to provide safer intersection operation and to accommodate additional increases in traffic demand during construction. The volume of construction vehicle movements using this intersection during the peak hour period will be restricted, with proportionate reductions also occurring during other times as applicable. This applies to the following locations:

- Intersection of Ulan Road/Neeleys Lane, where further investigation is needed to confirm that short channelised right turn and/or auxiliary left turn treatments (or suitable alternatives) are required for safe access to the workforce accommodation camp.
- Intersection of Golden Highway/ Ulan Road, where further investigation is needed to confirm that a new short channelised right turn treatment (or suitable alternative) is required.
- Intersection of Golden Highway / Blue Springs Road, where further investigation is needed to confirm that a new short channelised right turn treatment (or suitable alternative) is required.
- Typical access gate locations off Cope Road where further investigation is needed to confirm if short channelised right turn (CHRs) treatments (or suitable alternatives) is required.
- Typical access gate locations off Ulan Road (near Ulan township), where further investigation is needed to confirm that new channelised right turn treatments for a north/west access gate and short auxiliary left turn treatments for a south/east access gate (or suitable alternatives) are required.
- Typical access gate locations off Ulan Road (north of Ulan-Wollar Road), where further investigation is needed to confirm that new short channelised right turn treatments and short auxiliary left turn treatments (or suitable alternatives) are required.

Updates to mitigation measure T1 and have been made to this effect.

An additional mitigation measure (T13) has been also proposed to provide greater clarity and guidance for the establishment of new construction access points.

Other minor updates have been made to the management and mitigation measures originally proposed in Technical paper 9 however these changes do not have a material effect on the intent of the measures. Otherwise, the proposed management and mitigation measures remain unchanged from Technical Paper 13. The updated mitigation measures that would be implemented for the amended project to avoid and/or minimise potential traffic and transport impacts are listed in Table 6-1.

Table 6-1 Proposed updated traffic and transport mitigation measures

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
T1	Intersection upgrades	As part of the detailed design process, an evaluation of the potential need for upgrades to the following intersections will be undertaken as detailed below: — Intersection of Ulan Road/Neeleys Lane: Investigate and confirm if short channelised right and/or auxiliary left turn treatments (or suitable alternative) are required for safe access to the workforce accommodation camp. — Intersection of Golden Highway/Ulan Road: Investigate and confirm if a new short channelised right turn treatment (or suitable alternative) is required to provide safer intersection operation and to accommodate additional increases in traffic demand during construction. — Intersection of Golden Highway / Blue Springs Road: Investigate option to restrict construction vehicle volumes to levels which avoid the need for implementation of intersection upgrades. Where construction vehicle volumes cannot be limited to provide safe intersection operation, the required turning treatment upgrades (new short channelised right turn treatment or suitable alternative) will be implemented. — Typical access gates off Cope Road: Construction vehicle movements turning right into access gates on the northern side of Cope Road will be limited to vehicles 25 per hour during the AM peak hour period to ensure safe and efficient traffic movements compatible with a Basic right turn (BAR) treatment. If higher construction vehicle movements are required and are incompatible with a BAR treatment, the required turning treatment upgrades will be implemented. — Typical access gate locations off Ulan Road (near Ulan township): Construction vehicle movements turning into the northwest and southeast access gates will be limited to the following during the AM peak hour period: — left turning vehicles — 18 vehicles per hour (southeast access gates) — 5 vehicles per hour (northwest access gates) — Right turning vehicles – 5 vehicles per hour (all access gates) Turn warrant assessments will be conducted for each hour outside of the AM peak period to determine the maximum number of vehicle movements allowed to ensure safe and efficient traffic	Detailed design	Intersection of Ulan Road / Neeleys Lane Intersection of Golden Highway/ Ulan Road Intersection of Golden Highway / Blue Springs Road Typical access gate locations off Ulan Road (near Ulan township) Typical access gate locations off Ulan Road (north of Ulan-Wollar Road)

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
		movements compatible with a Basic right turn (BAR) and Basic left turn (BAL) treatments. If higher construction vehicle movements are required and are incompatible with BAR / BAL treatments, the required turning treatment upgrades will be implemented. — Typical access gate locations off Ulan Road (north of Ulan-Wollar Road): Construction vehicle movements turning into the west and east access gates will be limited to the following during the AM peak hour period: — left turning vehicles – 25 vehicles per hour (typical east access gates) — right turning vehicles – 5 vehicles per hour (all access gates). Turn warrant assessments will be conducted for each hour outside of the AM peak period to determine the maximum number of vehicle movements allowed to ensure safe and efficient traffic movements compatible with a Basic right turn (BAR) and Basic left turn (BAL) treatments. If higher construction vehicle movement volumes are required and are incompatible with BAR / BAL treatments, the required turning treatment upgrades will be implemented. Where the intersection upgrades are required, these will be designed and constructed in accordance with Austroads Guidelines, relevant applicable standards and consider the appropriate design vehicles.		
T2	Road and traffic management	Traffic control plans will be prepared in for locations where construction-related traffic enters and leaves the public road network for project construction related purposes. The plans will be implemented by licensed traffic management contractors. Necessary road occupancy licences and road related work approvals will be obtained prior to the commencement of relevant works (including site access and access tracks).	Construction	Construction routes, access tracks, construction compound and workforce accommodation camp accesses
T3	Road safety – design related	All accesses will be designed to accommodate the required construction vehicle(s) requiring access, and in accordance with relevant Austroads guidelines (where applicable) in consultation with the relevant roads authority. Appropriate traffic management and controls may be adopted to facilitate safe site access and egress for vehicles prior to access point installation and upgrading. Routine inspections will be completed on a regular basis.	Construction Operation	Construction routes, access tracks, construction compound and workforce accommodation camp accesses

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
T4	Road safety – driver related	The following road safety measures will be implemented with regard to driver management during construction: — a Driver Code of Conduct will be developed and implemented for the entire workforce. The code will define acceptable driver behaviour for proposal personnel to promote road safety and ensure that the impacts of construction-related vehicle movements on local roads and the local community are minimised — a Driver Fatigue Management Plan will be developed and implemented as part of the Construction Environmental Management Plan, and will incorporate appropriate measures to manage driver fatigue risks, including, but not limited to: — planning of regular breaks — mapping locations of driver rest areas along the proposed construction routes.	Construction	Construction routes, access tracks, construction compound and workforce accommodation camp accesses
T5	Rail safety	Early and ongoing consultation with the ARTC will be undertaken for works which will cross over existing rail lines. Relevant works will only proceed following receipt of applicable approvals/permits, including accreditations for workers requiring access within the rail corridor to undertake construction activities.	Construction	Where the transmission line requires access to rail corridor over railway tracks on select railway lines
T6	Access track condition	Access tracks used for construction sites, construction compounds and workforce accommodation camps will be maintained to safe standard.	Construction	All areas affected by construction including construction routes, access tracks, construction compounds and workforce accommodation camp accesses
T7	Road condition	Pre-construction road dilapidation surveys and routine inspections will be completed along all nominated construction routes on local roads. Where rectification works are required due to project impacts, consultation with the appropriate road authority will be undertaken to confirm the scope of the work required.	Pre-construction Construction	Local roads

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
T8	Temporary lane closures or temporary road closures	Road Occupancy Licence(s) will be sought for all temporary lane closures (as required by the relevant roads authority). Where road closures are likely to result in a significant traffic impact (e.g. short-term full road closure and long-term temporary lane/ road closures), prior consultation will be undertaken with potentially affected stakeholders (e.g. landowners, emergency services, transport services) and relevant approval(s) obtained from the relevant roads authority. Where feasible, temporary road closures will be planned to occur outside of the traffic peak periods to minimise impacts to the road network.	Construction	All locations where project works will occur within the public road network.
T9	Access to properties	Access to properties will be maintained throughout construction where feasible. Where this is not feasible, temporary alternative access arrangements will be provided following consultation with affected landowners and in accordance with the requirements of the pre-construction and construction Communication and Engagement Plan (as detailed in mitigation measure SI5). Disruptions to property access and traffic will be notified to landowners at least five days prior and in accordance with the relevant community consultation processes outlined in the Construction Environmental Management Plan.	Construction	All areas affected by construction.
T10	Pedestrian and cyclist access	The project will actively consult with local bicycle groups, such as Central West Cycle (CWC) during construction, particularly regarding construction routes proposed on CWC's cycling route between Gulgong to Dunedoo. Safe pedestrian and cyclist access will be maintained where the project interacts with existing pedestrian or bicycle facilities. Where this is not feasible, temporary alternative access arrangements will be provided following consultation with affected stakeholders and the relevant roads authority.	Construction	All areas affected by construction.

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
T11	Heavy vehicles using road network	A Vehicle Movement Plan will be prepared which identifies the construction vehicle route(s) (including OSOM routes) to be used during construction. The Vehicle Movement Plan will also include details of activities of adjoining land uses and awareness of public safety measures (e.g. entering urban areas from the highways) to provide guidance to drivers of construction vehicles travelling to and from project locations. Ongoing consultation will be undertaken with Transport for NSW regarding the use of State roads for OSOM vehicle routes.	Pre-construction Construction	Construction routes.
T12	Access tracks maintenance and safety	The following maintenance and safety measures will be implemented at relevant locations along each of the access tracks, construction compounds and workforce accommodation camp accesses: — appropriate line marking and signage at access points — wheel cleaning facility as required at access points/intersections — signage to indicate trucks turning — potential use of road plates, propping (or similar) over culverts where required — improvements to existing roads at new access points which may include importing or stabilising material if required.	Construction	Access tracks, construction compound and workforce accommodation camp accesses
T13	Access points	Access points on the public road network will be confirmed and implemented in consultation with the relevant roads authority. Establishment of access points will occur in accordance with road occupancy licences (or similar) where issued by the relevant roads authority. For access points that are deficient in Safe Intersection Sight Distance, temporary speed limits would be implemented at these intersections and access gates. This is to ensure sufficient sight distance for road users during construction. Temporary speed limits will be agreed with the relevant road authorities.	Pre-construction Construction	Access point on the public road network

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