13.0 Transport

13.1 Introduction

This transport chapter describes the existing transportation infrastructure within and surrounding the Study Area, and identifies potential impacts of the Project upon the transport environment. The impact assessment forecasts the likely traffic generated throughout the construction and operational phases of the Project and considers potential mitigation measures to appropriately reduce the level of impact and to maintain the operational efficiency of the existing transport networks.

The primary transport network of relevance to the Project is the road network; however, other transport modes have also been briefly described to identify their relevance to the Project in the context of moving materials to and from the Project Site.

13.2 Scope of assessment

This chapter has been prepared with reference to the Guidelines for Assessment of Road Impacts of Development (GARID) (DMR, 2006) by the Department of Main Roads (now the Department of Transport and Main Roads (DTMR)) to identify the Project's impact on State-controlled Roads (SCR).

The scope of the assessment consists of:

- A baseline study of the existing transport networks supporting the Project Site
- An assessment of the potential impacts on these transport networks due to Project generated traffic
- Potential mitigation measures to be applied to avoid or minimise potential impacts, where relevant.

This chapter focuses on the construction and operational phases of the Project where the worst case transport impacts are likely to occur.

13.3 Legislative requirements and policy

The following section provides a brief description of the principal State legislation related to transport that was used to guide the transport assessment.

The Transport Infrastructure Act 1994

The *Transport Infrastructure Act 1994* (TI Act) is the primary legislation relating to transport in Queensland. The overall objective of the TI Act is to encourage effective integrated planning and efficient management of transport infrastructure. The transport elements of relevance to the Project are roads, sea ports, rail and airports.

SCRs are defined by Chapter 6, Part 2 of the TI Act and managed in Queensland by DTMR. A number of SCRs fall within the Study Area and their use will be subject to the laws and regulations as stated in the TI Act.

The Transport Infrastructure (State Controlled Roads) Regulation 2006

The *Transport Infrastructure (State Controlled Roads) Regulation 2006* (TI Regulation) regulates access, road works and ancillary works encroaching on SCRs. SCRs in the vicinity of the Project Site include the Warrego Highway and the Bunya Highway. As the Project will require access to SCRs, the TI Regulation establishes the regulations and requirements which are to be adhered to (such as restrictions or prohibition of access during road works).

Transport Operations (Road Use Management) Act 1995

The *Transport Operations (Road Use Management) Act 1995* (Transport Operations Act) aims to provide a regulatory framework whose overall objective is to provide for the effective and efficient management of the use of Queensland state road network. The act provides a scheme which promotes the effective movement of goods and people, improves road safety and also contributes to the strategic management of the road network in ways consistent with the TI Act.

The Transport Operations Act also includes a number of subordinate legislation including the *Transport Operations (Road Use Management – Mass, Dimensions and Loading) Regulation 2005* and the *Transport Operations (Road Use Management – Fatigue Management) Regulation 2008*.

Both of these regulations act as instruments within the wider Transport Operations Act. These regulations identify whether certain loads are exempt or regulated (requiring a permit for approval prior to movement) as well as providing a regulatory framework on managing driver fatigue for heavy vehicle operators. As this Project will require transporting over-size and/or over-mass goods (turbine components) over relatively long distances (from the port to the Project Site), the requirements under the Transport Operations Act and associated regulations will dictate allowable driving times as well as permit requirements prior to transport (for over-size or over-mass goods).

Guidelines for Assessment of Road Impacts of Development

GARID (DMR, 2006) sets out the process to assess road impacts triggered by a proposed development. GARID provides a basis for the assessment of impacts on SCR by the Project and generally considers a development's road impacts to be insignificant if the development generates an increase in traffic on SCR of less than 5% over existing levels, measured either in terms of annual average daily traffic (AADT) or equivalent standard axles (ESA).

State Development Assessment Provisions – Module 20 Wind Farm Development

Under Module 20 of the SDAP, wind farm development provides suitable vehicular access, manoeuvring areas and parking for the ongoing operation and maintenance activities associated with the wind farm.

Regional and local planning requirements

The Project falls within the Western Downs Regional Council (WDRC) and the South Burnett Regional Council (SBRC) boundaries. The Project is also within regional planning areas for the Wide Bay Burnett and Surat Basin regions. The WDRC was formed in 2008 following the amalgamation of the former local government areas of Dalby, Chinchilla, Murilla, Tara and Wambo. The SBRC was also formed in 2008 as a result of the Local Government Reform Commission report released in 2007. It consists of the amalgamation of the shires of Kingaroy, Nanango, Murgon and Wondai.

The Draft Wide Bay Burnett Regional Plan and the Draft Surat Basin Regional Planning Frameworks emphasise the need for better integration of transport and land use planning, and accessibility between towns within the regions should be maintained or improved in line with growth in these towns. Assessment of the Project against the local and regional plans is contained within Chapter 11 Land Use and Planning.

In December 2013, the Queensland Government also established the single State Planning Policy (SPP) which replaced multiple previous planning policies. The aim of the SPP is to provide clarity to local and regional governments to ensure that local and regional planning polices adequately reflect and balance state interests. In relation to transport, the policy identifies State Transport Infrastructure as a state interest and the Project will need to abide by the relevant policies from the SPP. For example, the Project must not hinder or prevent transport infrastructure from being constructed in a future state transport corridor as per the SPP.

It is important to ensure that the Project complements the future planning intent for the local areas. Appropriate Schedules on Infrastructure Provisions from the Regional Council Planning Schemes (including the South Burnett Regional Council and the Western Downs Regional Council) will be considered in determining the standards required on any necessary upgrades to the road network.

13.4 Methodology

This section outlines the methodology adopted for the traffic and transport impact assessments for the Project's construction and operation phases and is based on the transport requirements. The key tasks included:

- Identifying the existing transport infrastructure in the region (i.e. road, sea ports, rail infrastructure and airports)
- Assessing the potential construction and operations impacts of the Project on the surrounding transport infrastructure, including the movement of materials, plant and equipment in addition to construction and operations workforce

- Identifying potential mitigation and management strategies to be implemented during construction and operations, where required.

The methodology centres on establishing a baseline, “without development” scenario for the transport routes and corridors, and comparing this with the anticipated impact due to Project-generated traffic, “with development” scenario.

Desktop studies use DTMR and Regional Council data as the source information to form the projected baseline “without development” traffic scenario. This baseline is compared with the traffic generation from the construction and operation phases of the Project, which is preliminarily quantified in this assessment. Potential mitigation and management measures are formulated to address the potential impacts caused by the Project’s traffic generation.

The traffic and transport impact assessments have been based on a number of assumptions, as documented throughout this chapter for the purposes of the assessments. These assumptions have been made due to a lack of certainty or limitations on data at this stage of the Project. In subsequent design phases, these assumptions may be reviewed (and adjusted as necessary) as more detail becomes available.

13.4.1 Data collection and desktop review

The most recent AADT volumes (a combination of available data for 2014 and 2015) for the SCR network was provided by DTMR for the road links identified as the transport routes adopted for the Project activities. More up to date traffic data was not available at the time of assessment.

From the traffic data provided by DTMR, the annual segment growth percentage based on five year average data and compounding growth have been adopted for the traffic assessments. To determine the 2016 “existing” traffic volumes, the five years’ average growth rates were applied to the historic (combination of 2014 and 2015 data) AADT volume data provided by DTMR.

Traffic data for the Regional Council roads (RCRs) potentially affected by the Project was also requested. Only one potentially affected RCR was identified namely Niagara Road. Different sections of Niagara Road fall under the jurisdiction of both WDRC and SBRC. WDRC has indicated that the most recent counts along the road in their possession were undertaken in 2002 and 2006. SBRC indicated that a count was undertaken along Jarail Road, approximately 50 m north of the Niagara Road intersection in 2014. The newer, 2014 traffic count volumes have been adopted for the traffic assessments.

Given the already very low traffic volumes and lack of significant development potential, a high level of traffic growth was not expected and SBRC has indicated that no growth is to be applied to the 2014 year traffic counts along Niagara Road. For the purpose of the traffic assessments, any road segments with an indicated negative traffic growth have been assumed to remain constant (i.e. flat-line traffic growth).

Desktop reviews of the existing road network were completed based on available data provided by DTMR including historical traffic volumes, road inventories and information for future road upgrade plans such as the ‘Queensland Transport and Road Investment Program 2016-2017 to 2019-2020’ (QTRIP). This information formed the basis of understanding the general conditions and operational efficiencies of the existing road network.

The impact of Project-generated traffic has been compared to the “without development” scenario to determine the percentage increase in traffic volume compared against the existing scenario as well as identifying the magnitude of these increases.

13.4.2 Impact assessment

The major mode of transport potentially impacted by the Project is the Queensland road network and was hence the focus of this traffic and transport impact assessment. Other transport modes have also been considered to identify their relevance to the Project.

Road impact assessment

In accordance with the GARID, the Road Impact Assessment (RIA) needs to identify and address the implications of the Project on the SCR. The RIA consists of both traffic and pavement impact assessment.

This assessment is undertaken with reference to the GARID and in particular the RIA process flowchart which is summarised in Figure 13.1.

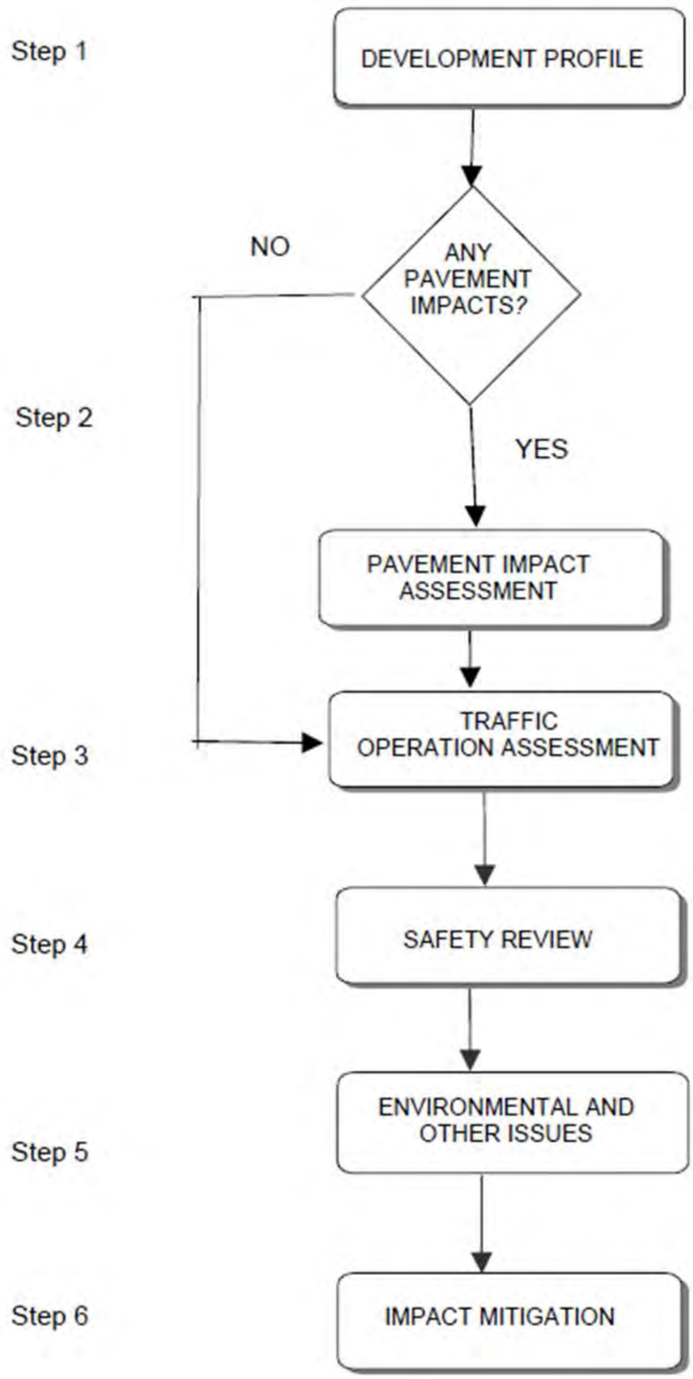

Figure 13.1 RIA process flowchart

Source: Figure 3.1 from GARID

GARID also outlines the performance criteria for the assessment of the road impacts which has been summarised in Table 13.1.

Table 13.1 Road impact performance criteria

Assessment type	Performance criteria
Pavement impact assessment	Construction or operational traffic generated by the development equals or exceeds 5% of the existing ESA on a road section.
Traffic operation assessment	Construction or operational traffic generated by the development equals or exceeds 5% of the existing AADT on a road section, intersection movements or turning movements.

Source: GARID (DTMR, 2006)

In order to identify the road sections potentially affected by the Project, the transport corridors related to the Project were identified. The quantity of materials, workforce and equipment were then estimated to determine the overall traffic generation for the identified construction and operation activities.

The 2016 “existing” traffic volumes along the State-controlled roads were developed based on 2014/2015 DTMR traffic census data, including the annual segment growth rates, provided by DTMR. Heavy vehicle (HV) proportions and historic traffic growth data for one, five and 10 years are also presented in the traffic census document. Average, annual segment growth rates based on the five year data were adopted in order to generate future projections of the background traffic data. The five year growth rates were adopted so that short term fluctuations in growth would not affect the assessment.

All potential traffic and transport impacts, considered for the purpose of the RIA, occur due to Project-related road usage. This is due to both the workforce and the construction materials and equipment being transported on road networks.

The roads of relevance to the Project are the domain of both State and local governments, being responsible for up-keeping operation and maintenance. As such these government bodies require assessment of the potential significant impacts upon road networks for future planning.

For the RIA, a brief overview of the methodology adopted to identify the background and Project related traffic volumes are summarised in Figure 13.2.

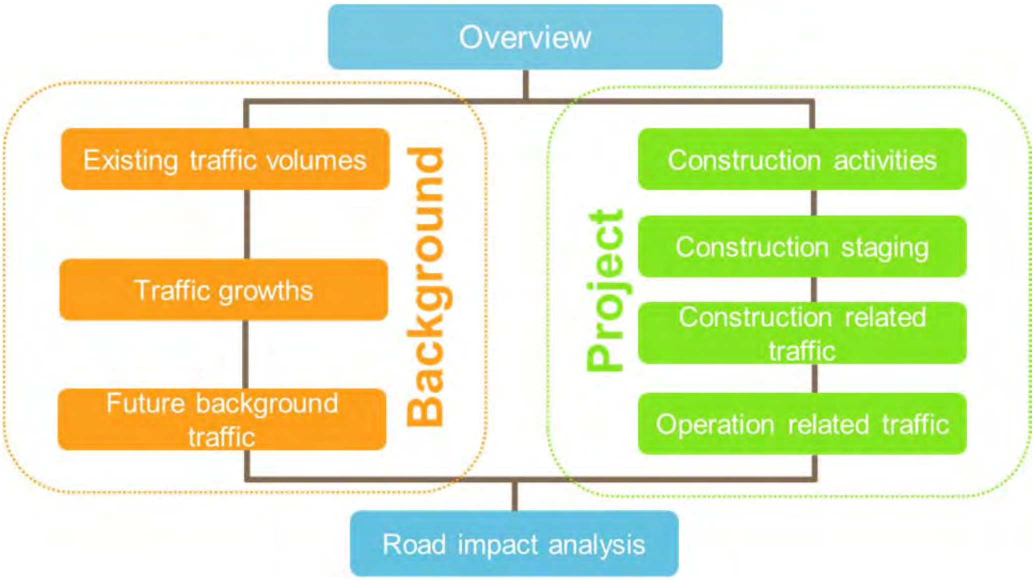

Figure 13.2 Methodology for generating Project traffic

Traffic operation impact assessment

The operational performance of the road network in the vicinity of the Project Site was assessed to understand the potential traffic impacts from the Project in terms of percentage increase and to identify the magnitude of the additional Project related traffic.

The traffic volumes for the various construction stages were calculated based on the indicative construction activities and timelines. These Project generated traffic volumes were then compared to the level of background traffic along the identified transport corridors to determine the likely level of impact.

According to DTMR's GARID, where Project generated traffic equals or exceeds 5% of the background traffic levels, the traffic operation of that road is considered to be impacted and further assessment is required. It should be noted that the traffic operation assessment is only designed to highlight potential areas of traffic impact and is not by itself a conclusive analysis on the likely impact to the road network.

The methodology highlighted in GARID (per cent comparison), may provide unexpected results if the background traffic is low. For this reason, it is important to consider the outcome of the per cent comparison alongside the actual magnitude of traffic generated. For this reason, the traffic operation impact assessment also considers the overall magnitude of Project generated traffic.

Pavement impact assessment

A preliminary desktop pavement impact assessment was undertaken based on the existing background traffic data available for the relevant road sections. The heavy vehicle component of the AADT was calculated for the construction period by adopting the background heavy vehicle percentages from the data provided.

The traffic volumes for the various construction stages were calculated based on the indicative construction activities and timelines (see Section 13.5.6). These traffic volumes were converted into ESA based on the assumed heavy vehicle classes used on the Project and the appropriate ESA for each vehicle class.

An ESA is a unit measurement which converts the wheel loads of traffic to an equivalent number of standard loads which is usually expressed in terms of the equivalent number of 80 kilonewtons (kN) single axle load.

The ESA for the background heavy vehicle component was calculated based on the provided heavy vehicle splits for the relevant road sections. The ESA factors were determined in consultation with DTMR.

Where the number of ESA of the additional Project related traffic equals or exceeds 5% of the background ESA (as outlined in GARID (DMR 2006)), the pavement is considered to be impacted and further assessment is required. It should be noted that the 5% pavement comparison assessment is only designed to highlight potential areas of pavement impact and is not by itself a conclusive analysis on the likely impact to the road network.

Port impact assessment

A desktop review of the current Queensland sea ports of relevance to the Project, including existing port infrastructure and future expansionary projects was conducted as part of the assessment.

Ultimately, the selection of a port for the delivery of imported construction materials, such as turbine components, will be undertaken following detailed design and be dependent upon a number of factors, including:

- The capacity of the port to handle ships carrying the components
- The capacity of the port to handle break bulk of sufficient dimensions (length of turbine blades and the weight of nacelles)
- The ability for turbine components to be transported from the port to the Project Site via road freight
- Costs associated with the use of the port.

This desktop analysis primarily focused on the Port of Brisbane which has been identified as part of the transport network for the Project. The desktop review includes the short and longer term port expansion planning including the Future Port Expansion Area project. The assessment also identifies the approximate quantities to be transported through Queensland ports and the likely impact of Project related movements.

Airport impact assessment

As part of the scope of assessment, a high level desktop review of existing airports in the vicinity of the Project was undertaken. This high-level review consisted of identifying the major aviation infrastructure in the area and determining the extent of any potential impacts (such as increased flights due to Fly in-Fly Out workforce or air freight transport) as a result of the Project.

Rail impact assessment

A high level desktop review of the rail infrastructure servicing the area in the vicinity of the Project was conducted as part of the assessment. This high-level review consisted of identifying existing rail infrastructure within the vicinity of the Project and determining the extent of impacts on Queensland rail lines (such as an increased number of trains due to the use of rail freight). Impacts at rail-road crossings have also been considered.

13.5 Existing environment

This section provides a summary of the existing transport infrastructure in the vicinity of the Project, and transport infrastructure between the Project and the Pot of Brisbane. In particular, it describes the road network and identifies the port, airport and rail infrastructure in the surrounding region. An overview of the existing transport infrastructure in the region can be found in Figure 13.1, Volume 2.

13.5.1 Road network

The Darling Downs region of Queensland is serviced by a network of highways, SCRs and RCRs that function as the main transport routes in the vicinity of the Project. The highways and other SCRs provide links from the Project to Kingaroy and Gayndah to the north, Brisbane and Toowoomba to the east, Dalby to the south and Chinchilla and Miles to the west.

13.5.1.1 State controlled road network

The major SCRs intersected by the Project transport corridors include sections of the Gateway Arterial Road (U13A – Gateway Motorway South), Cunningham Highway/Ipswich Motorway (17A and 17B) which will be used to transport turbine materials from the Port of Brisbane. Closer to the Project Site, the key SCRs consist of the Warrego Highway (18A and 18B), the Bunya Highway (45A), Dalby-Jandowae Road (421) and Kingaroy-Jandowae Road (424). The key SCRs in the vicinity of the Project are summarised in Table 13.2. A brief description of these roads is also provided in the following discussion.

Table 13.2 Key existing State-controlled road

Road ID	Description	Classification
U13A	Gateway Arterial Road (Gateway Motorway South)	National Highway
17A	Cunningham Highway (Ipswich Motorway)	National Highway
17B	Cunningham Highway (Ipswich – Warwick)	National Highway
18A	Warrego Highway (Ipswich – Toowoomba)	National Highway
18B	Warrego Highway (Toowoomba – Dalby)	National Highway
45A	Bunya Highway	Regional Road
421	Dalby-Jandowae Road	Regional Road
424	Kingaroy-Jandowae Road	District Road

Gateway Arterial Road

The Gateway Arterial Road (Gateway Motorway) is an approximately 50 km long highway, stretching from Drewvale (Brisbane) to Bald Hills (Brisbane). It is a major motorway which bypasses Brisbane to provide easier access between the Gold Coast and the Sunshine Coast. The southern section of the Gateway Arterial Road (Gateway Motorway South) is a fully access controlled, six lane dual carriageway, with a speed limit ranging from 80 km/hr to 100 km/hr.

Cunningham Highway (Ipswich Motorway)

The Cunningham Highway is an approximately 340 km long highway, stretching from Brisbane (where it is called Ipswich Road and Ipswich Motorway) to Goondiwindi. The relevant section of the Cunningham Highway (Ipswich Motorway) is a motorway grade, fully access controlled, six-lane dual carriageway, with a speed limit of 100 km/hr. In 2012, the Cunningham Highway (Ipswich Motorway) was upgraded to six-lanes between Dinmore and Goodna as part of the wider Ipswich Motorway upgrade project.

Warrego Highway

The Warrego Highway is an approximately 710 km long highway, stretching from Ipswich to Charleville. The highway connects the coastal centres of Queensland to the south western areas of the State. The section of the Warrego Highway forming part of the Project transport corridors is approximately 180 km in length from Ipswich to Dalby (18A and 18B).

The first approximately 100 km of the highway between Ipswich and Toowoomba is an access-controlled, four lane dual-carriageway. This section of the highway is access controlled using motorway style on and off ramps and has a speed limit ranging between 80 km/hr to 100 km/hr dropping to 60 km/hr through the Great Dividing Range and through Toowoomba.

From Toowoomba to Charleville, the highway turns into a two-lane, single carriageway with a speed limit of 100 km/hr.

Bunya Highway

The Bunya Highway is an approximately 170 km long highway, stretching from Dalby to Goomeri. The highway begins at the Warrego Highway at Dalby and heads towards the Project Site at Cooranga North where it turns north east and eventually terminates at the Burnett Highway in Goomeri. The section of the Bunya Highway forming part of the Project transport corridors is approximately 110 km in length from Dalby to Kingaroy.

The highway is predominantly a two lane, single carriageway except for the section within Dalby which is a four-lane, dual carriageway. The speed limit along the majority of the highway is 100 km/hr except for sections within built up areas (such as within Dalby) where the speed limit is reduced to 60 km/hr.

Kingaroy-Jandowae Road

Kingaroy-Jandowae Road is an approximately 40 km long road, linking the community of Jandowae to the Bunya Highway. The road begins at Jandowae and continues east towards Cooranga North, where it turns south-east and eventually terminates at the Bunya Highway.

The road is predominantly a two lane, sealed, single carriageway with centre line marking along some sections. The speed limit along the road is generally 100 km/hr and reduces to 60 km/hr around populated areas.

Dalby-Jandowae Road

Dalby-Jandowae Road is an approximately 50 km long road, linking the community of Jandowae to the Warrego Highway. The road begins at an intersection with the Warrego Highway in the township of Dalby and continues north, passing through Jandowae and eventually terminates at an intersection with Wondai Road.

The road is predominantly a two lane, sealed, single carriageway with centre line marking along some sections. The speed limit along the road is generally 100 km/hr and reduces to 60 km/hr through Jandowae.

13.5.1.2 Regional council roads

There are several RCRs in the vicinity of the Project Site including some non-gazetted roads. These roads fall under the jurisdiction of either the SBRC or the WDRC. For the Project related traffic, only Niagara Road is expected to be utilised as part of the proposed transport corridors during both the construction and operation phases.

Niagara Road

Niagara Road runs from a junction with Kingaroy-Jandowae Road east through the Project Site. It is sealed up to the intersection with Jarail Road. However, the road also runs in part as an unsealed access road through the site where it then joins the Bunya Highway south of Boyneside. Different sections of Niagara Road fall under the jurisdictions of both the SBRC and WDRC. The eastern portion of the road adjoining to the Bunya Highway is administered by the SBRC and the western portion towards Jandowae is administered by the WDRC.

13.5.1.3 Privately owned/operated roads

In addition to publicly owned and operated roads, privately owned and operated toll roads also form part of the Project's transport corridors. A brief description of these roads is provided in the following discussion.

Logan Motorway

The Logan Motorway (210A) is an approximately 30 km long highway stretching from stretching from the Pacific Motorway in Loganholme to the Ipswich Motorway in Gailes. It provides a quick connection between several major highways including the Pacific Motorway, Gateway Motorway, Centenary Highway and the Ipswich Motorway. The Logan Motorway is currently privately owned and operated by Queensland Motorways Limited and there are two toll points along the motorway at Staplyton Road and Loganlea Road.

The section of the Logan Motorway forming part of the Project transport corridors is approximately 20 km in length from the Gateway Extension Motorway merge to the Cunningham Motorway (Ipswich Motorway) merge. This section of the Logan Motorway is a fully access controlled, four lane dual carriageway with a speed limit of 100 km/hr.

Gateway Extension Motorway

The Gateway Extension Motorway (N332) is the southern expansion of the Gateway Motorway from the Pacific Motorway to the Logan Motorway. Originally completed in 1997, it is an approximately 10 km long stretch of motorway which allows traffic originating from the Bruce Highway and Gateway Motorways (west bound traffic heading towards the Warrego Highway), to bypass much of South Brisbane and Logan. The Gateway Extension Motorway is currently privately owned and operated by Queensland Motorways Limited and there is a single toll point along the motorway at Kuraby, adjacent to the Persse Road onramp.

The entire length of the Gateway Extension Motorway forms part of the Project transport corridors and consists of a fully access controlled, dual-carriageway varying between four to six lanes. The speed limit along the majority of the motorway is 100 km/hr, reducing to 80 km/hr in some sections.

13.5.1.4 Existing traffic volumes

The 2016 "existing" traffic volumes along each of the affected SCRs and RCRs were developed based on AADT data provided by DTMR (various regions) the SBRC and the WDRC. The AADT data made available for the traffic assessments were from various years, ranging from 2014 to 2015 depending on the road. The provided AADT data was then factored, using an average growth rate and compounding annually (from the year of the count) to develop the 2016 "existing" traffic volumes.

Based on the segment start and end through distances as presented in the DTMR's traffic census data, each of the SCR segments (for example the Warrego Highway, 18B: Toowoomba-Dalby) were subdivided into smaller road sections (for example 18B-1, 18B-2 etc.). The road section identifiers are presented in Figure 13.3, Volume 2.

Due to the level of available data, a number of assumptions had to be made regarding the existing traffic volumes for the purpose of the assessments. These assumptions are listed below and a summary of the "existing" year equivalent data used for the purpose of the assessments is provided in Table 13.3.

It should be noted that the transport corridors of the Project extend over three separate DTMR regions: the Metropolitan Region, the Downs South West Region and the Wide Bay Burnett Region. However, the roads falling within the Metropolitan region are predominantly multi-lane, national highway systems (such as the Cunningham Highway, Gateway Extension Motorway and the Logan Motorway).

Due to the high standard of construction and generally high background traffic volumes along these major highways, it is unlikely that the Project generated traffic volumes will have a significant traffic impact or pavement impact. Consequently, only roads along the transport corridors which fall wholly within either the Darling Downs or Wide Bay-Burnett regions have been considered and reported in Table 13.3.

The following key assumptions were adopted to derive the "existing" traffic volumes:

- For all SCRs, annual segment growth rates based on one, five and 10 year data was provided. However, for the purpose of the assessments, the five year annual growth rates (compounding annually) were adopted

- For any segments where the annual, five year growth rate was not available, the growth rate from the adjacent road section (where growth rate data was available) was adopted. This includes RCRs where growth rates were adopted from the adjacent DTMR road section
- If the provided traffic data indicated that negative growth would be present on any given segment, the growth rate was taken to be zero (flat-line AADT)
- For any segments where the percentage of heavy vehicles was not available, the percentage of heavy vehicles from the adjacent road section was adopted
- Where the data regarding the growth rate or percentage of heavy vehicles for a given segment was only available in one direction (gazettal or anti-gazettal), the same data was adopted for the opposing direction
- In the event that only combined bi-directional traffic data (such as bi-directional AADT) was available, a 50% / 50% split between the two directions of traffic flow was assumed.

Table 13.3 Summary of "Existing" 2016 traffic data

Segment ID	Road section name	Combined bi-directional traffic data				
		Historic AADT	Count year	%HV	Annual growth rate	2016 AADT ("Existing")
18B-1	Warrego Highway (Toowoomba to Dalby)	20,863	2015	11.66%	2.51%	21,387
18B-2	Warrego Highway (Toowoomba to Dalby)	15,306	2015	17.61%	1.17%	15,485
18B-3	Warrego Highway (Toowoomba to Dalby)	10,457	2015	8.83%	1.17% #	10,579
18B-4	Warrego Highway (Toowoomba to Dalby)	20,549	2015	7.54%	9.40%	22,481
18B-5	Warrego Highway (Toowoomba to Dalby)	13,515	2015	11.03%	1.14%	13,669
18B-6	Warrego Highway (Toowoomba to Dalby)	12,066	2015	18.19%	0.00% *	12,066
18B-7	Warrego Highway (Toowoomba to Dalby)	9,332	2015	19.15%	0.00% *	9,332
18B-8	Warrego Highway (Toowoomba to Dalby)	3,689	2015	21.42%	0.00% *	3,689
18B-9	Warrego Highway (Toowoomba to Dalby)	5,469	2015	25.78%	0.00% *	5,469
18B-10	Warrego Highway (Toowoomba to Dalby)	7,019	2015	23.31%	0.00% *	7,019
18B-11	Warrego Highway (Toowoomba to Dalby)	12,417	2015	16.50%	0.00% *	12,417
45A-1	Bunya Highway (Dalby to Kingaroy)	4,097	2015	12.57%	0.00% *	4,097
45A-2	Bunya Highway (Dalby to Kingaroy)	2276	2015	12.74%	9.71%	2,497
45A-3	Bunya Highway (Dalby to Kingaroy)	836	2015	20.33%	1.37%	847
45A-4	Bunya Highway (Dalby to Kingaroy)	588	2015	27.55%	0.77%	593
45A-5	Bunya Highway (Dalby to Kingaroy)	747	2015	21.15%	0.00% *	747
45A-6	Bunya Highway (Dalby to Kingaroy)	1,084	2015	17.44%	1.05%	1,095
45A-7	Bunya Highway (Dalby to Kingaroy)	2,488	2015	13.34%	1.09%	2,515
45A-8	Bunya Highway (Dalby to Kingaroy)	4,634	2015	10.14%	0.36%	4,651
421-1	Dalby - Jandowae Road	1,918	2015	15.84%	5.28%	2,019

Segment ID	Road section name	Combined bi-directional traffic data				
		Historic AADT	Count year	%HV	Annual growth rate	2016 AADT ("Existing")
421-2	Dalby - Jandowae Road	929	2015	17.89%	0.00% *	929
421-3	Dalby - Jandowae Road	687	2015	17.35%	0.00% *	687
424-1	Kingaroy-Jandowae Road	105	2014	13.21%	3.96%	113
RCR-1	Niagara Road	38	2014	23.70%	0.00% ^	38

** The published growth rates along these sections was negative, hence zero growth has been adopted for the purpose of this traffic assessment.*

 # Bi-directional, five year historic growth rates were not available for this section. The growth rate from the adjacent section has been adopted.

^ SBRC has indicated that no significant growths in traffic volumes are expected in the near term along Niagara Road and as such zero growth has been adopted for the assessment.

13.5.2 Stock routes

SBRC identifies, within Planning Scheme Policy (PSP) No. 8 of the former Kingaroy Shire Council (2006) Planning Scheme, a Stock Route that runs through the Project Site. This stock route is located within the road reserve of Ironpot Creek Road, north of the intersection with Niagara Road. The stock route follows north along the reserve of Ironpot Creek Road until the intersection of Ironpot Creek Road / Sarum Road, where the stock route follows Sarum Road north, out of the Project Site. The location of this stock route in relation to the road network is shown in Figure 13.4, Volume 2.

13.5.3 Port network

The closest commercial sea port to the Project Site is the Port of Brisbane. The port it is situated to the east of Brisbane City and is approximately 300 km (by road via the Warrego and Bunya Highways) to the south east of the Project Site. The Port of Brisbane is operated and managed by the Port of Brisbane Pty Ltd, under a 99 year lease from the Queensland Government.

13.5.4 Airport network

The closest major commercial airport to the Project Site is Toowoomba Airport (International Air Transport Association (IATA) Code: TWB). Toowoomba Airport is currently served by regional airlines such as Skytrans Airlines with direct flights from between Toowoomba and Brisbane, Sydney and Charleville.

There are also a number of smaller airports/aerodromes in the vicinity of the Project, within the WDRC and SBRC catchments including:

- Dalby Airport (IATA Code: DBY)
- Chinchilla Airport (IATA Code: CCL)
- Kingaroy Airport (IATA Code: KGY).

13.5.5 Rail network

The key existing rail infrastructure in the vicinity of the Project consists of the Western System rail-line, as shown in Figure 13.5, which is owned and operated by Queensland Rail (QR). The Western System is a 1,067 mm, narrow gauge, east-west running rail line linking Brisbane (via the Ipswich and Rosewood lines) to its current terminus at Quilpie in south-west Queensland. At Westgate station, the rail line splits into a north-south section terminating at Cunnamulla and the east-west section continuing further west until Quilpie. The system currently caters for all types of traffic including passenger and freight services.

A number of branch lines also connect to the Western System, including the Jandowae branch terminating at Jandowae, the Wandoan Branch terminating at Wandoan and the Glenmorgan branch terminating at Glenmorgan. The nearest railway station within the vicinity of the Project is Jandowae Station, located along the Jandowae branch, approximately 40 km west of the Project Site.

Figure 13.5 Western system rail network

(Source Reference: http://www.queenslandrail.com.au/NetworkServices/Documents/Western%20System%20Information%20Pack%20-%20Issue%202%20-%20March%2006.pdf)

13.5.6 Project description

The Project may consist of up to 115 wind turbines in an area near Cooranga North between Dalby and Kingaroy on land that is predominately used for cattle grazing and other farming activities. It should be noted that the exact number of turbines depends on the model of turbine adopted. Similarly, the exact locations of the wind turbines, access roads, electrical collector and feeder systems and other associated infrastructure will be determined during the Project's detailed design phase. For the purposes of this assessment, the maximum number of wind turbines (up to 115 turbines in total) has been adopted to provide an estimated ceiling in terms of potential additional traffic impacts. The exact number of turbines to be constructed will be determined in the Project's detailed design phase.

A maximum wind turbine layout has been used to inform the Project Site and the traffic assessment for the Project. The wind farm layout and Project Site are shown in Figure 2.1 in Volume 2. For additional detail on the Project, refer to Chapter 2 Project Description.

13.5.6.1 Construction phase

As the Project is currently in the preliminary planning and approvals stage, the detailed construction methodology and program have yet to be finalised. The Engineering, Procurement and Construction (EPC) contractor for the Project will be ultimately responsible for the detailed construction methodology for the Project. The following section describes a typical construction methodology that is likely to be used for the Project and has been adopted for the purposes of the traffic and transport assessments.

Construction activities

This section provides an indication of the key construction activities of the Project and their proposed mode of transport. For the construction of the Project, the following activities are expected to occur over a period of approximately 27 months (or two to two and a half years):

- Site establishment (temporary site facilities, lay down areas, equipment and materials)
- Earthworks for access roads and wind turbine hardstands
- Excavation for foundations
- Construction of wind turbine foundations (bolt cage, reinforcement and concrete)
- Installation of electrical and communications cabling and equipment (including overhead feeders from cable marshalling points to the substation)
- Installation of wind turbine transformers, in parallel with electrical reticulation works
- Installation of towers for the wind turbines, delivery of the wind turbine components to site
- Erection of wind turbines, using high-level mobile cranes
- Construction of the Project's substation and Powerlink substation (progressed in parallel with the construction of the Project)

- Commissioning of wind turbines, followed by reliability testing
- Rehabilitation and restoration of the site following commissioning.

Based on the construction activities listed above, Table 13.4 identifies the major construction materials and related transport modes for the traffic generated by the respective activities. As indicated below, for the purpose of this assessment; it has been assumed that all construction equipment, workforce and the majority of construction materials are being transported via the road network.

During the construction phase, works could potentially occur for six days during each week, 12 hours per day. Under such a scenario, materials could be transported to the site for up to 24 days per month (assuming a four week month). These working hour assumptions have been adopted for the purpose of the assessments; however the final working hours will depend on the terms of the Project's construction contract.

Table 13.4 Construction activities contributing to traffic generation and transport mode

Activity	Mode of transport
Road materials	Road
Concrete aggregates for footings	Road
Reinforcing steel (two deliveries per turbine)	Road
Other concrete supplies	Road
Transformers	Road
33 kV cabling	Road
Turbine blades (Three blades per turbine)	Sea and road
Turbine nacelles	Sea and road
Turbine cooling towers	Sea and road
Turbine hubs	Sea and road
Tower sections (Three sections per wind turbine)	Road and/or sea and road
Substation equipment	Road
Cranes and other heavy equipment	Road
Workforce	Road

13.5.6.2 Operational phase

The wind turbines automatically start, stop and alter their output as determined by wind speed and other environmental and electrical conditions. During operations, the wind farm will be managed by both on-site and off-site personnel.

During the operational phase, it is expected that there will not be a significant impact on any transport mode relative to the construction phase. The only Project related traffic expected to be generated during the operational phase would be a low volume of light vehicle trips from the small operational workforce. As such, the magnitude of these trips is not expected to have any adverse traffic impacts during the operational phase.

13.5.6.3 Decommissioning phase

At the end of the operational life of the Project, the wind farm operator may repower the wind farm (replace the wind turbines) or replace the wind turbine components, such as the gearbox and generator. Alternatively, the Project may be decommissioned, which would involve the turbines and all other above-ground infrastructure on-site being dismantled and removed from the Project Site. For further detail regarding the decommissioning phase, refer to Chapter 2 Project Description.

Regardless of the Project's ultimate decommissioning provisions, the decommissioning phase of the Project is unlikely to have an impact on existing transport networks greater in magnitude than during the construction phase. A decommissioning plan will be prepared by the wind farm operator and agreed with the relevant authorities prior to any decommissioning activities. The plan will take into account any new legislation, guidance and best practice to avoid or minimise potential adverse impacts to the road network.

13.5.7 Project related transport networks

This section describes the transport networks expected to be utilised by the Project, namely the road and port networks. These networks are described in the following sections in addition to highlighting the extent of any planned upgrades to the network. As the rail and airport networks are not considered to be significantly affected by the Project, they have not been further considered in this report.

13.5.7.1 Port network

Australia does not manufacture wind turbines; consequently, these components will be sourced from overseas. The turbine components will be shipped to the east coast of Australia for transport to the Project Site via the road network. Several port options exist for transporting the turbine components including the Port of Brisbane, the Port of Bundaberg and the Port of Gladstone. However, for the transport assessments, in view of its location and handling capability, the Port of Brisbane has been identified as part of the transport network for the Project.

For the purpose of the traffic assessments, it has been assumed that construction materials being transported via ocean freight services will be shipped to the Port of Brisbane where they will be transferred onto the road network. The Port of Brisbane is the largest general cargo port in Queensland; hence it is the most likely port to be able to accommodate ships, break bulk cargo and containers of sufficient size. Additionally, the Port of Brisbane is also the closest major port to the Project Site and is well connected via the road network, with major highways certified by DTMR for Higher Mass Limit (HML) vehicles linking both locations.

13.5.7.2 Road network

Transport Corridors

The three principal elements to be transported via the road network are the workforce, construction materials (which includes overland freight of turbine materials & infrastructure) and construction equipment. For the purpose of the assessments, indicative transport routes (referred to as Transport Corridors) for each of these three elements have been developed (as depicted in Figure 13.6a, Figure 13.6b and Figure 13.6c, in Volume 2).

The principal elements of road infrastructure in the region, utilised by the Project are described in Table 13.5 and Table 13.6. Three primary transport corridors have been identified, as shown in Table 13.5, consisting of Transport Corridors TC01, TC02 and TC03. These primary transport corridors are the main transport corridors which will be used for the transportation of workforce, equipment and materials for the Project's construction and operational phases. At Dalby, TC01 splits into four possible transport routes between Dalby and the Project Site providing alternate transport routes for traffic travelling along TC01. The alternative transport routes between Dalby and the Project Site are highlighted in Table 13.6 and consist of TC01A, TC01B, TC01C and TC01D.

Both TC01A and TC01B describe a one-way loop arrangement between Dalby, Jandowae, the Project Site and back to Dalby (via, Dalby-Jandowae Road, Kingaroy-Jandowae Road, Niagara Road and the Bunya Highway). TC01A describes a clockwise loop arrangement and TC01B describes the opposite, anti-clockwise arrangement (as depicted in Figure 13.6a and Figure 13.6b, Volume 2).

TC01C and TC01D both describe two-way routes from Dalby to the Project Site. TC01C involves a route from Dalby to the Project Site via Dalby-Jandowae Road through Jandowae. TC01D involves a route from Dalby to the Project Site via the Bunya Highway (as depicted in Figure 13.6c, Volume 2). All vehicles travelling along both TC01C and TC01D have been assumed to perform a return trip along the same corridor.

The purpose of identifying alternate transport corridors between Dalby and the Project Site is to provide a number of potential routes for the movement of heavy vehicles carrying materials and equipment travelling between Dalby and the Project Site. TC01D also serves the additional purpose of transporting workforce from Bell and the Project Site.

Table 13.5 Primary road transport corridors overview

Transport Corridor	Description	Constituting roads	Principal purpose
TC01	Port of Brisbane to Dalby	Port of Brisbane Road, Gateway Arterial Road, Gateway Extension Motorway, Logan Motorway, Cunningham Highway (Ipswich Motorway), Warrego Highway	Transport of equipment Transport of materials
TC02	Kingaroy to Coopers Gap Wind Farm	Bunya Highway, Niagara Road	Transport of equipment Transport of materials Transport of workforce
TC03	Jandowae to Coopers Gap Wind Farm	Kingaroy-Jandowae Road, Niagara Road	Transport of materials Transport of workforce

Table 13.6 Alternative transport routes

Transport routes	Description	Constituting roads	Principal purpose
TC01A	Dalby to Coopers Gap Wind Farm and back to Dalby (Clockwise, One-Way Loop)	Dalby-Jandowae Road, Kingaroy-Jandowae Road, Niagara Road, Bunya Highway	Transport of equipment Transport of materials
TC01B	Dalby to Coopers Gap Wind Farm and back to Dalby (Anti-Clockwise, One-Way Loop)	Dalby-Jandowae Road, Kingaroy-Jandowae Road, Niagara Road, Bunya Highway	Transport of equipment Transport of materials
TC01C	Dalby to Coopers Gap Wind Farm (via Jandowae)	Dalby-Jandowae Road Kingaroy-Jandowae Road, Niagara Road	Transport of equipment Transport of materials
TC01D	Dalby to Coopers Gap Wind Farm (via Bunya Hwy)	Bunya Highway Niagara Road	Transport of equipment Transport of materials Transport of workforce

It should be noted that the primary transport corridors for the Project extend over three separate DTMR regions: the Metropolitan Region, the Downs South West Region and the Wide Bay Burnett Region. However, the roads falling within the Metropolitan region are predominantly multi-lane, national highway systems (such as the Cunningham Highway, Gateway Extension Motorway and the Logan Motorway).

Along these roads, the Project related traffic is unlikely to have a significant impact on the pavement condition or traffic operation of these roads. This is because the Project related traffic is unlikely to exceed 5% of the background traffic volumes, owing to the generally higher levels of background traffic on these roads. Consequently, only roads along the transport corridors which fall wholly within either the Downs South West or Wide Bay-Burnett regions have been analysed as part of the RIA.

Planned upgrades

The QTRIP details DTMR's upcoming schedule of road works on SCRs in Queensland. The program sets the framework for the Queensland Government in meeting current and future infrastructure needs, and is a requirement of DTMR under the TI Act.

All potential road upgrade works along the roads forming the Project's transport corridors identified from QTRIP, which are contained wholly within the Darling Downs and Wide Bay Burnett Regions, have been listed in Table 13.7. It should be noted that all potential works identified in QTRIP have been reproduced, however it is not known which of these works will overlap with the construction period of the Project. Additionally, all works indicated in QTRIP for 2017-2018 and beyond are indicative only with no guaranteed funding as identified at the time of publication.

Table 13.7 Queensland Transport and Roads Investment Program (Darling Downs and Wide Bay Burnett Regions) - Indicative Road Funding 2016-2017 – 2019-2020

ID	Road	Location	Funding period	Work description
265/18B/10	Warrego Highway (Toowoomba-Dalby)	Acland Intersection (43.20 – 44.00)	2016 – 17 to 2019-20	Improve intersection
265/18B/11	Warrego Highway (Toowoomba-Dalby)	Kingsthorpe – Oakey (18.50 – 28.80)	2016 – 17 and 2018-19 to 2019-20	Undertake miscellaneous works
265/18B/4	Warrego Highway (Toowoomba-Dalby)	Nugent Pinch Road – West of Charlton	2016 – 17 to 2019 – 20	Duplicate from two to four lanes
265/18B/8	Warrego Highway (Toowoomba-Dalby)	Charlton – Kingsthorpe (14.10 – 18.20)	2016 – 17 to 2019 – 20	Duplicate from two to four lanes
265/18B/803	Warrego Highway (Toowoomba-Dalby)	0 – 4.50	2016-17	Rehabilitate pavement
265/18B/9	Warrego Highway (Toowoomba-Dalby)	Oakey – Dalby (28.80 – 84.10)	2016-17 to 2017-18	Construct additional lanes
265/18B/910	Warrego Highway (Toowoomba-Dalby)	Charlton	2016-17	Undertake transport planning project
222/18B/6	Warrego Highway (Toowoomba-Dalby)	Dalby eastern access (80.30 – 83.60)	2016-17 to 2017-18	Duplicate from two to four lanes

13.6 Potential impacts

13.6.1 Construction traffic generation

The volumes of traffic that are likely to be generated through the construction of the Project have been preliminarily estimated based on the traffic generation and distribution assumptions as described in the following sections. The major construction activities of the Project and their proposed mode of transport have already been identified in Section 13.5.6. The traffic generated due to the movement of construction equipment, materials and workforces relating to these activities form the basis of the RIA.

Indicative quantities

The total number of workforce as well as the quantities of equipment and materials has been estimated based on information from projects of a similar scale and preliminary assumptions made regarding the construction staging. For the purpose of this study, the transportable quantities were modified to suit the scope of this Project. The methodology used to identify the Project related quantities to be transported generally consisted of linearly pro-rating the transportable quantities from a project of similar magnitude to reflect the current scope of this Project. In conjunction with the pro-rating methodology, a number of further assumptions were also made for the purpose of the traffic assessments and these assumptions are listed below. The resulting indicative quantities of materials to be transported during the construction phase are highlighted in Table 13.8.

- The amount of water likely to be required for the construction activities has not yet been finalised. However, from experience with similar projects, it has been estimated that approximately 250 mega litres may be needed. It is anticipated that the water will come from groundwater bore holes within the Project Site.
- For the purpose of the assessments, a figure of 80% of gravel extracted on site and 20% hauled from external quarries has been adopted. However, the final amount of gravel to be extracted from within the Project Site is dependent on additional geotechnical investigations to be undertaken prior to detailed design of the Project.
- One electrical sub-station is likely to be required for this Project.

Table 13.8 Indicative quantities of to be transported during the construction phase

Construction activity	Total indicative quantity to be transported	Units
Road materials ^	**107,700**	Cubic metres (m^3)
Concrete aggregates for footings	**51,300**	Cubic metres (m^3)
Reinforcing steel (two deliveries per turbine)	**228**	Deliveries
Other concrete supplies	**10,260**	Cubic metres (m^3)
Construction water #	**250**	Mega litres
Transformers	**3**	each
33kV cabling	**146**	Rolls
Turbine blades (Three blades per turbine)	**345**	Each
Turbine nacelles	**115**	Each
Turbine cooling towers	**115**	Each
Turbine hubs	**115**	Each
Tower sections (Three sections per turbine)	**345**	Each
Substation equipment	**132**	Each
Cranes and other heavy equipment	**64**	Each
Peak construction workforce	**350**	Employees

^ *For the purposes of this traffic assessment, it has been assumed that 20% of the road materials will be imported with the remaining 80% sourced within Project Site.*

 # It has been assumed that construction water will be sourced onsite and hence will not require external transportation.

13.6.1.1 Traffic generation assumptions

As the Project is currently still in the planning and early stages of design, a series of assumptions regarding each of the construction activity categories have been made in determining the number of trips generated along each transport corridor.

Construction equipment

It has been assumed for the purpose of the assessments that construction equipment (cranes, heavy earth moving equipment etc.) will be sourced from Brisbane.

Due to the preliminary phase of the Project, detailed delivery dates and logistics plans are not available. However, the deliveries of construction equipment are unlikely to be all at the same time. It is also expected that construction equipment will vary in size, weight and divisibility depending on the type of equipment being transported.

Hence, for the purposes of this traffic assessment, it is reasonable to assume that, apart from construction related heavy vehicles; there will be over-dimensioned vehicles on the external road network which will require obtaining Excess Mass and Dimension Permits for Class 1 heavy vehicles from DTMR. However, these are likely to be occasional trips and infrequent in occurrence and are not expected to occur over the duration of the construction period.

Furthermore, due to their infrequent nature and the overall small magnitude, these trips are not expected to be critical in terms of traffic operation or pavement impact. As a result, they have not been accounted for in the Traffic Operation Impact and Pavement Impact Assessments (5% analysis). However, the likely impacts arising from these trips (such as impacts on traffic safety due to driver fatigue) will be accounted for as part of the overall Road Use management Plan (RUMP). For further discussion on occasional and infrequent trips and mitigation of their impacts on the road network, see Section 13.6.1.

Construction materials

A number of assumptions have been adopted regarding the transport of construction materials and are described below.

- For all construction materials which have been assumed to be hauled via TC01 (such as aggregates and road materials), four separate transport routes (scenarios) have been assessed. These scenarios relate to the transport of construction materials from Dalby to the Project. For each of the four scenarios, it was assumed that TC01 related construction material traffic would utilise TC01A, TC01B, TC01C and TC01D. That is, Scenario 1 comprises of TC01A, Scenario 2 comprises of TC01B, Scenario 3 comprises of TC01C, Scenario 4 comprises of TC01D
- It has been assumed that any aggregates sourced onsite will be unsuitable for use in concreting. Hence all concrete aggregates have been assumed to be imported from quarries within the region
- As the Project is still conceptual, it isn't possible to identify exactly which quarry or group of quarries will be utilised for extracting road materials and concrete aggregates for footings. Hence, the traffic related to the transport of road materials and concrete aggregates for footings have been distributed equally among the three primary transport corridors (TC01, TC02 and TC03)
- It has been assumed that reinforcing steel and other concrete supplies (such as cement) are sourced equally between Dalby via TC01 and Kingaroy via TC02
- There will potentially be two concrete batch pants on site for producing concrete required for foundations, hardstand areas etc. The equipment for these batch plants will be brought on site once, remain on site and then be demobilised as required and hence movements relating to the batch plants themselves are dealt with as occasional, infrequent trips (see section below)
- For the purposes of this traffic assessment it has been assumed that all construction water will be from within the Project Site. The ultimate water source utilised for the Project will be confirmed in subsequent design phases including the required permits from regional councils
- For the purposes of this traffic assessment it has been assumed that all tower and turbine components will be transported from Brisbane / Port of Brisbane via TC01. Whilst turbines must be sourced internationally via sea, there is potential for the tower sections to be sourced locally from within the region and hence sea transport may not be required. The source of turbine components may be further investigated as part of the assessments in subsequent phases of the Project. However, the deliveries of these components are likely to be limited by the size of the construction fleet and hence are unlikely to be delivered all at once. For the purposes of this assessment, it has been assumed that on the day of the assessment, one of each component type (totalling five components in total; a turbine blade, a nacelle, a cooling tower, a turbine hub and a tower section) will be delivered to the Project Site and stored at a laydown area. Such a transport strategy would ensure that all required components to construct a complete turbine would be present on site at any given time. This would minimise the chance of construction delays on-site as crews would not have to be waiting for components to arrive. Indicative imagery of the progressive transportation of the wind farm components are provided in Chapter 5 Landscape and Visual Assessment.
- It has been assumed that all electrical components such as large transformers, cable spools and sub-station equipment will be transported from Brisbane / Port of Brisbane via TC01. However, as part of the future design, the possibility of these items being sourced from alternative locations may be further investigated. The ultimate decision on where to source the electrical components will be undertaken in subsequent design phases and will depend on various factors, including logistical and economic considerations
- It has been assumed that some proportion of the road materials are likely to be sourced from within the Project Site. For the purposes of this assessment, it has been assumed that approximately 80% of road materials will be sourced from within the Project Site and the balance of material being imported from quarries within the region. However, the percentage split may change subject to further geotechnical investigation in the subsequent phases.

Construction workforce

A number of assumptions have been adopted regarding the transport of construction workforce, which has been listed below.

- For the purpose of the traffic assessments, it has been assumed that all construction workforce will be Drive-In/Drive-Out (DIDO). No Fly-In/Fly-Out (FIFO) workforce has been assumed for the purpose of the traffic assessments
- In order to present a conservative estimate, the entire construction workforce is assumed to travel to the Project Site in private vehicles, every day. It has also been assumed that all employees will travel in individual vehicles and with an occupancy of one person per vehicle
- It has been assumed that all construction crew are based around the townships of Toowoomba, Dalby, Kingaroy, Jandowae and Bell. The construction crew have been assumed to travel to the Project Site via TC01, TC02 and TC03. Furthermore, all workforce utilising TC01 have been assumed to travel from Dalby to the Project Site using the alternative route TC01D. The workforce splits from each of these locations have been assumed to be approximately 10% (Toowoomba), 35% (Dalby), 35% (Kingaroy), 10% (Jandowae) and 10% (Bell). It should be noted that this assumption includes the properties and areas surrounding the townships in addition to within the townships themselves
- In a typical construction project, the construction workforce is likely to vary throughout the project. However, in order to present a conservative estimate of the potential traffic impact, it has been assumed that on the day of the assessment the peak number of construction workforce (350 employees) will be on site.

Vehicle capacity

In order to estimate the traffic generated by the movement of construction materials and workforce, a number of assumptions also had to be made regarding the capacities of construction vehicles.

- It has been assumed for the purposes of this assessment that all road materials, concrete aggregates and other concrete supplies (such as cement) will be transported in 20 m^3 capacity heavy vehicles, likely consisting of truck-trailers (Austroads Class 9 truck-trailer)
- An assumption has been adopted that all reinforcement steel will be transported in Austroads Class 9 prime-mover with semi-trailer, with a capacity of one delivery of reinforcing steel (enough for one turbine footing) per load
- The exact specifications of the vehicle which will be utilised to haul the tower and turbine components are as yet unknown. It has therefore been conservatively assumed that they will have a similar number of axles (hence have a similar effect on pavement condition) to a Large Combination vehicle (Austroads Class 12 triple road train). It has also been assumed that the capacity of these trucks is one component per vehicle
- An assumption has been made that the transmission cabling will be transported on Austroads Class 9 truck-trailers with a capacity of two spools per truck
- It has been assumed that all sub-station equipment will be transported on Austroads Class 9 truck-trailers with a capacity of one piece of heavy equipment per truck.

Occasional infrequent trips

In addition to regular occurrence trips, such as the movement of workforce, there are likely to be a number of occasional but infrequent trips. These occasional trips mainly relate to the movement of large transformers, cranes and other heavy equipment which are expected to be delivered onsite and remain there for the duration of construction.

These trips will primarily relate to the movement of cranes / other heavy construction equipment as well as the movement of turbine components and power transformers. Of these trips, the movement of the turbine components are likely to occur at regular intervals throughout the duration of the Project.

However, the trips relating to the movement of cranes, transformers and other heavy construction equipment are likely to be occasional, infrequent trips. It is expected that these trips would likely occur at the start of the construction period during the mobilisation period when other Project generated traffic is minimal. The equipment would likely stay on site for the duration of the construction period (approximately two to two and a half years) and then be demobilised again at the end of the construction period. Given the infrequent nature of these trips and also because they are not likely to occur when the majority of other materials are being delivered, it would be inappropriate to consider these trips as occurring during the 'typical' construction day.

As the 5% comparison which forms the basis of the Traffic Operation Impact and Pavement Impact analysis, works on the basis of a 'typical' worst case construction these trips have not been included as part of the 5% comparison. However, the impacts which may arise from these trips (such as traffic safety impacts due to driver fatigue) will be considered as part of the wider RUMP.

Over dimensioned vehicles

It has been assumed that the vehicles carrying the power transformers, cranes, heavy construction equipment and turbine components will be considered to be excess dimension vehicles (including vehicles carrying indivisible loads). It is expected that the transport of these materials will not be possible on conventional heavy vehicles due to their indivisible nature and excess dimensions.

As these excess dimension vehicles are likely to be special purpose vehicles which require a pilot or escort, it is likely that a special permit will be required for the transport of these construction equipment and / or components.

DTMR has developed guidelines and policies to facilitate the movement of large vehicles and vehicles carrying large indivisible articles within Queensland in a safe and efficient manner. The regulation mass and dimension rules are described in the *Transport Operations (Road Use Management — Mass, Dimension and Loading) Regulation 2005*. The guidelines provide an exemption from regulations and are considered a legal authority. These guidelines enable access to the road network, in some cases, without the need for obtaining individual permits.

13.6.2 Traffic distribution

Based on the assumptions stated in Section 13.6, Table 13.9 provides the indicative traffic distribution (for each construction activity) adopted for the traffic assessments.

Table 13.9 Indicative traffic distribution profile for each construction activity

Construction activity	% of total quantity transported	Transported via	Transport Corridor
Road materials	100% (of 20% that is imported)	Quarry Site	TC01, TC02 and TC03
Concrete aggregates for footings	100%	Quarry Site	TC01, TC02 and TC03
Reinforcing steel	50%	Dalby	TC01
	50%	Kingaroy	TC02
Other concrete materials	50%	Dalby	TC01
	50%	Kingaroy	TC02
Transformers	100%	Brisbane	TC01
33 kV cabling	100%	Brisbane	TC01
Turbine blades (Three Blades per turbine)	100%	Port of Brisbane	TC01
Nacelles	100%	Port of Brisbane	TC01
Cooling towers	100%	Port of Brisbane	TC01
Turbine hubs	100%	Port of Brisbane	TC01
Tower sections	100%	Port of Brisbane	TC01
Substation equipment	100%	Brisbane	TC01
Cranes and other heavy equipment	100%	Brisbane	TC01
Construction workforce	10%	Toowoomba	TC01
	35%	Dalby	TC01
	35%	Kingaroy	TC02

Construction activity	% of total quantity transported	Transported via	Transport Corridor
	10%	Jandowae	TC03
	10%	Bell	TC01

13.6.3 Forecast project traffic volumes

To determine the total quantity of material, workforce and equipment transported along each of the transport corridors, the material quantities shown in Table 13.8 were distributed among the transport corridors, as per Table 13.9. The likely, total daily, two-way traffic movements along each transport corridor on the day of the assessment were then estimated by applying the assumptions stated in Section 13.6.1.1. The indicative daily total two-way traffic movements (on the day of the assessment) for TC01, TC02 and TC03, are shown in Table 13.10 to Table 13.12. All traffic volumes shown in these tables are the regular occurrence trips which have also been incorporated into the RIA.

In addition to regular occurrence trips, a number of occasional but infrequent trips are also likely to be generated by the Project. These infrequent trips relate to the movement of heavy transformers, cranes and other heavy equipment. It should be noted that these infrequent trips are not expected to occur every day and hence been excluded from the subsequent traffic assessments.

Table 13.10 Daily Project related traffic volumes on TC01 (two-way)

Construction activity	Total daily two-way vehicle trips			
	Light vehicle trips	Heavy vehicle trips	Over dimensioned vehicle trips	Total trips
Road materials *	0	14	0	**14**
Concrete aggregates for footings *	0	6	0	**6**
Reinforcing steel (two deliveries per turbine) *	0	2	0	**2**
Other concrete supplies *	0	2	0	**2**
33 kV cabling *	0	2	0	**2**
Turbine blades (three blades per turbine) *	0	0	2	**2**
Nacelles *	0	0	2	**2**
Cooling towers *	0	0	2	**2**
Turbine hubs *	0	0	2	**2**
Tower sections (three sections per turbine) *	0	0	2	**2**
Substation equipment *	0	4	0	**4**
Construction workforce #	386	0	0	**386**
Total trips	**386**	**30**	**10**	**426**

Not all activities generate the indicated traffic volumes along the entire length of the transport corridor.

For all activities, the average daily trips have been rounded up to the nearest 2 whole trips (along both directions).

* Four scenarios (TC01A, TC01B, TC01C and TC01D) have been assessed for these activities.

The workforce figure includes 10% of construction workforce travelling from Bell who will specifically travel along TC01D.

Table 13.11 Daily Project related traffic volumes on TC02 (two-way)

Construction activity	Total daily two-way vehicle trips			
	Light vehicle trips	Heavy vehicle trips	Over dimensioned vehicle trips	Total trips
Road materials	0	14	0	**14**
Concrete aggregates for footings	0	6	0	**6**
Reinforcing steel (two deliveries per turbine)	0	2	0	**2**
Other concrete supplies	0	2	0	**2**
33 kV cabling	0	0	0	**0**
Turbine blades (three blades per turbine)	0	0	0	**0**
Nacelles	0	0	0	**0**
Cooling towers	0	0	0	**0**
Turbine hubs	0	0	0	**0**
Tower sections (three sections per turbine)	0	0	0	**0**
Substation equipment	0	0	0	**0**
Construction workforce	246	0	0	**246**
Total Trips	246	24	0	**270**

Not all activities generate the indicated traffic volumes along the entire length of the transport corridor.

For all activities, the average daily trips have been rounded up to the nearest 2 whole trips (along both directions).

Table 13.12 Daily Project Related Traffic Volumes on TC03 (Two-Way)

Construction activity	Total daily two-way vehicle trips			
	Light vehicle trips	Heavy vehicle trips	Over dimensioned vehicle trips	Total trips
Road materials	0	14	0	**14**
Concrete aggregates for footings	0	6	0	**6**
Reinforcing steel (two deliveries per turbine)	0	0	0	**0**
Other concrete supplies	0	0	0	**0**
33 kV cabling	0	0	0	**0**
Turbine blades (three blades per turbine)	0	0	0	**0**
Nacelles	0	0	0	**0**
Cooling towers	0	0	0	**0**
Turbine hubs	0	0	0	**0**
Tower sections (three sections per turbine)	0	0	0	**0**
Substation equipment	0	0	0	**0**
Construction workforce	70	0	0	**70**
Total Trips	**70**	**20**	**0**	**90**

Not all activities generate the indicated traffic volumes along the entire length of the transport corridor.

For all activities, the average daily trips have been rounded up to the nearest 2 whole trips (along both directions).

13.6.4 Construction phase road impact assessments

The following sections examine the potential impacts of the Project on the surrounding road network during the construction phase. It is anticipated that the road impacts would primarily be during the construction phase as once constructed, the turbines will require minimum external input to operate outside of general maintenance. It is anticipated that only a small number of contingent workforce will be required during the operational phase of the Project to provide general maintenance of the wind farm infrastructure. Furthermore, it is expected that trips generated during the operational phase will primarily consist of light vehicle trips as opposed to the large numbers of heavy vehicle trips required during the construction phase.

As stipulated in GARID; the following traffic analysis is performed as part of the RIA:

- 5% pavement impact – Comparison of existing ESA with Project related ESA
- 5% traffic impact – Comparison of existing traffic with Project related traffic.

In conjunction with the analysis outlined in GARID, the following additional assessment was also performed:

- Traffic impact by magnitude – Comparison of the magnitude of traffic generated by construction of the Project.

13.6.4.1 Traffic operation impact assessment

This section examines the potential impact of the Project generated traffic on the operation of the existing road network during the construction phase in the context of traffic operation. Overall, four scenarios have been assessed for the traffic operation impact assessment. These scenarios consist of the four alternative transport routes (i.e. TC01A, TC01B, TC01C and TC01D) identified for the movement of construction material and equipment between Dalby and the Project Site. TC02 and TC03 are common to all four scenarios.

Scenario 1 and Scenario 2

Scenario 1 and Scenario 2 assume that all traffic relating to the movement of construction material and equipment (i.e. movement of aggregates, road materials and sub-station equipment) between Dalby and the Project Site will use transport route TC01A and TC01B, respectively.

Under Scenario 1, construction traffic along TC01 will access the Project Site via the one-way clockwise loop between Dalby and the Project Site along Dalby-Jandowae Road, Kingaroy-Jandowae Road and Niagara Road via Jandowae. Construction traffic will then exit the Project Site via Niagara Road and back to Dalby via the Bunya Highway.

Under Scenario 2, construction traffic along TC01 will access the Project Site via the one-way anti-clockwise loop. It describes the same route as per Scenario 1, but in the opposite running direction.

Apart from the directional splits along these road sections, the traffic volumes on these routes are the same for both scenarios. As the results of the traffic impact analysis are the same for both Scenario 1 and Scenario 2, only a single summary table has been presented.

Scenario 3

Scenario 3 assumes that all traffic relating to the movement of construction material between Dalby and the Project Site will utilise transport route TC01C. Under this scenario, construction related traffic will travel between Dalby and the Project Site along Dalby-Jandowae Road through Jandowae, Kingaroy-Jandowae Road and Niagara Road.

Scenario 4

Scenario 4 assumes that all traffic relating to the movement of construction material between Dalby and the Project Site will utilise transport route TC01D. This means that under Scenario 4, such traffic is assumed to travel along the Bunya Highway between Dalby and the Project Site and return via the same route.

Traffic operation impact assessment findings

A summary of the results from the traffic operation impact assessments for Scenario 1 / Scenario 2, Scenario 3 and Scenario 4 are presented in Table 13.13, Table 13.14 and Table 13.15 respectively.

Under Scenarios 1 and 2, the results indicate that all segments of the Bunya Highway (45A), Kingaroy-Jandowae Road (424) and Niagara Road (RCR-1) will be equal to or in excess of 5% of the background AADT.

Under Scenario 3, the results indicate that all segments of the Bunya Highway (45A), Kingaroy-Jandowae Road (424) and Niagara Road (RCR-1) as well as some sections of Dalby-Jandowae Road (421), will be equal to or in excess of 5% of the background AADT.

Under Scenario 4, the results indicated that all segments of the Bunya Highway (45A), Kingaroy-Jandowae Road (424) and Niagara Road (RCR-1) will be equal to or in excess of 5% of the background AADT.

The assessment found that under all four scenarios, the Bunya Highway (45A), Kingaroy-Jandowae Road (424) and Niagara Road (RCR-1) are likely to be impacted as a result of the Project. Some parts of Dalby-Jandowae Road (421) are also likely to be affected in certain scenarios. The worst affected road in terms of percentage impact is likely to be Niagara Road (RCR-1), as Niagara road is the main access road connecting the Project to the external road network and hence the terminus point of all transport corridors.

For the purpose of the assessments, light vehicles have been assumed to be the main mode of transport by construction workforce travelling to and from the site each day. As indicated in Table 13.10, Table 13.11 and Table 13.12, the total number of daily two-way trips relating to the movement of workforce is approximately 702 trips in total.

Hence whilst some road sections are likely to be over 5%, the majority of vehicle trips generated by the Project are likely to be light vehicle trips only which are unlikely to significantly impact traffic operations based on the overall magnitude of traffic likely to be generated. Furthermore, the construction traffic generated by the Project will only be generated over a relatively short construction period.

Table 13.13 Summary of traffic operation impact assessment results – for Scenario 1 and 2

			Available traffic data			'Existing' 2016 traffic data	Traffic operation impact assessment	
DTMR section ID	Sub-section ID	Road name	Count year	AADT	Annual growth factor	AADT	Increase in AADT from Existing	Per cent increase in AADT from Existing
18B	18B-1	Warrego Highway (Toowoomba to Dalby)	2015	20,863	2.51%	21,387	106	1%
	18B-2	Warrego Highway (Toowoomba to Dalby)	2015	15,306	1.17%	15,485	106	1%
	18B-3	Warrego Highway (Toowoomba to Dalby)	2015	10,457	1.17%	10,579	106	1%
	18B-4	Warrego Highway (Toowoomba to Dalby)	2015	20,549	9.40%	22,481	106	1%
	18B-5	Warrego Highway (Toowoomba to Dalby)	2015	13,515	1.14%	13,669	106	1%
	18B-6	Warrego Highway (Toowoomba to Dalby)	2015	12,066	0.00%	12,066	106	1%
	18B-7	Warrego Highway (Toowoomba to Dalby)	2015	9,332	0.00%	9,332	106	1%
	18B-8	Warrego Highway (Toowoomba to Dalby)	2015	3,689	0.00%	3,689	106	3%
	18B-9	Warrego Highway (Toowoomba to Dalby)	2015	5,469	0.00%	5,469	106	2%
	18B-10	Warrego Highway (Toowoomba to Dalby)	2015	7,019	0.00%	7,019	106	2%
	18B-11	Warrego Highway (Toowoomba to Dalby)	2015	12,417	0.00%	12,417	106	1%
45A	45A-1	Bunya Highway (Dalby to Kingaroy)	2015	4,097	0.00%	4,097	336	8%
	45A-2	Bunya Highway (Dalby to Kingaroy)	2015	2276	9.71%	2,497	336	14%
	45A-3	Bunya Highway (Dalby to Kingaroy)	2015	836	1.37%	847	406	48%
	45A-4	Bunya Highway (Dalby to Kingaroy)	2015	588	0.77%	593	406	69%
	45A-5	Bunya Highway (Dalby to Kingaroy)	2015	747	0.00%	747	696	93%
	45A-6	Bunya Highway (Dalby to Kingaroy)	2015	1,084	1.05%	1,095	270	25%

Table 13.13 Summary of traffic operation impact assessment results – for Scenario 1 and 2

			Available traffic data			'Existing' 2016 traffic data	Traffic operation impact assessment	
DTMR section ID	Sub-section ID	Road name	Count year	AADT	Annual growth factor	AADT	Increase in AADT from Existing	Per cent increase in AADT from Existing
	45A-7	Bunya Highway (Dalby to Kingaroy)	2015	2,488	1.09%	2,515	270	11%
	45A-8	Bunya Highway (Dalby to Kingaroy)	2015	4,634	0.36%	4,651	270	6%
421	421-1	Dalby - Jandowae Road	2015	1,918	5.28%	2,019	20	1%
	421-2	Dalby - Jandowae Road	2015	929	0.00%	929	22	2%
	421-3	Dalby - Jandowae Road	2015	687	0.00%	687	20	3%
424	424-1	Kingaroy-Jandowae Road	2014	105	3.96%	113	110	97%
RCR	RCR-1	Niagara Road	2014	38	0.00%	38	766	2016%

Table 13.14 Summary of traffic operation impact assessment results – for Scenario 3

			Available traffic data			'Existing' 2016 traffic data	Traffic operation impact assessment	
DTMR section ID	Sub-section ID	Road name	Count year	AADT	Annual growth factor	AADT	Increase in AADT from Existing	Per cent increase in AADT from Existing
18B	18B-1	Warrego Highway (Toowoomba to Dalby)	2015	20,863	2.51%	21,387	106	1%
	18B-2	Warrego Highway (Toowoomba to Dalby)	2015	15,306	1.17%	15,485	106	1%
	18B-3	Warrego Highway (Toowoomba to Dalby)	2015	10,457	1.17%	10,579	106	1%
	18B-4	Warrego Highway (Toowoomba to Dalby)	2015	20,549	9.40%	22,481	106	1%
	18B-5	Warrego Highway (Toowoomba to Dalby)	2015	13,515	1.14%	13,669	106	1%
	18B-6	Warrego Highway (Toowoomba to Dalby)	2015	12,066	0.00%	12,066	106	1%
	18B-7	Warrego Highway (Toowoomba to Dalby)	2015	9,332	0.00%	9,332	106	1%
	18B-8	Warrego Highway (Toowoomba to Dalby)	2015	3,689	0.00%	3,689	106	3%
	18B-9	Warrego Highway (Toowoomba to Dalby)	2015	5,469	0.00%	5,469	106	2%
	18B-10	Warrego Highway (Toowoomba to Dalby)	2015	7,019	0.00%	7,019	106	2%
	18B-11	Warrego Highway (Toowoomba to Dalby)	2015	12,417	0.00%	12,417	106	1%
45A	45A-1	Bunya Highway (Dalby to Kingaroy)	2015	4,097	0.00%	4,097	316	8%
	45A-2	Bunya Highway (Dalby to Kingaroy)	2015	2276	9.71%	2,497	316	13%
	45A-3	Bunya Highway (Dalby to Kingaroy)	2015	836	1.37%	847	386	46%
	45A-4	Bunya Highway (Dalby to Kingaroy)	2015	588	0.77%	593	386	65%
	45A-5	Bunya Highway (Dalby to Kingaroy)	2015	747	0.00%	747	696	93%
	45A-6	Bunya Highway (Dalby to Kingaroy)	2015	1,084	1.05%	1,095	270	25%

Table 13.14 Summary of traffic operation impact assessment results – for Scenario 3

			Available traffic data			'Existing' 2016 traffic data	Traffic operation impact assessment	
DTMR section ID	Sub-section ID	Road name	Count year	AADT	Annual growth factor	AADT	Increase in AADT from Existing	Per cent increase in AADT from Existing
	45A-7	Bunya Highway (Dalby to Kingaroy)	2015	2,488	1.09%	2,515	270	11%
	45A-8	Bunya Highway (Dalby to Kingaroy)	2015	4,634	0.36%	4,651	270	6%
421	421-1	Dalby - Jandowae Road	2015	1,918	5.28%	2,019	40	2%
	421-2	Dalby - Jandowae Road	2015	929	0.00%	929	40	4%
	421-3	Dalby - Jandowae Road	2015	687	0.00%	687	40	6%
424	424-1	Kingaroy-Jandowae Road	2014	105	3.96%	113	130	115%
RCR	RCR-1	Niagara Road	2014	38	0.00%	38	786	2068%

Table 13.15 Summary of traffic operation impact assessment results – for Scenario 4

			Available traffic data			'Existing' 2016 traffic data	Traffic operation impact assessment	
DTMR section ID	Sub-section ID	Road name	Count year	AADT	Annual growth factor	AADT	Increase in AADT from Existing	Per cent increase in AADT from Existing
18B	18B-1	Warrego Highway (Toowoomba to Dalby)	2015	20,863	2.51%	21,387	106	1%
	18B-2	Warrego Highway (Toowoomba to Dalby)	2015	15,306	1.17%	15,485	106	1%
	18B-3	Warrego Highway (Toowoomba to Dalby)	2015	10,457	1.17%	10,579	106	1%
	18B-4	Warrego Highway (Toowoomba to Dalby)	2015	20,549	9.40%	22,481	106	1%
	18B-5	Warrego Highway (Toowoomba to Dalby)	2015	13,515	1.14%	13,669	106	1%
	18B-6	Warrego Highway (Toowoomba to Dalby)	2015	12,066	0.00%	12,066	106	1%
	18B-7	Warrego Highway (Toowoomba to Dalby)	2015	9,332	0.00%	9,332	106	1%
	18B-8	Warrego Highway (Toowoomba to Dalby)	2015	3,689	0.00%	3,689	106	3%
	18B-9	Warrego Highway (Toowoomba to Dalby)	2015	5,469	0.00%	5,469	106	2%
	18B-10	Warrego Highway (Toowoomba to Dalby)	2015	7,019	0.00%	7,019	106	2%
	18B-11	Warrego Highway (Toowoomba to Dalby)	2015	12,417	0.00%	12,417	106	1%
45A	45A-1	Bunya Highway (Dalby to Kingaroy)	2015	4,097	0.00%	4,097	356	9%
	45A-2	Bunya Highway (Dalby to Kingaroy)	2015	2276	9.71%	2,497	356	14%
	45A-3	Bunya Highway (Dalby to Kingaroy)	2015	836	1.37%	847	426	50%
	45A-4	Bunya Highway (Dalby to Kingaroy)	2015	588	0.77%	593	426	72%
	45A-5	Bunya Highway (Dalby to Kingaroy)	2015	747	0.00%	747	696	93%
	45A-6	Bunya Highway (Dalby to Kingaroy)	2015	1,084	1.05%	1,095	270	25%

Table 13.15 Summary of traffic operation impact assessment results – for Scenario 4

			Available traffic data			'Existing' 2016 traffic data	Traffic operation impact assessment	
DTMR section ID	Sub-section ID	Road name	Count year	AADT	Annual growth factor	AADT	Increase in AADT from Existing	Per cent increase in AADT from Existing
	45A-7	Bunya Highway (Dalby to Kingaroy)	2015	2,488	1.09%	2,515	270	11%
	45A-8	Bunya Highway (Dalby to Kingaroy)	2015	4,634	0.36%	4,651	270	6%
421	421-1	Dalby - Jandowae Road	2015	1,918	5.28%	2,019	0	0%
	421-2	Dalby - Jandowae Road	2015	929	0.00%	929	0	0%
	421-3	Dalby - Jandowae Road	2015	687	0.00%	687	0	0%
424	424-1	Kingaroy-Jandowae Road	2014	105	3.96%	113	90	79%
RCR	RCR-1	Niagara Road	2014	38	0.00%	38	786	2068%

13.6.4.2 Pavement impact assessment

A preliminary desktop analysis, based on the GARID has been conducted to identify the likely magnitude of pavement impacts on the SCRs and RCRs due to the additional heavy vehicle movements generated by the Project.

Similarly to the Traffic Operation Impact Assessment (see Section 13.6.4.1), four scenarios have been assessed for the Pavement Impact Assessment. These scenarios consist of the four alternative transport routes (i.e. TC01A, TC01B, TC01C and TC01D) identified for the movement of construction material and equipment between Dalby and the Project Site.

Assumptions

For the purpose of pavement impact assessments, assumptions were made to generate the background as well as the development related traffic loadings. For each segment of the road pavement, several parameters were defined based on assumption, estimation or through calculation using appropriate data. These include the average annual daily traffic (AADT) for both the background and the Project related construction traffic, Lane Distribution Factor (LDF), Equivalent Standard Axles per Heavy Vehicle (ESA/HV) and the Directional Factor (DF).

In addition to the assumptions described in Section 13.6, the following assumptions were adopted for the preliminary pavement impact assessments:

- For the purposes of the traffic analysis, an ESA/HV value of 3.2 was adopted for the background traffic for all road segments under investigation (previously indicated by TMR as being appropriate for all roads other than the Bruce Highway). However, this value may be updated during subsequent detailed design phases of the Project when a more detailed pavement impact assessment will be conducted
- For the construction activities, three vehicle types have been adopted for the Project:
    1. Over Dimensioned / Heavy Mass Limit vehicles (assumed to be similar to Austroads Class 12)
    2. Six-axle, truck-trailer vehicles (Austroads Class 9)
    3. Light vehicles (Austroads Class 1)

    For each of these vehicle types a combined bi-directional ESA/HV value has been adopted and are summarised in Table 13.16.
- As the majority of the transport routes assessed only consist of one traffic lane in each direction, the Lane Distribution Factor (LDF) has been assumed to be equal to one, which signifies that all heavy vehicles will utilise the left hand lane where there is more than one lane in each direction
- The transport of cranes and other heavy construction equipment and transformers has been assumed to be transported by a mixture of over dimensioned vehicles and six-axle truck-trailer vehicles. However, as these trips are infrequent and not expected to be a daily occurrence they have not been accounted for as part of the PIA (see Section 13.6.1.1 for additional discussion).

Table 13.16 ESA multiplier factors for development traffic

Construction activity	Typical construction vehicle (AustRoads vehicle class)	ESA/HV factor adopted for assessment #
Turbine blades (Three blades per turbine)	Over Dimensioned / Higher Mass Limit Vehicle (Special Permit Vehicle)	12.33
Nacelles		12.33
Cooling towers		12.33
Turbine hubs		12.33
Tower sections (Three sections per turbine)		12.33
Road materials	6 Axle – Truck-Trailer (AustRoads Class 9)	5.44
Concrete aggregates for footings		5.44

Construction activity	Typical construction vehicle (AustRoads vehicle class)	ESA/HV factor adopted for assessment #
Reinforcing steel (Two deliveries per turbine)		5.44
Other concrete supplies		5.44
33 kV cabling		5.44
Substation equipment		5.44
Peak construction workforce	2 Axle – Short (Light) Vehicles (AustRoads Class 1)	1.00
Occasional trips		
Cranes and other heavy equipment*	Over Dimensioned / Higher Mass Limit Vehicle (Special Permit Vehicle) and 6 Axle – Truck-Trailer (AustRoads Class 9)	Not assessed
Transformers*	6 Axle – Truck-Trailer (AustRoads Class 9)	Not assessed

* As the trips relating to the movement of transformers, cranes and other heavy construction equipment are expected to be infrequent (i.e. occasional trips), they have not been included as part of the pavement impact assessment.

ESA / HV Figures have been derived from allowable axle loading calculations.

The adopted ESA/HV conversion factors are considered to be conservative estimates as a distinction between the laden and unladed direction has not been made. Instead, for the purpose of this assessment, the same ESA multiplier factor has been applied to both directions (denoting vehicles travelling in both directions are laden).

Pavement impact assessment findings

A summary of the results from the pavement impact assessments carried out for Scenarios 1 to 4 are provided in Table 13.17, Table 13.18 and Table 13.19.

The results of the analysis indicate that all segments of the Bunya Highway (45A), Kingaroy-Jandowae Road (424) and Niagara Road and one isolated section of the Warrego Highway (18B-8) will be over 5% of the background ESA under all four scenarios. Under Scenario 1, Scenario 2 and Scenario 3, sections of Dalby-Jandowae Road (421) will also potentially be over 5% of the background AADT. Under all four scenarios, the worst affected road in terms of percentage impact is likely to be Niagara Road (RCR-1), as Niagara road is the main access road for the Project Site. It should also be noted that the very large percentage impact indicated along Niagara Road (RCR-1) is due to the low background traffic volumes. The estimated 2016 two-way traffic volume along Niagara Road is only 38 (58 ESA) vehicles per day.

Based on the estimated traffic generation for the various construction activities, the total number of trips relating to the movement of workforce along the transport corridors is approximately 702 trips in total (as shown in Table 13.10, Table 13.11 and Table 13.12). For the purpose of the traffic assessments, these trips are assumed to be light vehicles mainly related to construction workforce travelling to and from the Project Site each day.

Hence whilst some road sections are likely to be over 5%, it should be noted that the majority of the trips are likely to be light vehicle trips which are likely to only cause very minor degradation in pavement conditions. Furthermore, due to the relatively short construction duration, the additional ESAs generated by the Project's construction traffic will only be present for a limited duration of time.

Table 13.17 Summary of pavement impact assessment – for Scenario 1 and 2

			Available traffic data			'Existing' 2016 traffic data		Traffic operation impact assessment	
DTMR section ID	Segment ID	Road name	Count year	AADT	Annual growth factor	AADT	Background traffic ESA	Magnitude of development related ESA	Per cent increase in ESA from Existing
18B	18B-1	Warrego Highway (Toowoomba to Dalby)	2015	20,863	2.51%	21,387	26,873	335	1%
	18B-2	Warrego Highway (Toowoomba to Dalby)	2015	15,306	1.17%	15,485	21,484	335	2%
	18B-3	Warrego Highway (Toowoomba to Dalby)	2015	10,457	1.17%	10,579	12,634	335	3%
	18B-4	Warrego Highway (Toowoomba to Dalby)	2015	20,549	9.40%	22,481	26,210	335	1%
	18B-5	Warrego Highway (Toowoomba to Dalby)	2015	13,515	1.14%	13,669	16,986	335	2%
	18B-6	Warrego Highway (Toowoomba to Dalby)	2015	12,066	0.00%	12,066	16,895	335	2%
	18B-7	Warrego Highway (Toowoomba to Dalby)	2015	9,332	0.00%	9,332	13,264	335	3%
	18B-8	Warrego Highway (Toowoomba to Dalby)	2015	3,689	0.00%	3,689	5,427	335	6%
	18B-9	Warrego Highway (Toowoomba to Dalby)	2015	5,469	0.00%	5,469	8,571	335	4%
	18B-10	Warrego Highway (Toowoomba to Dalby)	2015	7,019	0.00%	7,019	10,618	335	3%
	18B-11	Warrego Highway (Toowoomba to Dalby)	2015	12,417	0.00%	12,417	16,924	335	2%
45A	45A-1	Bunya Highway (Dalby to Kingaroy)	2015	4,097	0.00%	4,097	5,230	460	9%
	45A-2	Bunya Highway (Dalby to Kingaroy)	2015	2276	9.71%	2,497	3,197	460	14%
	45A-3	Bunya Highway (Dalby to Kingaroy)	2015	836	1.37%	847	1,226	530	43%
	45A-4	Bunya Highway (Dalby to Kingaroy)	2015	588	0.77%	593	952	530	56%
	45A-5	Bunya Highway (Dalby to Kingaroy)	2015	747	0.00%	747	1,095	1005	92%
	45A-6	Bunya Highway (Dalby to Kingaroy)	2015	1,084	1.05%	1,095	1,516	332	22%

Table 13.17 Summary of pavement impact assessment – for Scenario 1 and 2

			Available traffic data			'Existing' 2016 traffic data		Traffic operation impact assessment	
DTMR section ID	Segment ID	Road name	Count year	AADT	Annual growth factor	AADT	Background traffic ESA	Magnitude of development related ESA	Per cent increase in ESA from Existing
	45A-7	Bunya Highway (Dalby to Kingaroy)	2015	2,488	1.09%	2,515	3,253	332	10%
	45A-8	Bunya Highway (Dalby to Kingaroy)	2015	4,634	0.36%	4,651	5,688	332	6%
421	421-1	Dalby - Jandowae Road	2015	1,918	5.28%	2,019	2,723	143	5%
	421-2	Dalby - Jandowae Road	2015	929	0.00%	929	1,295	143	11%
	421-3	Dalby - Jandowae Road	2015	687	0.00%	687	949	322	34%
424	424-1	Kingaroy-Jandowae Road	2014	105	3.96%	113	146	322	220%
RCR	RCR-1	Niagara Road	2014	38	0.00%	38	58	1040	1798%

Table 13.18 Summary of pavement impact assessment – for Scenario 3

			Available traffic data			'Existing' 2016 traffic data		Traffic operation impact assessment	
DTMR section ID	Segment ID	Road name	Count year	AADT	Annual growth factor	AADT	Background traffic ESA	Magnitude of development related ESA	Per cent increase in ESA from Existing
18B	18B-1	Warrego Highway (Toowoomba to Dalby)	2015	20,863	2.51%	21,387	26,873	335	1%
	18B-2	Warrego Highway (Toowoomba to Dalby)	2015	15,306	1.17%	15,485	21,484	335	2%
	18B-3	Warrego Highway (Toowoomba to Dalby)	2015	10,457	1.17%	10,579	12,634	335	3%
	18B-4	Warrego Highway (Toowoomba to Dalby)	2015	20,549	9.40%	22,481	26,210	335	1%
	18B-5	Warrego Highway (Toowoomba to Dalby)	2015	13,515	1.14%	13,669	16,986	335	2%
	18B-6	Warrego Highway (Toowoomba to Dalby)	2015	12,066	0.00%	12,066	16,895	335	2%
	18B-7	Warrego Highway (Toowoomba to Dalby)	2015	9,332	0.00%	9,332	13,264	335	3%
	18B-8	Warrego Highway (Toowoomba to Dalby)	2015	3,689	0.00%	3,689	5,427	335	6%
	18B-9	Warrego Highway (Toowoomba to Dalby)	2015	5,469	0.00%	5,469	8,571	335	4%
	18B-10	Warrego Highway (Toowoomba to Dalby)	2015	7,019	0.00%	7,019	10,618	335	3%
	18B-11	Warrego Highway (Toowoomba to Dalby)	2015	12,417	0.00%	12,417	16,924	335	2%
45A	45A-1	Bunya Highway (Dalby to Kingaroy)	2015	4,097	0.00%	4,097	5,230	317	6%
	45A-2	Bunya Highway (Dalby to Kingaroy)	2015	2276	9.71%	2,497	3,197	317	10%
	45A-3	Bunya Highway (Dalby to Kingaroy)	2015	836	1.37%	847	1,226	387	32%
	45A-4	Bunya Highway (Dalby to Kingaroy)	2015	588	0.77%	593	952	387	41%
	45A-5	Bunya Highway (Dalby to Kingaroy)	2015	747	0.00%	747	1,095	1005	92%
	45A-6	Bunya Highway (Dalby to Kingaroy)	2015	1,084	1.05%	1,095	1,516	332	22%

Table 13.18 Summary of pavement impact assessment – for Scenario 3

			Available traffic data			'Existing' 2016 traffic data		Traffic operation impact assessment	
DTMR section ID	Segment ID	Road name	Count year	AADT	Annual growth factor	AADT	Background traffic ESA	Magnitude of development related ESA	Per cent increase in ESA from Existing
	45A-7	Bunya Highway (Dalby to Kingaroy)	2015	2,488	1.09%	2,515	3,253	332	10%
	45A-8	Bunya Highway (Dalby to Kingaroy)	2015	4,634	0.36%	4,651	5,688	332	6%
421	421-1	Dalby - Jandowae Road	2015	1,918	5.28%	2,019	2,723	287	11%
	421-2	Dalby - Jandowae Road	2015	929	0.00%	929	1,295	287	22%
	421-3	Dalby - Jandowae Road	2015	687	0.00%	687	949	287	30%
424	424-1	Kingaroy-Jandowae Road	2014	105	3.96%	113	146	466	318%
RCR	RCR-1	Niagara Road	2014	38	0.00%	38	58	1183	2046%

Table 13.19 Summary of pavement impact assessment – for Scenario 4

			Available traffic data			'Existing' 2016 traffic data		Traffic operation impact assessment	
DTMR section ID	Segment ID	Road name	Count year	AADT	Annual growth factor	AADT	Background traffic ESA	Magnitude of development related ESA	Per cent increase in ESA from Existing
18B	18B-1	Warrego Highway (Toowoomba to Dalby)	2015	20,863	2.5%	21,387	26,873	335	1%
	18B-2	Warrego Highway (Toowoomba to Dalby)	2015	15,306	1.2%	15,485	21,484	335	2%
	18B-3	Warrego Highway (Toowoomba to Dalby)	2015	10,457	1.2%	10,579	12,634	335	3%
	18B-4	Warrego Highway (Toowoomba to Dalby)	2015	20,549	9.4%	22,481	26,210	335	1%
	18B-5	Warrego Highway (Toowoomba to Dalby)	2015	13,515	1.1%	13,669	16,986	335	2%
	18B-6	Warrego Highway (Toowoomba to Dalby)	2015	12,066	0.0%	12,066	16,895	335	2%
	18B-7	Warrego Highway (Toowoomba to Dalby)	2015	9,332	0.0%	9,332	13,264	335	3%
	18B-8	Warrego Highway (Toowoomba to Dalby)	2015	3,689	0.0%	3,689	5,427	335	6%
	18B-9	Warrego Highway (Toowoomba to Dalby)	2015	5,469	0.0%	5,469	8,571	335	4%
	18B-10	Warrego Highway (Toowoomba to Dalby)	2015	7,019	0.0%	7,019	10,618	335	3%
	18B-11	Warrego Highway (Toowoomba to Dalby)	2015	12,417	0.0%	12,417	16,924	335	2%
45A	45A-1	Bunya Highway (Dalby to Kingaroy)	2015	4,097	0.0%	4,097	5,230	603	12%
	45A-2	Bunya Highway (Dalby to Kingaroy)	2015	2276	9.7%	2,497	3,197	603	19%
	45A-3	Bunya Highway (Dalby to Kingaroy)	2015	836	1.4%	847	1,226	673	55%
	45A-4	Bunya Highway (Dalby to Kingaroy)	2015	588	0.8%	593	952	673	71%
	45A-5	Bunya Highway (Dalby to Kingaroy)	2015	747	0.0%	747	1,095	1005	92%
	45A-6	Bunya Highway (Dalby to Kingaroy)	2015	1,084	1.1%	1,095	1,516	332	22%

Table 13.19 Summary of pavement impact assessment – for Scenario 4

			Available traffic data			'Existing' 2016 traffic data		Traffic operation impact assessment	
DTMR section ID	Segment ID	Road name	Count year	AADT	Annual growth factor	AADT	Background traffic ESA	Magnitude of development related ESA	Per cent increase in ESA from Existing
	45A-7	Bunya Highway (Dalby to Kingaroy)	2015	2,488	1.1%	2,515	3,253	332	10%
	45A-8	Bunya Highway (Dalby to Kingaroy)	2015	4,634	0.4%	4,651	5,688	332	6%
421	421-1	Dalby - Jandowae Road	2015	1,918	5.3%	2,019	2,723	0	0%
	421-2	Dalby - Jandowae Road	2015	929	0.0%	929	1,295	0	0%
	421-3	Dalby - Jandowae Road	2015	687	0.0%	687	949	0	0%
424	424-1	Kingaroy-Jandowae Road	2014	105	4.0%	113	146	179	122%
RCR	RCR-1	Niagara Road	2014	38	0.0%	38	58	1183	2046%

13.6.5 Operational phase impact assessment

During the operational phase, the expected impact on the regional road network will be limited to the movement of operational and maintenance workforce. It is anticipated that only a small workforce will be required during the operational phase of the Project to provide general maintenance of the Project infrastructure. This workforce has been assumed to travel to the Project Site each day via private vehicles with no carpooling.

For the purpose of the traffic assessments, it has been assumed that the operational workforce will follow the same distribution assumption adopted for the construction workforce. The distribution proportions of the workforce are 10% (Toowoomba), 35% (Dalby), 35% (Kingaroy), 10% (Jandowae) and 10% (Bell). As the only trips are expected to be a small number of light vehicle trips, the potential impact of operational traffic along any of the SCRs is not considered to be significant in terms of pavement or traffic operational impacts.

Along the RCRs, the operational traffic may potentially exceed 5% of the background ESA and background AADT along Niagara Road (RCR-1). This may occur because of the low background traffic volumes along this road rather than a large number of Project generated trips. Moreover, the order of magnitude of the traffic impact is likely to be significantly less compared to during the construction phase. As such, if the appropriate construction phase mitigation measures are implemented, then it is expected that they will also be sufficient to ameliorate any traffic impacts during the operational phase.

In addition to regular maintenance workforce, from time to time, major maintenance may be required. During these particular maintenance tasks, additional workforce may be required at the Project Site. There is also a potential requirement for additional construction equipment and materials during these times. However, these major maintenance tasks are likely to be temporary in nature and are not expected to be a regular occurrence. DTMR and other relevant authorities will be consulted prior to any major maintenance events and appropriate temporary traffic management measures will be implemented. Additionally, the distribution as well as the total workforce requirements will be further refined (as required) in the subsequent design phases.

13.6.6 Intersection analysis

The impacts of the Project on road intersections have not been considered in detail at this stage of the Project's development. This is because detailed intersection analysis is deemed not warranted until the Project generated traffic volumes, vehicle routes and vehicle types (size and type of heavy vehicles, especially over-size and over-mass vehicles) are better defined. A summary of the intersection types and key intersections affected by the transport corridors assumed for this assessment are summarised in the sections below. Once the construction activities and the overall freight task associated with the Project is better defined in future design phases, subsequent to consultation DTMR and Regional Councils, more detailed intersection analysis may be undertaken.

13.6.6.1 External road network intersections

The key transport corridors for the transportation of materials, workforce and equipment assumed for this assessment have been identified in Section 13.5.7.2. From these transport corridors, key intersections have been identified which might potentially be affected by the Project related traffic. These key intersections are:

1. Warrego Highway / Bunya Highway.
2. Bunya Highway / Niagara Road.
3. Kingaroy-Jandowae Road / Niagara Road.
4. Dalby-Jandowae Road (High Street) / George Street (Kingaroy-Jandowae Road).
5. Kingaroy-Jandowae Road / George Street.

The intersection at Warrego Highway / Bunya Highway is currently a four-approach signalised intersection with two lanes per approach.

The intersection at Bunya Highway / Niagara Road is a sealed T-intersection with no additional protected turning pockets or deceleration lanes.

The intersection at Kingaroy-Jandowae Road / Niagara Road is a sealed T-intersection with no additional protected turning pockets or deceleration lanes.

The remaining two intersections at Dalby-Jandowae Road / George Street and at Kingaroy-Jandowae Road / George Street are priority intersections.

At this stage of the Project a detailed intersection analysis is not warranted as the Project generated traffic has been estimated at a concept level. In future design phases additional intersection analysis may be undertaken if requested by DTMR and regional councils once the Project's transport requirements are further refined. The types of intersection analysis which may be undertaken (if any) could include, capacity analysis, turning lane warrant analysis and / or swept path analysis.

13.6.6.2 Site access

Based on the assumed transport corridors outlined in Section 13.5.7.2 and for the purpose of this assessment, it has been assumed that access to the Project Site will primarily be provided along Niagara Road (RCR-1). Moreover, in view of the spread of the Project Site, it is anticipated that more than one site access will be required, with some site accesses possibly along other local council roads.

At this stage of the Project, detailed construction scheduling and transport logistics plans have not yet been completed. As a result, final details such as the volume of additional traffic, movements at the site access points as well as during which time frame have not been considered. The assessment presented throughout this chapter primarily focused on the traffic impacts at a road-link level (five percent comparison). In the detailed design stage and prior to the commencement of construction, once the finer details of construction are better understood, these assumptions will be reviewed and updated if necessary.

However whilst detailed assessment has not been undertaken, owing to the relatively low overall traffic volumes, it is not anticipated that site access intersections will experience significant capacity issues. Furthermore, as numerous site access locations are likely to be utilised, the Project generated traffic will be spread over more than one site access.

As such, the primary impact at the site access locations is likely to be operational safety as the Project will increase the number of turning heavy vehicles at these minor intersections. In subsequent design phases, as the site access arrangements and traffic volumes per access location are better understood, intersection safety checks will be undertaken. This will include reviewing available crash data at each location as well as determining the adequacy of the sight lines. Traffic management measures such as additional signage and advanced warning of turning heavy vehicles will also be considered.

13.6.7 Other road impacts

As part of the traffic and transport impact assessments, other road impacts were also considered. The impacts include the operation of school bus routes as well as stock routes and are briefly discussed in this section.

13.6.7.1 School bus routes

A preliminary review of the school bus routes based on information that was readily available online indicated that there are a number of school bus routes which intersect the proposed transport corridors. It should be noted that this preliminary search is not exhaustive and prior to the commencement of construction activities, regional councils and bus operators will be consulted and mitigation measures identified to minimise the impacts on the school bus routes.

The majority of the school bus routes identified are around the major towns and population centres along the transport corridors (namely Dalby, Cooranga, Bell, and Kingaroy). It is not expected that school bus routes will be adversely affected as a result of the Project due to the short operational period of the school buses during the day.

School bus operators will be consulted as part of the community communication strategy and made aware of the various construction activities. The contractors will also be made aware of the presence of school bus routes and their operational hours as part of the Project induction process.

In subsequent stages, traffic management plans will be developed for the various construction activities affecting the existing traffic operations and included as part of a RUMP and/or Traffic Management Plan (TMP). This will include identifying the possible impacts on school bus routes and if required, temporary traffic mitigation measures to be provided during the construction phase. However, based on the relatively low number of heavy vehicle movements expected per day, the impacts on school bus routes are expected to be minimal. Following discussions with key stakeholders such as regional councils and bus operators, if it is deemed to be necessary, potential mitigation measures such as restricting or controlling movement of heavy vehicles during the school bus hours will be imposed where possible.

A summary of the identified school bus routes which intersect the Project Transport corridors are summarised in Table 13.20.

Table 13.20 Potentially affected school bus routes

Bus service ID	Service name	Operator	Impacting Transport Corridor
S123	Bowenville to Dalby State High School	Bowenville Motors	TC01
P147	Irvingdale to Dalby State School	Stonestreet's Coaches	TC01
S152	Kaimkillenbun to Dalby State High School	A.J. & M.A. Johnston	TC01
P218	Nandi to Dalby State School	Brigalow Park Pty Ltd	TC01
P353	Spring Meadows to Dalby South State School	Stonestreet's Coaches	TC01
P378	Oakleigh Park to Dalby South State School	Oakleigh Park Pty Ltd	TC01
P492	Malakoff to Dalby State School	Stonestreet's Coaches	TC01
S525	Bell to Dalby State High School	Stonestreet's Coaches	TC01
P585	Norbell to Bell State School	G.L. & C.M. Patch	TC01
P756	St Ruth to Dalby South State School	Stonestreet's Coaches	TC01
P1389	Branch Creek to Dalby South State School	Stonestreet's Coaches	TC01
S113	Cooranga and Bell to Bell State School	D.S. & L.J. Caldwell	TC01 and TC02
S16	Kumbia to Kingaroy State School	Coast & Country Buses	TC02
S664	Kumbia to Kingaroy State High School	Coast & Country Buses	TC02
P729	Stuart Valley to Taabinga State School and Kingaroy State School	A.R. & T.M. Peebles	TC02
P1724	Taabinga Village to Taabinga State School - Kingaroy	Edenvale Enterprises Pty Ltd	TC02
S136	Bushgrove to Jandowae State School	D.J. Schultz	TC03

Source Reference: http://www.qldbuses.info

13.6.7.2 Stock routes

As discussed in Section 13.5.2, SBRC identifies, within PSP No. 8 of the former Kingaroy Shire Council (2006) Planning Scheme, a Stock Route that runs through the Project Site. This route runs along the road reserve of Ironpot Creek Road from the intersection of Niagara Road / Ironpot Creek Road to the intersection of Ironpot Creek Road / Sarum Road where it continues north along Sarum Road out of the Project Site.

As Ironpot Creek Road and Sarum Road are not part of the Project transport corridors, it is not expected that the Project will adversely impact these roads. However, during the subsequent stages of this Project, discussions will be held with relevant Regional Councils and other affected parties regarding the Project's potential impact on stock routes in order to identify whether any further investigations are required.

13.6.7.3 Tourism routes

With the exception of the major, state-controlled roads such as the Warrego Highway there is unlikely to be substantial amount of tourist traffic along the Project's transport corridors. Given the relatively low numbers of heavy vehicle traffic generated by the Project and that major, disruptive movements such as OSOM movements will be minimised and undertaken during the least disruptive times, it is not expected that the project will cause undue impact on tourist routes.

13.6.8 Summary of road impacts

13.6.8.1 Construction phase impacts

In summary, the results of the traffic and transport assessments indicated that during the construction phase, the potential impacts caused by the Project on the road network are likely to consist of two elements:

- Impacts to the pavement condition.
- Impacts to the traffic operation.

In order to identify the locations of these potential impacts, pavement and traffic operation analysis were carried out (i.e. 5% comparison analysis) for the identified transport corridors. In terms of pavement and traffic operation impacts, the analysis indicated that four sections of the identified transport corridors are likely to be affected during the construction phase of the Project. These road sections are Bunya Highway (45A), Dalby-Jandowae Road (421), Kingaroy-Jandowae Road (424) and Niagara Road (RCR-1). The other road sections investigated, such as the Warrego Highway were found to be below 5% of the existing baseline levels in both the traffic impact and pavement impact assessments.

Along the affected road sections, the vast majority of additional Project related traffic volumes are expected to be from the movement of workforce. These trips are expected to be light vehicle trips only as opposed to heavy vehicle trips which typically have a much larger impact on pavement condition due to their higher ESA per vehicle value. Along Niagara Road (RCR-1), the analysis also shows a large percentage increase in ESA and AADT during the construction phase of the Project. However, this increase is primarily due to the very low background traffic along Niagara Road and the movement of construction work force which typically has a lower pavement impact due to the majority of vehicles generated being light vehicles (low ESA per vehicle value).

Based on the assumed transport corridors, five key intersections have been identified which will be affected by the Project related traffic. These key intersections are:

1. Warrego Highway / Bunya Highway
2. Bunya Highway / Niagara Road
3. Kingaroy Jandowae Road / Niagara Road
4) Dalby-Jandowae Road (High Street) / George Street (Kingaroy-Jandowae Road)
5) Kingaroy-Jandowae Road / George Street.

No detailed intersection assessment has been performed at this preliminary assessment stage although based on the magnitude of overall traffic expected to be generated by the Project, intersection capacity is not expected to be a significant concern. Further to discussion with DTMR and Regional Councils, and if required, detailed intersection analysis may be undertaken during the subsequent design phases.

13.6.8.2 Operational phase impacts

During the operational phase, the only expected impact on the regional road network is the movement of operational workforce. The operational workforce is expected to be minimal as the turbines are largely self-regulated once maintained. Furthermore, some of the operational staffs are likely to be offsite staff working remotely (not required to be onsite).

The minimal volume of operational traffic may exceed 5% of the background ESA and background AADT along Niagara Road (RCR-1). However this is due to the relatively low background traffic volume along Niagara Road (estimated to be around 77 vehicles per day in 2016) and not necessarily due to the volume of operational traffic; hence the impact is not expected to be significant, especially compared to the construction phase.

13.6.9 Port impacts

The Queensland port network has the potential to be impacted as a result of the Project only during the transport of wind turbine components through the Port of Brisbane. However, the total number of wind turbines expected to be constructed is up to 115 wind turbines over a period of approximately two to two and a half years.

It is not expected that the transport of all wind turbine components will occur at once. This is unlikely to be a feasible strategy due to the significant size and weight of the turbine and tower components and consequently the large number of shipping vessels and size of the holding yards that would be required. A more likely transport strategy would be to import the wind turbine and tower components at a rate consistent with the rate at which the wind turbines are able to be transported and constructed on site. Such a transportation strategy will spread the overall freight task over the construction period and hence greatly reduce the overall shipping and storage requirements at Queensland ports.

As a result, the impacts of the Project on Queensland ports are not expected to be significant. Detailed port freight logistics will be investigated prior to the commencement of construction by the shipping contractor. These investigations will be undertaken in consultation with the port authorities as part of regular commercial negotiations prior to the commencement of shipments.

13.6.10 Airport impacts

It is not expected at this stage that the Project will utilise Fly-in/Fly-Out workforces for either the construction or operations phases. All transport of materials and equipment is also expected to be through the use of overland freight services. As such, this Project is not forecast to increase the number of regional flights during either the construction or operations phases. Furthermore, the project is not located within close proximity to an airport and the turbine towers will are not considered to pose any significant hazard to aircraft.

Consequently, this Project is not expected to adversely impact the operation of Queensland Airports or pose a significant hazard to aircraft and hence no further detailed assessment on air transport has been undertaken. For further information on potential impacts to airports refer to Chapter 8 Aviation.

13.6.11 Rail impacts

This Project will not utilise rail freight for either the construction or operations phases. All freight movements (such as the movement of equipment or materials) will be undertaken overland and hence the Project will not generate any additional rail traffic. As the Project is not expected to have any additional impact on the Queensland rail network, no further detailed assessment on rail transport have be carried out as part of the traffic and transport assessment.

13.6.11.1 Impacts at rail crossings

As the transport corridors and the Project generated traffic volumes have not yet been finalised, detailed assessment of the Project's impacts at rail crossings have not been undertaken at this stage of the Project. Whilst this Project will temporarily increase road traffic (mainly during the construction phase), it is not expected to increase rail traffic. At this stage of the Project, it is expected that the overall magnitude of development generated traffic in comparison to the background traffic volumes as well as the temporary nature of the additional traffic (which is largely limited to the construction phase only), is unlikely to significantly impact existing level crossings.

In subsequent design phases, once the Project's transport corridors and traffic volumes have been confirmed, the likelihood of impacts at road-rail crossings will be discussed with the relevant network authorities including DTMR and Queensland Rail. Subsequent to these discussions, if it is deemed to be required by the road and / or rail infrastructure managers, additional investigation may be undertaken (if required).

No new rail crossings are proposed as part of this Project.

13.6.12 Other transport impacts

This section highlights other transport related impacts which might arise from the Project, but are not directly attributable to the road, rail, port or airport networks. These other impacts, as well as their applicability to this Project, have been listed in Table 13.21.

Table 13.21 Table of Other Transport Impacts

Predicted impact	Applicability
Severance Severance is a perception that a road is more difficult or possibly less safe to cross. Increased severance can result in the isolation of areas of a settlement or individual properties. However, It is important to note that the impact is largely a function of traffic volumes, rather than one of vehicle composition amongst traffic.	The Project Site is located in a rural environment where there is not expected to be any significant pedestrian demands. The only locations along the Project's transport corridors where the pedestrian volumes may be significant are through regional towns such as Dalby or Jandowae. However, coupled with a 12 hour working day, it is considered that the Project will not generate sufficient traffic volumes for severance to be a major impact. Consequently, the impact of severance is not considered to be significant.

Predicted impact	Applicability
Driver delay Driver delay is that experienced by non-development related road users on the surrounding roads and particularly as a consequence of slow moving traffic associated with construction.	The majority of traffic generated by the Project will be light vehicles only. It is not considered that the light vehicle traffic generation will be of sufficient magnitude to significantly impact background vehicle delays. It is acknowledged however that there may be an element of localised delays directly attributable to construction traffic, especially as a result of heavy and over-sized and over-mass vehicle movements. The overall impact of these movements is not considered to be significant given that deliveries will be timed to minimise disruption and will be undertaken in consultation with DTMR, affected councils and other stakeholders such as emergency services, as required.
Pedestrian delay and pedestrian amenity Pedestrian delay is affected by changes in traffic volume, HGV movements and traffic speed. Pedestrian delay also depends on the existing level of pedestrian activity, visibility and current infrastructure provision. There is no threshold against which pedestrian delay is assessed. Pedestrian amenity can be affected by traffic volumes and the distance between pedestrians on a footway and passing traffic.	The Project Site is located in a rural environment where there is not expected to be any significant pedestrian demands with the exception of through regional towns. The majority of heavy and particularly over-size and over-mass deliveries are expected to be undertaken outside of normal hours when disruptions to pedestrian and vehicular traffic will be minimal. The remaining heavy vehicle movements which are undertaken during normal hours are likely to be spread out over 12 hours of construction per day. Hence the impacts relating to Pedestrian Delay and Pedestrian Amenity are considered to be not significant.
Fear and intimidation The degree of fear and intimidation experienced by pedestrians is affected by the volume of passing traffic, the proportion of HGV traffic and its proximity to pedestrians.	As there is unlikely to be significant pedestrian activity along the majority of this Project's transport corridors, pedestrian fear and intimidation is not expected to be a significant issue along these sections of road. However, in and around regional population centres such as Dalby or Jandowae, this impact may be significant over short, discrete timeframes. This could include times of concentrated heavy vehicle movements or while an over-size / over-mass vehicle movement is taking place. The majority of the daily traffic generated by the Project is expected to be light vehicles related to workforces; hence the impacts of pedestrian fear and intimidation are not considered to be significant when considered across the whole construction period.
Accidents and safety Road accidents are attributable to a variety of local factors and as such do not provide a threshold to determine significance but relies more on the assessor to use their own judgement.	Based on the overall level of traffic generation and predominantly light vehicle composition, it is considered unlikely that the Project will increase the number of accidents or impact road safety by itself. However, the increased generation of heavy vehicles, especially turning heavy vehicles at intersections may potentially have an impact on accident rates. Furthermore, as this Project may potentially require construction workforces or contractors to drive long distances to complete some deliveries (Port of Brisbane to site and then back), driver fatigue may also adversely impact road safety. However the low magnitude of construction traffic and the relatively limited duration they are generated over should be

Predicted impact	Applicability
	kept in mind. These two elements of the Project have the potential to cause some localised impacts on road safety and hence mitigation measures are provided in Section 13.7.
Mishandling of hazardous materials and spills Due to the number of construction equipment and heavy machinery likely to be required on-site, the transportation and/or storage of hazardous materials such as fuel, chemicals and lubricants are likely to be required. Fuels and chemicals can pose a fire and/or explosive hazard. They can also be environmentally damaging in the event of a major spill or leak, especially if they manage to enter local creeks or waterways.	Mishandling or accidental spillage of hazardous materials such as fuel or chemicals required for construction can have major environmental consequences. Whilst it is not considered likely, if it eventuates, the potential impact could be is considered to be significant if it eventuates. Mitigation is therefore provided in Section 13.7.

13.7 Mitigation measures

13.7.1 Road Use Management Plan

As stated in the DTMR's GARID, "*the Road Use Management Plan (RUMP) is a plan specifically for managing road related issues and is based on negotiation with industry to best manage current and future increases in district road use/access by specific freight commodities and specific types of heavy vehicles to alleviate and manage adverse traffic management risks and road impacts*".

The purpose of developing a RUMP for the Project is to identify, if required, appropriate traffic and transport management strategies for the use of the SCRs and, where necessary, RCRs over the construction phase of the Project. The intended objective of these strategies are to minimise the impact on the efficiency of the SCR and RCR networks as well as the operational safety of the Project related vehicles accessing the construction sites.

13.7.1.1 Preliminary RUMP

A preliminary RUMP will be developed for the Project at the subsequent detailed design stage in consultation with the relevant authorities, including DTMR and emergency services such as the Queensland Police Service. The assessments presented throughout this chapter will form the basis for the development of various strategies in managing the potential transport impacts from the construction phase of this Project, all of which will be documented in the preliminary RUMP. As the project progresses, if any assessment is revised or additional assessment is undertaken (if required by DTMR or affected regional councils), the RUMP will be updated to effectively capture the changes.

The preliminary RUMP will also include strategies to deal with safe temporary access to/from public roads and construction sites as well as safe decommissioning of any stockpile sites over the construction phase of the Project. Temporary and permanent traffic arrangements will also be developed (if required) and included as part of the TMP that will be implemented during the various stages of the Project. The framework for the preliminary RUMP will be in accordance with the 'Guideline for preparing a Road Use Management Plan' (DTMR, 2012).

13.7.2 Other management plans

A Driver Fatigue Management Plan and Emergency Response/Disaster Management Plan will be prepared as part of the overall Project and will be provided to the workforce as part of the Project induction process.

The Driver Fatigue Management Plan will set out any restrictions on travel times and specify durations for drivers operating within and outside of the Study Area as well as the Project Site. As trip schedules and drivers rosters are some of the key factors in managing driver fatigue, the Driver Fatigue Management Plan will apply to the all staff and contractors working on the Project.

In addition to driver fatigue, due to the number of heavy construction machinery and equipment expected to be on site, the transportation hazardous materials such as fuel, lubricants and chemicals needs to be considered. To ameliorate any potential impacts of the movement of fuel or other hazardous materials, all hazardous materials used on site will be managed in accordance with the relevant Australian Standards.

Industry best practices will be observed for activities relating to the transportation, storage and handling of environmentally hazardous substances such as fuel, throughout the Project. Only licensed contractors will be used, specific procedures will be developed for loading, unloading and handling the materials and all transport activities will comply with the requirements of the Australian Dangerous Goods (ADG) Code.

Throughout the Project's construction phase, any fuel or chemical spill will be monitored regularly to make sure that there is no adverse impact on environmentally sensitive areas such as creeks and rivers, along the transport routes. The RUMP developed for this Project will also include strategies to minimise the effects of a product spill as a result of the Project's transport activities during the construction phase. Subsequent to discussion with the relevant authorities, if required, a separate Spill Prevention and Response Plan (SPRP) may also be developed by the contractor and included as part of the Project's RUMP.

13.7.3 Summary of mitigation strategies and management measures

Table 13.22 provides a summary of the proposed mitigation strategies and management measures for the potential traffic and transport impacts identified for the Project.

Table 13.22 Mitigation and management measures for potential impacts on the transport network

Project phase	Mitigation or management measure
Design phase	- Ongoing consultation will be undertaken with DTMR, relevant regional councils and other agencies such as Queensland Police Services and Emergency Services - Investigate detailed design solutions to minimise impact on existing roads and stock routes - Suitable vehicular access, manoeuvring areas and parking for the ongoing operation and maintenance activities associated with the wind farm will be proved at the detailed design phase. - Establish infrastructure agreements with DTMR and regional councils.
Construction phase - traffic safety and deterioration in road conditions	- Development of a RUMP prior to the commencement of construction and implemented as part of the CEMP. The purpose of the RUMP is to demonstrate how road impacts generated by the Project, particularly from heavy vehicle use, will be managed. Consultation with the DTMR, relevant regional councils and other agencies such as Queensland Police Services and Emergency Services will be undertaken as part of this plan - Finalise impact mitigation strategies comprising a combination of road use management strategies, such as variable message signs, bussing workers, avoiding peak hour traffic especially near schools/bus routes and fatigue management strategies, and infrastructure strategies where required - A TMP will be prepared in accordance with the latest edition of the 'Manual of Uniform Traffic Control Devices: Part 3 – Works on Roads' and DTMR's specification "MRTS02 – Provision for traffic" prior to the commencement of construction. Road safety measures will take into consideration speed restrictions, driver fatigue, in-vehicle communications, signage, demarcations, maintenance, safety checks, and interaction with public transport, transport of hazardous and dangerous goods and emergency response and disaster management.
Operational phase - traffic safety	- Develop and implement operational traffic management measures including driver fatigue management.

13.8 Residual Impacts

Based on the traffic and transport assessments, two key potential impacts have been identified:

- Impacts on the pavement condition as a result of the Project
- Impacts on the traffic operation as a result of the Project.

In order to alleviate the potential impacts on regional transport infrastructure, a number of mitigation measures have been identified in Table 13.22. Measures to mitigate Project related impacts will include the development of a RUMP and TMP prior to the commencement of construction.

In the subsequent detailed design phases of the Project, once the potential traffic operation and pavement impacts are further understood, mitigation measures will be further discussed and agreed upon with the relevant authorities including DTMR and Western Downs and South Burnett Regional Councils as required. It is considered that once adequate mitigation measures are agreed upon and implemented, they will adequately address any potential Project related impacts. Residual impacts after the implementation of the agreed mitigation measures are expected to be negligible and not significant over the construction period.

13.9 Cumulative impacts

At the time of carrying out traffic and transport assessments for the Project, there may be other projects in the region which are at the planning, design or construction stages. Some of these projects may potentially generate road traffic along the transport corridors expected to be utilised by the Project. In order to appreciate the cumulative impact on the regional transport infrastructure, the traffic generation estimations from these developments have been considered for the purposes of calculating the future year background traffic.

For the purpose of the assessments, only developments which have been declared a ‘coordinated project’ by the Coordinator-General, requiring the submission of an Environmental Impact Statement (EIS), where published traffic volumes are readily available, have been considered.

Only one such development was identified as potentially having a cumulative impact on the Project transport corridors:

- New Acland Coal Mine Expansion - Stage 3 (proposed by New Acland Coal Pty Ltd).

The terms of reference for the original proposal’s EIS was finalised by the Coordinator-General in October 2007. Subsequent to this, in November 2009, New Acland Coal submitted an EIS covering the New Acland Coal Mine Expansion – Stage 3 project.

The New Acland Coal Mine is an open cut coal mine located approximately 35 km north-west of Toowoomba. Owing to its close proximity to Toowoomba, the EIS submitted in 2009 indicated that the Project is likely to generate road traffic along the Warrego Highway (along TC01), both due to construction activities and mine operations.

However in response to concerns raised by the Queensland State Government about the project’s potential impacts, the project was modified and reduced in scope. The modified project proposal is now approximately 63% or 2,300 hectares smaller than the original proposal (*New Acland Coal Mine Stage 3, Project Overview).*

As a result of the project modifications, the proponent has submitted a revised EIS in early 2014. Based on the EIS, the proponent has provided estimated, development generated traffic volumes. Along the Warrego Highway (between Toowoomba and Dalby), the proponent estimated that a maximum of approximately 220 vehicles per day (50 heavy vehicles and 170 light vehicles) may be generated during the peak construction phase (2016). This additional traffic likely to be generated by the New Acland Coal Mine Expansion project is considered to be additional background traffic along the Warrego Highway, which has not been captured by the historic traffic counts.

In order to provide a conservative, worst-case estimate of the overall traffic impact, this additional background traffic has not been added onto the historical background traffic for the purposes of the 5% assessment. Based on the assessment undertaken, this project is not expected to adversely impact either the traffic operation or pavement condition of this section of the Warrego Highway – 18B (i.e. less than 5%) even without taking into account the additional background traffic. As such, the cumulative impacts of both projects are not expected to be significant along the affected road sections (18B).

The South Burnett Coal Project (proposed by MRV Tarong Basin Coal Pty Ltd) was declared a 'coordinated project' on 18 August 2016. The project is located approximately 35 km east of the Coopers Gap Wind Farm Project and proposes to utilise the D'Aguilar Highway via Kilcoy during construction. The indicative transport route for the transport of equipment and materials to the Coopers Gap Project Site is the Warrego Highway via Dalby (Section 13.5.7.2), and does not require use of the D'Aguilar Highway. Cumulative impacts on local roads will be limited due to the distance between the projects. As such, the cumulative impacts of both projects are not expected to be significant.

13.10 Summary and conclusions

Traffic and transport assessments require consideration of a range of matters relevant to State and local government approvals.

In terms of impact on Queensland's road network, the traffic and transport assessments reveal that during the construction phase the potential impacts caused by the Project are likely to consist of two elements:

- Impacts to the pavement condition
- Impacts to the traffic operation.

During the construction phase, the assessment indicated that the potential impacts under both elements are likely to be along four roads, the Bunya Highway (45A), Dalby-Jandowae Road (421), Kingaroy-Jandowae Road (424) and Niagara Road (RCR-1). Along these roads, both the Project related ESA and traffic volumes are expected to exceed 5% of the respective background ESA and traffic volumes.

Of these roads, the analysis also shows a large percentage increase in ESA and AADT along Niagara Road (RCR-1) during the construction phase of the Project. Niagara Road is the main access road for the Project and hence will be utilised by all Project related vehicles. It is noted that the large percentage increases are mainly due to the low background traffic volume along Niagara Road.

Through the development of a RUMP and TMPs, mitigation measures will be established for the Project to assist in minimising the extent of road traffic and pavement impacts. These plans will be prepared prior to the commencement of construction in consultation with DTMR, regional councils and other authorities and implemented as part of the CEMP. Other management strategies such as a Driver Fatigue Management Plan and an Emergency Management Plan will also be implemented to minimise the potential for incidents.

During the operational phase, as the wind turbines are largely self-operating once constructed, the only impact on the road network is expected to be due to from the maintenance workforce. A small number of inspection and maintenance workforce trips are expected on a regular basis during the operational phase. However, the volumes of these trips (and consequent traffic impacts) are expected to be significantly less than during the construction phase.

As the wind turbines are not manufactured in Australia, the wind turbine components will likely be sourced from overseas. As a result, the Queensland port network has the potential to be impacted during the transport of wind turbine components through the Port of Brisbane. The movement of these components will be further refined at the detailed design stage and will include discussions between AGL and the Port of Brisbane on the likely arrangements.

The total number of wind turbines expected to be constructed is up to 115 over a period of approximately two to two and a half years. It is not expected that the transport of all wind turbine components will occur at once and instead a transport strategy which spreads the delivery of turbines over the construction period is likely to be adopted. As the transportation of turbine components is likely to be spread over approximately two to two and a half years, the impacts of the Project on Queensland ports are not expected to be high; hence detailed analysis has not been undertaken. Instead, prior to the commencement of construction, the freight logistics for the Project will be further investigated and carried out in consultation with the Port of Brisbane.

The Queensland Rail network is not expected to be used during the construction or operational phases of the Project as all construction materials, equipment and workforce is anticipated to be transported either by road or by sea. As a result detailed impact assessment on rail infrastructure has not been undertaken.

The Project will not utilise any air transport services as all Project related workforce, during the construction and operational phase, are assumed to be Drive-In/Drive-Out trips from the surrounding population centres. In addition, all construction equipment and materials are expected to be transported either by road or by sea. Hence no regional, commercial airports are expected to be impacted as a result of the Project.

In the subsequent detailed design phases of the Project, once the potential impacts on the road and port network are further defined and understood, any potential mitigation measures will be further discussed and agreed upon with the relevant authorities including DTMR and Western Downs and South Burnett Regional Councils as required. Any residual impacts which may remain after the implementation of any agreed mitigation measures are expected to be negligible and not significant over the construction period.