6.6 Traffic and transport

The potential impacts of the proposal on traffic and transport are assessed in the *Hexham Straight Widening Traffic and Transport Assessment* provided in **Appendix P**. The potential impacts and safeguards to mitigate impacts, are summarised in this section.

6.6.1 Methodology

Overview

The traffic and transport assessment evaluates the construction and operational impacts arising from the REF area and includes consideration of the surrounding road network. Assessment of the transport and traffic impact of the proposal includes consideration of the following aspects of the transport network both during construction and operation:

- Review of the existing traffic and transport network and activity in the study area through a suite of traffic surveys
- Analysis of crash data for the study area for the most recent five-year period
- Traffic model development:
    - Forecasts for population and employment growth and inter-regional traffic growth for future years 2028 (the proposal opening year), 2038 (10 years after opening) and 2048 (20 years after opening) to develop future trip matrices
    - Develop future 'Do minimum' traffic models at opening (2028) and in future years (2038 and 2048), by developing a microsimulation traffic model which includes other network enhancements unrelated to the proposals that are already committed too or recognised as likely to be committed to
    - Develop future traffic models at opening (2028) and in future years (2038 and 2048), by developing a microsimulation traffic model which includes the proposal
- Identification of construction staging, compound locations and associated construction traffic impact were assessed
- Assessment of impact on pedestrians, cyclists and local access during construction
- Assessment of operational benefits and impact through
    - Traffic modelling to assess the broad operational traffic benefits of the proposal.
    - Qualitative and quantitative assessment of the operational impact on transport services by mode and local access
- Assessment of cumulative impact as a result of the construction and operation activities of the proposal based on the most current and publicly available information, a qualitative assessment was undertaken on approved and proposed projects in the study area.

Road traffic assessment methodology

The modelling for the proposal was undertaken by using the pre-existing VISSIM microsimulation model developed as part of the Outer Newcastle Study and M1 Motorway extension to Raymond Terrace project. The Hexham Straight model pivots off the pre-existing model to ensure the scenarios run are specific to the proposal.

To determine a reasonable growth rate for traffic passing through the study area, forecasting of traffic growth was undertaken on a first-principles basis by relating growth in population and employment to traffic growth in the study area.

The operation of the modelled road network provides an overview of the performance of the road network and is used to identify the impact of the proposal. This impact can be seen either across

the network or at individual locations (i.e. an intersection). The assessment of the REF area focuses on average network travel speed, intersection performance and queues.

The performance of an intersection and its LoS is determined by the average delay per vehicle. The performance criteria for intersections is shown in **Table 6.27**. LoS D is the target performance level generally accepted and if the performance of an intersection.

Table 6.27 LoS of service criteria

LoS	Average delay (seconds per vehicle)	Traffic signals and roundabout operations
A	Less than 14	Good operation
B	15 to 28	Good with acceptable delays and spare capacity
C	29 to 42	Satisfactory
D	43 to 56	Operating near capacity
E	57 to 70	At capacity, at signals incidents will cause excessive delays
F	Greater than 70	Exceeds capacity roundabouts require other control mode

A more detailed description of the process of traffic modelling is presented in Attachment B of **Appendix P**, including an overview of the steps undertaken, the assumptions used, and how data is passed between each stage in the traffic modelling process.

6.6.2 Existing environment

Existing road network

The key state roads in the construction area include:

- Maitland Road, in the study area is about six kilometres long starting around 290 metres to the south of the intersection with the NICB at Sandgate and extending to around 760 metres north of Hexham Bridge at Hexham. The section of Maitland Road to the east of the A1 Pacific Highway intersection that is located to the south of the Hunter River and Hexham Bridge is also recognised as the Pacific Highway (A43). The section of Maitland Road to the northwest of the Maitland Road and A1 Pacific Highway intersection (south of the Hunter River and Hexham Bridge) is also recognised as the New England Highway (A43) and the A1 Pacific Highway. The sections of Maitland Road within the construction area is generally comprised of two lanes in each direction and an 80 kilometres per hour speed limit
- NICB is located at the southern end of the proposal and provides an orbital road within Newcastle's road network to connect the Pacific Highway at Bennetts Green with the A1 Pacific Highway at Sandgate. In the study area, it is generally comprised of two travel lanes in each direction and has a speed limit of 90 kilometres per hour
- A1 Pacific Highway is located at the northern end of the proposal and includes a small section to the east of the Hunter River, the bridges over the Hunter River for northbound and southbound traffic (recognised as Hexham Bridge), the on ramps and off ramp for the A1 Pacific Highway at the intersection with Maitland Road and the section of Maitland Road to the north of Hexham Bridge. In the study area, the A1 Pacific Highway is generally comprised of two travel lanes in each direction with a speed limit of 80 kilometres per hour except for the southbound approach to Hexham Bridge where the speed drops to 60 kilometres per hour.

Key local roads in the construction area include:

- Old Maitland Road, Sandgate is a two-way, no through road that intersects with Maitland Road about 320 metres north of the NICB and Maitland Road intersection. The road has a speed limit of 50 kilometres per hour and provides access to a number of land uses including industrial properties and the Calvary St Joseph's Retirement Community at Sandgate
- Sparke Street is a two-way, no through road that intersects with Maitland Road about 300 metres north of Ironbark Creek Bridge. The road has a speed limit of 50 kilometres per hour and provides access to heavy industrial properties including a recycling centre
- Millams Road is a narrow two-way located about 110 metres to the south of Shamrock Street, Hexham on the eastern side of Maitland Road. Millams Road provides access to Kooragang Island, the Hunter Wetlands National Park and Schoolbox Road via Millams Road and a narrow bridge identified as the Ash island Bridge over the South Channel Hunter River
- Shamrock Street is a two-way road that intersects with Maitland Road in Hexham. Shamrock Street provides access to a variety of land uses including residential properties, commercial (McDonalds) and a truck port. At the end of Shamrock Street there is a railway level crossing that provides access to the rail corridor and western side of the rail tracks
- Fenwick Street is a no through road that intersects with Maitland Road about 300 metres north of the Maitland Road and Shamrock Street intersection. The road is about 100 metres long, has posted speed limit of 50 kilometres per hour and provides access to about 10 residential properties
- Merchant Street is a no through road that intersects with Maitland Road about 370 metres north of the Shamrock Street and Maitland Road intersection. The intersection only allows vehicles to turn left into and out of Merchant Street. The road is about 100 metres long, has no posted speed limit and provides access to about 10 residential properties
- Clark Street is an unpaved, no through road that intersects with Maitland Road about 500 metres north of the Shamrock Street and Maitland Road intersection. The intersection only allows vehicles to turn left into and out of Clark Street. The road provides access to a single residential property
- Old Maitland Road, Hexham is a 1.7 kilometre two-way, ring road which intersects Maitland Road at two locations in Hexham to the north and south of the Hexham Industrial Estate. The southern intersection of Old Maitland Road and Maitland Road is located to the south of Hexham Bowling Club. The northern intersection of Old Maitland Road at Maitland Road is to the north of Hexham Railway Station. The road provides access to both residential and heavy industrial properties
- Old Punt Road in Hexham is a two way 250 metre paved road without shoulders. It intersects with Old Maitland Road and provides access to a few industrial properties and the Hunter River.

Further description of the local roads along the proposal and existing intersection configuration is included in **Section 2.2.1**.

Road safety and crash history

A total of 178 crashes were recorded along the road corridor between Maitland Road and Wallsend intersection and Maitland Road and the A1 Pacific Highway between October 2013 and September 2018. Fifteen per cent of those crashes being fatal or serious injury crashes. The most prevalent crash movement type in the corridor was found to be rear-end crashes (65 per cent). The majority of crashes involved a motor vehicle, accounting for 88 per cent of all crashes. Location which exhibit a high number of crashes include:

- A1 Pacific Highway and Maitland Road intersection (eight per cent of crashes)
- Old Maitland Road (north) and Maitland Road intersection (seven per cent of crashes)
- Midblock road section between the intersections on Maitland Road with the A1 Pacific Highway and Old Maitland Road (south) (eight per cent of crashes).

Road traffic volumes and patterns

Traffic surveys were undertaken between 10 October 2017 and 23 October 2017 at various locations in the study area to gain an understanding of daily traffic volumes and traffic composition. The average daily traffic volumes observed on key routes throughout the network are presented in **Figure 6.5**.

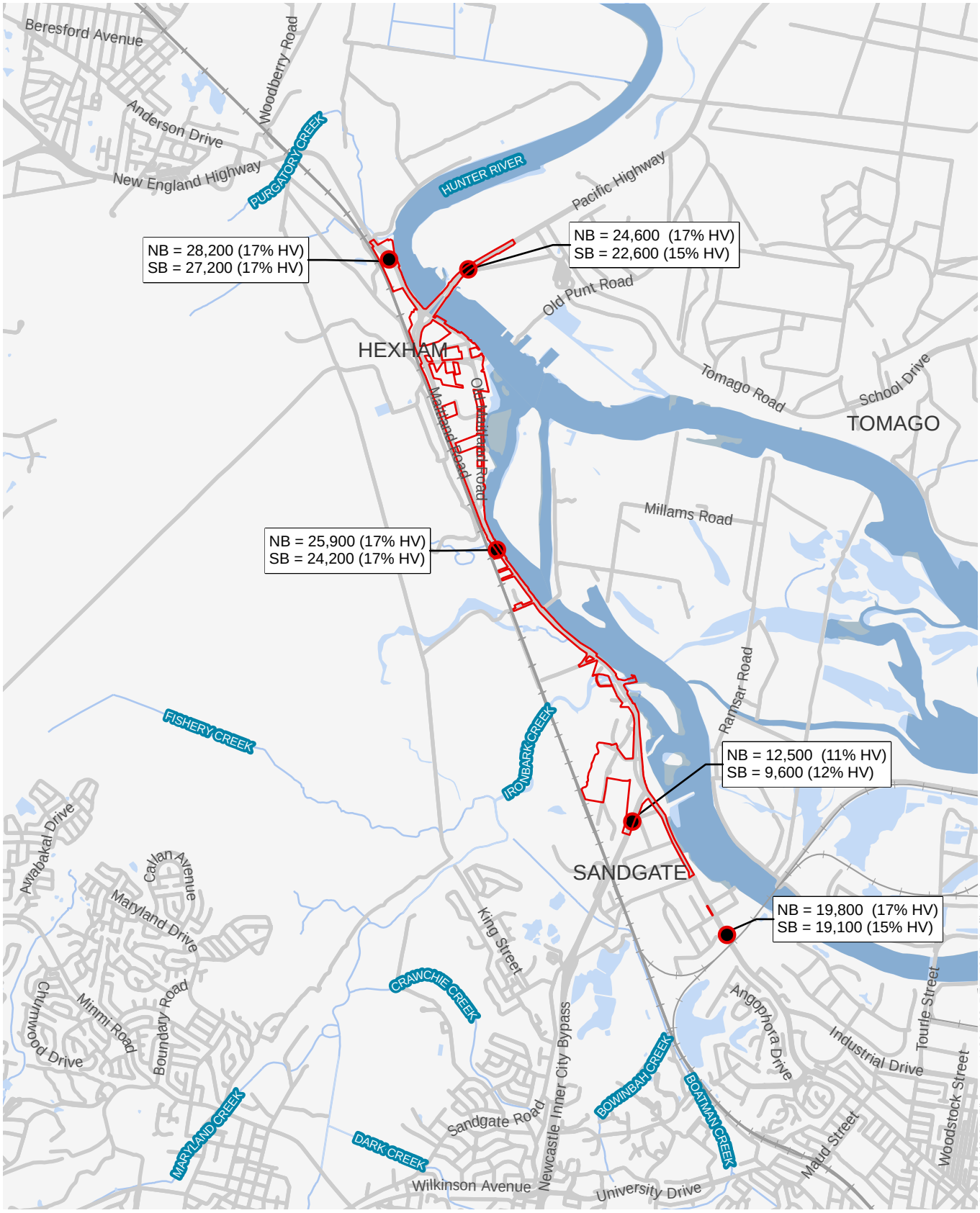
Intersection performance

Intersection delays and LoS for existing intersections within the study area for the morning and afternoon peak periods are provided in **Table 6.28**. These results are based on modelled average delay for the morning and evening peak hour in the VISSIM model.

The worst performing intersection is Maitland Road/NICB intersection which operates at a LoS D and contributes to increased travel times and reduced travel speeds in the segment of Maitland Road between the section of the road located 290 metres south of the NICB and extending to Sparke Street. Overall, the intersection delay and LoS for all intersections in the study area are satisfactory operating at LoS D or better in 2017 during the peak hours.

Table 6.28 Performance of modelled intersections in 2017

Intersection	Morning peak (8-9am)		Evening peak (5-6pm)	
	Avg delay (sec)	LoS	Avg delay (sec)	LoS
Maitland Road and NICB	36	D	50	D
Maitland Road and Old Maitland Road (north of NICB)	21	C	44	D
Maitland Road and Sparke Street	8	A	15	B
Maitland Road and Shamrock Street	16	B	13	B
Maitland Road and Old Maitland Road (south)	8	A	7	A
Maitland Road and Old Maitland Road (north)	10	B	8	A
Maitland Road and A1 Pacific Highway	22	C	7	A



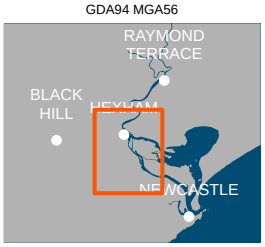
Legend

- REF area
- Traffic volume survey locations
- Waterway
- Road
- Railway

0 1 2 km

Scale 1:50,000 at A4

GDA94 MGA56



Data sources:

Jacobs 2020

Department Finance, Services and Innovation 2020

Figure 6.5 Daily traffic volumes of key routes in the network

Public transport

A summary of the existing public transport services within the study area of the REF area is provided in **Table 6.29**.

Table 6.29 Existing public transport services

Public transport mode	Description
Rail	• Main North Rail Line with access from two stations; Hexham and Sandgate • NSW TrainLink Hunter Line between Hamilton and Scone/Dungog • NSW TrainLink regional services between Sydney and Morree
Bus	• Route 47, which operates between Jesmond and Marketown, via Warabrook • Route 140, which connects Newcastle Interchange and Raymond Terrace, via Maitland Road and the Pacific Highway • Route 150[1], which connects Taree to Newcastle via Forster, Hawks Nest and Tea Gardens • Route 151[1], which connects Taree to Newcastle via Forster and The Rock • Route 152[1], which connects Hawks Nest and Newcastle • Route 160, which connects Newcastle and Cessnock via the NICB, Maitland Road, New England Highway and John Renshaw Drive • Maitland Road within the study area is also used by 22 school bus routes that provide access for students in Raymond Terrace, Maitland, Clarence Town, Woodberry and Beresfield to schools and educational facilities in Newcastle, Raymond Terrace and Maitland.

Note 1: Routes 150, 151 and 152 do not service bus stops in the study area.

Pedestrian and cycle links

The pedestrian network in the study area is limited to the following facilities:

- On the western side of Maitland Road between the NICB and 100 metres south of the Maitland Road and NICB intersection
- The eastern side of Maitland Road between Hexham Bridge and Old Maitland Road (north).

The cycle network in the construction area is facilitated by Maitland Road shoulders which provided dedicated on road bike baths for most of the study area.

6.6.3 Potential impacts

Construction

Construction staging

Indicative construction staging plans have been developed to ensure the capacity of the roadway is maximised, and that existing capacity is not diminished where possible. Six stages have been developed for the construction works and are described in **Section 3.3.2** and shown in **Appendix D**.

Construction traffic and haulage routes

Construction related traffic would use the surrounding road network to:

- Provide access for the workforce to the ancillary sites and construction access locations
- Haul construction related materials to and from the construction access locations
- Carry equipment and materials from one area of the construction area to another.

Construction haulage routes would use Maitland Road to the north and south of the proposal or the A1 Pacific Highway to the east of the proposal or the NICB to the south-west of the proposal (refer to **Figure 6.6**). These major highways are sufficient to cater for heavy construction vehicles without imparting significant road user delay to other vehicles. Vehicles would transport materials to the four construction ancillary facilities identified in **Figure 1.2.**

Where possible, materials for the proposal would be sourced from local suppliers and it is assumed that the majority of building materials would originate from the north of the proposal from Maitland Road or the A1 Pacific Highway, which offers potential sources of fill material.

Heavy machinery would need to be transported to and from site during off peak hours to minimise road user delays due to turning movements. Oversize and overmass vehicles are likely to be escorted and travel at slower speeds than other vehicles on the existing road network and would park in the OSOM parking areas located at the southern and northern ends of the proposal, refer to **Figure 1.2**.

There are about 400 daily vehicle in and out movements expected as part of construction activities. This includes about 300 daily heavy vehicle movements and 106 construction workforce (light vehicle) movements. On average there are about 30 heavy vehicle movements and 10 construction workforce (light vehicle) in and out movements during the peak hour across the four ancillary facilities. When compared to traffic volumes along Maitland Road without construction, additional traffic volumes generated are relatively minor (refer to **Table 6.30**).

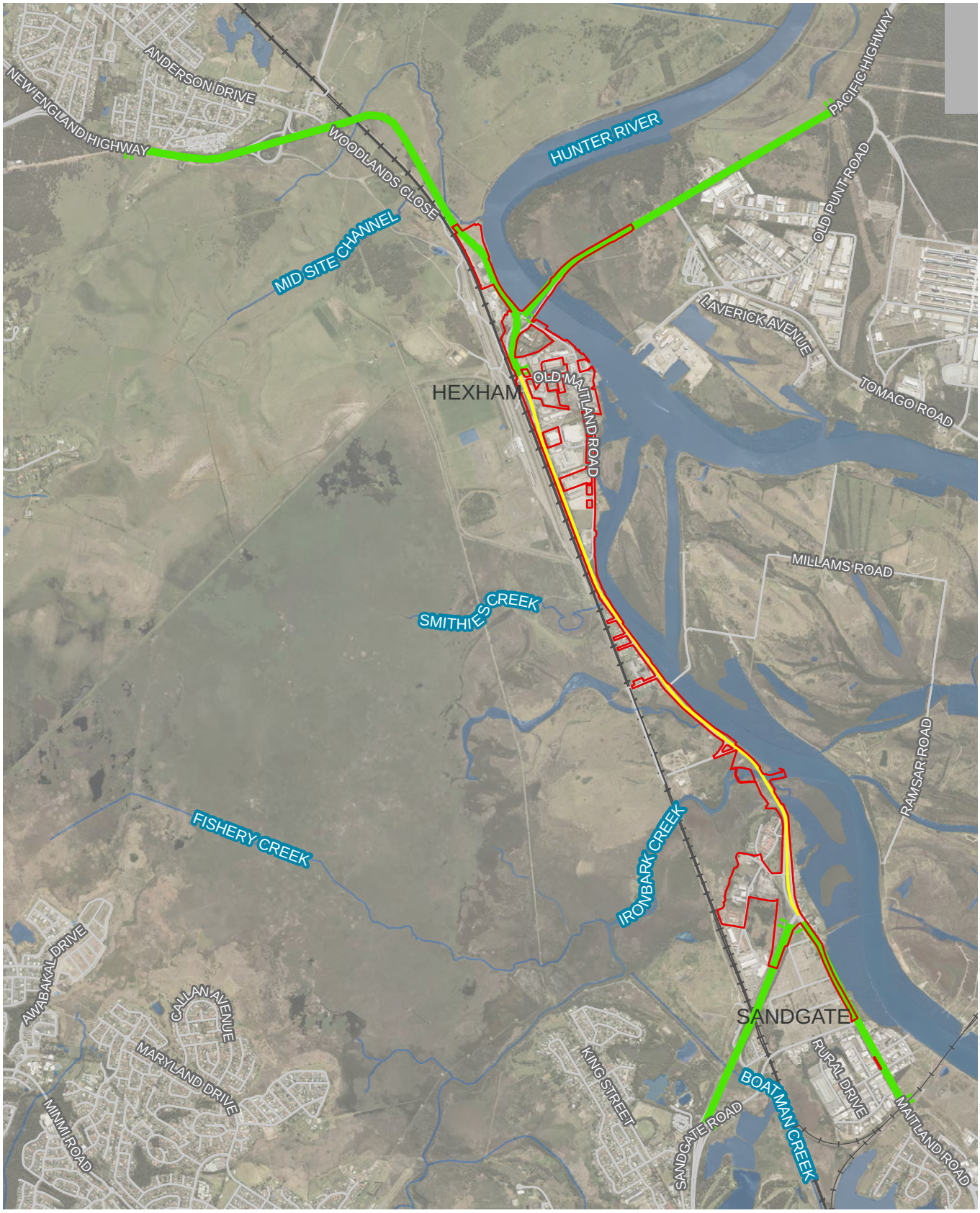
Table 6.30 Daily construction traffic movements

Compound	Additional vehicle movements			
	Heavy vehicles	Light vehicles	Total vehicles	Peak hour vehicles
C1	121	42	162	16
C2	91	32	122	12
C3	45	16	61	6
C4	45	16	61	6
Total	**302**	**106**	**406**	**40**

Travel time

To quantify the impact upon traffic conditions on the existing road network that arise from construction activities, traffic modelling was undertaken using VISSIM to compare construction traffic models to a future base model in 2025. The models assessed a worst-case scenario, with two lanes operational in each direction throughout the construction corridor and a reduced speed limit of 60 kilometres per hour in both the morning peak and evening peak traffic conditions.

Travel time results indicate delays are to be expected under worst-case scenarios developed when compared to future base conditions in 2025. The impacts are most notable in the northbound direction in the evening peak traffic period, with the reduction from three lanes to two at the southern approach to A1 Pacific Highway and Maitland Road intersection the most significant cause of potential delays. The construction phase results display a travel time improvement for a segment of the southbound carriageway due to the reduction in lanes for construction that removes any three lanes to two merging issues. However, vehicles experience increased delays at the approach to the construction zone, which is not captured in this analysis.



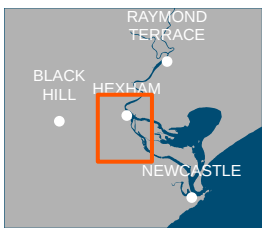
Legend

- REF area
- Haulage route
- Pacific Highway/Maitland Road (A43) Study Corridor
- Railway
- Road
- Waterway

0 0.5 1 km

Scale 1:40,000 at A4

GDA94 MGA56



Data sources:
Jacobs 2020
Department Finance, Services and Innovation 2020

Figure 6.6 Construction haulage routes

Hexham Straight Widening

Vehicles may therefore be able to travel this portion of the corridor quicker in the construction phase, but they would experience lengthier delays at the approach to Hexham Straight. In the southbound direction in the evening peak and both directions during the morning peak, expected travel time delays across the extent of the proposal are within 60 seconds.

Impact on property access

Maitland Road would remain open in both directions during the extent of construction and all movements would be maintained. All major movements at key intersections would be maintained. Some minor impacts to breaks in the median at Fenwick Street, Millams Road (Ash Island Bridge and Hunter Wetlands National Park) and at the access to Gilbert & Roach would occur during construction.

Existing pedestrian access to residential and commercial properties fronting Maitland Road would be maintained throughout the construction works.

Access to properties near the proposal would be maintained during construction, although temporary access changes may be required for some properties that have a frontage to Maitland Road. Alteration to access arrangements is likely to be required during pavement widening works being undertaken immediately in front of a driveway. This would be for a duration of one shift. Where possible, pavement widening works being undertaken immediately in front of a driveway would be completed outside of business hours to minimise impacts. In addition, local residents and businesses will be consulted prior to the commencement of the works and would be kept informed of the construction progress works and alternative routes to minimise any impacts. Traffic control personnel would be in attendance at the working area to assist with local access and egress throughout the construction works.

Impact on public transport

There would be minimal impact on the function of the Main North Rail Line and rail maintenance facility during the proposal's construction. Access to Hexham Railway Station and ARTC assets via Maitland Road would be affected by road closures during the concrete and asphalt pouring for road surfacing, however, temporary measures would be adopted by the construction contractor to provide alternative commuter access points. Where this is not possible, activities would need to take place during evening and night-time periods ('out-of-hours work') to minimise disruption to rail users.

Construction staging would ensure movements are maintained in both directions along Maitland Road, therefore there would not be an impact on any of the bus routes. However, impacts to travel time can be expected.

Access to existing bus stops would be temporarily impacted during the concrete and asphalt pouring. If bus stops are required to be relocated to maintain access, bus stops would be located as close as possible to the original bus stop locations, and pedestrian pathways would be provided.

Impact on freight

Construction staging would ensure that freight movements are enabled in both directions along the Maitland Road, including heavy vehicle movements. Freight vehicles users can maintain use of this major transport corridor, however, the travel reductions are also valid for freight vehicles. Overall, the provision of traffic management measures is expected to minimise the impact on the freight network.

Roadworks are not expected to impact rail freight operations on the Main North Rail Line, with road access to loading areas maintained throughout staged works and no temporary closures of rail operations required.

Impact on the pedestrian and cycle network

During construction, access would be maintained for cyclists and pedestrians in both direction. Impacts on the pedestrian and cycle network is likely to occur during construction of the proposal where alternate lanes are set up to facilitate traffic movement. Where construction activities impact pedestrian and cyclist movements, temporary measures would be adopted by the construction contractor to minimise impacts including the provision of facilities such as bridges and ramps to separate pedestrians and cyclists from proposed works and maintain safety. The provision of traffic control staff during construction hours to manage pedestrian and cyclist movements through the construction area may also be mandated during all stages of construction.

Impact on maritime network

Although the proposal involves the replacement of the bridge which spans Ironbark Creek with new twin bridges, impact to maritime operations from the construction of the proposal is expected to be negligible, as there is no major maritime traffic along Ironbark Creek aside for some occasional recreational vessels.

Operation

Network statistics

A comparison of network statistics between the 'Do minimum' and 'With proposal' scenarios are provided in **Table 6.31** for 2028, **Table 6.32** for 2038 and **Table 6.33** for 2048.

Comparison of the 'Do minimum' and 'With proposal' scenarios for the 2028 horizon year shows the following:

- Substantial increase in average network speed, particularly during the evening peak period. Forecast average network speed is likely to increase by 13 per cent
- Minimal variance in total vehicle kilometres travelled (VKT) across the 'Do minimum' and 'With proposal' options. However, there is a substantial reduction in total vehicle hours travelled (VHT) of up to 12 per cent. These improvements, coupled with the constant total throughput between the 'Do minimum' and 'With proposal' models, indicate vehicles can complete the same quantity of trips but in a faster manner
- Substantial reduction in stops by up to 80 per cent, indicating traffic is smoother and not subject to flow breakdown, which means trips can complete their journey with less interruption
- During the evening period, the latent demand has decreased by about 1,000 vehicles in the 'With proposal' model in comparison to the 'Do minimum' model. All unreleased trips in 2028 are associated with the south approach at Maitland Road.

Table 6.31 Network statistics (2028)

Network statistics	2028 morning peak		2028 evening peak	
	Do minimum	With proposal	Do minimum	With proposal
Total throughput	42,187	42,933	46,742	48,078
VHT	8,558	7,530	9,629	8,702
VKT	482,785	485,787	522,185	535,372
Network speed (km/h)	57	65	54	62
Total stops	451,083	88,488	333,762	142,666

Network statistics	2028 morning peak		2028 evening peak	
	Do minimum	With proposal	Do minimum	With proposal
Latent demand	2	1	1,549	534

Comparison of the 'Do minimum' and 'With proposal' scenarios for the 2038 horizon year shows the following:

- Substantial improvement in the operational performance of the road network is likely, up to an additional 9 per cent of vehicles can complete their trips within the modelled period. The forecasted average network speed is likely to increase by 12 per cent in the morning peak and 22 per cent in the evening peak
- VKT is likely to increase by up to 9 per cent due to more released traffic on the network compared to 'Do minimum' and the proposal would likely lead to a substantial reduction in VHT of up to 14 per cent
- Substantial reduction in stops of up to 78 per cent, indicating traffic is smoother and not subject to flow breakdown, which means trips can complete their journey with less interruption
- The 'With proposal' scenario would also relieve substantial congestion at the edge of the study area during the morning and evening peaks. Up to 2,300 vehicles, which previously were unable to enter the study area, can now enter as a result of network improvements that occur due to the proposal.

Table 6.32 Network statistics (2038)

Network statistics	2038 morning peak		2038 evening peak	
	Do minimum	With proposal	Do minimum	With proposal
Total throughput	46,194	50,481	52,796	55,939
VHT	12,055	10,867	15,117	13,103
VKT	535,374	584,407	591,989	645,481
Network speed (km/h)	48	54	41	49
Total stops	1,335,331	306,039	1,299,529	616,118
Latent demand	20	9	3,546	1,189

Comparison of the 'Do minimum' and 'With proposal' scenarios for the 2048 horizon year shows the following:

- Substantial improvement in the operational performance of the road network is likely, particularly during the evening peak period. Forecast average network speed is likely to increase by up to 24 per cent in the peak periods
- VKT is likely to increase by up to 14 per cent due to more released traffic on the network compared to 'Do minimum' and a substantial reduction in VHT of up to 20 per cent is anticipated
- Substantial reduction in stops of up to 71 per cent in the morning peak period, indicating traffic is free flowing and not subject to congestion, meaning trips can complete their journey with less interruption

- In the ‘do minimum’ models latent demand significantly increase in 2048, this is evidence the network cannot cater for the expected volumes without proposal upgrades. While ‘Do minimum’ upgrades were implemented to reduce latent demand and provide a comparable network, levels of latent demand could not be significantly reduced without implementing the proposal itself. Overall, the proposals significantly reduce latent demand and improves throughput across the network which is supporting the strategic need for the proposal
- The ‘With proposal’ scenario would also relieve congestion at the edge of the study area, with up to 40 per cent fewer vehicles waiting to enter the network at the edge of the model during the peak periods.

Table 6.33 Network statistics (2048)

Network statistics	2048 morning peak		2048 evening peak	
	Do minimum	With proposal	Do minimum	With proposal
Total throughput	48,161	53,408	54,147	58,281
VHT	18,231	14,612	19,486	18,051
VKT	545,367	620,906	604,784	678,631
Network speed (km/h)	35	42	33	38
Total stops	3,041,822	916,940	3,127,789	1,747,518
Latent demand	6,402	2,090	11,646	4,721

Travel time

A comparison between the travel times from ‘Do minimum’ and ‘With proposal’ scenarios for the years 2028, 2038 and 2048 was undertaken. The proposal results in faster travel times along the Maitland Road corridor in both the northbound and southbound directions in all modelled scenarios when compared with the ‘Do minimum’ scenario. Overall, the proposal would reduce travel times on Maitland Road in the study area by about 34 per cent in 2028, about 31 per cent in 2038 and by about 27 per cent in 2048.

In the southbound direction, the most significant reduction in travel times occurs between the northern extent of the upgrades and Old Maitland Road (north). In this road section, travel time is reduced by about 60 per cent. This occurs due to the reduction in delays at Maitland Road intersection.

In the direction of peak traffic flow (southbound in the morning peak and northbound in the evening peak), travel times increase in the section of road between Old Maitland Road (north) and the southern extent of the proposed road upgrades. This is a result of increased volumes on Maitland Road that occur due to the removal of network pinch points at the northern and southern ends of the study area.

In the northbound direction in 2048, there is a slight increase in travel times. This can be attributed to an increase in northbound traffic as a greater proportion of vehicle are released from the NICB due to the provision of the third turn lane.

Intersection performance

The operational performance at key intersections within the network is presented in **Table 6.34**. Analysis of the modelled intersections shows that the key differences in intersection performance are primarily at the following locations:

- A1 Pacific Highway and Maitland Road intersection located at the northern end of the proposal to the south of the Hunter River and Hexham Bridge: The proposal would substantially improve the performance of this intersection in both peak periods across all modelled years. The lane configuration from the east approach includes three left turn and two right turn lanes that operate under traffic signals. This new lane configuration is enabled by the construction of the M1 Motorway Extension to Raymond Terrace, which reduces the number of east to north traffic moments at this intersection as vehicles divert to the new motorway. Overall, the new lane configuration is designed to meet traffic demands for each approach to the intersection. This reduces the signal green time allocated to the east approach leading to increased signal green time for north-south movements on Maitland Road, resulting in greater north-south capacity and reduced delays at the intersection.
- Old Maitland Road (north) and Maitland Road intersection: The proposal includes an additional northbound and southbound lane on Maitland Road. This increases the capacity of the intersection leading to a significant reduction in delays at this intersection.
- NICB intersection and Maitland Road: The proposal provides an additional lane in the northbound and eastbound direction, adding capacity to the intersection which results in a reduction in delays and improved LoS. The provision of an additional left turn lane from the NICB leads to significant improvements in the delays and LoS for the eastbound approach.
- Shamrock Street and Maitland Road intersection and Sparke Street and Maitland Road intersection: In 2038 and 2048 the delays at these two intersections increase as a result of the proposal. This increase in delays can be attributed to an increase in traffic volume that occurs due to the release of additional trips and the change in traffic flow patterns. Furthermore, the shockwave that is formed in the southbound direction in the AM peak due to increased volumes, which is responsible for the increase in delays at these intersections. This originates just to the south of the Maitland Road and NICB intersection, where the Maitland Road and Wallsend intersection acts as a pinch point on the network.
- Traffic counts were undertaken in March 2021 at the Shamrock Street and Maitland Road intersection. Extrapolating growth from 2017 to 2021, it was found the model overestimates trips using Shamrock Street by about 20 per cent, thus the model results for Shamrock Street can be viewed as conservative. The real-world performance of the intersection is expected to be better in future years than the traffic model predicts.

All modelled intersections in 2028, 2038 and 2048 operate at a satisfactory LoS (LoS D or better) when modelled with the proposal. The proposal improves the capacity between the A1 Pacific Highway and Maitland Road intersection and the NICB and Maitland Road intersection which currently act as a pinch point. These improvements increase the traffic volume on Maitland Road leading to a slight increase in delays at the Maitland Road and Shamrock Street and the Maitland Road and Sparke Street intersection for through traffic. The approaches of minor roads such as Sparke Street, Shamrock Street and Old Maitland Road to Maitland Road do not experience lengthy delays and have suitable capacity at the traffic signals to cater for demand. Despite some increases in intersection delays, travel times over the entire length of the corridor decrease.

Table 6.34 Performance of modelled intersections with and without the proposal in 2028, 2038 and 2058

Intersection	Year	Do minimum				With proposal			
		8-9am		5-6pm		8-9am		5-6pm	
		Avg delay (s)	LoS	Avg delay (s)	LoS	Avg delay (s)	LoS	Avg delay (s)	LoS
NICB and Maitland Road	2028	24	C	62	E	23	C	33	C
	2038	54	D	72	E	41	D	27	C
	2048	72	E	58	E	40	D	32	C
Sparke Street and Maitland Road	2028	9	A	21	C	7	A	7	A
	2038	26	C	20	C	46	D	7	A
	2048	29	C	22	C	42	D	20	B
Shamrock Street and Maitland Road	2028	22	C	22	C	11	B	11	B
	2038	27	C	22	C	38	D	11	B
	2048	28	C	19	B	39	D	20	B
Old Maitland Road (south) and Maitland Road	2028	11	B	11	B	5	A	8	A
	2038	10	A	17	B	16	B	8	A
	2048	10	A	14	B	17	B	16	B
Old Maitland Road (north) and Maitland Road	2028	45	D	34	C	5	A	9	A
	2038	44	D	46	D	5	A	9	B
	2048	44	D	48	D	10	A	15	B
A1 Pacific Highway and Maitland Road	2028	60	E	40	D	18	B	21	C
	2038	63	E	79	E	23	C	22	C
	2048	72	E	78	E	30	C	33	C

Impact on property access

The proposal would impact access to a few informal locations and private properties through the closure of the median at four locations and minor changes in access arrangements. Locations with impacted accesses include:

- Closure of the median along Maitland Road at Millams Road would impact access to and from Ash Island Bridge and Hunter Wetlands National Park. Millams Road access would be left-in and left out only. Vehicles accessing Millams Road from the south would be required to travel an additional 470 metres to use the U-turn facility in Shamrock Street to access Millams Road from the north. Vehicles departing Millams Road to the north would be required to travel an additional 1.7 kilometres to the south to use the U-turn facility in Sparke Street
- The informal service road located on the western side of Maitland Road at the approach to Shamrock Street would be removed. Access to three properties (15 to 19) on Maitland Road would be maintained via new driveways constructed off Maitland Road via the shoulder

- The median on Maitland Road at Fenwick Street would be closed and the right turn into and out of Fenwick Street would be removed. Access to Fenwick Street would be left in and left out only. Vehicles accessing Fenwick Street from the north, would be required to travel an additional 840 metres and turn right at the Shamrock Street and Maitland Road intersection in order to use the new U-turn facility that would be provided on the western end of Shamrock Street. Vehicles departing Fenwick Street to travel south would be required to travel an additional 1.4 kilometres turning right at the Old Maitland Road and Maitland Road intersection to the south of the Hexham Bowling Club and then using the new U-turn facility located about 220 metres to the north-east of the intersection. The closure of the median at Fenwick Street would impact all residential properties located to the west of Maitland Road and north of the service station
- The closure of the median on Maitland Road north of Shamrock Street and the subsequent rerouting of vehicles to the U-turn facility on Shamrock Street would result in additional vehicles on Shamrock Street. Analysis found that the closure of the medians expected to lead to about 45 additional vehicles traveling on Shamrock Street daily. Traffic counts undertaken in March 2021 indicate about 2,150 vehicles currently use Shamrock Street daily, therefore the closure of the median is expected to lead to a two per cent increase in traffic movement which is not considered significant. The Shamrock Street and Maitland Road intersection would continue to operate at a satisfactory level of service
- Closure of the median and the right-turn facility at Gilbert & Roach trucks would mean drivers would have to make a detour when accessing the facility form the south. Two options are available and include:
    - Accessing the rear of the property from Galleghan Street via Old Maitland Road (south). This would be an increase of between 200 metres but would only be available for light vehicles
    - Using the existing U-turn facility at the northern end of the proposal opposite the Oak Factory access road (heavy and light vehicles permitted) which would be increase in 2.4 kilometres. Vehicles could access the front access on Maitland Road
- Closure of the right-turn facility at Gilbert & Roach trucks would mean drivers of light vehicles accessing Industrial Galvanizers Corporation from the south are unable to perform U-turns on Maitland Road and would be required to access the property from the entrance at Old Maitland Road, or alternatively use detours proposed for Gilbert & Roach trucks discussed above
- Access to the Hexham Railway Station for northbound vehicles would be modified to include a new left slip lane about 150 metres to the south of the existing access road. For southbound vehicles travelling to the Hexham Railway Station the closure of the U-turn facility on Maitland Road opposite Truckline Newcastle would require vehicles to use Old Maitland Road (either north or south) at Hexham to access the station. A new access road has been added to the western side of the intersection of Old Maitland Road (north) and Maitland Road to Hexham Railway Station
- Closure of the median and the U-turn facility on Maitland Road opposite Truckline Newcastle at Hexham would mean drivers of light vehicles exiting the Ampol Hexham Diesel Stop and Truckline Newcastle to head north to Beresfield would be required to use turn around at the intersection of Old Maitland Road (south) and Maitland Road, increasing travel distance by up to 2.7 kilometres. Heavy vehicles would need to continue south to use the U-turn facility at Sparke Street, increasing travel distance by up to six kilometres
- Access to the Oak Factory to the north of the A1 Pacific Highway and Maitland Road intersection would be upgraded to a short left-turn slip lane from Maitland Road to provide safer access. Access southbound to this site would be via the existing right turn lane at the signalised intersection. The uncontrolled right turn 150 metres to the north of this would be removed as a solid median barrier would be in place

- Closure of the median at Brancourts Dairy along with the right in and right out movements. Access to Brancourts Dairy northbound would be maintained as left in and left out only. Access for southbound traffic would be via the existing signalised intersection of the Oak Factory southern access road. Vehicles exiting the site and travelling south would use the existing southern access signalised intersection to turn right onto Maitland Road.

No property has been identified as requiring a permanent property adjustment. All impacted driveway accesses would be reinstated following the completion of the proposal. Transport would continue to consult with affected landowners regarding access during detailed design.

Impact on public transport

Widening of the existing lanes for the proposal would not affect current bus routes. The proposal would improve bus travel time reliability due to decreased congestion and improved intersection performance within the study area. Some bus stops would be relocated to provide safer connectivity and access (refer to Section 5.3.2 of **Appendix P**).

There would be no impact to the function of the Main North Rail Line and rail maintenance facility during the proposal's operation. Vehicular access to the Hexham Railway Station for northbound vehicles would be modified to include a new left slip lane about 150 metres to the south of the existing access road. For southbound vehicles travelling to the Hexham Railway Station the closure of the U-turn facility on Maitland Road opposite Truckline Newcastle would require vehicles to use Old Maitland Road (either north or south) at Hexham to access the station. A new access road has been added to the western side of the intersection of Old Maitland Road (north) and Maitland Road to Hexham Railway Station.

Impact on pedestrian and cycle links

The proposal includes upgraded pedestrian crossing facilities at some of the signalised intersections along Maitland Road and including:

- Across the eastbound and westbound lanes of the NICB and across the northbound travel lanes of Maitland Road
- Across the north bound and southbound Maitland Road travel lanes to the north of the U-turn crossing near Calvary St Joseph's Retirement Community entrance
- Across the northbound access road into Sparke Street
- At Shamrock Street intersection across the northbound and southbound Maitland Road travel lanes and across the eastbound and westbound Shamrock Street travel lanes
- At Old Maitland Road (south) intersection across the northbound and southbound Maitland Road travel lanes
- At the A1 Pacific Highway intersection across the northbound and southbound Maitland Road travel lanes and across the A1 Pacific Highway travel lanes into Newcastle
- At the Oak Factory access road, two signalised pedestrian crossings are proposed and includes one across the northbound access road into the Oak Factory and one across the eastbound and westbound travel lanes of the Oak Factory access road and the Maitland Road intersection.

These changes to the pedestrian network would improve connectivity, improve desire lines and provide safer access to bus stops, Hexham Railway Station and adjacent commercial and industrial properties.

The proposal includes a dedicated two metre-wide shoulders for cyclist which would improve cycle connectivity through the study area and encourage an increased mode share to cycle.

The proposal also includes changes to the cycling network in the following locations:

- The short cycle lane at the east approach to the A1 Pacific Highway and Maitland Road intersection would be removed. This would be replaced with off-road provisions at the intersection which would connect to the off-road shared path located on the eastern side of Maitland Road between the A1 Pacific Highway and Maitland Road intersection and the Old Maitland Road (north), the rail access maintenance road and Maitland Road intersection
- The dedicated-on road cycle lane at the northern approach to the A1 Pacific Highway intersection and Maitland Road would be removed. A shoulder would be provided at the intersection for southbound cyclists to use
- A new 900 metre shared user path along Maitland Road on the western side of Maitland Road north of the Oak Factory access road and the Maitland Road intersection A new 900 metre shared user path along Maitland Road on the western side of Maitland Road north of the Oak Factory access road and Maitland Road intersection.

Impact on freight

The proposal would substantially improve the operation of road freight within the modelled area by substantially reducing delays and travel times. The proposal would reduce travel times on Maitland Road in the study area for freight by about 30 per cent in future years. Furthermore, the proposal would also reduce the total number of stops made by vehicles in the network, which results in freer flowing traffic and greater efficiency of heavy vehicle operations.

Road safety

The proposal includes separated travel lanes with a central median with solid barrier, which would improve safety for all road users (including cyclists and pedestrians). The proposal would generally improve road safety by:

- Improving traffic flow, reducing the number of stops vehicles make leading to a decreased risk of rear end crashes
- Removal of the southbound merge to the south of the Old Maitland Road (south) and Maitland Road intersection would decrease lane change crashes
- Improvements to the cycle network at the northern end of the proposal through improved cycling infrastructure would reduce the risk of cyclist crashes in this location
- Removal of uncontrolled U-turn provisions.

6.6.4 Safeguards and management measures

The environmental management measures that will be implemented to minimise traffic and transport impacts of the proposal within the REF area, along with the responsibility and timing for those measures, are presented in **Table 6.35**.

Table 6.35 Safeguards and management measures – traffic and transport

Impact	Environmental safeguards	Responsibility	Timing
Impacts to traffic during construction	A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will be prepared in accordance with the T*raffic Control at Work Sites Manual* (Roads and Traffic Authority, 2010) and *QA Specification G10 Control of Traffic*. The TMP will include: • Confirmation of haulage routes • Measures to maintain access to local roads and	Contractor	Prior to construction/ construction

Impact	Environmental safeguards	Responsibility	Timing
	properties • Site specific traffic control measures (including signage) to manage and regulate traffic movement • Measures to manage temporary changes to the road network including use of barriers or lane occupancies • Measures to maintain pedestrian and cyclist access (including communication, signage and alternative routes) • Requirements and methods to consult and inform the local community of impacts on the local road network (including for out of hours work) • Access to construction areas including entry and exit locations and measures to prevent construction vehicles queuing on public roads • A response plan for any construction traffic incident • Consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic • Any licences or permits required before starting activities • Monitoring, review and amendment mechanisms.		
Property access during construction	Property access will be maintained at all times during construction. Any changes to access arrangements or alternative access required during construction to be done in consultation with the landowner and will provide the same equivalent pre-existing level of access unless agreed to. Consultation with landowners on property access to continue during detailed design and construction.	Transport/ Contractor	Detailed design/ prior to construction/ construction
Access	Where any legal access to property is permanently affected, arrangements for appropriate alternative access will be determined in consultation with the affected landowner and local road authority.	Contractor	Post-Construction
Pedestrian and cyclist access during construction	Pedestrian and cyclist access will be maintained throughout construction. Where maintaining access is not feasible or necessary, temporary alternative access arrangements will be provided following consultation with affected landowners and the local road authority.	Contractor	Construction
Access to bus stops and public transport during construction	Access for public transport services, including school bus services, will be maintained where possible. The requirements for any temporary changes will be confirmed following consultation with local bus operators and the community.	Contractor	Prior to construction/ construction
Impacts to traffic from construction traffic	Haulage vehicle movements will be planned to minimise movements on the road network during the morning and evening peak periods where practicable.	Contractor	Prior to construction/ construction

Impact	Environmental safeguards	Responsibility	Timing
Road closures, diversions or reconfigurations during construction	During any road closures, diversions or reconfigurations of the road and cycle network relevant consultation will be carried out with Transport, Local Council (where relevant), emergency services and public transport authorities.	Contractor	Prior to construction/ construction
Impacts to road users from changed traffic arrangements, traffic delays and disruptions during construction	Road users and local communities will be provided with timely, accurate, relevant and accessible information about changed traffic arrangements and delays due to construction activities.	Contractor	Prior to construction/ construction
Damage or impacts on local road infrastructure during construction	Pre-construction and post construction road condition reports for local roads likely to be used for construction will be prepared. Any damage resulting from construction (not normal wear and tear) will be repaired unless alternative arrangements are made with the relevant road authority. Copies of road condition reports will be provided to the local roads authority.	Contractor	Prior to construction