TECHNICAL PAPER
03

Traffic impact assessment

NARRABRI TO NORTH STAR—PHASE 2 ENVIRONMENTAL IMPACT STATEMENT

Technical and Approvals Consultancy Services: Narrabri to North Star

Traffic Impact Assessment

Narrabri to North Star: Phase Two

May 2022

2-0001-262-EAP-00-RP-0032

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Glossary

AADT	Annual Average Daily Total
ARTC	Australian Rail Track Corporation
CEMP	Construction Environmental Management Plan
EIS	Environmental Impact Statement
HESP	Health, Environment & Safety Plan
IFC	Issue for Construction
IRDJV	Inland Rail Design Joint Venture – WSP|MM JV legal entity
N2NS	Narrabri to North Star
RFI	Request for Information
RFT	Ready for Tender
RISI	Rail Industry Safety Induction card
RIW	Rail Industry Worker card
SIDRA	Traffic modelling software used to assess the performance of intersections
SHE	Safety, Health & Environment
SHEQ	Safety, Health, Environment and Quality Management
WSP|MM	WSP | Mott MacDonald JV trading as IRDJV

Executive summary

The Australian Government has committed to delivering a direct interstate freight rail corridor between Melbourne and Brisbane, via central-west New South Wales (NSW) and Toowoomba in Queensland. Known as Inland Rail, this 1,700 km project would enhance Australia's existing national rail network and serve the interstate freight market. Australian Rail Track Corporation (ARTC) is seeking approval to construct and operate the Narrabri to North Star (N2NS) Phase 2 Moree to Camurra North section of Inland Rail ('the proposal'), which consists of 15 kilometres of upgraded rail track and associated facilities.

The purpose of this traffic impact assessment (TIA) is to assess potential traffic and transport issues from the construction and operation of the proposal, and where required, identify feasible and reasonable mitigation measures.

Key roads within the study area include Newell Highway, Gwydirfield Road, River Road and the Gwydir Highway. Traffic volumes on these roads were found to very low relative to their overall capacity. The roads were assessed and found to operate at excellent Levels of Service (LOS) with minimal traffic delays. In addition to the above-mentioned roads, there are various (generally unnamed) local roads within the study area that provide access to local properties.

There are nine level crossings within the study area; six of which are on private roads while the remaining three are on public roads. One of these level crossings (which intersects a private road) is proposed to be removed while eight would undergo upgrades to comply with relevant Australian and ARTC standards. Of these eight, the three public road crossings would be upgraded to have active controls with flashing lights and boom barriers. The remaining five level crossings (all of which intersect private roads) would retain passive controls which is adequate given the flat topography, unobstructed sight lines and no recorded level crossing crashes at these locations.

Construction impacts

Construction related traffic is expected be around 260 vehicles per day. Of these, 200 vehicles per day are associated with the commuting patterns of the estimated 150-person workforce. The surrounding road network has ample capacity to accommodate this additional volume of traffic and therefore delays associated with construction are likely to be minimal.

Existing rail operations will be suspended throughout the construction period. There would still be some train activity associated with the movement of construction materials which may result in delays at some level crossings.

Proposed works on level crossings may also result in minor disruptions to local traffic. It is anticipated that traffic can continue to use the level crossings while they are being upgraded and their movements will be managed through the provision of suitable traffic control measures.

Operational impacts

The key traffic impact of the proposal will be impacts on travel time as a result of increased train activity at level crossings. The duration of delays would in some cases be reduced at private level crossings due to the increased train speeds that would be possible. In addition, the proposed upgrades to the level crossings would reduce the risk of train-vehicle collisions and enhance road safety.

The proposal is also expected to result in the modal shift of freight from road to rail thereby reducing the volume of freight being transported on road through the study area.

1 Introduction

1.1 Overview

The Australian Government has committed to delivering a significant piece of national transport infrastructure by constructing a high performance and direct interstate freight rail corridor between Melbourne and Brisbane, via central-west New South Wales (NSW) and Toowoomba in Queensland. Inland Rail is a major national project that would enhance Australia's existing national rail network and serve the interstate freight market.

The Inland Rail route, which is about 1,700 kilometres long, would involve:

- using the existing interstate rail line through Victoria and southern NSW
- upgrading about 400 kilometres of existing track, mainly in western NSW and
- providing about 600 kilometres of new track in northern NSW and south-east Queensland.

Inland Rail has been divided into 13 sections, seven of which are located in NSW. Each of these projects can be delivered and operated independently with tie-in points on the existing railway.

In 2015 Australian Rail Track Corporation Ltd (ARTC) ('the proponent') developed a ten-year program to deliver Inland Rail by 2027. ARTC was created in 1997 after the Australian and State governments agreed to the formation of a 'one stop shop' for all operators seeking access to the national interstate rail network. Across its network, ARTC is responsible for:

- selling access to train operators
- developing new business
- capital investment in the corridors
- managing the network and
- infrastructure maintenance.

Further information on ARTC and Inland Rail can be found at http://www.artc.com.au and www.inlandrail.com.au.

1.2 The proposal

ARTC is seeking approval to construct and operate the Narrabri to North Star (N2NS) Phase 2 Moree to Camurra North section of Inland Rail ('the proposal'), which consists of 15 kilometres of upgraded rail track and associated facilities.

The N2NS section of Inland Rail was declared a Critical State Significant Infrastructure (CSSI) project under the Environmental Planning and Assessment Act 1979 (NSW) (EP&A Act), and is currently undergoing the environmental impact assessment process under the EP&A Act, and bilateral assessment under the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act).

In 2017, an Environmental Impact Statement (EIS) was prepared for the entire N2NS section. Since then, the alignment within what is now the N2NS Phase 2 area changed (IRDJV, 2019a). Specifically, it was required to modify the N2NS project to upgrade a section of approximately 15 kilometres of the corridor running from Moree to north of the Camurra Bypass, including the Mehi-Gwydir River crossings (Figure 1). The upgrade involved an altered vertical and horizontal alignment to allow for the balancing of complex flood mitigation as well as a new greenfield section in the north allowing for advanced curve easing. The original N2NS EIS did not assess these upgraded design requirements. Consequently, this section of the N2NS alignment was omitted from the original project and therefore requires separate assessment under the EP&A Act and the EPBC Act. The Phase 2 component of N2NS is the subject of this EIS, and the original N2NS project is referred to as Phase 1.

1.2.1 Location

The proposal is primarily an upgrade of approximately 13 kilometres of existing rail corridor between Moree and Camurra North, with a small portion (~1.6 kilometres) of greenfield re-alignment (IRDJV, 2019a). N2NS Phase 2 corridor is located between south of the Mehi River at approximate chainage 666.000 to north of the Camurra Bypass at chainage 681.000, the northern tie-in beyond the revised Camurra Junction. This includes structures over the Mehi and Gwydir Rivers.

ARTC is seeking approval under Part 5 of the EP&A Act to construct and operate the N2NS Phase 2 section of Inland Rail. Refer to Figure 1-1 for the location of the N2NS Phase 2 proposal. Chapter 2 of this EIS (General biophysical and cultural environment) provides further information on the location of the proposal, and a description of the proposal site.

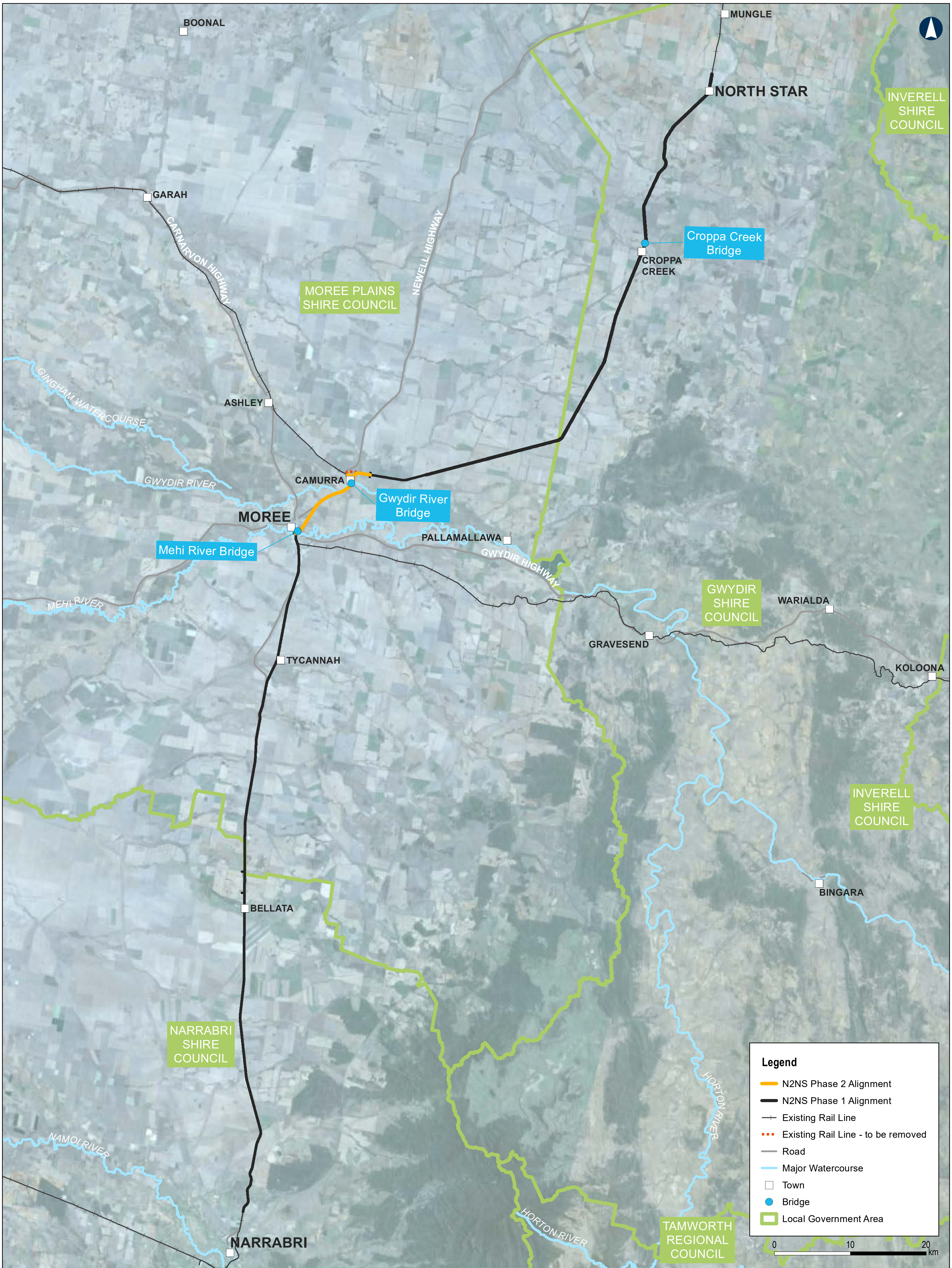


Figure 1-1 Location of the proposal

Data Sources: ARTC, IRDJV, LPI

Coordinate System: GDA 1994 MGA Zone 55
Scale: 1:450,000
Paper size: A3
Date: 9/23/2021

Map 1 of 1

N2NS_SP2_TT_F01_01_LocationOfProject_r2v2.mxd

1.2.2 Key features

The key features of the proposal are:

- enhancement of about 13.7 km of existing track through minor adjustments to the vertical and horizontal alignment, and the construction of about 1.6 km of new rail corridor, including rail embankments
- demolition and reconstruction of eight underbridges at Mehi River, Gwydir River, Skinners Creek, Duffys Creek and at four other un-named water courses
- installation of approximately 1,100 new flood relief box culverts along the formation
- three new signalised level crossings at Gwydirfield Road, the Rocks Road and Back Pally Road replacing the existing level crossings
- realignment and changes to six private level crossings (including closure of one private level crossing)
- new turnout between the Gwydir River and Back Pally Road, immediately north of the new Gwydir underbridge, to provide a connection to the Inland Rai l / North Star line to the east and the Weemelah line to the west
- decommissioning and removal of the Camurra hairpin and the associated formation, through the construction of the greenfield Camurra Bypass, providing connections to the existing rail lines to the east and the Weemelah line to the west
- reconstruction of a new rail spur for the Weemelah line.

Associated works would include installation of signalling systems, signage, fencing, drainage, the relocation of services and utilities where necessary and the formation of rail maintenance access roads (RMARs) within the rail corridor adjacent to the line. The construction and operation of the proposal would also require the following ancillary facilities:

- construction access and haul roads linking to the surrounding public road network
- construction storage and laydown areas
- associated earthworks for the construction of pads for piling rigs and cranes at underbridge locations.

Additional ancillary facilities could also include mobile batch plant, accommodation for construction workers and construction water supply and storage.

1.2.3 Timing and operation

Construction is anticipated to commence in the first quarter of 2024 and is expected to take about 26 months to construct. The N2NS section is expected to have an average weekly demand of up to 11 trains per day (2027) with a peak demand of up to 20 trains per day (2039). The new rail line would be a faster, more efficient route that bypasses the Sydney rail network, enabling the use of double-stacked trains along its entire length.

Further information on the construction and operation of the proposal is provided in Chapter 7 (Proposal features and operation) and Chapter 8 (Construction of the proposal) of the EIS.

1.3 Purpose and scope of this report

The purpose of this traffic impact assessment (TIA) report is to assess potential traffic and transport issues from the construction and operation of the proposal, and where required, identify feasible and reasonable mitigation measures. This report:

- describes the existing conditions on the transport network
- considers the impact of construction activities by determining the likely traffic generation, access and egress routes and parking requirements in the context of the surrounding road network
- determines the delays (total closure time) at level crossings based on the expected train lengths, travel speeds and pre- and post-train closure times
- investigates the delay and level of service impacts using calculations and SIDRA modelling
- recommends mitigation measures to address any issues identified as part of the assessment.

2 Assessment approach

The SEARs requirements shown in Table 2-1 and the Austroads Guide to Traffic Management have been used to guide the approach taken for this traffic and transport technical report.

Table 2-1 SEARs requirements – Transport and Traffic

Key Issues and desired performance outcomes	Requirement (specific assessment requirements in addition to the general requirements above)	Document Reference
9.Transport and Traffic Network connectivity, safety and efficiency of the transport system in the vicinity of the project are managed to minimise impacts. The safety of transport system customers is maintained. Impacts on network capacity and the level of service are effectively managed. Works are compatible with existing infrastructure and future transport corridors.	**1** Construction transport and traffic (vehicle, pedestrian and cyclists) impacts, including, but not necessarily limited to:	
	a the likely construction access routes (including haul routes the scheduling of construction vehicle movements	4.1.1
	b the indicative number, frequency and size of construction related vehicles (passenger, commercial and heavy vehicles, including spoil management movements and track machines)	4.1.3
	c construction worker parking	4.1.7
	d the nature of existing traffic (types and number of movements) on construction access routes (including consideration of peak traffic times, movement of livestock, agricultural machinery, farm vehicles and other farm infrastructure, construction deliveries and parking arrangements) and assessment of traffic impacts on these routes including identifying traffic management measures to mitigate any issues	4.1.4
	e provisions proposed to ensure safe access and egress to/from the classified road network	4.2.1
	f the nature of any train paths (types and number of movements) and potential impact to these train paths due to additional track possession requirements; and	3.3
	g the need to close, divert or otherwise reconfigure elements of the road and cycle network associated with construction of the project and the duration of these changes.	4.1.2 and 4.1.4
	2 Operational transport impacts of the project for both road and rail, including:	
	a forecast travel demand and traffic volumes for the project (road and rail)	4.2.1
	b travel time analysis	4.2.1
	c performance of key intersections and level crossings by undertaking a level of service analysis at key locations	4.2.1
	d wider transport interactions (local and regional roads, cycling, public and freight transport and the broader NSW rail network); and	4.2.1
	e identification of traffic and transport measures to mitigate any impacts.	4.3
	The assessment must include the modelling of the operational impact of the project.	

Key Issues and desired performance outcomes	Requirement (specific assessment requirements in addition to the general requirements above)	Document Reference
	3 Assess the feasibility of level crossings (existing and proposed), and justify the safety and operational impacts and/or benefits of the proposed crossing type, taking into account the NSW Government's Construction of New Level Crossings Policy.	4.2.1 Table 4-8
	4 In the assessment of level crossings, the EIS must:	
	a provide a safety assessment for each level crossing. The safety assessment is to be consistent with ALCAM, and any Interface Agreements and related Safety Management Plans	4.2.1
	b demonstrate how the risks identified in the So Far As Is Reasonably Practical (SFAIRP) process will be reduced in consultation with the relevant road authority and TfNSW	4.2.1
	c assess potential short-stacking impacts	4.2.1
	d confirm road approaches to level crossings are fit for purpose, safe and designed and constructed in accordance with Austroads Guide to Road Design; and	4.2.1
	e account any rationalisation of private and public level crossings in line with the NSW Government's Level Crossing Closure Policy.	4.2.1

2.1 Methodology

The methodology for undertaking this TIA was as follows:

- Review concept design for the proposal.
- Identify existing and proposed rail/road network crossing locations.
- Update traffic volume data from Moree Plains Shire Council and TfNSW for the road network surrounding the proposal site and key level crossings.
- Update 5-year crash data statistics for the study area from TfNSW.
- Construction Impacts:
  - determine the likely traffic generation of the construction activities associated with the proposal
  - assess the traffic impacts of construction, including on pedestrians, cyclists, and public transport
  - determine the existing and future delays (total closure time) at level crossings based on train lengths, travel speeds and pre- and post-train closure times.
- Operational Impacts:
  - use SIDRA Network 9.0 to model key level crossings and intersections to determine quantitative level of service impacts of the proposal in operation
  - assess operational impacts on travel time of road users due to the proposal
  - assess operational impacts on wider transport network, including impacts to cyclists, pedestrians and public transport.
- Determine appropriate mitigation measures for any impacts identified in the assessment. Mitigation measures at level crossings will need to consider:
  - opportunities and priorities associated with NSW Level Crossing Improvement Program
  - NSW Government Level Crossing Closure Policy
  - level crossing ALCAM assessments and site-specific risk assessments.

It should be noted that when the traffic and transport assessment and modelling was conducted, Inland Rail was forecast to be operational in 2026. This forecast operational date has been revised to 2027. Please note that the traffic and train forecast results under the 2026 noise model remain applicable for the 2027 operational date. For clarity, this will be highlighted in relevant sections as '2026 (2027)' to indicate the use of the 2026 model, which remains applicable for 2027.

2.2 Legislative and policy context to the assessment

The following documents are referenced in the SEARS for this proposal:

- New England North West Regional Transport Plan (TfNSW 2014-2015)
- Construction of New Level Crossing Policy (TfNSW)
- NSW Freight and Ports Plan 2018-2023 (TfNSW 2018)
- Austroads Guide to Road Design
- Austroads Guide to Traffic Management
- Central West Regional Transport Plan (TfNSW 2013)
- Western Regional Transport Plan (TfNSW 2013)
- ONRSR Railway Crossing Policy (2016)
- *Roads Act 1993* (NSW)
- Guide to Traffic Generating Developments (RTA, 2002)
- Level Crossing Closures Policy (TfNSW)
- *Marine Safety Act 1998* (NSW).

3 Existing environment

3.1 Road network

The study area consists of the proposal site and surrounding road network. The road network within the study area consists mainly of local roads, private rural roads and the Newell Highway, detailed in Table 3-1. The road network surrounding the study area is shown in Figure 3-1.

Table 3-1 Key roads within the study area

Road Name	Public / Private	Extent	Intersections
Newell Highway (including Moree Bypass)	Public	From Gwydir Highway (Alice Street) 14.5 km north to study area extent	• Gwydir Highway • Gwydirfield Road • Boggabilla Road • River Road • The Rocks Road • Private roads (as listed below)
Gwydir Highway (Also known as Alice Street in the area of the project)	Public	From Oak Street (north) to Gosport Street	• Moree Bypass
Gwydirfield Road	Public	From Moree Bypass to Newell Highway	• Moree Bypass • Newell Highway
River Road (Back Pally Road)	Public	From Newell Highway towards Pallamallawa for about 2 kms to study area extent	• Newell Highway • The Rocks Road (north)
The Rocks Road	Public	From Newell Highway for about 1 km to study area extent	• Newell Highway
Unnamed road (d) in Figure 3-1	Public	From Newell Highway up to and including level crossing LX3149	• Newell Highway – 3.5 kms north of from River Road intersection

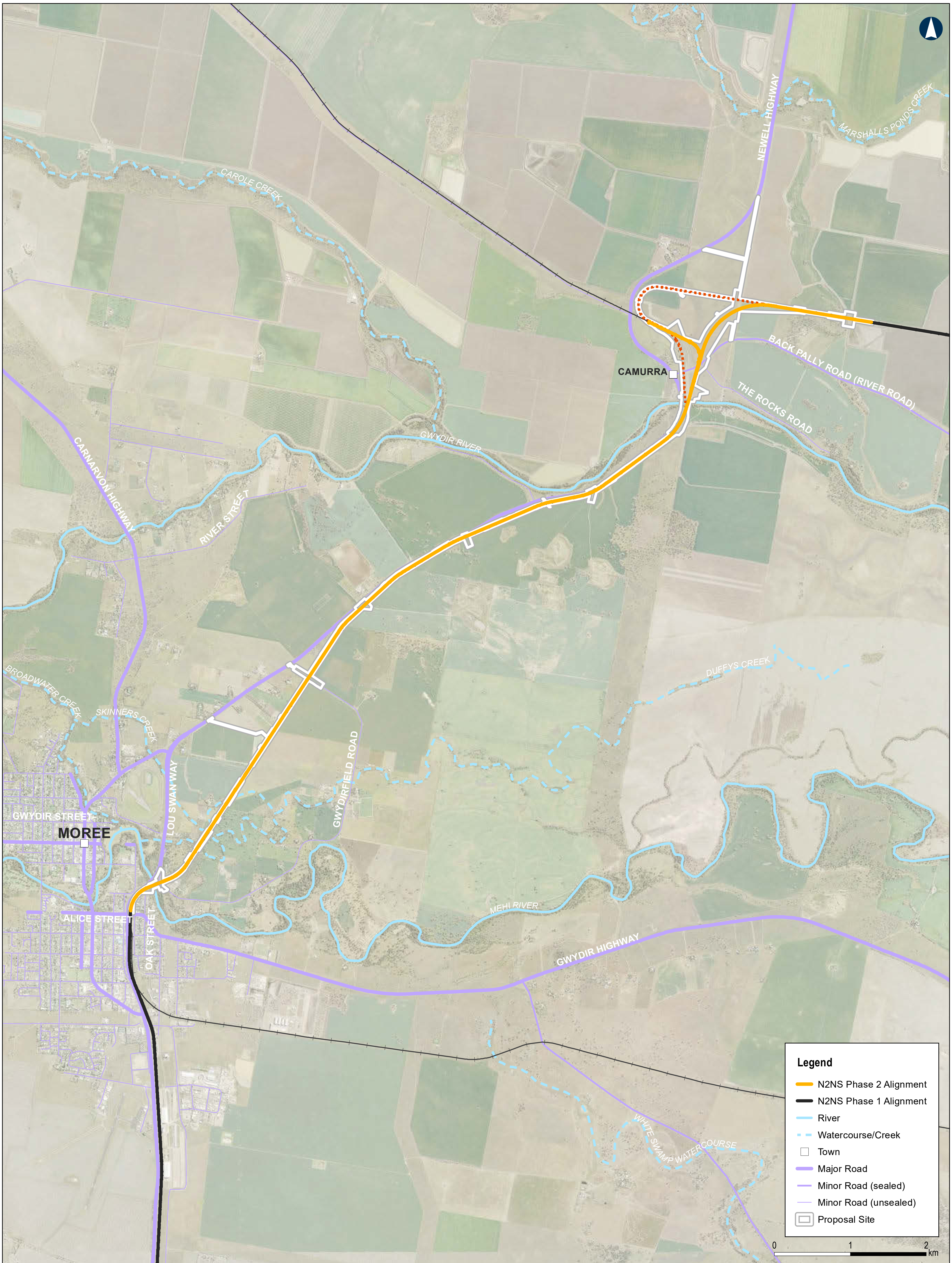


Figure 3-1 Road network impacted by proposal site

Data Sources: ARTC, IRDJV, LPI

Coordinate System: GDA 1994 MGA Zone 55
Scale: 1:45,000
Paper size: A3
Date: 9/28/2021
Map 1 of 1

N2NS_SP2_TT_F03_01_RoadNetworkImpactedByStudyArea_r2v2.mxd

3.1.1 Newell Highway

The Newell Highway runs generally north-south and connects between the Goulburn Valley Highway near the Victoria/New South Wales border, and Leichardt Highway near the Queensland/New South Wales border. It forms the primary inland road route between Melbourne and Brisbane, via Narrandera, Parkes, Dubbo and Moree. Within the study area, the Newell Highway runs generally parallel to the rail line. The rail alignment does not cross the Newell Highway.

Outside of built-up areas, the Newell Highway has a posted speed limit of 110 km/h, and generally comprises a single lane of travel in each direction on a single carriageway. Overtaking lanes are provided in some locations. At Moree, the Moree Bypass provides a limited access route through the eastern areas of Moree's urban area. The northern part (stage 1) of this bypass, north of the Gwydir Highway (also referred to as Alice Street) opened in April 2012 and the southern part (stage two) opened in August 2015. The Moree Bypass has a single lane of through traffic in each direction, with a posted speed limit of 60 km/h.

Traffic volumes on the Newell Highway immediately south of the intersection with Murrays Road are available for both directions during the period May to November 2008. This data is the most recent where traffic flows in both directions is available. These volumes were collected by TfNSW and are available through the Open Data Traffic Volume Viewer for Station ID 91117. More recent traffic data is available at this station for northbound traffic only between July to October 2008-2011. A review of the traffic data over this period showed that traffic volumes increased by an average annual growth factor of 2.6 per cent. Given only two data sets are available there is a low level of accuracy in this growth rate calculation, however it is adopted in further calculations as a worst case scenario. The observed traffic volumes indicate the following:

- Average Annual Daily Traffic (AADT) volumes of 1,978 vehicles per day (two-way) in 2008, and 2,697 vehicles per day (two-way) when an average annual growth rate of 2.6 per cent is applied through to 2020.
- In 2008, two-way traffic volumes of around 130-150 vehicles per hour between 9.00 am to 3.00 pm as shown in Figure 3-2. The peak hour occurs between 2.00 to 3.00 pm with 150 vehicles of which 36 per cent are heavy vehicles. In 2020, this is predicted to be around 205 vehicles which is equivalent to 258 PCUs
- A daily average of 47 per cent heavy vehicles with a range from 28 per cent during the morning peak hour to 85 per cent between 0.00 and 2.00 am.

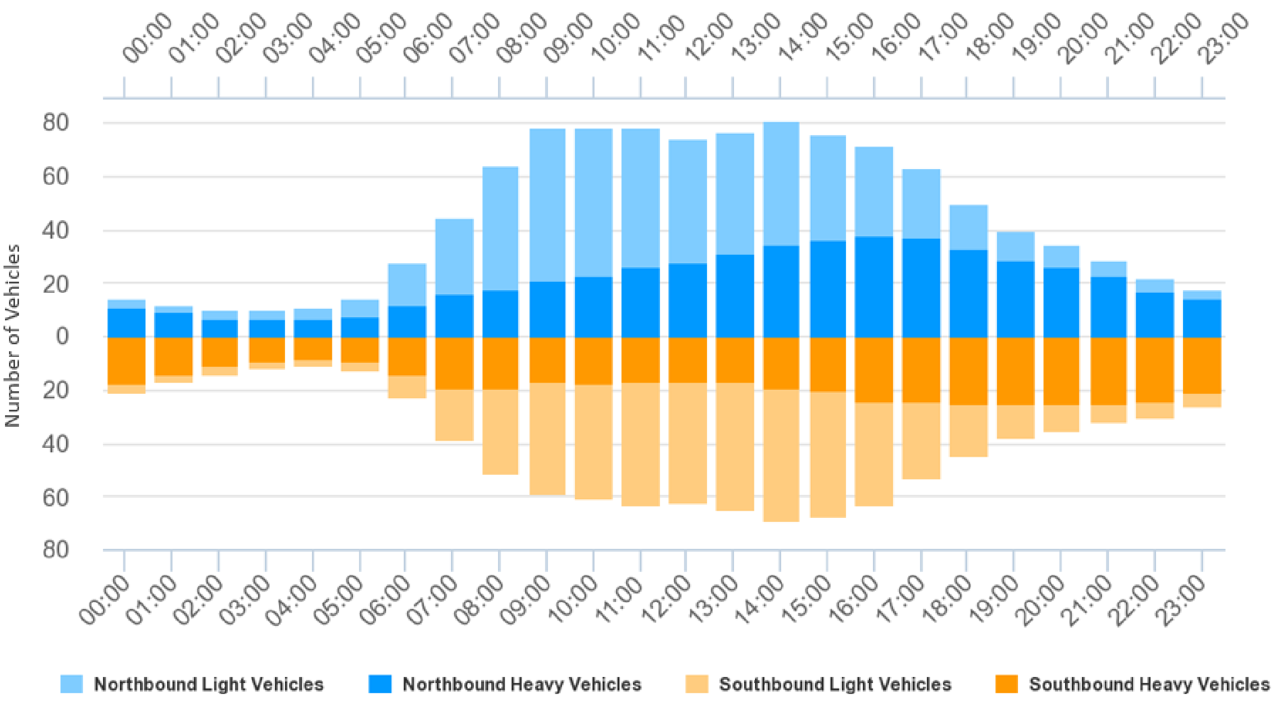


Figure 3-2 Newell Highway daily traffic profile, 2008 (Source: TfNSW Traffic Volume Viewer Station ID 91117)

Figure 3-2 shows consistently larger heavy vehicle flows in the northbound direction. This could be attributed to the proximity of this count location to Brisbane and its ports relative to Sydney, and alternative routes being taken on return trips. As the data does not cover a full year cycle, seasonal variations in the traffic flows, cannot be assessed. However, it would be expected that increases in heavy vehicles would occur during harvesting seasons.

To establish a Level of Service (LOS), both average travel speed and per cent time-spent-following need to be considered. In absence of this data, an assessment has been done using the methodology outlined in the Austroads Guide to Traffic Management Part 3 (AGTM). Table 3-2 summarises the driving conditions as outlined in the AGTM. The Highway Capacity Manual 2016 (HCM) also states the capacity of a two-lane, two-way highway being 3,200 Passenger Car Unit (PCU) equivalents per hour, which is also considered in the following assessment.

Table 3-2 Level of Service bands for two-lane highways (Source: Austroads Guide to Traffic Management Part 3)

LOS	Average travel speed (km/h)	Per cent time-spent-following (PTSF) (%)	Class 1 Highway driving conditions
A	> 90	≤ 35	Motorists experience high operating speeds and little difficulty in passing. Platoons of three or more vehicles are rare.
B	> 80 – 90	> 35 – 50	Passing demand and passing capacity are balanced. The degree of platooning becomes noticeable. Some speed reductions are present.
C	> 70 – 80	> 50 – 65	Most vehicles are travelling in platoons. Speeds are noticeably curtailed.
D	> 60 – 70	> 65 – 80	Platooning increases significantly. Passing demand is high but passing capacity approaches zero. A high percentage of vehicles are now travelling in platoons, and PTSF is quite noticeable.
E	≥ 60	> 80	Demand is approaching capacity. Passing is virtually impossible, and PTSF is more than 80%. Speeds are seriously curtailed. The lower limit of this LOS represents capacity.

The study area is located within a generally flat landscape with relatively straight roads and gentle turns. Low traffic volumes are also characteristic of the region contributing to ideal driving conditions. Taking this into consideration, the following LOS assessment was undertaken for the Newell Highway.

The busiest section of the Newell Highway, as recorded in 2008, within the vicinity of the study area is located immediately north of Narrabri. Peak two-way volumes of 228 vehicles per hour and 35 per cent heavy vehicles were recorded at this location (TfNSW Traffic Volume Viewer, Station ID 92725). Scaling this up to 2020 levels using the same annual growth rate as previous, 311 vehicles per hour would be likely at this location. Compared to light vehicles, heavy vehicles have a greater impact on the road network due to their size and longer stopping distances. To account for this difference, heavy vehicles are converted to Passenger Car Unit (PCU) equivalents using various factors outlined in Part 3 of the AGTM. Considering each heavy vehicle to have a PCU factor of three would result in the peak two-way flow of 311 vehicles being equivalent to a two-way flow of 529 PCUs. This equates to around 17 per cent of the Newell Highway's two-way capacity of 3,200 PCUs.

If 265 vehicles travel in one direction during the peak hour, this equates to an average of five vehicles per minute. Under these conditions, it can be considered that an average travel speed of greater than 90 km/h could be achieved and platoons of three or more vehicles would be rare. Therefore, even the busiest section of the Newell Highway, close to the study area, operates at a good LOS during peak traffic conditions. If the volume of traffic on the highway were to increase by four times, this would be equivalent to a two-way flow of 2,116 PCUs during peak hour which is still two thirds of the Newell Highway's capacity.

3.1.2 Gwydir Highway (also known as Alice Street)

The Gwydir Highway runs generally east-west and connects between Castlereagh Highway at Walgett and the Pacific Highway at Grafton. The Gwydir Highway passes through Moree (where it is called Alice Street) and crosses the rail line at a level crossing. Within Moree, Alice Street has a single lane in each direction with a posted speed limit of 50 km/h.

Traffic volume data from May 2015, provided by Moree Plains Shire Council, on Alice Street west of the Moree Bypass is presented in Figure 3-3. This indicates an average daily weekday volume of 9,000 vehicles. Peak hour volumes are in the order of 350 vehicles in each direction. Westbound traffic experiences a short peak in the morning, while in the afternoon the eastbound peak runs between 3.00 pm and 6.00 pm.

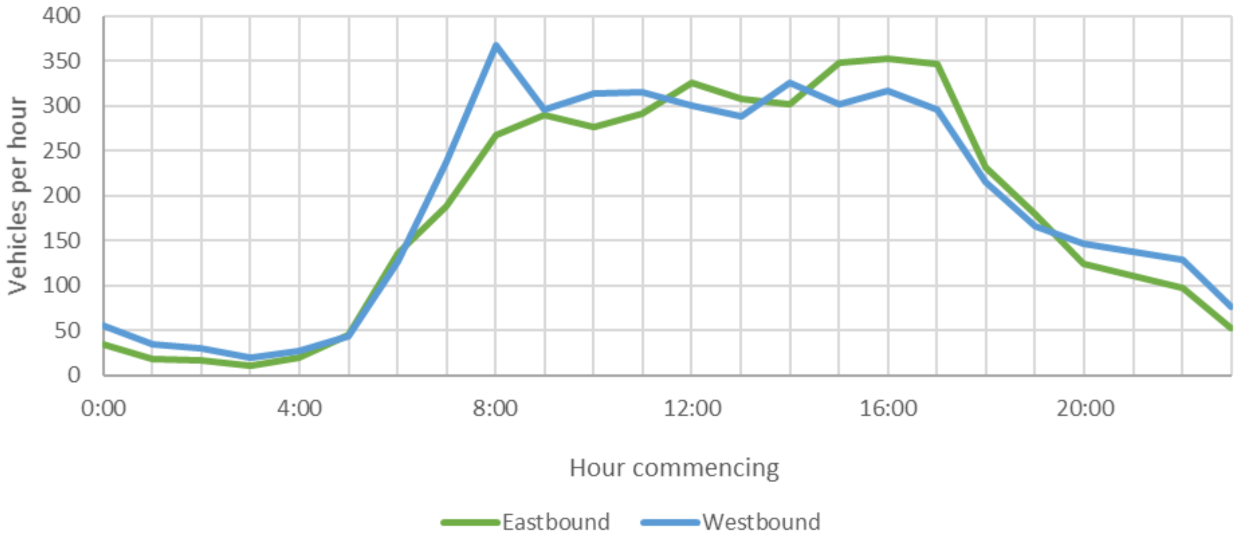


Figure 3-3 Average weekday traffic profile on Alice Street (May 2015)

3.1.3 Gwydirfield Road

Gwydirfield Road is a local two-way road with a posted speed limit of 80 km/h. It intersects the Newell Highway at two priority intersections spaced around three kilometres apart. Both intersections allow all traffic movements. It also crosses the rail alignment at two locations by means of an underbridge by the Mehi River and a level crossing further to the north.

A level crossing report on Gwydirfield Road in August 2020 recorded two-way traffic volumes of 96 vehicles per day.

3.1.4 River Road (also known as Back Pally Road)

River Road is a two-way road that generally runs in an East-West direction. It connects the Newell Highway with the town of Pallamallawa around 23 kilometres to the east of the Newell Highway. A level crossing report on River Road in August 2020 recorded two-way traffic volumes of 319 vehicles per day.

3.1.5 The Rocks Road

The Rocks Road is a two-way local road that intersects with the Newell Highway around 10 kilometres north of Moree by means of a priority intersection allowing all traffic movements. It also crosses the rail alignment at a level crossing.

To the north of the Gwydir River, another section of The Rocks Road intersects with River Road to the east of the level crossing LX0564. This section is an unsealed two-way local road. The Rocks Road does not cross the Gwydir River at any point.

3.1.6 Rail Maintenance Access Road (RMAR)

An internal access track used by maintenance vehicles runs along (within) the rail corridor for most of its length in the proposal site. Access to this track is provided off the local road network in a number of locations in the study area. Use of this track is restricted to authorised ARTC maintenance vehicles.

3.1.7 Summary of roads

A summary of the roads along the Moree to Camurra North section of the Narrabri to North Star line (N2NS SP2) is shown in Table 3-3. Local roads are managed by Moree Plains Shire Council. State roads and the National Highway are managed by Transport for NSW (TfNSW). Regional roads are managed by TfNSW with maintenance and control delegated to local government.

Table 3-3 Public roads impacted by N2NS Phase 2 Moree to Camurra North proposal

Road Name	Road Management	Surface Type	Shoulders	Line Marking
Newell Highway	National Highway	Sealed	Yes	Yes
Gwydir Highway (also known as Alice Street)	State	Sealed	No (kerb and footpath provided)	Yes
Gwydirfield Road	Local - Moree Plains	Sealed	No	No
River Road (Back Pally Road)	Local - Moree Plains	Sealed	No	Yes
The Rocks Road	Local - Moree Plains	Unsealed	No	Yes

Traffic volumes for these roads, where available, are listed in Table 3-4.

Table 3-4 Local road volumes

Road Name	Average Daily Volume (2-way)	Date of Count	Source
Newell Highway (at intersection with Murrays Road)	2,000 (47% heavy vehicles)	2008	Transport for NSW Traffic Volume Viewer (Station ID: 91117)
Gwydir Highway (also known as Alice Street)	9,000	2015	Moree Plains Shire Council
Gwydirfield Road	96	August 2020	Public Road Level Crossing Detail Report (2-0001-260-DCW-00-DS-0001)
River Road (also known as Back Pally Road)	319	August 2020	Public Road Level Crossing Detail Report (2-0001-260-DCW-00-DS-0001)
The Rocks Road	21	August 2020	Public Road Level Crossing Detail Report (2-0001-260-DCW-00-DS-0001)

3.1.8 Seasonal variation

Based on the dominant rural/agricultural land uses of the study area, traffic volumes on the road network are likely to increase during harvesting seasons. Given the region's climate and soil conditions, two growing seasons can be achieved in this area. Harvest of winter crops in the study area can begin in late September and continue through to December. Key winter crops in the study area include wheat, barley, oats and cereal rye. The summer crops are harvested between February and May and may include sorghum, sunflowers and maize (Australian Grain Magazine, 2019).

During these seasons, it is assumed that heavy vehicle usage on local and main roads in the study area is likely to increase as trucks transport grain, and tractors and harvesters move between properties. Farming machinery is generally much larger and slower than other vehicles using the roads and may result in localised delays.

A sensitivity assessment for seasonal variation in potential traffic impacts has been undertaken, detailed in Section 4.1.4.

3.2 Road safety

The 5-year crash history (2014-2018) for the various roads in the study area was obtained from the Transport for NSW Centre for Road Safety. This is summarised in Table 3-5.

Table 3-5 Crash history (2014-2018)

Street Name	Fatal	Serious	Moderate	Minor	Total
Moree Bypass (A39) / Alice St	0	0	2	0	**2**
Boggabilla Rd / Moree Bypass (A39)	0	1	1	0	**2**
Gwydirfield Rd	0	1	1	0	**2**
Newell Hwy (A39) / Boolooroo Weir Rd	0	1	0	0	**1**
Newell Hwy (A39) / The Rocks Rd	0	1	0	0	**1**
Newell Hwy (A39) (near River Rd)	0	0	1	0	**1**
Newell Hwy (A39) (north of River Rd)	2	0	0	0	**2**
Total	**2**	**4**	**5**	**0**	**11**

Most crashes occurred on the Newell Highway (A39), which is to be expected given the length of road considered in this assessment. The high proportion of serious and moderate injury crashes is also noted, most likely a factor of higher vehicle speeds on rural roads. Rear ending was the most common accident type which generally took place within or close to Moree town centre. This is potentially a result of the change in road conditions from continuous rural highways to numerous intersections and the resulting varying speed of the traffic. Vehicles leaving the carriageway and hitting an object or vehicle head on collisions also occurred more than once within the study area. No accidents were recorded at any of the level crossings within the study area.

3.3 Rail network

Moree is located on the Mungindi (North West) railway line, which branches from the Main North Line at Werris Creek and heads north west through the towns of Gunnedah and Narrabri to Moree. After passing through Moree, the line branches to the north west to Mungindi at Camurra (about 10 kilometres north-west of Moree). North Star is located on the Boggabilla line, which branches from the Mungindi line at Camurra to the north east. The first 2.5 kilometres of the Boggabilla line is within the N2NS SP2 study area although it has been closed to regular operations since 2013 but is still used occasionally. The rail network around Moree is illustrated in Figure 3-4.

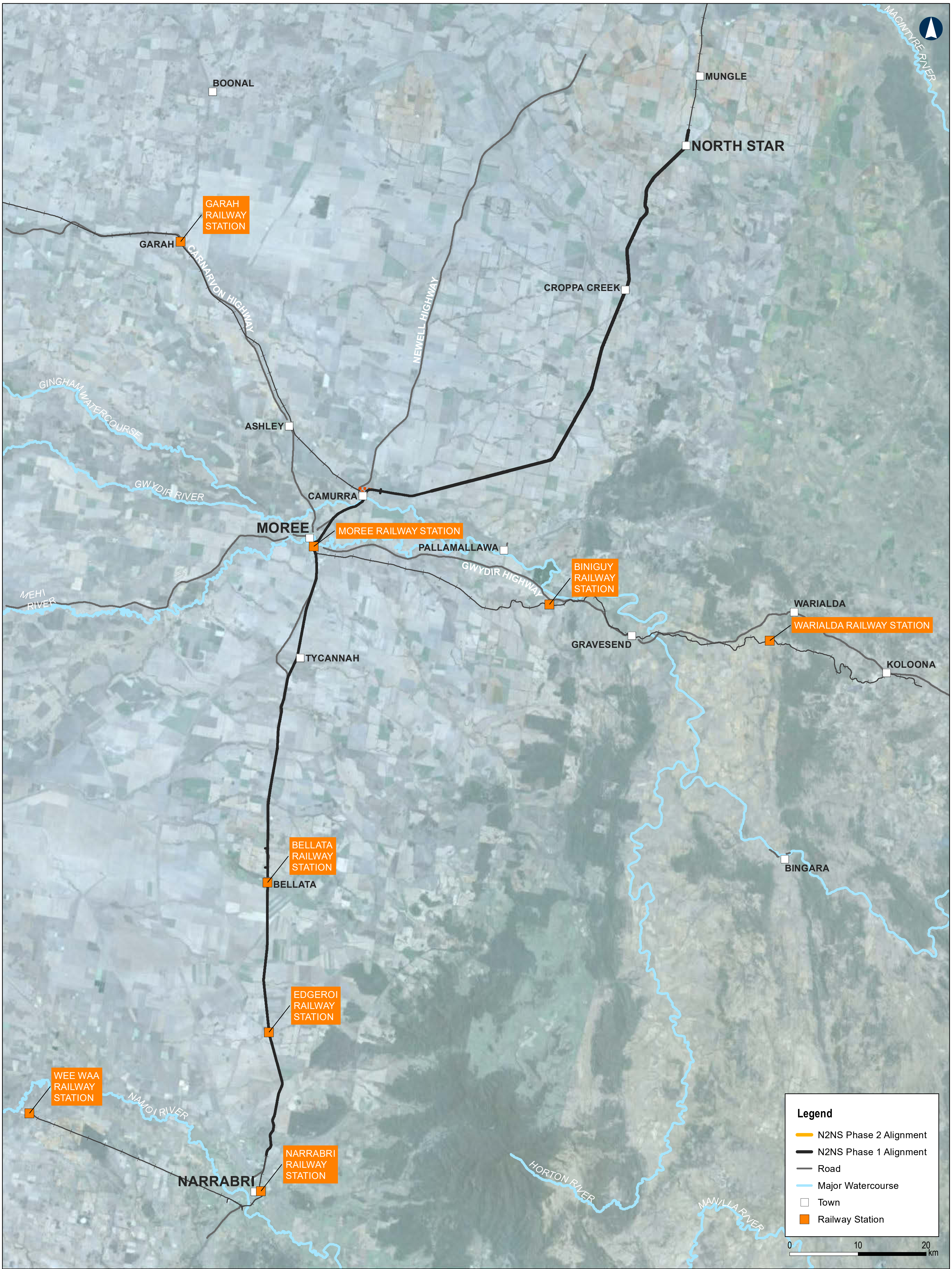


Figure 3-4 Existing rail lines

Data Sources: ARTC, IRDJV, LPI

Coordinate System: GDA 1994 MGA Zone 55
Scale: 1:500,000
Paper size: A3
Date: 9/23/2021

Map 1 of 1

N2NS_SP2_TT_F03_04_ExistingRailLines_r2v2.mxd

3.3.1 Passenger services

Passenger trains operate to Moree from as far as Sydney. The service to Moree is provided by NSW TrainLink's Northern Tablelands Xplorer. Moree station is located just outside the southern boundary of the N2NS SP2 study area. There are no rail passenger services in the study area which is north of Moree station. A map showing the passenger rail network and other public transport services operating to Moree is provided in Section 3.5.

3.3.2 Freight services

Occasional grain/goods trains operate on an as needs basis through the study area. Train count data between January 2014 and December 2015 shows an average of 1.8 freight trains per day, with up to seven trains on a peak day. The majority of these services finish at Moree, and the line to North Star is used only occasionally.

Between Moree and North Star, current train speeds are limited to a maximum of 80 km/h depending on the axle weight. There are also local speed restrictions due to existing track conditions.

3.4 Key intersection performance

This section identifies all intersections within the study area that are impacted by the proposal. Where appropriate and where data is available, analysis of the intersections have been provided.

3.4.1 Level crossings

A total of nine level crossings are located along the proposal site, illustrated in Figure 3-5. Of these, three are located on public roads and six crossings are located on private roads. The details of each level crossing is provided in Table 3-6. Given the very low number of vehicles using these level crossings, all are estimated to operate at Level of Service A.

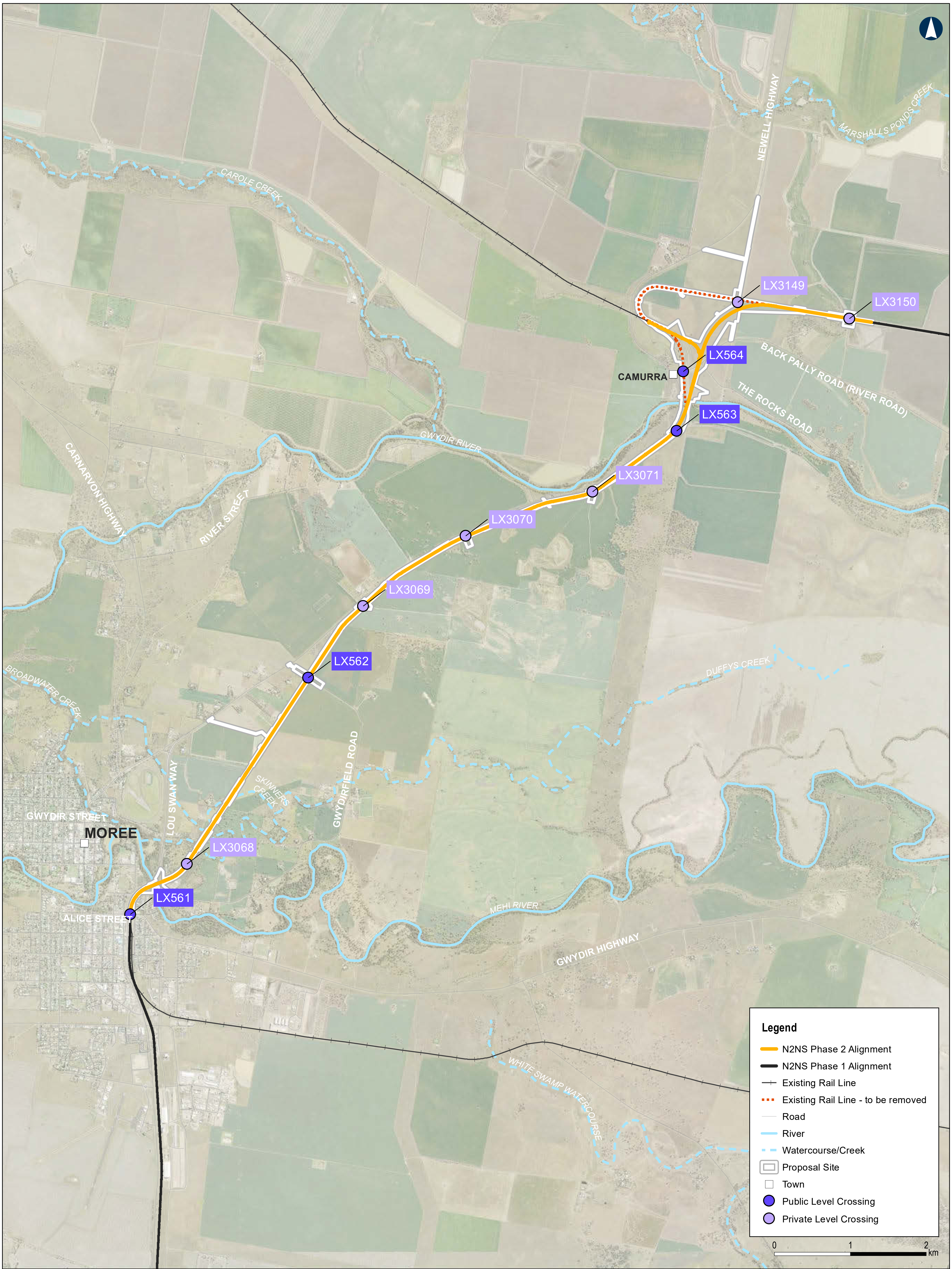


Figure 3-5 Level crossing locations

Data Sources: ARTC, IRDJV, LPI

Coordinate System: GDA 1994 MGA Zone 55
Scale: 1:45,000
Paper size: A3
Date: 9/23/2021

Map 1 of 1

N2NS_SP2_TT_F03_05_LevelCrossingLocations_r2v2.mxd

Table 3-6 Level crossings within the proposal site

ID Number	Public / Private	Chainage	Road Name	Current Control Type	Usage	Site Image (Source: Nearmap)
LX3068	Private	666.731	*Unnamed road*	Passive	-To be closed	
LX0562	Public	669.932	Gwydirfield Road	Passive – Stop signs	96 vehicles/day (August 2020)	
LX3069	Private	671.128	*Unnamed road*	Passive – Stop signs	Usage less than 5 vehicles/day (August 2020)	
LX3070	Private	672.772	*Unnamed road*	Passive – Stop signs	Usage less than 5 vehicles/day (August 2020)	
LX3071	Private	674.547	*Unnamed road*	Passive – Stop signs	Usage less than 5 vehicles/day (August 2020)	

ID Number	Public / Private	Chainage	Road Name	Current Control Type	Usage	Site Image (Source: Nearmap)
LX0563	Public	675.904	The Rocks Road	Passive – Stop signs	21 vehicles/day (August 2020)	
LX0564	Public	676.815	River Road	Passive – Stop signs	319 vehicles/day (August 2020)	
LX3149	Private	677.720	*Unnamed road*	Passive – Stop signs	Usage around 10 vehicles/day (August 2020)	
LX3150	Private	680.703	*Unnamed road*	Passive – Stop signs	Usage estimated at around 30 vehicles/day	

In addition to the above, there is an active level crossing at the intersection of Alice Street / Moree Bypass, indicated as 561 in Figure 3-5. While this crossing is outside the study area, construction vehicles accessing the site would be expected to travel through this intersection. The performance of this intersection is assessed in the next sub-section: Alice Street/Moree Bypass.

3.4.1.1 Alice Street/Moree Bypass

The Alice Street/Moree Bypass intersection, illustrated in Figure 3-6, is a four-leg signalised intersection that incorporates the railway level crossing into the traffic signals. This allows the north-south through movement on Newell Highway-Moree Bypass to continue while a train is crossing the Gwydir Highway (indicated in blue in Figure 3-6). Eastbound traffic from Alice Street, the left turn from Moree Bypass onto Gwydir Highway East and the right turn from the Newell Highway onto the Gwydir Highway (east) is stopped to allow trains to cross Alice Street (indicated in red in Figure 3-6).

The performance of this intersection was assessed in SIDRA Intersection 9.0 using turn movements as surveyed by Moree Plains Shire Council in February 2019. Independent of the level crossing being activated, the modelled Level of Service at this intersection is good, with LOS C in both the AM and PM peak periods for 2019.

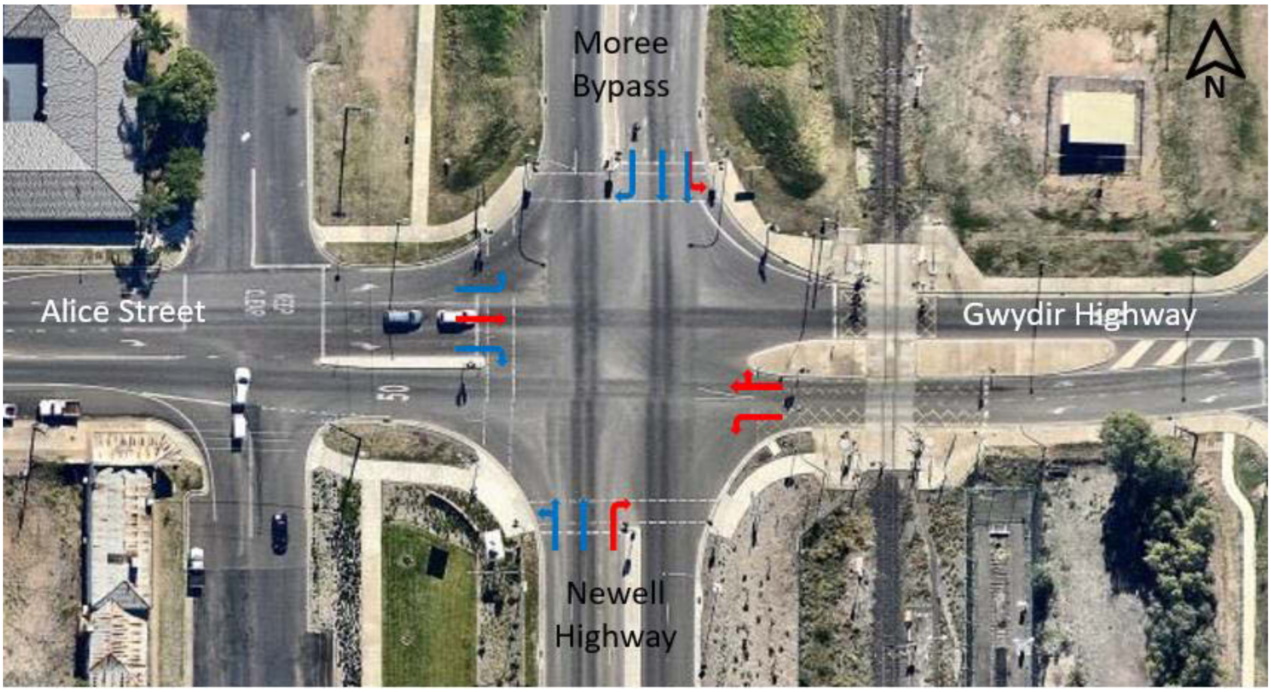


Figure 3-6 Alice Street / Moree Bypass intersection layout and vehicle movements

The duration of any delay at a level crossing is related to factors including the train length (up to the 1,800 metre maximum length currently allowed on the line) and the train speed. At active crossings, ARTC Engineering (Signalling) Standard ESD-03-01 requires a minimum pre-train warning time of 30 seconds, and a minimum 5 seconds once the train has passed.

The current delays experienced at the Alice Street / Moree Bypass level crossing were assessed based on a maximum train length of 1,800 metres and a conservative assumption of 45 second pre-train warning time and five seconds post-train. The result of this assessment for various train speeds is presented in Table 3-7 and shows that a 1,800 metre length train travelling at 60 km/h would result in a delay of 158 seconds to traffic that conflicts with the train movement.

Table 3-7 Level crossing delay for a train length of 1800m

Train speed (km/h)	Pre train warning time (seconds)	Train travel time (seconds)	Post train wait time (seconds)	Total time of crossing closure (seconds)
60	45	108	5	158

The intersection performance is impacted by the level crossing of which the effects are included in the analysed model. The following modelling inputs were used:

- Two peak hour periods were modelled: 8.30 am to 9.30 am and 4.30 pm to 5.30 pm.
- The traffic was classified into light vehicles, heavy vehicles and large trucks.
- Pedestrian counts were not included with the 2019 data, so 2016 pedestrian data was used. Additionally, as separate pedestrian movements were not recorded in the 2016 data, the highest total number of pedestrians using the intersection during peak hours was applied to all three possible movements to achieve a worst-case scenario. This resulted in 22 pedestrian movements being applied to the North, South and West approach.
- The traffic volume from 2019 to 2020 was not scaled up as it is likely that no or minimal growth would have taken place over this period. All traffic volumes that were applied to the SIDRA model can be found in Appendix A.

To simulate the effects of a train crossing the intersection during the peak hour, the phasing of the intersection was adjusted to spread the impact of prohibited movements over the whole hour. That is, for movements that were not able to take place during a train crossing period, their active green time was reduced using the late start feature by the total length of the crossing closure divided by the number of cycles within the hour. This resulted in reduced capacity of movements indicated in red in Figure 3-6.

A summary of the SIDRA analysis results are shown in Table 3-8 and full results provided in Appendix A.

Table 3-8 Existing performance of Alice Street / Moree Bypass intersection

Peak Period	Train calls per hour	Traffic Volume	Average Delay	LOS
8.30 – 9.30 am	0	515	41 seconds	C
	1	515	48 seconds	D
4.30 – 5.30 pm	0	556	41 seconds	C
	1	556	45 seconds	D

3.4.2 Road intersections

There are a number of minor intersections located near the proposal site, as listed in Table 3-9. The performance of these intersections was not quantified as part of the assessment. However, given the very low traffic volumes in the area (as detailed in section 3.1), it is expected that there would be little to no delay.

Table 3-9 Key intersections located near the proposal site

Locality	Intersecting Road	Intersecting Road	Image Reference
Moree	Moree Bypass	Boggabilla Road	Figure 3-7
Moree	Moree Bypass	Gwydirfield Road	Figure 3-8 (left)
Moree	Newell Highway	Gwydirfield Road	Figure 3-8 (right)
Camurra	Newell Highway	The Rocks Road	Figure 3-9
Camurra	Newell Highway	River Road (Back Pally Road)	Figure 3-10
Camurra	River Road (Back Pally Road)	The Rocks Road	Figure 3-11

Figure 3-7 Moree Bypass / Boggabilla Road intersection layout and vehicle movements

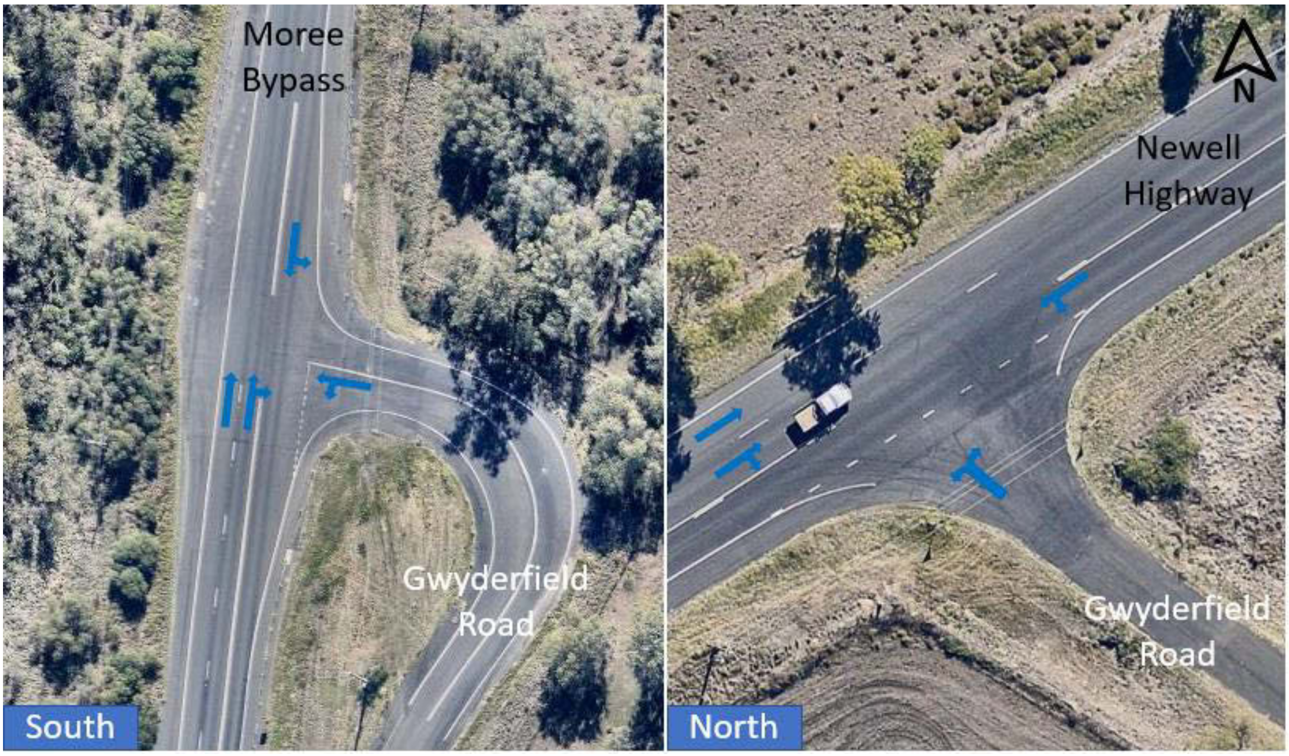


Figure 3-8 Moree Bypass / Newell Highway / Gwydirfield Road intersection layout and vehicle movements

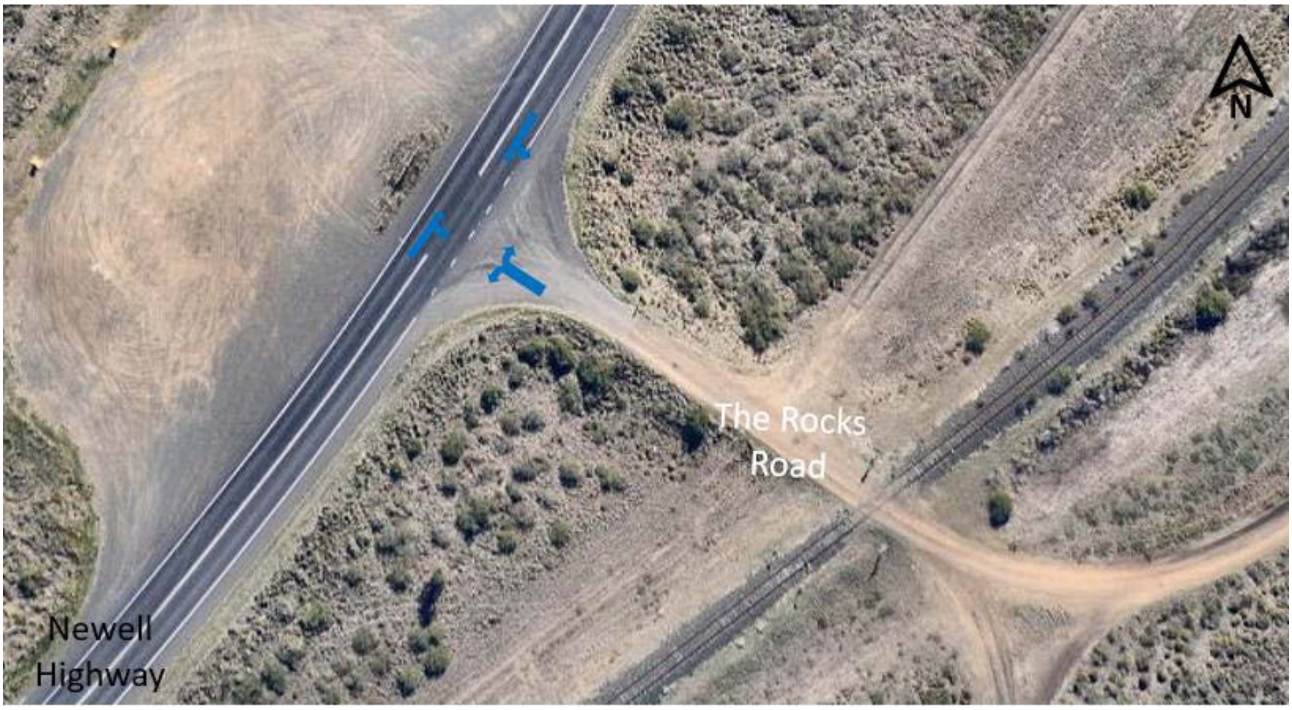


Figure 3-9 Newell Highway / The Rocks Road intersection layout and vehicle movements

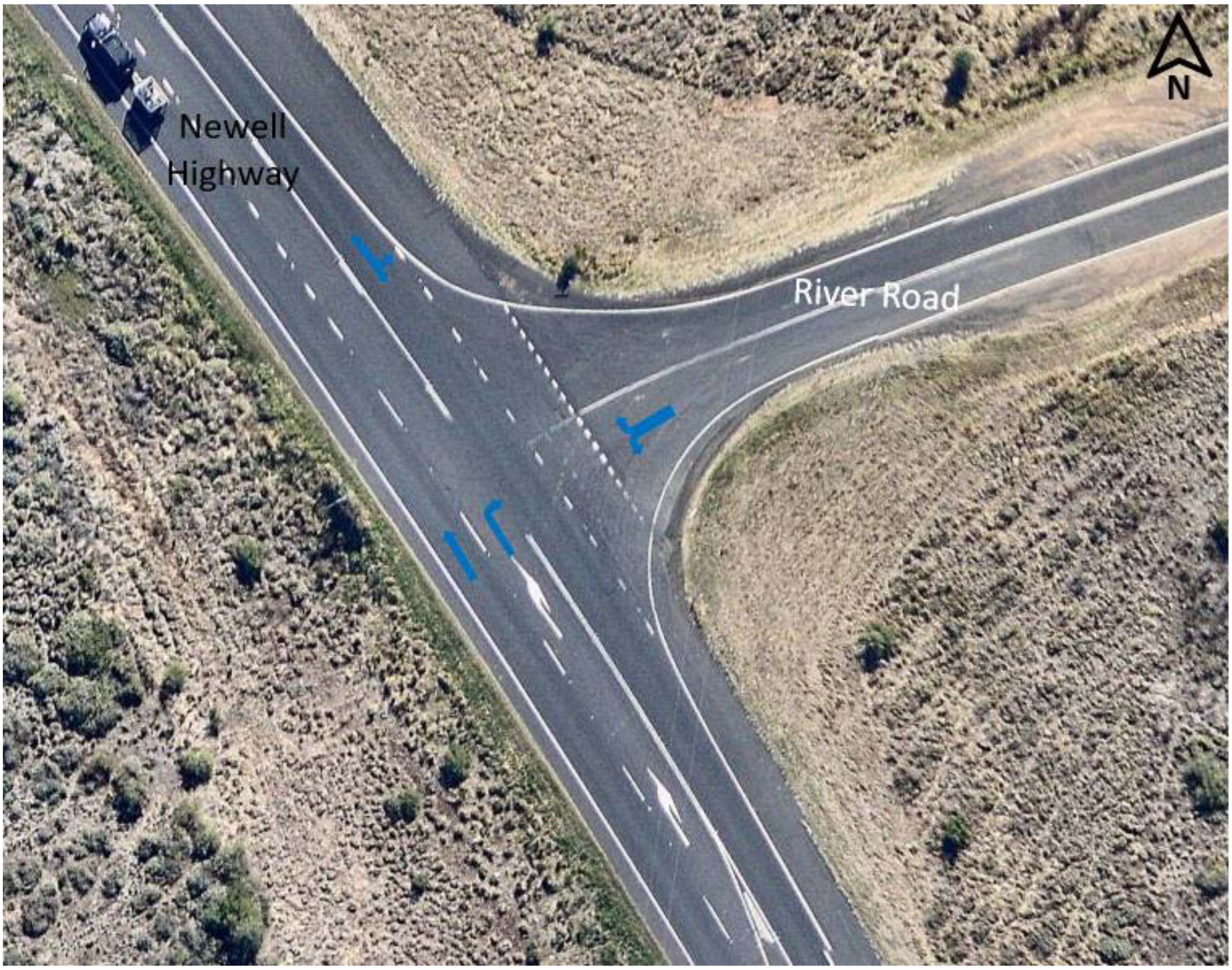


Figure 3-10 Newell Highway / River Road intersection layout and vehicle movements

Figure 3-11 River Road(Back Pally Road) / The Rocks Road intersection layout and vehicle movements

3.5 Public transport

The traffic conditions within the project area are not heavily influenced by the public transport services offered around Moree. In addition to the Northern Tablelands Xplorer train service to/from Moree (represented in orange in Figure 3-12) there are buses that operate in Moree, close to the study area. The bus services that have been identified are as follows:

- Two regional coach services operate from Moree (shown in Figure 3-12):
  - A daily coach service operates to Sydney via Narrabri using the Newell Highway from Moree. Connections to Tamworth and Armidale are possible from this route.
  - From Monday to Saturday, a service operates between Moree and Grafton along the Gwydir Highway. Connections to other towns, such as Tenterfield, Armidale and Tamworth, are possible from this route.
- Moree has a local bus service which provides routes around Moree, including along Alice Street to the proposal site.
- An On-Demand service trial began in November 2018 which offers to pick up or drop off passengers anywhere within Moree.
- School services also operate on various routes across the study area, including Newell Highway, River Road and Gwydir Highway/Alice Street.

Due to the low demand on the offered services, more personalised approaches to public transport options such as on-demand bus services are available increasing the likelihood for buses to take previously unused routes.

The passenger rail service, Northern Tablelands Xplorer, provides access to Moree from further afield, including from as far as Sydney. This service combined with the bus services, gives Moree a basic public transport network that is commensurate with the population.

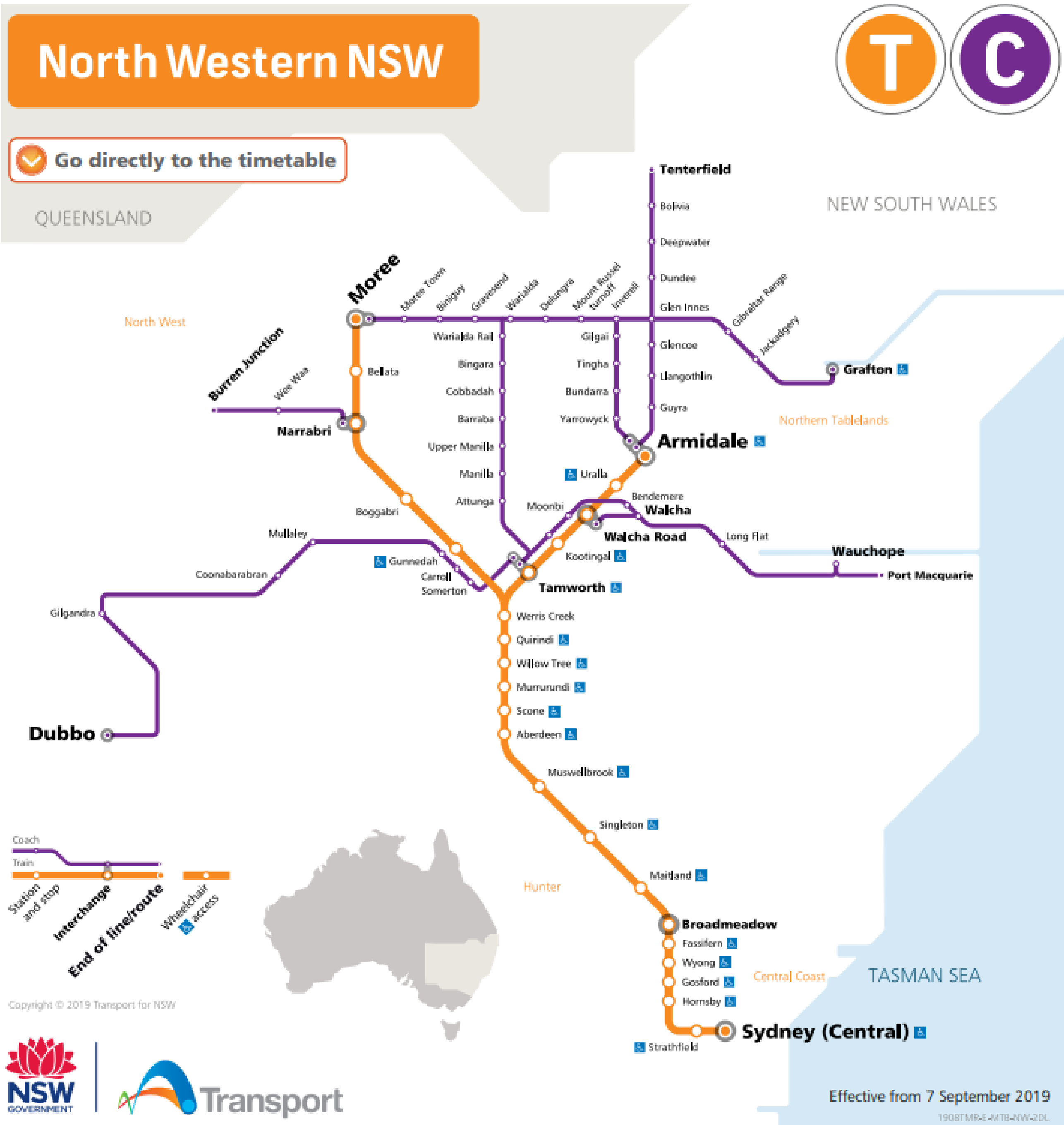


Figure 3-12 North-western NSW train and coach services (Source: TfNSW)

3.6 Active transport

Pedestrian and cyclist activity is minimal adjacent to the proposal site, with no facilities for pedestrians or cyclists provided along the Newell Highway (outside of Moree) and Moree Bypass, although cycling is catered for on road shoulders. Pedestrian crossings of the Moree Bypass and adjacent rail line are provided at Alice Street and at Moree Station. Pedestrian paths are provided along both sides of Alice Street.

An existing shared pathway is located at River Street in Moree which provides access along the foreshore of Mehi River and under the rail line and Mehi River bridge. The path extends under the Newell Highway and provides walking and recreational access to path users into Moree town.

3.7 Parking

The majority of the proposal site is situated outside of Moree town centre. Therefore, due to the low parking demand around the proposal site no formal public parking areas are provided within its vicinity. Residents and visitors to areas within of adjacent to the proposal site would park on the street if parking on a private property was not possible. Moree Train Station, to the south of the study area, has a public car park of about 50 spaces, intended for use by passenger train services. The small parking facility is located to the east of the rail alignment and is accessed from Morton St.

Rest areas are provided at various locations along the Newell Highway. Between Moree and Camurra, there is one rest area designated for heavy and light vehicles.

4 Impact assessment

This section identifies the impacts the proposal has on the existing environment within the study area during the construction phase and subsequent operational phase.

4.1 Construction impacts

4.1.1 Access routes

4.1.1.1 Access to construction sites

Access to the construction sites would generally be from Moree via the Newell Highway, Gwydirfield Road and River Road (also known as Back Pally Road). A Rail Maintenance Access Road (RMAR) runs parallel to the rail line along the majority of the alignment and would provide a haul route.

Construction vehicle access to the proposal site would be via the existing road network and access tracks within the rail corridor. 12 access points to the rail corridor have been proposed and are presented in Table 4-1 and the Constructability chapter of the EIS (Chapter 8).

Table 4-1 Proposed access points to the rail corridor

Access No.	Access via
1	River Road (also known as Back Pally Road)
2	Newell Highway and River Road (also known as Back Pally Road)
3	River Road (also known as Back Pally Road)
4	Rocks Road
5	Newell Highway
6	Newell Highway
7	Newell Highway
8	Gwydirfield Road North
9	Temporary construction haul road to the Newell Highway through paddock.
10	Gwydirfield Road, South
11	Oak Street, Moree
12	299 Morton Street, Moree

Most traffic accidents on construction sites occur at site entry and exit points, road crossings and pedestrian walkways. Consideration has been given to the type of access control required at each of the access points to the rail corridor listed in Table 4-1. These are detailed below:

- Access 1 – Via River Road (also known as Back Pally Road): A low number of construction vehicles are likely to access the rail corridor from this location. Traffic controllers are unlikely to be required due to low numbers of vehicles using this road (see Section 3.1.4) and negligible numbers of pedestrians. OSOM vehicles are not approved on River Road.
- Access 2 – Newell Highway and River Road (also known as Back Pally Road): A low number of construction vehicles are likely to access the rail corridor from this location. Traffic controllers may be required during periods of peak construction activity to ensure that large construction vehicles can safely access the Newell Highway after exiting the rail corridor from this location. A review of aerial photography at this intersection indicates that most heavy vehicles would be able to safely manoeuvre through this intersection. OSOM vehicles are not approved on River Road.

- Access 3 – River Road (also known as Back Pally Road): A low number of construction vehicles are likely to access the rail corridor from this location. Traffic controllers may be required during periods of peak construction activity to ensure that large construction vehicles can safely access the Newell Highway after exiting the rail corridor from this location. OSOM vehicles are not approved on River Road.
- Access 4 – Rocks Road: A low number of construction vehicles are likely to access the rail corridor from this location. Traffic controllers may be required during periods of peak construction activity to ensure that large construction vehicles can safely access the Newell Highway after exiting the rail corridor from this location. A review of aerial photography at the intersection of Rocks Road/Newell Highway indicates that most heavy vehicles would be able to safely manoeuvre through this intersection. OSOM vehicles are not approved on Rocks Road.
- Accesses 5,6,7 – Newell Highway: Low numbers of construction vehicles are likely to access the rail corridor from these locations. Traffic controllers may be required during periods of peak construction activity to ensure that large construction vehicles can safely access the Newell Highway after exiting the rail corridor from this location. A swept path analysis may also be required to ensure heavy vehicles can safely manoeuvre through each of the access points.
- Access 8 – Gwydirfield Road North: A low number of construction vehicles are likely to access the rail corridor from this access point. Traffic controllers may be required during periods of peak construction activity to ensure that large construction vehicles can safety access the Newell Highway after exiting the rail corridor from this location. A review of aerial photography at the intersection with the Newell Highway indicates that most heavy vehicles would be able to safely manoeuvre through this intersection. OSOM vehicles are not approved on Gwydirfield Road.
- Access 9 – Temporary construction haul road to the Newell Highway through paddock (chainage 669000) – A low number of construction vehicles are likely to access the rail corridor from this access point. Traffic controllers may be required during periods of peak construction activity to ensure that large construction vehicles can safety access the Newell Highway after exiting the rail corridor from this location. A swept path analysis may need to be undertaken to ensure construction vehicles can safely access the rail corridor from this location.
- Access 10 – Gwydirfield Road, South - A low number of construction vehicles are likely to access the rail corridor from this access point. Traffic controllers may be required during periods of peak construction activity to ensure that large construction vehicles can safety access the Newell Highway after exiting the rail corridor from this location. Signage would also be required restricting vehicles over 3.7 m from using this access due to the height clearance at the rail underpass. A review of aerial photography at the intersection with the Newell Highway indicates that most heavy vehicles will be able to safely manoeuvre through this intersection. OSOM vehicles are not approved on Gwydirfield Road.
- Access 11 – Oak Street, Moree - As this is an urban area with potentially high numbers of pedestrians, traffic controllers are likely to be required throughout the construction period to ensure safe movement of construction vehicles onto the rail corridor. OSOM vehicles are not approved on Oak Street.
- Access 12 – 299 Morton Street, Moree - As this is an urban area with potentially high numbers of pedestrians, traffic controllers are likely to be required throughout the construction period to ensure safe movement of construction vehicles onto the rail corridor. OSOM vehicles are not approved on Morton Street.

Further investigation of these access locations is required once detail around the planned construction methodology is known. Encroachment of construction works into existing road reserves is not anticipated.

All state roads within the study area, Newell Highway, Gwydir Highway and Boggabilla Road are approved for oversize and overmass (OSOM) vehicles. High vehicles are not approved on Gwydirfield Road at the existing rail underpass due to a low clearance height of 3.7 m. Other local roads within the study area are not approved for OSOM vehicles.

Any movement of OSOM vehicles will, if required, be subject to specific-route planning and approvals as required by Transport for NSW and Moree Plains Shire Council. The timing of oversize vehicle movements may also be restricted to minimise impacts.

4.1.1.2 Access to compounds

Two existing ARTC compounds from N2NS Phase 1 would be used for construction of the proposal. Situated outside the flood susceptible Phase 2 area, one compound would be located south of Moree and the other north of the Camurra hairpin. The existing compounds would be used for storage of equipment, mobile plant, fuel and hazardous materials as well as providing site office space. In the event of a flood warning for the region, plant and equipment would be evacuated from work sites to the compounds.

Construction compounds would be created at major activity sites along the proposal to provide an enclosed work site, not open to the public and used to support construction. A typical construction compound would include portable site offices, lunchroom and toilets.

A construction site compound would most likely be established at:

- Mehi and Gwydir bridge demolition and construction works (on both sides of river)
- Areas already used by N2NS Phase 1 construction works.

The proposed locations of these construction compounds are shown in the Constructability chapter of this EIS (Chapter 8).

Access routes to compounds have been determined based on the following criteria:

- provision of a suitably wide road to achieve a single lane, two-way access
- provision of adequate turning circles for crane and heavy vehicles – at least a 25 metre turning radius capability
- minimal property impacts by using access alignments within and adjacent to the rail corridor and existing agreed property access roads as far as practicable
- provision of more than one access point where possible to allow access from either road direction.

The number and locations of construction compounds may change during detailed design stage. Any additional construction compounds would be subject to a consistency assessment in accordance with the planning approval.

4.1.1.3 Haul routes

The key haul routes for construction materials and equipment are described below.

- Proposed quarry sites identified for the project are located at Pallamallawa and North Star. Routes to and from these quarries would be via River Road (also known as Back Pally Road) and Newell Highway, respectively.
- The prefabricated concrete culverts would be delivered to sites along the rail corridor by road via the Newell Highway and side roads to access the rail corridor.
- Materials for the rail underbridges including piles, prefabricated beams and concrete would be delivered to site through Moree via the Newell Highway and the closest crossing points to the rail corridor.
- Existing sleepers and ballast would need to be removed by road. These would be transported to waste and disposal sites via the Newell Highway.
- Ballast and track would most likely be transported to the work areas via dedicated rail trains; while prefabricated concrete units, fill and equipment deliveries would be via road from manufactures or town centres.

Twelve access points to the rail corridor are proposed as shown above in Table 4-1. These are illustrated in the Constructability chapter of this EIS (Chapter 8).

4.1.2 Timing and staging

Construction of the proposal is expected to commence in the first quarter of 2024 and take around two years to complete. The rail line would be closed throughout the construction period except for transporting construction materials such as sleepers and ballasts to work sites. An indicative construction program is shown in Table 4-2. Staging is subject to agreement with the relevant stakeholders and detailed design.

Table 4-2 Indicative construction program

Construction Stage	Q1 2024	Q2 2024	Q3 2024	Q4 2024	Q1 2025	Q2 2025	Q3 2025	Q4 2025	Q4 2026
Stage 1 Enabling Works	■	■	■						
Stage 2 Demolition of existing bridges		■	■	■					
Stage 3 Construction of new bridges			■	■	■	■	■		
Stage 4 Installation of culverts		■	■	■	■	■	■	■	
Stage 5 Brownfield track works			■	■	■	■			
Stage 6 Camurra hairpin bypass						■	■	■	
Stage 7 Rehabilitation							■		■

4.1.2.1 Working hours

Proposed construction hours would be from 6:00 am to 6:00 pm, Monday to Sunday, with respite provided every second weekend with works ceasing at 1 pm on Saturday and not occurring on Sunday. Work undertaken outside of the Interim Construction Noise Guideline (DECC, 2009) standard hours (7:00 am to 6:00 pm Monday to Fridays, 8:00 am to 1:00 pm Saturdays, and at no time on Sundays or public holidays) would be in accordance with the *Inland Rail NSW Construction Noise and Vibration Management Framework*. Under the framework, proposed construction hours have been developed to accommodate the remote location of worksites and efficient use of the workforce and minimise disruption to commuters and freight operators using existing operational rail lines. If approved, the proposed working hours would be:

- Monday to Friday 6:00 am to 6:00 pm
- Saturday 6:00 am to 6:00 pm
- Sunday and public holidays 6:00 am to 6:00 pm (occurring on every second Sunday).

Works that may need to be undertaken outside standard working hours would include the following activities:

- where out-of-hours work has been approved by the Environmental Representative for DPIE or Environment Protection Authority (EPA)
- require continuous construction support, such as continuous concrete pours, pipe-jacking or other forms of ground support necessary to avoid a failure or construction incident
- track possessions
- delivery of materials
- movement of heavy plant equipment
- oversize transport and assembly
- arrival of staff
- roadworks
- utility relocations that are required to be undertaken out of hours to avoid impact to residents and businesses
- installation of level crossings where road closures are not approved during normal hours.

Activities carried out in an emergency to avoid the loss of life, damage to property, or to prevent environmental harm may be undertaken at any time.

4.1.3 Vehicle movements

Vehicle movements during the construction stage would be generated by:

- the construction workforce commuting to site each day
- excavation and material delivery

Further details on vehicle movements associated with the workforce and excavation and material delivery are presented in sections below.

There is no freight currently being transported by rail between Moree and North Star and therefore there would no diversion of rail freight onto the road network during the construction period (Source: Tonnage Profile and Train plan, reference: 0-0000-900-POP-00-BR-1000 Rev 2, ARTC).

4.1.3.1 Workforce

The construction workforce would peak at about 150 people. For some limited items of work an additional short-term workforce may be required. Assuming that all of the workforce would commute by car with an average vehicle occupancy of 1.5, this would result in 100 private car trips to and from the sites each day. This is equivalent to 200 vehicle movements each day as shown in Table 4-5. As shown in Section 4.1.2.1, hours of construction and the consequent movement of workers would begin and end outside of peak hour traffic movements. Therefore, traffic movements generated by the workforce would have negligible impact on the transport network during peak hours.

Parking for the construction workforce would need to be considered for each work site. Work site plans should show that parking has been provided for all workers using the rate of 0.67 spaces per worker (using assumed vehicle occupancy of 1.5 per car). The designated worker car park should not impede movements of construction vehicles that need to access the site.

4.1.3.2 Excavation and material delivery

Excavation works and material delivery would occur using a combination of light trucks, haulage and delivery trucks. Components being delivered by road would include:

- bulk material for track formation
- pre-cast concrete elements such as culverts
- in-situ lime treatment
- capping material
- non-structural material.

It is expected that tracks, secondary ballast and sleepers would be delivered by rail and would therefore not have an impact on the road network. An estimate of the number of construction vehicles generated by the excavation works and the transport of materials is shown in Table 4-3.

Table 4-3 Estimated number of construction vehicles generated by the works

Material	Quantity	Vehicle in which material is to be transported	Vehicle Capacity	Number of vehicles required throughout construction period
In-situ Lime Treatment	8,000 m^3	Pneumatic Tank Trailer	60 m^3	133
Capping Material	13,000m^3	Truck and Dog Trailer	30m^3	433
Bedding Ballast	12,550 m^3	Truck and Dog Trailer	30 m^3	418

Material	Quantity	Vehicle in which material is to be transported	Vehicle Capacity	Number of vehicles required throughout construction period
Sleepers (removal)	24,810 units	Truck and Dog Trailer	30 m^3 (200 units per vehicle)	60
Additional material required for formation*	68,000 m^3 converted to 92,200m^3	Truck and Dog Trailer	30 m^3	3,173
Culverts	1,550 units	Special vehicle	3 per vehicle	517
Mehi River Bridge material (BR09)	12 spans 13 piers	Special vehicle	1 span per vehicle 4 pier per vehicle	16
Gywdir River Bridge material (BR10)	9 spans 10 piers	Special vehicle	1 span per vehicle 4 pier per vehicle	12
BR11	9 spans 10 piers	Special vehicle	1 span per vehicle 4 pier per vehicle	12
BR12	9 spans 10 piers	Special vehicle	1 span per vehicle 4 pier per vehicle	12
BR13	9 spans 10 piers	Special vehicle	1 span per vehicle 4 pier per vehicle	12
BR14	2 spans 3 piers	Special vehicle	1 span per vehicle 4 pier per vehicle	3
BR15	12 spans 13 piers	Special vehicle	1 span per vehicle 4 pier per vehicle	16
Total				**4,817**

*The 68,000 m^3 of additional material required for formation equates to 92,200 m^3 of material once it is excavated from the ground. This was determined by applying a bulking factor of 40 per cent.

As shown in Table 4-3, around 4,800 construction vehicles would be required throughout the construction period. The conversion of these vehicles to an equivalent number of vehicle movements per day is shown in Table 4-4. This conversion is dependent on the number of days over which excavation and transport of each material would occur and has been estimated through consultation with the constructability team.

Table 4-4 presents the number of Passenger Car Units (PCU) and roads on which the transport of material is expected to occur. The conversion of heavy vehicles to PCUs is used to account for heavier vehicles having a larger impact on the road network than smaller vehicles due to their difference in size and stopping distances. Part 3 of the *Australian Guide to Traffic Management* provides the following PCU values:

- light vehicles are equivalent to one PCU
- light trucks such as three axle trucks (Class 4) are equivalent to two PCUs
- haulage and delivery trucks such as B-Doubles and specialised vehicles are equivalent to four PCUs.

Table 4-4 Vehicle movements associated with transport of material for construction

Material	Number of vehicles required throughout construction period	Number of days to transport material	Number of Vehicles movements per day (two way)	PCU per day (two way)	Roads to be used for transport
In-situ Lime Treatment	133	250	1.1	4.4	Newell Highway
Capping Material	433	180	4.8	19.2	River Road, Newell Highway
Ballast	418	250	3.3	13.2	Newell Highway
Sleepers (removal)	60	250	0.5	2.0	Newell Highway
Additional material required for formation	3,173	250	25.4	101.6	River Road, Newell Highway
Culverts	517	250	4.1	8.2	Newell Highway
Mehi River Bridge material (BR09)	16	10	3.2	12.8	Newell Highway Gwydirfield Road Oak Road
Gywdir River Bridge material (BR10)	12	10	2.4	9.6	Newell Highway Gwydirfield Road
BR11	12	10	2.4	9.6	Newell Highway
BR12	12	10	2.4	9.6	Newell Highway
BR13	12	10	2.4	9.6	Newell Highway
BR14	3	10	0.6	2.4	Newell Highway
BR15	16	10	3.2	12.8	Newell Highway
Total			**51.0**	**196**	

Based on the analysis in Table 4-4, it is estimated that transport of construction materials would generate a maximum of 200 PCUs per day. Over a 12-hour construction period, this is equivalent to around 17 PCUs per hour distributed across the multiple access points presented in Table 4-1. The access points to the rail corridor are listed in Table 4-1 and illustrated in the Constructability chapter of this EIS (Chapter 8). All state roads within the study area, Newell Highway, Gwydir Highway and Boggabilla Rd are approved for oversize and overmass (OSOM) vehicles. High vehicles are not approved on Gwydirfield Road at the existing rail underpass due to a low clearance height of 3.4 m. Other local roads within the study area are not approved for OSOM vehicles.

4.1.3.3 Summary of construction vehicle movements

A summary of expected construction vehicle movements is presented in Table 4-5.

As construction working hours would occur between 6.00 am to 6.00 pm (as detailed in Section 4.1.2.1), the majority of the 150 person workforce would be travelling to and from construction sites outside peak hours. Assuming an average occupancy of 1.5 persons per vehicle, this is equivalent to around 100 vehicle movements at the start and end of each shift. As a worst-case scenario, a notional value of 50 vehicle movements has been assumed to be generated by the workforce during peak hours (8.00 am to 9.00 am). This is likely to be an overestimate as it assumes that half the traffic generated by the workforce would be using the roads a full hour after the start of construction activity at 7.00 am.

Peak hour construction vehicle movements associated with excavation and material delivery during each of the are unlikely to be more than 20 per cent of the daily construction traffic. This assumption is likely to be an overestimate given the 12 hour working day. If an equal distribution of construction vehicles for excavation and material delivery was assumed over this period, the hourly traffic would only be 8.3 per cent of the daily total.

Table 4-5 Expected vehicle movements during construction stage

Category	Vehicle Type	Vehicle movements per day (two way)	PCU movements per day (two way)	PCU movements during AM peak (two way)	PCU movements during PM peak (two way)
Workforce	Light Vehicles	200	200	50	50
Excavation and material delivery	Trucks & Specialised vehicles	52	196	39	39
Total		**252**	396	89	89

4.1.4 Road network impacts

Construction of the proposal would result in temporary impacts to traffic and access within the study area, and a small increase in both heavy and light vehicle movements on the local road network. The extent of impacts will depend on the location of the works and the origin of material and/or workers. A worst-case assessment is detailed below.

Daily traffic generation associated with construction is around 400 PCU movements of which 200 PCUs are generated by the workforce commuting to site. During each peak hour, the traffic generated by construction activity is expected to generate around 90 PCUs. The Newell Highway is the busiest of the roads likely to be used for construction access. As discussed in Section 3.1.1, the busiest section of the Newell Highway in the vicinity of the study area (just north of Narrabri) is forecast to have a peak hour traffic volume of around 265 PCUs in each direction. An additional 90 PCUs per hour would result in a directional volume of nearly 400 PCUs per hour which is only 25 per cent of the highway's capacity of 1,600 PCUs in each direction.

Even if the peak hourly volume on the Newell Highway was to be increased due to seasonal variation by around 50 per cent to 600 PCUs per hour, an additional 90 PCUs per hour generated by construction activity would maintain the road at LOS A.

Proposed works on level crossings may also result in disruptions to local traffic. It is anticipated that traffic can continue to use the level crossings while they are being upgraded and their movements will be managed through the provision of suitable traffic control measures. These will be detailed in a Construction Traffic Management Plan prepared by the contractor (see further discussion in Section 5.2.1).The intersection of Alice Street and Newell Highway is likely to attract some of the construction traffic. As presented in Table 4-5, construction traffic is estimated to be 89 PCUs during each of the AM and PM peak hours across the entire study area.

To simulate worse case conditions, it was assumed that all of these vehicles would pass through the intersection of Alice Street and Newell Highway and make multiple movements within the AM and PM peak hours as follows:

- 89 PCUs would make the northbound through movement on Newell Highway
- 89 PCUs would make the southbound though movement on Newell Highway
- 89 PCUs would make the right turn movement from the south leg of the intersection (Newell Highway onto the Gwydir Highway)
- 89 PCUs making the left turn movement from the north leg of the intersection (Newell Highway onto the Gwydir Highway).

The performance of this intersection with these additional construction vehicles is summarised in Table 4-6.

Table 4-6 Performance of Alice Street and Newell Highway during construction phase

Peak Period	Train calls per hour	Traffic Volume	Degree of Saturation (DoS)	Average Delay	LOS
8.30 to 9.30 am (Construction phase)	0	871	0.526	44 seconds	D
4.30 – 5.30 pm (Construction phase)	0	912	0.563	42 seconds	C

A more detailed summary of the model outputs is provided in Appendix A. It should be noted that the following individual movements are modelled to operate with an LOS of E in both the AM and PM peaks:

- the right turn from the south leg of the intersection (Newell Highway onto the Gwydir Highway)
- the right turn from the north leg of the intersection (Newell Highway onto Alice Street)
- the right turn from Alice Street onto Newell Highway.

Although these movements are modelled to operate at LOS E, they would still be able to move through the intersection within a single cycle.

Some local roads may not be suitable for use by large volumes of heavy vehicles. It is therefore necessary to undertake a Road Dilapidation Assessment on all roads designated as a haul route prior to commencement of construction activities.

4.1.4.1 Mehi River underbridge

Construction traffic on the west bank of the Mehi River would require access from Gwydir Highway and Oak Road. There may be occasional short-term disruptions to traffic, pedestrians and cyclists at the intersection of Gwydir Highway and Oak Street as heavy vehicles manoeuvre through this intersection. As per Table 4-4, this would only occur about six times per day and there would be no reason to redirect traffic pedestrians or cyclists to an alternate route. Temporary traffic management would be required to minimise the impacts on access to the residential properties on either side of Oak Street.

The construction contractor will be responsible for management of traffic access to the construction site, and for the movement of local traffic, pedestrians and cyclists around the area whilst construction is occurring.

4.1.5 Impacts to train paths

A review of the Tonnage Profile and Train Plan prepared by ARTC indicates that no freight is transported between Moree and North Star. No impacts to train paths are therefore foreseen along this section of the railway line.

4.1.6 Public transport impacts

Slight delays may be experienced by the existing public transport services on a few occasions each day as a result of the construction of the proposal. Rail passengers can continue to arrive at Moree Station where the Xplorer train service terminates. Connections to the regional coach services can continue on the east side of the station on Morton Street. All bus services within Moree, including the regional coach services, local and on-demand bus services and school bus routes, will continue to operate as normal with only minor delays likely for:

- services using the Alice Street/Moree Bypass intersection
- the school bus routes that use the Newell Highway and River Road.

4.1.7 Parking impacts

Construction worker parking would be located at the proposal sites and is unlikely to have any impacts on existing parking supply. Based on a workforce of 150 persons (as detailed in Section 4.1.3), car parking for around 100 vehicles is expected to be required on site.

4.1.8 Pedestrian and cyclist impacts

Given the generally low volume of pedestrian and cyclist activity through much of the study area, impacts to pedestrian and cyclists are likely to be negligible. The area around the intersection of Moree Bypass and Gwydir Highway is likely to have the highest pedestrian and cyclist volumes and would require specific pedestrian management measures within the traffic management plan. These would be subject to site specific planning and reflect the nature of the works underway and the impacts on the existing pedestrian and cycle network.

The shared pathway at River Street and under the rail line near the Mehi River would need to be closed for the duration of construction works on the Mehi River bridge. This pathway is located within a recreational area that is not the most direct route to the town centre and therefore it is not anticipated that it would affect many commuters or those needing to access Moree township directly. The closure would be managed as part of the traffic, transport and access management plan.

4.1.9 Navigational waterways

The *Marine Safety Act 1998* (NSW) provides for the safe operation of vessels in ports and other waterways and to promote the responsible operation of vessels. Under section 18 of the Act, regulations may prohibit or regulate the conduct of aquatic activities. The definition of aquatic activity includes an activity (whether or not involving vessels or equipment) that is conducted in or on any navigable waters and that restricts the availability of those waters for normal use by the public.

During construction, waterway access beneath the Gwydir and Mehi River bridges would be partially restricted for construction and safety purposes. Depending on the final construction method, authorisation or approval from Transport for NSW may be required with respect to any obstruction to navigation. No commercial vessels operate within the Gwydir or Mehi River's, however, to ensure that any adverse outcomes to navigation for recreational vessels are minimised as much as is practical, a Marine Traffic Management Plan would be prepared. The other waterways crossed by the proposal site have been identified as not navigable waters as defined in the Act.

4.2 Operation impacts

4.2.1 Forecast travel demands

4.2.1.1 Roads

During operation, there would be some maintenance/operational traffic generated, however this is not expected to be significantly higher than existing. Also, there is not expected to be an increase in traffic to the train stations within the study area as no change is proposed to passenger train services. Therefore, there is expected to be minimal traffic generation as a result of this proposal.

Travel times along the Newell Highway are expected to be maintained at existing levels, with no impact as a result of the operation of the proposal. For roads which cross the rail line at a level crossing, minor increases in delay could be expected, as discussed later in this in Section.

4.2.1.2 Rail

Inland Rail as a whole would be operational once all 13 sections are complete, which is estimated to be in 2027. Daily and weekly forecast train volumes for 2026 (2027) and 2039 are shown in Table 4-7.

Table 4-7 Forecast average train volumes in 2026 (2027) and 2039 between Narrabri South Junction and North Star

	2026 (2027) Daily	2026 (2027) Weekly	2039 Daily	2039 Weekly
North Star – Moree	11	79	17	120
Moree – Narrabri South Junction	13	93	19	135

4.2.1.3 Level crossings

All level crossings within the study area have been assessed for safety, compliance and suitability for closure. The potential (and potential impacts of) closure of each of the existing level crossings was analysed, as per the methodology detailed in Appendix B. This included ALCAM assessments, which were carried out for each level crossing. Each of the existing level crossings were reviewed considering traffic volumes, alternative routes, land use, property ownership and possible special user groups which may use the level crossing. Where a closure of a crossing was deemed feasible, stakeholder and community consultation occurred to discuss the potential closure. This approach is in line with TfNSW Level Crossing Closures Policy. Further, ARTC will enter into interface agreements as per the Rail Safety National and State Laws for all Public level Crossings, as detailed within Appendix B.

All nine level crossings within the study area will undergo changes to comply with the relevant Australian and ARTC standards. Given the very low traffic volumes recorded at each of the crossings, eight level crossings will undergo upgrades to reduce safety risks in favour of implementing grade separated crossings, while one private crossing, LX3068, will be closed. The realignment of the track to the east at the northern end of the section eliminates the possibility of short stacking occurring at any of the crossings. Short stacking occurs where the distance between the closest rail of the level crossing and a downstream intersection (or other construction) is not long enough to accommodate the design vehicle, plus a safety factor of 5 metres, when stopped at the intersection without blocking the tracks. Short stacking issues have not been identified at any public level crossings. Table 4-8 outlines the design vehicle used for the short stacking assessment at each level crossing to be upgraded. All designs of level crossing road approaches are designed in accordance with Austroads Guide to Road Design. Designs for each level crossing will be provided to TfNSW for review by the relevant road manager during the detailed design process.

Changes and improvements proposed for each level crossing are detailed in Table 4-8. Some key results from ALCAM data sheets, conducted on the current design data of all eight retained level crossings, are included in the table. Consultation of the ALCAM assessments will provide sufficient evidence to warrant the proposed improvements detailed in the current design. The contents of this table are subject to change once the policy and risk assessments are completed and finalised.

Table 4-8 Proposed level crossing conditions

ID number	Road name	Design vehicle	Current control type	Proposed treatment	Crossing safety improvements and operational impacts	Short stacking design vehicle
LX3068 (Private)	Private road		Passive	Close crossing	• Access to cross the alignment removed therefore removing the risk of collision	Level crossing to be decommissioned
LX0562 (Public)	Gwydir field Road	A-Double	Passive	Active controls with flashing lights and boom barriers.	• RX-5 (flashing signal and boom barrier assemble) • Crossing to be upgraded to comply with the relevant Australian and ARTC standards, crossing surface and road approaches.	36.5 m Type 1 A-double
LX3069 (Private)	Private road	A-Double	Passive	Passive stop sign controls	• RX-2 “Stop” assembly • Crossing to be upgraded to comply with the relevant Australian and ARTC standards, crossing surface and road approaches.	26 m B-double
LX3070 (Private)	Private road	B-Double	Passive	Passive stop sign controls	• RX-2 “Stop” assembly • Crossing to be upgraded to comply with the relevant Australian and ARTC standards, crossing surface and road approaches.	26 m B-double
LX3071 (Private)	Private road	B-Double	Passive	Passive stop sign controls	• RX-2 “Stop” assembly • Crossing to be upgraded to comply with the relevant Australian and ARTC standards, crossing surface and road approaches.	26 m B-double
LX0563 (Public)	The Rocks Road	AB-Triple	Passive	Active controls with flashing lights and boom barriers.	• RX-5 (flashing signal and boom barrier assemble) • Crossing to be upgraded to comply with the relevant Australian and ARTC standards, crossing surface and road approaches.	36.5 m AB-triple

ID number	Road name	Design vehicle	Current control type	Proposed treatment	Crossing safety improvements and operational impacts	Short stacking design vehicle
LX0564 (Public)	River Road	A-Double	Passive	Relocated as a double rail crossing 200m to east. Active controls with flashing lights and boom barriers.	• RX-5 (flashing signal and boom barrier assemble) • Crossing to be upgraded to comply with the relevant Australian and ARTC standards, crossing surface and road approaches.	36.5 m Type 1 A-double
LX3149 (Private)	Private road	B-Double	Passive	Passive stop sign controls	• RX-2 “Stop” assembly • Crossing to be upgraded to comply with the relevant Australian and ARTC standards, crossing surface and road approaches.	26 m B-double
LX3150 (Private)	Private road	B-Triple	Passive	Passive stop sign controls	• RX-2 “Stop” assembly • Crossing to be upgraded to comply with the relevant Australian and ARTC standards, crossing surface and road approaches.	36.5 m B-triple

The table shows that every public level crossing will be upgraded to include active controls (RX-5) which include boom gates and warning lights. Retaining passive controls on the private roads is acceptable in this situation due to the very low vehicle numbers. Vehicle usage of crossings of private roads ranges from 4 per day (LX3069, LX3070, LX3071) to 30 per day (LX3150), as recorded in August 2020. In addition to the low traffic volumes, flat land, unobstructed sight lines and no recorded level crossing crashes in the study area confirms adequacy of the continued passive control.

Increasing the level of safety at private crossings has still been achieved through:

- increased pavement surface level such as improved surface quality and rideability of the surface along the approaches
- improvements to the transition along the approach towards the crossing point, and
- improved road alignment on approaches to the crossings where necessary.

These improvements increase the drivers’ sight distances and awareness of the level crossing as well as forcing a decrease in speed on approach.

The key traffic impact of the proposal will be impacts on travel time as a result of increased train activity at level crossings and the introduction of active control signals which force drivers to wait longer. The duration of delays will in some cases be reduced at private level crossings due to the increased train speeds that will be possible. Potential train speeds and the corresponding closure times for the Alice Street level crossing are presented in Table 4-9. These are based on a train length of 1.8 kilometres.

Table 4-9 Alice Street delays per train

Train speed (km/h)	Pre train warning time (seconds)	Train travel time (seconds)	Post train wait time (seconds)	Maximum time of crossing closure under active control (seconds)
60	45	108	5	158
80	45	81	5	131
90	45	72	5	122
100	45	65	5	115
110	45	59	5	109
115	46	56	6	108

The likelihood of the crossings seeing two trains pass within the peak hour is also considered for the year 2039 in the following section.

4.2.1.4 Traffic and intersection impacts

The project will cause a small increase in traffic on the road network. Within this section of the N2NS project, only the Alice Street/Newell Highway intersection would be impacted due to increased queuing. Other road intersections within the study area have not been addressed as they present very low hourly traffic volumes as indicated in Table 3-4 and Table 3-6.

To assess the impact of the crossing closures on the Alice Street / Moree Bypass intersection, four different scenarios have been modelled. These are:

- Year 2026 (2027) (initial operational year) with one train call during AM peak hour
- Year 2039 with two train calls during the AM peak hour
- Year 2026 (2027) (initial operational year) with one train call during PM peak hour

Year 2039 with two train calls during the PM peak hour. A 0.5 per cent per annum growth rate was applied to the 2019 traffic survey data to achieve the predicted 2026 (2027) and 2039 traffic volumes. Two train calls during one peak hour were also modelled in consideration of Table 4-7. The modelling used a train speed of 60 kilometres per hour, with a 45 second pre-train warning period, along with a 5 second period after the train has passed, where road traffic is prohibited from proceeding. These values are longer than the absolute minimum producing a conservative assessment of potential level crossing delays and the impact on the intersection. The results of the SIDRA analysis are presented in Table 4-10. More detailed outputs are presented in Appendix A.

Table 4-10 Performance of Alice Street / Moree Bypass intersection (with proposal)

Peak Period	Train calls per hour	Traffic Volume	Average Delay	LOS
8.30 to 9.30 am (2027)	1	533	48 seconds	D
8.30 – 9.30 am (2039)	2	569	55 seconds	D
4.30 – 5.30 pm (2027)	1	576	49 seconds	D
4.30 – 5.30 pm (2039)	2	616	55 seconds	D

As detailed in Section 3.4.1, the peak hour operation of this intersection without the impact of a train arrival has been modelled as Level of Service C, and with the impact of a train crossing the intersection reduced the Level of Service to LOS D in both peak hour periods. Note that this is based on average delays over the peak hour, so while substantial delays may be experienced while a train is crossing the road, this occurs for only a small proportion of the peak hour, so average delays are contained. The time between trains would allow traffic conditions to recover to “normal” conditions.

4.2.1.5 Access and egress

During operation, minimal impacts are anticipated as access to the rail line would be via existing corridor access points. These access points must be chosen such that adequate sight distance and a safe access/egress path is available and be built in accordance with Austroads design standards.

4.2.1.6 Impacts to train paths

The upgrades will not have any negative impacts to train paths when in operation. Proposed freight train speeds would vary according to axle loads and range from 80 (25 tonne) to 115 kilometres per hour (21 tonne). This is an improvement on existing train speeds that are limited to a maximum of 90 to 100 kilometres per hour (60 kilometres per hour within Moree), and with local speed restrictions due to existing track condition.

4.2.1.7 Parking impacts

The proposal does not require removal of any existing parking provision and is expected to generate minimal demand for parking around the Moree train station given that no change is forecast to passenger train services. Therefore, no impacts to parking are expected as a result of the proposal.

4.2.1.8 Road network impacts

As discussed in Section 4.2.1, there is expected to be minimal increase in traffic on the road network as a result of the proposal. The increased delay at intersections and level crossings is expected to have a localised impact only. In particular, through movements on the Newell Highway are not likely to be affected.

Overall, the proposal is expected to have a positive impact on the road network by relocating some of the road freight task to rail, thereby reducing the heavy vehicle freight traffic on the roads both within the study area and in the greater NSW network.

4.2.1.9 Pedestrian and cyclist impacts

There will be little impact to pedestrians and cyclists given the generally low volumes within most of the proposal area. Pedestrians and cyclists using the Alice Street and Moree Station pedestrian crossings may experience some additional delay as a result of increased frequency and length of trains.

4.2.1.10 Public transport impacts

There will be no negative impacts to passenger train services as a result of the proposal. Bus services which cross the rail line may experience a small increase in delays at level crossings due to the increased rail use, in line with other road users on these roads.

4.2.2 Cumulative impacts

There are a number of other projects at various stages of planning or construction that could potentially impact the performance of the road network within the study area. These projects are presented in Table 4-11. This table also presents the potential traffic impact of these projects on the proposal. A more detailed assessment of these projects has been made elsewhere in the Cumulative Chapter of the EIS.

4.3 How potential impacts have been avoided

Once the proposal is operational, the changes observed by road users would be unlikely to affect their behaviour, or interpretation of a situation. Level crossings would continue to operate as normal, with warning devices and other controls installed as per the Level Crossing Treatment methodology detailed in Appendix B. Interactions between vehicles on the road network would continue to be defined by road rules and the physical configuration of the road, which in most cases will not change from existing conditions.

In most cases all construction activities will be located clear of the existing road network. Oversize overmass (OSOM) vehicles may occasionally be required to travel through the local road network, requiring special permits and traffic management to do so. Any short-term impacts associated with construction vehicle access or works at particular sites will be managed by specific traffic management arrangements put in place by the construction contractor.

Table 4-11 List of projects

Project and proponent	Location	Description	Statutory approval status	Construction dates	Construction jobs	Operation jobs	Relationship to the proposal and potential traffic and transport Impacts	Included in traffic and transport assessment
Narrabri to North Star phase 1 (ARTC) (SSI-7474)	Narromine NSW to North Star NSW	The proposal consists of 188 km of upgraded track and associated facilities, generally within the existing rail corridor between Narrabri and North Star, via Moree.	Approved, construction to commence end of 2020, or start of 2021	2020-2023	500	50	Dividing Narrabri to North Star Inland Rail projects into a phase 1 and phase 2 allows phase 1 to commence construction whilst phase 2 remains in the planning and environmental approvals stage. There is potential for overlap on construction commencement for phase 1 and phase 2. If construction is undertaken at the same time, traffic impacts are expected on the Newell Highway. Although the Newell Highway has significant reserve capacity, the volume of construction vehicles generated by this proposal would need to be understood and the impacts on the performance of the road network assessed.	Yes
Narromine to Narrabri – Inland Rail (ARTC) (SSI-9487)	Narromine to Narrabri in NSW	The construction of approximately 300 km of new single track rail line, through private and public property in a greenfield environment between Narromine and Narrabri.	EIS being prepared. Registered as CSSI Project #9487	2021-2024	TBA	TBA	While the northern section of this rail line is situated some 150 km south of Moree, it is possible that the town of Narrabri may not have the capacity to service the project. The potential exists for some spill over to occur into the town of Moree. Construction timing is likely to coincide. Construction traffic associated with this proposal is likely to be limited to excavators and less than 10 heavy vehicles per day. The Newell Highway would have sufficient capacity to accommodate this.	Yes

Project and proponent	Location	Description	Statutory approval status	Construction dates	Construction jobs	Operation jobs	Relationship to the proposal and potential traffic and transport Impacts	Included in traffic and transport assessment
Newell Highway upgrade north of Moree	Moree, NSW	Project involves heavy duty pavement upgrades along eight sections of the Newell Highway, five between Narrabri and Moree and three north of Moree	Design complete	2021-2024	TBA	-	The upgrade of the Newell Highway is planned from approximate rail chainage 671900 to 50 km north of Moree. It is likely that the timing of construction of the two projects will coincide. If construction is undertaken at the same time as the rail corridor project, some traffic impacts are expected on the Newell Highway due to the Newell highway serving as a portion of the haul route. These impacts would include: • reduced speed limits through construction zones • potential changes to property accesses • increased heavy vehicle movements on the road network. There is also the potential for construction worker accommodation pressure in Moree and surrounds. Most of the construction workforce associated with this project would live in Moree. However, traffic generated by these workers within the SP2 study area would occur outside of peak hours.	Yes

Project and proponent	Location	Description	Statutory approval status	Construction dates	Construction jobs	Operation jobs	Relationship to the proposal and potential traffic and transport Impacts	Included in traffic and transport assessment
Queensland -Hunter Gas Pipeline	Wallumbilla to Newcastle, NSW	825 km high pressure gas pipeline, connecting the existing gas transmission hub at Wallumbilla in south-eastern QLD to the industrial area to the north of Newcastle.	Project classified as Critical State Significant Infrastructure, and in 2009 Minister for Planning approved the NSW component of the project.	Department has recommended that Hunter Gas be given until 15 October 2024 to physically commence the project development, after which the approval will lapse.	600	150	If construction occurs at the same time, there is potential for increase in traffic using similar routes and demand for construction resources and personnel. There is also the potential for construction worker accommodation pressure in Moree and surrounds. A small proportion of the construction workforce associated with this project may live in Moree. Traffic generated by these workers within the SP2 study area is likely to be minimal and would occur outside of peak hours. Some construction traffic for the movement of materials and equipment would travel through the SP2 study area via the Newell Highway. However, the volume of this traffic is likely to be less than 50 vehicles per day through the SP2 study area. The Newell Highway would have sufficient capacity to accommodate this.	Yes

Project and proponent	Location	Description	Statutory approval status	Construction dates	Construction jobs	Operation jobs	Relationship to the proposal and potential traffic and transport Impacts	Included in traffic and transport assessment
Sundown Solar Farm	South of Gwydir Highway, 30km east of Inverell, NSW	The project consists of a large-scale solar photovoltaic generation facility, including battery storage and associated infrastructure, with an estimated maximum capacity of up to 600 MW.	SEARs issued by NSW Department of Planning, Industry and Environment in 2017	2021-2023	TBA	TBA	If construction occurs at the same time, there is potential for increase in traffic on the Gwydir Highway and the Newell Highway. However, the volume of construction traffic within the SP2 study area is likely to be less than 50 vehicles per day which can be accommodated on both roads. It is likely that the town of Inverell will support the demand for construction resources and personnel.	No
Bonshaw Solar Farm	Bruxner Highway, 16km south of Bonshaw and 66km north of Inverell (NSW)	The development of a 200 MW solar farm, energy storage facility and associated infrastructure.	The project is currently sitting with the IPC for assessment, after a recommendation was made by the Department of Planning, Industry and Environment to approve the project, in November 2020.	12 months. Start date TBA	180	10	It is unlikely that construction will occur concurrently, due to this project currently still in the approval phase. However, if construction occurs at the same time, there is potential for increase in traffic on the Gwydir Highway and the Newell Highway. Construction traffic through the SP2 study area road is likely to be less than 50 vehicles per day and this can be accommodated on both roads. It is likely that the towns of Inverell and Glen Innes will support the demand for construction resources and personnel. The project is not considered spatially relevant for this assessment.	No

Project and proponent	Location	Description	Statutory approval status	Construction dates	Construction jobs	Operation jobs	Relationship to the proposal and potential traffic and transport Impacts	Included in traffic and transport assessment
Narrabri Gas Project	The Narrabri Gas project will be located over 95,000 ha of state land in the Pilliga set aside by state government for extractive industries. The site is approximately 150 km south west of Moree, and 300 km west of Armidale.	The Narrabri Gas project involves the development of a coal seam gas field, comprising up to 850 gas wells on 425 well pads over 20 years. The facility will include infrastructure for gas processing and water treatment.	The Independent Planning Commission issued their consent for the Narrabri Gas project on 30 September 2020.	12-18 months of appraisal drilling, to inform final plans for phased development of the project.	1300	350	While the Narrabri gas fields are situated approximately 150 km from Moree, Narrabri town has limited capacity to service a project of this magnitude. As such it is expected that some spill over into Moree will result, particularly with respect to socio economic influences and it is included in the cumulative assessment. A proportion of the construction workforce associated with this project may live in Moree. Traffic generated by these workers commuting to Narrabri is likely to be minimal and would occur outside of peak hours. Some construction traffic for the movement of materials and equipment would travel through the SP2 study area via the Newell Highway. However, the volume of traffic is likely to be less than 50 vehicles per day. The Newell Highway would have sufficient capacity to accommodate this.	Yes

5 Mitigation and management

5.1 Options for impact mitigation

The options for reducing the potential for increased delays to road traffic as a result of the proposal include:

- Maintaining current maximum train lengths:
  - with no change in train speeds the duration of delays at level crossings would be similar to existing
  - with improved train speeds the duration of delays would be less than existing
  - however, increased train lengths will provide the freight efficiency that is one of the objectives of the proposal.
- Grade separation of the rail line at road crossings:
  - delays to road vehicles would be removed entirely, and the safety risks associated with train/vehicle conflict eliminated
  - this will require a significant variation to the proposal, and would have additional impacts in terms of construction footprint, costs and environmental issues
  - applying the Public Level Crossing Treatments methodology, which was reviewed by the Office of the National Rail Safety Regulator (ONRSR), grade separation was not deemed to be reasonably practicable for any of the public roads within the proposal sites. All of the existing level crossings are on relatively low volume local roads.

During construction, options for impact mitigation will depend on the specific activity being undertaken, and the location where it is occurring. It will be up to the construction contractor to select and implement appropriate controls, keeping within findings of this report and more generally the philosophy of the constructability report.

5.2 Summary of measures

5.2.1 During construction

It is recommended that a Construction Traffic Management Plan be developed that will guide the interaction of construction activities with the public road network. It should cover such aspects as:

- access routes
- driver behaviour/codes of conduct
- traffic control procedures:
  - development and implementation of traffic control plans
  - temporary speed limit requirements
  - temporary road closures and detours
- construction site access:
  - upgrades to be designed in accordance with Austroads Guide to Road Design and Roads and Maritime Services Supplements, and local council requirements where appropriate
- road pavement condition
- worker car parking
- movement of oversize vehicles (if required)
- management of public transport impacts (including school buses)
- management of pedestrian and cyclist impacts
- managing movements at the Alice Street/Moree Bypass intersection which operate at a LOS of E or F during the construction period. These are detailed in Section 4.1.4. Management of these movements is to be further refined in the Traffic and Transport Management Plan which is a subplan to the Construction Environmental Management Plan (CEMP).

A Road Dilapidation Report will be prepared for local roads to be used by haulage vehicles before the commencement of use by such vehicles. Copies of the Road Dilapidation Report will be provided to the relevant road authorities no later than one (1) month before the use of local roads by heavy haulage vehicles.

Consultation with relevant road authorities (TfNSW and Moree Plains Shire Council) would be undertaken regarding the potential for preventive measures to be undertaken prior to construction to minimise potential road damage during the construction period.

A Construction Traffic Management Plan should also be developed in consultation with Moree Plains Shire Council, and Transport for NSW and be subject to periodic review and update as agreed between the stakeholders.

The following Construction Monitoring Programs should also be prepared in consultation with the relevant government agencies and Moree Plains Shire Council:

- noise and vibration
- water usage
- air quality
- physical condition of local roads.

Each construction Monitoring Program must provide:

- details of baseline data available
- details of any baseline data to be obtained and when
- details of all monitoring of the Critical State Significant Infrastructure (CSSI) to be undertaken
- the parameters of the CSSI to be monitored
- the frequency of monitoring to be undertaken
- the location of monitoring
- the reporting of monitoring and analysis results against relevant criteria
- procedures to identify and implement additional mitigation measures where results of monitoring are unsatisfactory
- any consultation required in relation to the monitoring programs.

5.2.2 During operation

It is not considered feasible to avoid any increase in potential delays to road users at level crossings as a result of the proposal. However, it is recommended that measures be put in place to manage any localised safety implications that may occur, due to increase queueing. These will include:

- provision of all necessary and appropriate warning signage, line marking and other traffic controls at level crossings, in accordance with ARTC and Australian Standards. It is critical that controls at level crossings be consistently applied throughout the proposal
- Interface agreements for all public level crossings to ensure that road and road managers work together to manage any risks at the crossings once the project has been completed.

6 References

- Australian Grain Magazine, 2019, website accessed November 2020 http://www.ausgrain.com.au/industry.html
- Moree Plains Shire Council, Traffic Count Data, 2015
- Moree Plains Shire Council, Traffic Count Data, 2016
- Moree Plains Shire Council, Traffic Count Data, 2019
- Roads and Maritime Services rest area maps, obtained from RMS website http://www.rms.nsw.gov.au/roads/using-roads/trip-information/rest-areas/restareasmap/index.html
- Roads and Maritime Services traffic volume data, obtained from Roads and Maritime Services website https://www.rms.nsw.gov.au/about/corporate-publications/statistics/traffic-volumes/aadt-map/index.html#/?z=6
- Tonnage Profile and Train plan, reference: 0-0000-900-POP-00-BR-1000 Rev 2, ARTC, 2018
- Transport for NSW Centre for Road Safety crash statistics https://roadsafety.transport.nsw.gov.au/statistics/interactivecrashstats/nsw.html?tabnsw=3
- Narrabri to North Star Phase 2 Moree to Camurra North. Private Road Level Crossing Detail Report Reference: 2-0001-260-DCW-00-DS-0002
- Narrabri to North Star Phase 2 Moree to Camurra North. Public Road Level Crossing Detail Report. Reference: 2-0001-260-DCW-00-DS-0002

TECHNICAL PAPER

03

Traffic impact assessment

Appendix A SIDRA modelling results

NARRABRI TO NORTH STAR—PHASE 2 ENVIRONMENTAL IMPACT STATEMENT

Alice St / Newell Highway intersection traffic volume data - Existing AM peak

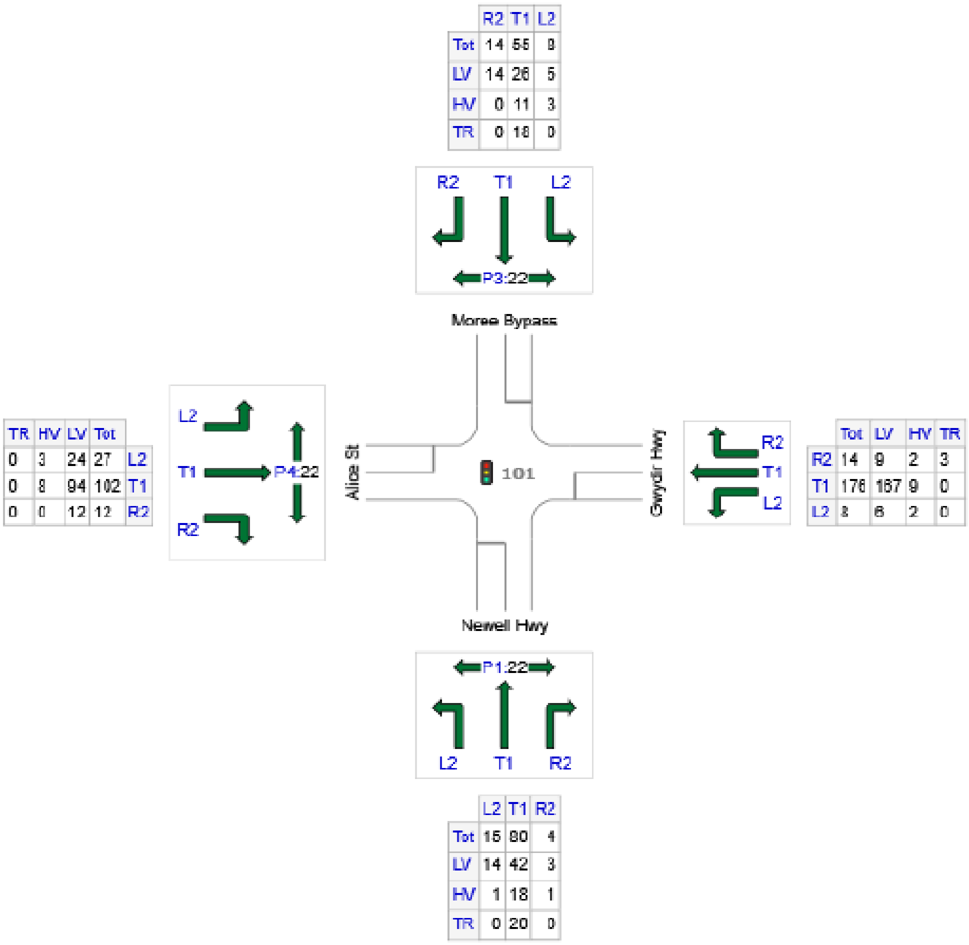
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

Site: 101 [AM Peak - 0 Train (Site Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Volume Display Method: Separate



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)	Large Trucks (TR)
S: Newell Hwy	99	59	20	20
E: Gwydir Hwy	198	182	13	3
N: Moree Bypass	77	45	14	18
W: Alice St	141	130	11	0
Total	515	416	58	41

Organisation: MOTT MACDONALD | Licence: NETWORK / 1PC | Created: Wednesday, September 30, 2020 2:50:02 PM
Project: C:\Users\EDU88591\AppData\Local\Packages\Microsoft.MicrosoftEdge_8wekyb3d8bbwe\TempState\Downloads\Alice St-Moree Bypass (SE) (1).sip9

Alice St / Newell Highway intersection traffic volume data - Existing PM peak

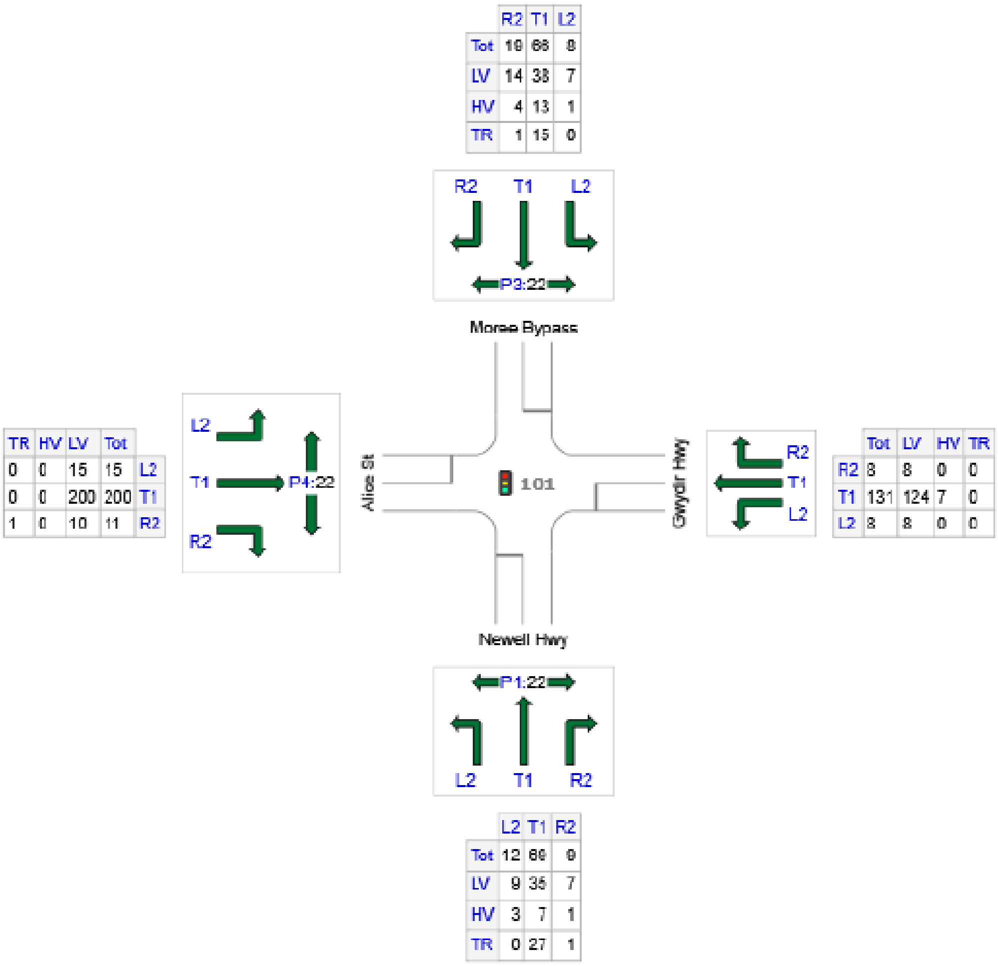
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

Site: 101 [PM Peak - 0 Train (Site Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Volume Display Method: Separate



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)	Large Trucks (TR)
S: Newell Hwy	90	51	11	28
E: Gwydir Hwy	147	140	7	0
N: Moree Bypass	93	59	18	16
W: Alice St	226	225	0	1
Total	556	475	36	45

Alice St / Newell Highway intersection movement summary - Existing AM peak

MOVEMENT SUMMARY

Site: 101 [AM Peak - 0 Train (Site Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated   Cycle Time = 120 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Newell Hwy														
1	L2	15	1	16	6.7	0.152	57.5	LOS E	1.5	15.2	0.93	0.71	0.93	24.6
2	T1	80	38	84	47.5	* 0.389	52.4	LOS D	3.9	50.7	0.95	0.74	0.95	32.2
3	R2	4	1	4	25.0	0.026	59.3	LOS E	0.2	1.9	0.93	0.64	0.93	23.0
Approach		99	40	104	40.4	0.389	53.4	LOS D	3.9	50.7	0.94	0.73	0.94	30.8
East: Gwydir Hwy														
4	L2	8	2	8	25.0	0.018	38.0	LOS C	0.3	2.9	0.73	0.66	0.73	29.0
5	T1	176	9	185	5.1	* 0.377	36.4	LOS C	9.3	71.1	0.84	0.71	0.84	19.6
6	R2	14	5	15	35.7	0.377	42.3	LOS C	9.3	71.1	0.84	0.71	0.84	29.5
Approach		198	16	208	8.1	0.377	36.9	LOS C	9.3	71.1	0.84	0.71	0.84	21.1
North: Moree Bypass														
7	L2	8	3	8	37.5	0.133	33.2	LOS C	0.8	9.9	0.89	0.67	0.89	32.1
8	T1	55	29	58	52.7	0.229	43.5	LOS D	2.1	30.1	0.92	0.69	0.92	34.9
9	R2	14	0	15	0.0	0.079	59.4	LOS E	0.8	5.6	0.94	0.69	0.94	24.2
Approach		77	32	81	41.6	0.229	45.3	LOS D	2.1	30.1	0.92	0.69	0.92	32.7
West: Alice St														
10	L2	27	3	28	11.1	* 0.062	25.5	LOS B	0.8	6.1	0.78	0.69	0.78	35.7
11	T1	102	8	107	7.8	0.215	36.7	LOS C	4.9	36.4	0.82	0.66	0.82	19.6
12	R2	12	0	13	0.0	* 0.113	65.9	LOS E	0.7	5.1	0.98	0.68	0.98	22.7
Approach		141	11	148	7.8	0.215	37.1	LOS C	4.9	36.4	0.82	0.67	0.82	23.4
All Vehicles		515	99	542	19.2	0.389	41.4	LOS C	9.3	71.1	0.87	0.70	0.87	26.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Alice St / Newell Highway intersection movement summary - Existing PM peak

MOVEMENT SUMMARY

Site: 101 [PM Peak - 0 Train (Site Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated   Cycle Time = 120 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Newell Hwy														
1	L2	12	3	13	25.0	0.133	55.8	LOS D	1.3	14.8	0.91	0.70	0.91	24.8
2	T1	69	34	73	49.3	* 0.340	51.1	LOS D	3.3	48.7	0.93	0.73	0.93	32.6
3	R2	9	2	9	22.2	0.063	60.1	LOS E	0.5	5.0	0.93	0.68	0.93	22.8
Approach		90	39	95	43.3	0.340	52.6	LOS D	3.3	48.7	0.93	0.72	0.93	30.7
East: Gwydir Hwy														
4	L2	8	0	8	0.0	0.019	43.2	LOS D	0.4	2.6	0.79	0.66	0.79	27.6
5	T1	131	7	138	5.3	* 0.334	41.3	LOS C	7.2	52.2	0.88	0.72	0.88	18.0
6	R2	8	0	8	0.0	0.334	46.9	LOS D	7.2	52.2	0.88	0.72	0.88	28.4
Approach		147	7	155	4.8	0.334	41.8	LOS C	7.2	52.2	0.87	0.72	0.87	19.4
North: Moree Bypass														
7	L2	8	1	8	12.5	0.135	37.3	LOS C	1.0	11.6	0.89	0.68	0.89	30.9
8	T1	66	28	69	42.4	0.232	43.9	LOS D	2.5	30.5	0.91	0.69	0.91	34.7
9	R2	19	5	20	26.3	0.132	60.8	LOS E	1.1	10.2	0.94	0.71	0.94	23.4
Approach		93	34	98	36.6	0.232	46.8	LOS D	2.5	30.5	0.92	0.70	0.92	32.2
West: Alice St														
10	L2	15	0	16	0.0	* 0.027	21.9	LOS B	0.4	2.6	0.72	0.67	0.72	37.9
11	T1	200	0	211	0.0	0.337	33.6	LOS C	9.4	65.6	0.81	0.68	0.81	20.8
12	R2	11	1	12	9.1	* 0.064	58.5	LOS E	0.6	5.4	0.93	0.68	0.93	24.2
Approach		226	1	238	0.4	0.337	34.0	LOS C	9.4	65.6	0.81	0.68	0.81	22.4
All Vehicles		556	81	585	14.6	0.340	41.2	LOS C	9.4	65.6	0.86	0.70	0.86	26.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Alice St / Newell Highway intersection movement summary - Construction Phase AM peak

MOVEMENT SUMMARY

Site: 101 [AM Peak (Construction)

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated   Cycle Time = 120 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Newell Hwy														
1	L2	15	1	16	6.7	0.183	51.7	LOS D	2.6	23.8	0.89	0.70	0.89	26.7
2	T1	169	38	178	22.5	* 0.468	47.1	LOS D	7.5	73.4	0.93	0.75	0.93	33.8
3	R2	93	1	98	1.1	0.526	63.0	LOS E	5.7	40.0	0.99	0.78	0.99	22.4
Approach		277	40	292	14.4	0.526	52.7	LOS D	7.5	73.4	0.95	0.76	0.95	29.8
East: Gwydir Hwy														
4	L2	8	2	8	25.0	0.022	43.0	LOS D	0.4	3.2	0.79	0.67	0.79	27.3
5	T1	176	9	185	5.1	* 0.456	42.0	LOS C	10.0	76.7	0.90	0.75	0.90	17.8
6	R2	14	5	15	35.7	0.456	48.0	LOS D	10.0	76.7	0.90	0.75	0.90	27.5
Approach		198	16	208	8.1	0.456	42.5	LOS C	10.0	76.7	0.90	0.75	0.90	19.2
North: Moree Bypass														
7	L2	97	3	102	3.1	0.250	24.9	LOS B	3.0	22.7	0.82	0.74	0.82	35.7
8	T1	144	29	152	20.1	0.430	43.2	LOS D	6.9	67.0	0.91	0.75	0.91	35.0
9	R2	14	0	15	0.0	0.079	59.4	LOS E	0.8	5.6	0.94	0.69	0.94	24.2
Approach		255	32	268	12.5	0.430	37.1	LOS C	6.9	67.0	0.88	0.74	0.88	34.5
West: Alice St														
10	L2	27	3	28	11.1	* 0.062	24.8	LOS B	0.7	5.4	0.78	0.69	0.78	36.1
11	T1	102	8	107	7.8	0.215	36.7	LOS C	4.9	36.4	0.82	0.66	0.82	19.6
12	R2	12	0	13	0.0	* 0.113	65.9	LOS E	0.7	5.1	0.98	0.68	0.98	22.7
Approach		141	11	148	7.8	0.215	36.9	LOS C	4.9	36.4	0.82	0.67	0.82	23.5
All Vehicles		871	99	917	11.4	0.526	43.3	LOS D	10.0	76.7	0.90	0.74	0.90	28.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Alice St / Newell Highway intersection movement summary - Construction Phase PM peak

MOVEMENT SUMMARY

Site: 101 [PM Peak (Construction)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated   Cycle Time = 120 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Newell Hwy														
1	L2	12	3	13	25.0	0.148	48.0	LOS D	2.3	23.0	0.85	0.68	0.85	27.6
2	T1	158	34	166	21.5	0.378	42.9	LOS D	6.6	67.9	0.88	0.72	0.88	35.2
3	R2	98	2	103	2.0	0.563	63.4	LOS E	6.0	43.5	1.00	0.78	1.00	22.3
Approach		268	39	282	14.6	0.563	50.6	LOS D	6.6	67.9	0.92	0.74	0.92	30.2
East: Gwydir Hwy														
4	L2	8	0	8	0.0	0.021	46.0	LOS D	0.4	2.7	0.82	0.66	0.82	26.7
5	T1	131	7	138	5.3	0.374	44.3	LOS D	7.4	54.2	0.91	0.74	0.91	17.1
6	R2	8	0	8	0.0	0.374	49.9	LOS D	7.4	54.2	0.91	0.74	0.91	27.4
Approach		147	7	155	4.8	0.374	44.7	LOS D	7.4	54.2	0.90	0.73	0.90	18.5
North: Moree Bypass														
7	L2	97	1	102	1.0	* 0.223	23.2	LOS B	3.0	22.6	0.79	0.73	0.79	36.8
8	T1	155	28	163	18.1	* 0.384	39.7	LOS C	7.1	65.9	0.88	0.73	0.88	36.2
9	R2	19	5	20	26.3	0.132	60.8	LOS E	1.1	10.2	0.94	0.71	0.94	23.4
Approach		271	34	285	12.5	0.384	35.3	LOS C	7.1	65.9	0.85	0.73	0.85	35.3
West: Alice St														
10	L2	15	0	16	0.0	* 0.032	24.2	LOS B	0.4	2.5	0.77	0.67	0.77	36.7
11	T1	200	0	211	0.0	0.401	38.9	LOS C	10.1	70.9	0.87	0.73	0.87	18.8
12	R2	11	1	12	9.1	* 0.119	66.5	LOS E	0.7	5.9	0.98	0.68	0.98	22.5
Approach		226	1	238	0.4	0.401	39.3	LOS C	10.1	70.9	0.87	0.72	0.87	20.5
All Vehicles		912	81	960	8.9	0.563	42.3	LOS C	10.1	70.9	0.89	0.73	0.89	28.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Alice St / Newell Highway intersection movement summary - 2026 AM peak

MOVEMENT SUMMARY

Site: 101 [AM Peak - 1 Train per hour (2026) (Site Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated   Cycle Time = 120 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Newell Hwy														
1	L2	15	1	16	6.7	0.228	63.8	LOS E	1.6	16.0	0.97	0.72	0.97	23.1
2	T1	83	40	87	48.2	0.581	59.2	LOS E	4.5	57.9	0.99	0.79	1.03	30.4
3	R2	4	1	4	25.0	0.040	64.4	LOS E	0.2	2.0	0.96	0.64	0.96	21.9
Approach		102	42	107	41.2	0.581	60.1	LOS E	4.5	57.9	0.99	0.77	1.01	29.1
East: Gwydir Hwy														
4	L2	8	2	8	25.0	0.017	37.2	LOS C	0.3	2.9	0.73	0.66	0.73	29.3
5	T1	182	9	192	4.9	* 0.378	35.6	LOS C	9.5	72.5	0.84	0.71	0.84	19.9
6	R2	14	5	15	35.7	0.378	41.6	LOS C	9.5	72.5	0.84	0.71	0.84	29.8
Approach		204	16	215	7.8	0.378	36.1	LOS C	9.5	72.5	0.83	0.71	0.83	21.3
North: Moree Bypass														
7	L2	8	3	8	37.5	* 0.203	36.9	LOS C	0.8	10.4	0.95	0.70	0.95	30.5
8	T1	57	30	60	52.6	0.349	49.7	LOS D	2.5	34.7	0.96	0.72	0.96	33.0
9	R2	14	0	15	0.0	0.079	59.4	LOS E	0.8	5.6	0.94	0.69	0.94	24.2
Approach		79	33	83	41.8	0.349	50.1	LOS D	2.5	34.7	0.96	0.72	0.96	31.3
West: Alice St														
10	L2	28	3	29	10.7	* 0.064	26.7	LOS B	0.9	6.9	0.78	0.69	0.78	35.0
11	T1	105	8	111	7.6	0.252	40.4	LOS C	5.3	39.4	0.86	0.69	0.86	18.3
12	R2	12	0	13	0.0	* 0.113	65.9	LOS E	0.7	5.1	0.98	0.68	0.98	22.7
Approach		145	11	153	7.6	0.252	39.9	LOS C	5.3	39.4	0.85	0.69	0.85	22.4
All Vehicles		530	102	558	19.2	0.581	43.9	LOS D	9.5	72.5	0.89	0.71	0.89	25.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Alice St / Newell Highway intersection movement summary - 2026 PM peak

MOVEMENT SUMMARY

Site: 101 [PM Peak - 1 Train per hour (2026) (Site Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated   Cycle Time = 120 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Newell Hwy														
1	L2	12	3	13	25.0	0.192	62.0	LOS E	1.4	15.6	0.95	0.71	0.95	23.3
2	T1	71	35	75	49.3	0.490	57.4	LOS E	3.7	54.4	0.98	0.76	0.98	30.8
3	R2	9	2	9	22.2	0.095	65.4	LOS E	0.5	5.3	0.97	0.68	0.97	21.7
Approach		92	40	97	43.5	0.490	58.8	LOS E	3.7	54.4	0.97	0.74	0.97	29.1
East: Gwydir Hwy														
4	L2	8	0	8	0.0	0.015	37.5	LOS C	0.3	2.4	0.73	0.66	0.73	29.6
5	T1	135	7	142	5.2	* 0.275	35.1	LOS C	6.8	49.3	0.81	0.67	0.81	20.1
6	R2	8	0	8	0.0	0.275	40.7	LOS C	6.8	49.3	0.81	0.67	0.81	30.8
Approach		151	7	159	4.6	0.275	35.5	LOS C	6.8	49.3	0.81	0.67	0.81	21.5
North: Moree Bypass														
7	L2	8	1	8	12.5	* 0.200	38.4	LOS C	1.0	10.9	0.94	0.70	0.94	30.5
8	T1	68	29	72	42.6	0.344	48.9	LOS D	2.8	35.1	0.96	0.72	0.96	33.2
9	R2	19	5	20	26.3	0.132	60.8	LOS E	1.1	10.2	0.94	0.71	0.94	23.4
Approach		95	35	100	36.8	0.344	50.4	LOS D	2.8	35.1	0.95	0.72	0.95	31.1
West: Alice St														
10	L2	16	0	17	0.0	* 0.034	25.9	LOS B	0.5	3.5	0.77	0.67	0.77	35.7
11	T1	207	0	218	0.0	0.474	42.9	LOS D	11.1	77.4	0.91	0.76	0.91	17.6
12	R2	11	1	12	9.1	* 0.119	66.5	LOS E	0.7	5.9	0.98	0.68	0.98	22.5
Approach		234	1	246	0.4	0.474	42.8	LOS D	11.1	77.4	0.91	0.75	0.91	19.3
All Vehicles		572	83	602	14.5	0.490	44.7	LOS D	11.1	77.4	0.90	0.72	0.90	24.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Alice St / Newell Highway intersection movement summary - 2039 AM peak

MOVEMENT SUMMARY

Site: 101 [AM Peak - 2 Trains per hour (2039) (Site Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 120 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Newell Hwy														
1	L2	16	1	17	6.3	0.167	56.8	LOS E	1.7	16.6	0.92	0.71	0.92	24.8
2	T1	88	42	93	47.7	0.426	52.6	LOS D	4.4	56.1	0.95	0.75	0.95	32.1
3	R2	4	1	4	25.0	* 0.053	67.5	LOS E	0.2	2.1	0.97	0.64	0.97	21.2
Approach		108	44	114	40.7	0.426	53.7	LOS D	4.4	56.1	0.95	0.74	0.95	30.8
East: Gwydir Hwy														
4	L2	9	2	9	22.2	0.030	48.3	LOS D	0.4	3.7	0.84	0.67	0.84	25.7
5	T1	195	10	205	5.1	* 0.639	48.8	LOS D	12.1	92.0	0.97	0.81	0.97	16.0
6	R2	15	5	16	33.3	0.639	54.8	LOS D	12.1	92.0	0.97	0.81	0.97	25.5
Approach		219	17	231	7.8	0.639	49.2	LOS D	12.1	92.0	0.97	0.81	0.97	17.3
North: Moree Bypass														
7	L2	9	3	9	33.3	* 0.166	35.5	LOS C	0.8	9.7	0.93	0.69	0.93	30.9
8	T1	61	32	64	52.5	0.286	46.6	LOS D	2.7	37.9	0.93	0.71	0.93	33.9
9	R2	15	0	16	0.0	0.067	56.0	LOS D	0.8	5.8	0.91	0.69	0.91	25.1
Approach		85	35	89	41.2	0.286	47.1	LOS D	2.7	37.9	0.93	0.70	0.93	32.2
West: Alice St														
10	L2	30	3	32	10.0	0.062	23.7	LOS B	0.8	6.2	0.76	0.70	0.76	36.6
11	T1	113	9	119	8.0	0.331	45.5	LOS D	6.1	45.4	0.91	0.73	0.91	16.9
12	R2	13	0	14	0.0	* 0.122	66.0	LOS E	0.8	5.6	0.98	0.68	0.98	22.7
Approach		156	12	164	7.7	0.331	43.0	LOS D	6.1	45.4	0.88	0.72	0.88	21.4
All Vehicles		568	108	598	19.0	0.639	48.1	LOS D	12.1	92.0	0.94	0.75	0.94	24.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Alice St / Newell Highway intersection movement summary - 2039 PM peak

MOVEMENT SUMMARY

Site: 101 [PM Peak - 2 Trains per hour (2039) (Site Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated   Cycle Time = 120 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Newell Hwy														
1	L2	13	3	14	23.1	0.157	57.1	LOS E	1.4	16.6	0.92	0.70	0.92	24.5
2	T1	77	38	81	49.4	0.401	52.6	LOS D	3.8	55.3	0.95	0.74	0.95	32.1
3	R2	10	2	11	20.0	* 0.138	68.7	LOS E	0.6	5.9	0.98	0.68	0.98	21.0
Approach		100	43	105	43.0	0.401	54.8	LOS D	3.8	55.3	0.95	0.73	0.95	30.2
East: Gwydir Hwy														
4	L2	9	0	9	0.0	0.031	51.6	LOS D	0.5	3.3	0.87	0.67	0.87	25.1
5	T1	145	8	153	5.5	* 0.546	51.2	LOS D	8.9	65.3	0.97	0.79	0.97	15.4
6	R2	9	0	9	0.0	0.546	56.7	LOS E	8.9	65.3	0.97	0.79	0.97	25.4
Approach		163	8	172	4.9	0.546	51.5	LOS D	8.9	65.3	0.97	0.78	0.97	16.8
North: Moree Bypass														
7	L2	9	1	9	11.1	* 0.178	36.7	LOS C	1.1	11.4	0.94	0.69	0.94	31.0
8	T1	73	31	77	42.5	0.306	46.6	LOS D	3.2	39.0	0.94	0.72	0.94	33.9
9	R2	20	5	21	25.0	0.110	57.3	LOS E	1.1	10.2	0.92	0.71	0.92	24.3
Approach		102	37	107	36.3	0.306	47.8	LOS D	3.2	39.0	0.93	0.71	0.93	31.9
West: Alice St														
10	L2	17	0	18	0.0	0.029	21.4	LOS B	0.4	2.9	0.71	0.67	0.71	38.2
11	T1	222	0	234	0.0	0.527	44.3	LOS D	12.1	84.8	0.93	0.78	0.93	17.2
12	R2	12	1	13	8.3	* 0.082	61.0	LOS E	0.7	5.9	0.94	0.69	0.94	23.7
Approach		251	1	264	0.4	0.527	43.6	LOS D	12.1	84.8	0.92	0.77	0.92	19.1
All Vehicles		616	89	648	14.4	0.546	48.2	LOS D	12.1	84.8	0.94	0.76	0.94	23.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

TECHNICAL PAPER

03

Traffic impact assessment

Appendix B Public level crossing treatment methodology

Public Level Crossing Treatment Methodology

Introduction

This notes details the decision making process for determining treatments at level crossings across the Inland Rail program. The key principles guiding this approach include:

- Utilising a risk based decision making process focused on minimising risk so far as is reasonably practicable;
- Consistency in the determination of level crossing treatments across the projects of the Inland Rail program;
- Consistent methodology used in the determination of whether the cost of the potential available treatment is grossly disproportionate to the level of risk to safety and the projected benefits;
- Ensuring the feasibility of the Inland Rail program by proposing cost-effective solutions.

An overview of the process followed in the assessment of level crossings across the Narrabri to North Star (N2NS) project and the methodology followed in the development of level crossing treatments is outlined below.

Process overview - determination of level crossing treatments

Identification of all level crossings within the project area

An important objective of level crossing investigations is the clear and accurate identification of all level crossings within the project area. The development of an initial level crossing listing encompasses a review of existing level crossing datasets including the Australian Level Crossing Assessment Model (ALCAM) database, ARTC's asset management database and any relevant property records. The list of level crossings is then provided to the relevant road manager for review in order to ensure that all level crossings and the associated road infrastructure managers have been correctly identified.

Level crossing closure review

Initial consideration will be given to the elimination of level crossing risks by assessing all level crossings for closure. This is in line with the TfNSW Level Crossing Closures Policy, which notes that *"in order to manage the risks to safety associated with road and rail interfaces, the closure of public and private level crossings in NSW is to be pursued, where it is practical and cost effective to do so"*.

In New South Wales formal closure of any level crossing requires ministerial approval and needs to be undertaken in accordance with the requirements of the *Transport Administration Act 1998*.

TfNSW reviews all applications for level crossing closures before they are submitted to the Minister to ensure that the relevant issues have been considered and adequate consultation has been undertaken with the land owner, the local council, emergency services, Roads and Maritime Services (if they are the road authority), and any other relevant parties.

Review whether the Level crossing meets the criteria for automatic grades separation?

ARTC's policy is that rail-road interfaces will be automatically grade separated in the following three instances:

- rail-road crossings with four rail tracks (current)
- rail-road crossings of freeways and highways of four or more lanes (current and committed future plans)
- where grade separation is the logical option for topographical reasons.

All other crossings will be assessed using the Level Crossing Risk Tool.

Level Crossing Risk Tool

Where closure is not feasible a methodology was developed to identify what risk treatments should be implemented at individual level crossings as part of the Inland Rail project scope. This methodology is in the form of a formalised Level Crossing Risk Tool that identifies risk treatments and assists ARTC in being able to demonstrate that risks to safety would be managed So Far As Is Reasonably Practicable (SFAIRP) for both Brownfields and Greenfields interfaces.

In line with Office of the National Rail Safety Regulator (ONRSR's) recommendation around the use of quantitative risk assessment techniques, a decision was made to develop a tool which moved from a "warrant" approach (e.g. decisions around control types based on basic metrics such as road type or traffic volumes) to a cost benefit analysis (CBA) approach for safety risk management. The approach utilises ALCAM as one of the main inputs into the decision process for the recommended level of control at Inland Rail level crossings.

The Australian Transport Council in May 2003 agreed to adopt the Australian Level Crossing Assessment Model (ALCAM) as the only comprehensive level crossing assessment model in Australia. ALCAM is an assessment tool used to identify key potential risks at level crossings and assess the overall effects of proposed treatments. It does not specify what treatment is warranted at level rail-road crossing sites nor attempt to define a 'safe' or acceptable level of risk. This is a decision for each Rail Infrastructure Manager.

Section 10 of ONRSR's Policy on Level Crossings (June 2016) provides support for the use of ALCAM as follows:

> *"ONRSR accepts the use of ALCAM as a tool to help prioritise investment (when used in conjunction with other relevant factors, such as recent occurrence history). This tool has been endorsed by state and territory ministers."*

Consideration of factors other than ALCAM that may influence the recommended level of control are also taken into account where relevant on a case by case basis including:

- Collision and near-collision history;
- Engineering experience (both rail and road);
- Traffic and transport impacts; and
- Local knowledge of driver or pedestrian behaviour.

Level Crossing treatment (control) options considered as part of the process include:

- upgrade of passive (stop sign) level crossings to flashing lights and boom barriers;
- upgrade of existing flashing light controlled level crossings to include boom barriers;
- retain existing passive controls and renew the level crossing infrastructure including signage and road markings to ensure the crossing complies with the Australian Standard;
- grade separation; and
- other treatments identified based on site specific risks.

As per the TfNSW position any upgrades from passive/stop sign controls to active controls will include boom barriers. Active controls are where a device such as flashing lights or boom barriers are activated prior to and during the passage of a train through the level crossing.

Cost Benefit Analysis (CBA)

Part of the test as to whether risks have been managed SFAIRP is to determine whether the cost of the additional control is grossly disproportionate to the benefit gained via a Cost Benefit Analysis (CBA).

From a financial perspective to do the CBA, 3 key inputs are required. The basis for these inputs is detailed below:

- *The avoided cost if an additional risk control is implemented* - The risk tool relies on ALCAM which provides a quantitative measure of risk also enables the modelling of risk reduction generated by changing the controls at the level crossing. Risk reduction (benefits) can be calculated by comparing two risk scores for two scenarios – for example one proposal with stop signs and one with flashing lights and boom barriers.
- *The cost of implementing the additional risk control* - This is a combination of the capital cost of the additional control and the annual maintenance and repair cost over the life of the additional control
- *What would be considered grossly disproportionate - From a legal perspective the ONRSR Meaning of Duty to Ensure Safety So Far As Is Reasonably Practicable Guideline* provides some guidance on what would be considered grossly disproportionate in other words guidance on a "Grossly Disproportionate Factor" or GDF. The guideline suggests that the GDF may be dependent on the likelihood and consequence with low risks having a factor of 2 and high risk having a factor of 10.

The use of ALCAM assessments in the determination of level crossing treatments

ALCAM assessments have been undertaken for all public road level crossings in N2NS thus providing a baseline risk score.

The proposal functionality in the ALCAM system is used to model what the ALCAM risk score would be assuming the introduction of Inland Rail. This incorporates forecast changes to train speeds, volumes and train lengths. Updated road traffic counts including a breakdown between light are heavy vehicles are also collected for all public roads and included in this analysis.

If a crossing is assessed as being non-compliant for the existing control, the next level of control will be applied. For example if based on the updated train speeds, sufficient sighting distance for a stop sign crossing as per Australian Standard 1742.7-2016 (Manual of uniform traffic control devices Part 7: Railway crossings) cannot be achieved, then the minimum control will be flashing lights and boom barriers.

Even when a crossing is compliant for the current control, the next level of control is modelled in ALCAM and a cost benefit/grossly disproportionate analysis is undertaken e.g.

- An existing passive crossing would be compared to a boom barrier crossing
- An active crossing would be compared to grade separation.

i.e. additional levels of control are modelled and a cost-benefit/gross disproportionate analysis carried out until the risk factor is reduced and a cost-effective level of crossing protection is established.

In parallel to this ARTC review the ONRSR incident data to determine if there have been any road rail collisions at the respective level crossings.

Preliminary Design

A preliminary level of design is first undertaken to confirm that a level crossing with the proposed control, which complies with the relevant standards can be constructed onsite. This design incorporates any road design standards which have been provided by the relevant road infrastructure manager.

Site specific level crossing treatments are then reviewed with the respective road infrastructure managers as the project progresses through detailed design.

Interface Agreements

In accordance with National and State Rail Safety Law requirements, all current and proposed public road crossings will be subject to an Interface Agreement.

Consultation

Consultation with key level crossing stakeholders including Narrabri, Moree Plains & Gwydir Shire Councils, RMS, adjacent landowners and the emergency services will be ongoing throughout the detailed design process.

Information sharing agreements have been established to enable the prompt transfer of information between councils and the project team. This information can include inputs into the design process including road traffic counts, proposed changes in road usage and feedback on any future development plans.

Typical level crossings designs based on the relevant Australian Standards are provided to the respective road managers for review. The road managers are invited to provide any additional stakeholder specific design requirements as an input into the design process. For level crossing where RMS is the road manager, the project team will work with RMS to execute an RMS works authorisation deed.

Consultation with the relevant road manager about the proposed treatments for public level crossings includes a combination of face to face meetings, the provision of design memos or designs for review, and workshops where required. These communications can include the N2NS design engineers and project team, technical experts and community engagement specialists as required. Key interactions are included below:

- Overview provided to road managers on the Inland Rail methodology for determining level crossing treatments
- Feedback sought from road manager on the typical level crossing designs and key stakeholder specific design inputs
- Following the 1st project milestone, the relevant road managers review the proposed level crossing treatments and have the opportunity to provide comment
- Any proposed public level crossing closure is reviewed by the relevant road manager. Only if the road manager has no objection to the closure do the broader consultation processes commence. This will be undertaken in accordance with the requirements of the *Transport Administration Act 1998*.
- Throughout the design development, workshops are arranged with the road manager where necessary to discuss any location specific design complexities
- Prior to finalising the design, the draft designs are provided to road managers for review, ensuring that time is allowed to incorporate any required changes.

A Level Crossing Fact Sheet has been published. In addition to being made available on the ARTC Inland Rail website, it has been distributed at key project related forums including at all drop in sessions during the EIS display period.

Conclusion

The objective is to develop a consistent methodology in the selection of level crossing treatments which is acceptable to key stakeholders and minimises risk so far as is reasonably practicable.