Gateway Upgrade Project

5. Transportation

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5. Transportation

5.1 Introduction

An assessment of the traffic and transport effects of the proposed GUP has been undertaken by Masson Wilson Twiney (MWT) and specialist public transport subconsultant Booz Allen Hamilton to provide information on the existing transport network, road network performance, future traffic conditions (with and without GUP) and the potential impacts on transportation and traffic issues.

5.2 Background

The Gateway Motorway, north and south of the Brisbane River, provides a critical city bypass and "through" route and is part of the National Highway System in Queensland. The motorway is also a nominated “dangerous goods” route. The Gateway Bridge (including the immediate approaches) is excluded from the National Highway System and is owned and operated by Queensland Motorways Limited (QML) (and its subsidiary Gateway Bridge Company Limited), as a toll bridge under a road franchise agreement with the state government. QML and its subsidiaries are public companies constituted under the Corporations Law and are wholly owned by the Queensland government through MR.

The Gateway Motorway lies to the east of the Brisbane CBD and connects the Pacific Motorway to the south, the Bruce Highway to the north, and the Logan and Ipswich Motorways to the west. As such it is strategically located as the north-south arterial spine servicing the ATC area, including the airport and seaport, and the established commercial industrial suburbs in Brisbane’s north. Unlike other arterial routes in the Brisbane metropolitan area, it is not a primary “journey to work” or commuter corridor. Much of its use is high value business and freight related.

In the future, it is predicted that reduced efficiency and effectiveness of the operation of the Gateway Motorway will result in substantial delays, congestion, diversion of traffic to lower order routes, increased accident rates and attendant road user, economic and social costs.

The location of the proposed GUP is shown on Figure 1.1. The context of the GUP within the Brisbane metropolitan transport network is shown on Figure 2.1.

5.3 Existing Transport Network

TOR Requirements:
The existing transport operations within the corridor should be described, in terms of:

- the road network, broadly for the regional network and in more detail for the local road system;
- road traffic movements patterns;
- traffic flows – peak, daily, composition;
- interaction of public transport services – existing services details and facilities; and
- rail network and function.

This section describes the existing transport network and regional travel demands. The information primarily relates to traffic conditions in 2003. This was the most recent data available based on surveys at the time of preparation of the EIS.

5.3.1 The Study Area

Figure 5.1 shows the study area in which traffic would be most influenced by the GUP. This essentially follows the road corridor from Nudgee to Rochedale. However, given the size of the project and its important function as part of the National Highway System, an understanding is also required of its Brisbane wide effects.

5.3.2 The Road Network

The existing road network and hierarchy in and surrounding the study area is shown in Figure 5.1. For traffic management purposes, roads in the Brisbane metropolitan network are defined by a five tier road hierarchy according to the function each performs. The classification system from the Transport Plan for Brisbane 2002-2016 (BCC 2003) is as follows:

- **Motorways** – serve inter and intra-regional connections for high volumes of people and goods, directing longer distance traffic away from heavily developed areas with volumes over 40,000 vehicles per day (over 3,500 vehicles per hour in peak periods).

- **Arterial roads** – provide connections for the movement of people and goods between major activity centres and residential areas of the city with volumes over 15,000 vehicles per day (over 1,500 vehicles per hour in peak periods).

- **Suburban roads** – supplement arterial roads but also have a distributor function within a region, typically carrying volumes between 5,000 and 20,000 vehicles per day (500 to 2,000 vehicles per hour in peak periods).

- **District roads** – provide a link between local roads and regional roads, typically carrying between 2,000 and 10,000 vehicles per day (250 to 1,000 vehicles per hour in peak periods). At volumes greater than 5,000 vehicles per day, residential amenity begins to decline noticeably.

- **Local streets** – provide access to individual properties, carrying low volumes, typically less than 2,000 vehicles per day (250 vehicles per hour in peak periods).

The functional classification system presented above was developed as a tool to identify appropriate frontage land use and access allocation, support preferred land use and urban form throughout the city and to assist in the formulation of traffic management strategies. It also provides guidance as to the normal spacings of different order roads against which the existing road pattern can be examined.

Ideally, regional routes supporting regional movements, would comprise roads in the first two levels of the hierarchy; whilst local traffic routes would comprise district roads and local streets.

This assessment is principally concerned with the management of the arterial road system with particular regard to its sufficiency and the need to appropriately cater for the competing road space needs of public transport, local access traffic, pedestrians and cyclists.

Brisbane's existing road network is essentially a series of radial corridors focused on the CBD, with the Gateway Motorway providing the only major high quality north-south orbital road corridor. A major constriction on the development of Brisbane's road network is the Brisbane River which restricts the location and capacity of crossings. The stretch of river between the Gateway Bridge and the nearest river crossing to the west, the Story Bridge, is approximately 11.5 kilometres.

These factors and strong population and job growth in the Gateway Motorway catchment has led to significant pressure on this corridor since the opening of the Gateway Bridge in 1986 with a historical traffic growth rate in the order of 8 per cent per annum. The existing motorway can be characterised as a four lane divided motorway with limited access provided to lower order

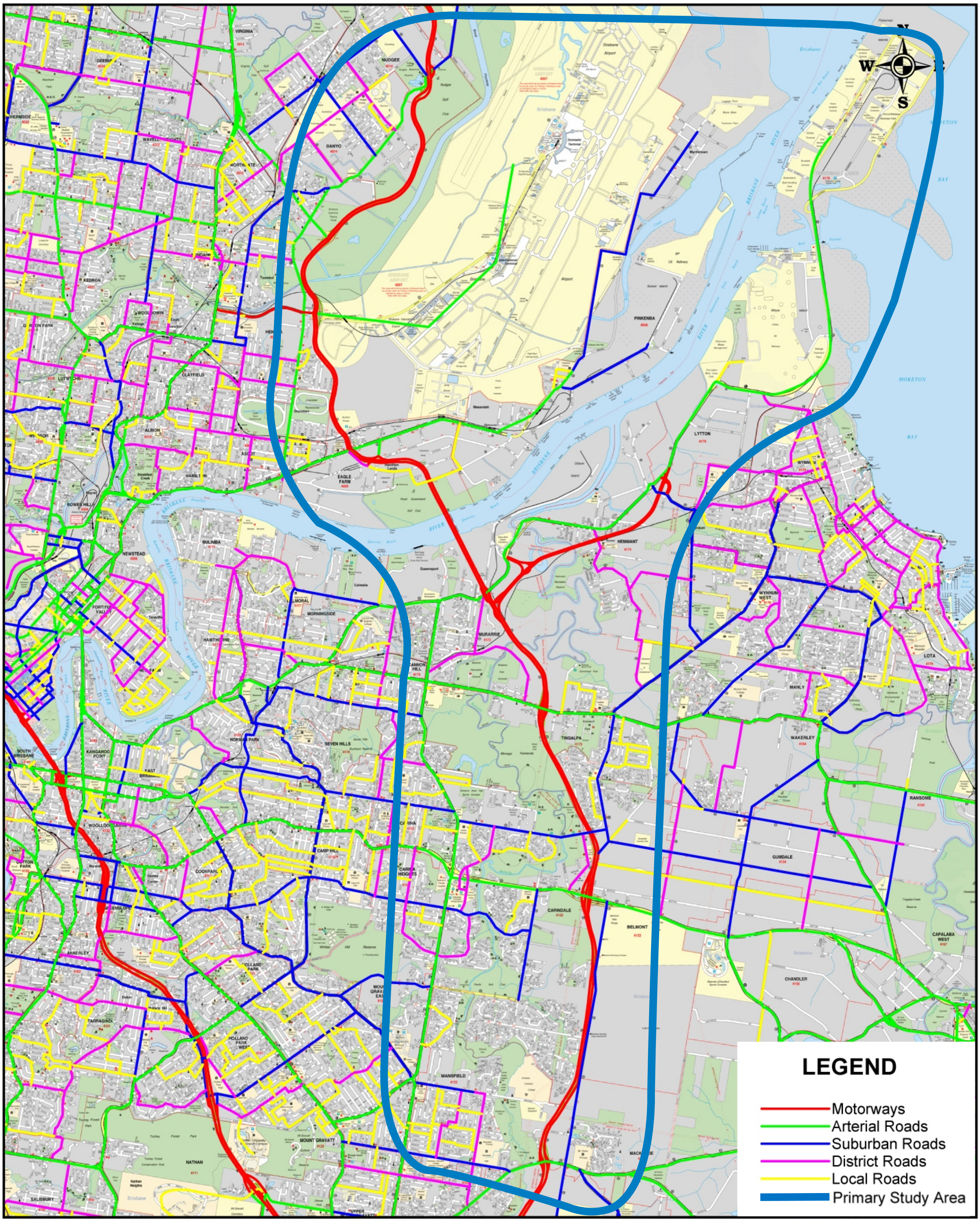

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FIGURE 5.1
Existing Road Hierarchy

roads at interchanges. The posted speed limit on the motorway is primarily 100km/h with the section between Airport Drive and Wynnum Road reduced to 90km/h with a speed limit of 80km/h imposed on the Gateway Bridge.

Characteristics of east-west arterial routes connecting to the Gateway Motorway within the study area are as follows:

- Mt Gravatt-Capalaba Road – a four lane arterial forming part of the Metroads 2 route which links the Ipswich Motorway with the Gateway Motorway, continues east with some two lane segments to join Old Cleveland Road in Capalaba West.

- Old Cleveland Road – a four lane arterial linking O'Keefe Street at Woolloongabba to the Gateway Motorway and continuing out to Capalaba where it links with Finucane Road and the bayside suburb of Cleveland.

- Wynnum Road – a four lane arterial with some two lane sections linking Shafton Avenue/Lytton Road at Kangaroo Point to the bayside suburb of Wynnum.

- Port of Brisbane Motorway – stage one of this motorway was completed in late 2002 connecting the Port of Brisbane with the Gateway Motorway via a high speed interchange and motorway link.

- Lytton Road – a mostly two lane arterial with some four lane sections linking Bulimba with Lytton and the Port of Brisbane.

- Kingsford Smith Drive – a four lane arterial running along the Brisbane River linking the Inner City Bypass and Breakfast Creek Road with the Gateway Motorway and continuing on to connect with Eagle Farm Road and the ATC North precinct.

- East-West Arterial – a four lane motorway/arterial linking Sandgate Road at Clayfield with the Gateway Motorway and Airport Drive via a large grade separated roundabout interchange.

- Airport Drive –a dual two lane private road of arterial standard with public access which has been recently upgraded to six lanes between the Gateway Motorway interchange and the access to number 1 Airport Drive precinct. It currently provides the only major road link to the Brisbane Domestic and International Airports.

- Toombul Road – is a four lane arterial linking Sandgate Road at Virginia with the Gateway Motorway via a large grade separated roundabout interchange.

- Nudgee Road – is a two lane arterial running parallel to the Gateway Motorway between Kingsford Smith Drive, connecting with the Gateway Motorway at Nudgee and continuing on to Nudgee Beach.

5.3.3 The Transport Task

There is a significant demand for travel to and from the ATC as well as through trips bypassing the Brisbane CBD. The amount of travel is driven by employment and population levels and distribution in the Brisbane metropolitan area. Present and expected future population levels are discussed in detail in Section 5.5.1.

The ATC is the key generator of traffic on the Gateway Bridge and contributes around 46% of the 2003 average weekday traffic volume of 87,000 vehicles per day (vpd). The ATC covers an area of approximately 8,000 hectares north and south of the mouth of the Brisbane River. This precinct includes Brisbane Airport, the Port of Brisbane and a number of public and privately controlled business parks and industrial estates. It is already home to around 7,600 businesses, many of these being major industry and logistics operators. Employment within the ATC is forecast to increase significantly, by 120% to approximately 80,000 jobs by 2016. This will also result in a 75,000 trip increase in ATC traffic using the Gateway Bridge increasing the share of ATC trips to around 50% of average weekday traffic volumes by 2016.

As discussed above, the Gateway Motorway currently provides the only major high quality north-south orbital road corridor bypassing the Brisbane CBD and is integral to the efficient regional movement of goods and people. Through trips on the Gateway Motorway currently contribute around 18% of the average weekday traffic volumes using the Gateway Bridge. The remainder of trips comprising 36% of average weekday traffic volumes are shorter trips using segments of the Motorway to travel between major activity centres in preference to the radial road network which is becoming increasingly congested.

5.3.4 Road Traffic Movement Patterns

Traffic models were prepared to forecast traffic growth on the road network and to assess the redistribution of traffic likely to arise as a result of the proposal. These models are described in detail in Section 5.5.

The traffic models also determined the origins and destinations of traffic currently using the corridor. The origins and destinations of existing traffic on the Gateway Bridge, which would be most affected by the proposal, are indicated on Figure 5.2 with paired plots for the morning peak hour flow northbound and the evening peak hour flow southbound. Figure 5.2 shows that the primary catchment is the ATC with high concentrations of trips to/from the Brisbane Airport and the ATC North precinct. The suburbs south of the Brisbane River that are east of the Gateway Motorway are also primary catchments areas, in addition to suburbs north of the Brisbane River that are east of the Gympie Road corridor.

With the nearest alternative river crossing located 11.5 kilometres to the west, these catchments are left with little alternative than to use the Gateway Bridge at present and into the perceivable future. Further analysis of the travel time savings experienced by current Gateway Bridge users indicated that on average a saving of 22 minutes was experienced in the peak periods and 17 minutes in off peak periods compared to the next best alternative.

5.3.5 Traffic Flows

Consideration of traffic flows on roads in a study area allow comparisons to assess growth over time and to estimate changes arising from land use development or transport system changes. Traffic flows are also a necessary input to the analysis of network capacity.

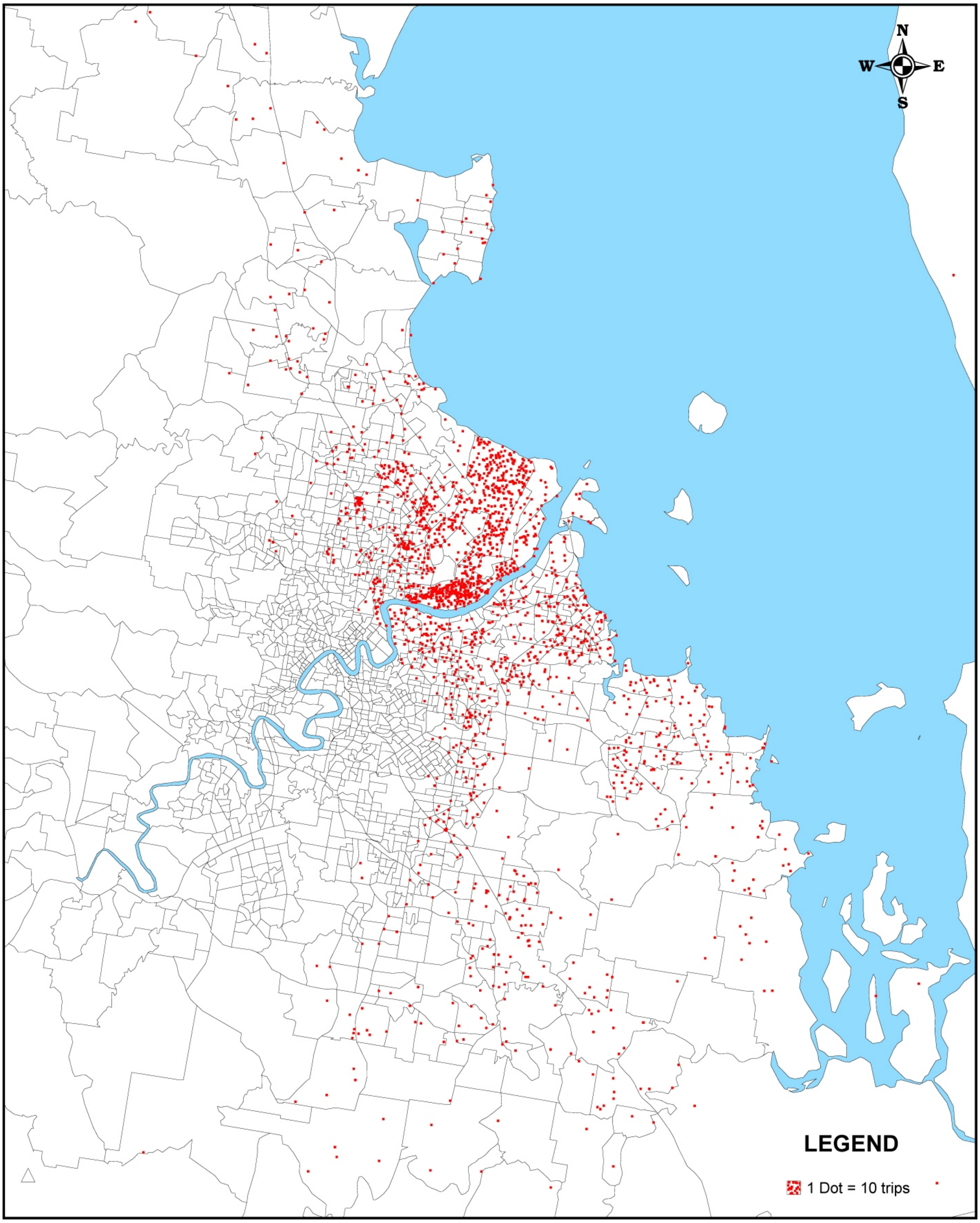

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FIGURE 5.2
Gateway Bridge Peak Direction Trip Catchments

The following subsections present information on traffic flows at different locations in the road network; variations in traffic flow throughout the day; and the mix of different vehicle types using the Gateway Motorway corridor. It presents both peak period and daily traffic to define how a road system is operating.

When considering the traffic volumes, it is worth having regard to typical mid-block lane operating conditions and theoretical capacities which are set out in Table 5.1. These are theoretical capacities. In practice higher traffic throughputs are possible whilst conversely, local conditions can reduce capacities.

Table 5.1 Theoretical Traffic Lane Mid-block Capacities (veh/lane/hr)

Hierarchy Description	Typical Capacity Range
Motorway	1700 - 2000
Arterial road	1100 - 1600
Suburban road	950 - 1400
District road	800 - 1200
Local street	< 600

Table Note: Actual traffic throughput depends on capacities of upstream and downstream intersections.
Source: Masson Wilson Twiney, Brisbane City Council, Austroads.

Gateway Motorway Peak Hourly Traffic Flows

Historical traffic count data from permanent counters and toll plazas allows the overall trends in the corridor to be assessed. Permanent counters on the Gateway Motorway are located at two locations within the study area; south of Airport Drive and south of Mt Gravatt-Capalaba Road. The historical data available from the permanent counters is presented in Table 5.2 for peak periods.

Table 5.2 Gateway Motorway Peak Hourly Traffic Flows (Average Weekday)

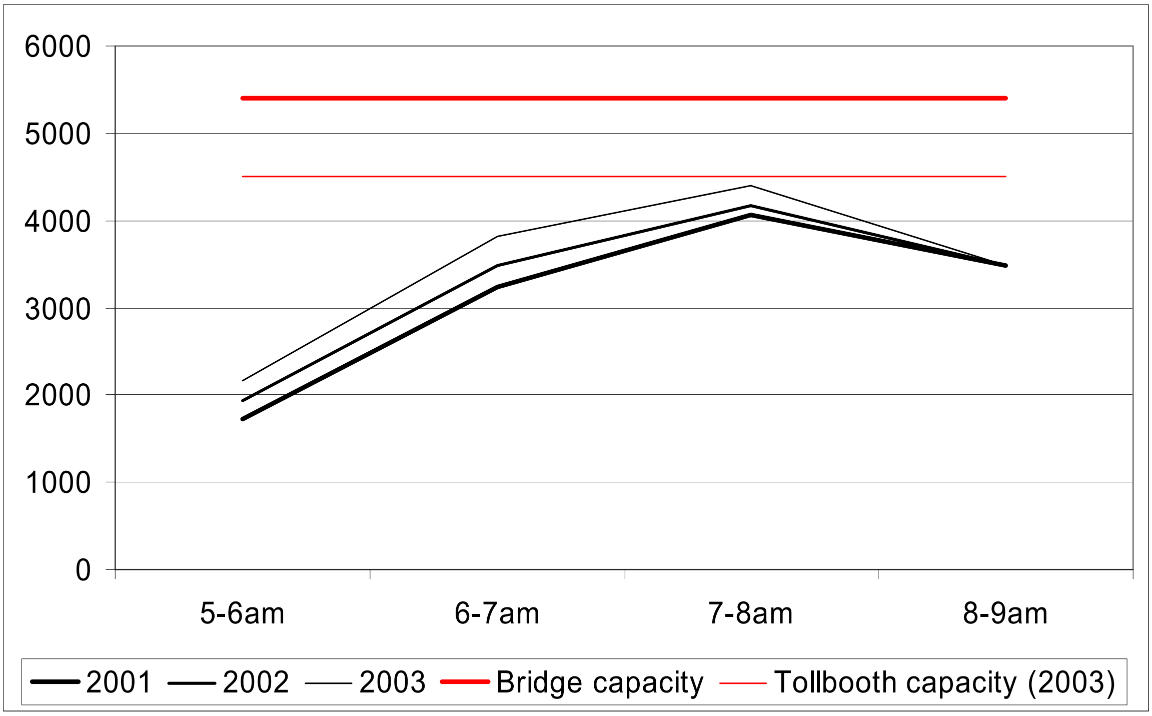
Location	Traffic Lanes	Morning Peak Flow (veh/hr)	Morning Peak Flow/ Mid-Block Capacity	Evening Peak Flow (veh/hr)	Evening Peak Flow/ Mid-Block Capacity
South of Airport Drive					
Northbound					
1999	2	3,862	0.97	2,953	0.74
2000	2	4,032	1.01	3,100	0.78
2001	2	4,033	1.01	3,156	0.79
2002	2	3,961	0.99	3,083	0.77
2003	2	3,909	0.98	3,233	0.81
Southbound					
1999	2	3,339	0.83	3,941	0.99
2000	2	3,435	0.86	4,021	1.01

Location	Traffic Lanes	Morning Peak Flow (veh/hr)	Morning Peak Flow/ Mid-Block Capacity	Evening Peak Flow (veh/hr)	Evening Peak Flow/ Mid-Block Capacity
2001	2	3,480	0.87	4,005	1.00
2002	2	3,120	0.78	3,682	0.92
2003	2	3,584	0.90	4,093	1.02
South of Mt Gravatt-Capalaba Road					
Northbound					
1999	2	2,833	0.71	2,124	0.53
2000	2	2,981	0.75	2,208	0.55
2001	2	2,996	0.75	2,230	0.56
2002	2	3,101	0.78	2,394	0.60
2003	2	3,148	0.79	2,534	0.63
Southbound					
1999	2	2,203	0.55	2,790	0.70
2000	2	2,340	0.59	2,934	0.73
2001	2	2,376	0.59	2,933	0.73
2002	2	2,554	0.64	3,109	0.78
2003	2	2,621	0.66	3,154	0.79

Source: Department of Main Roads Metropolitan District Traffic Census 2003.

As shown in Table 5.2, the section of the Gateway Motorway south of Airport Drive has been operating at its capacity in the peak directions for at least the past five years. Flows in the contra-peak directions are also approaching capacity on this section. The data from the permanent counter south of Mt Gravatt-Capalaba Road show that this section of the motorway is currently operating at volumes below capacity for this type of road. As shown by these results, the peak direction traffic volumes carried by this section have been steadily increasing and if this trend continues then the peak direction flows will approach the midblock capacity for this section.

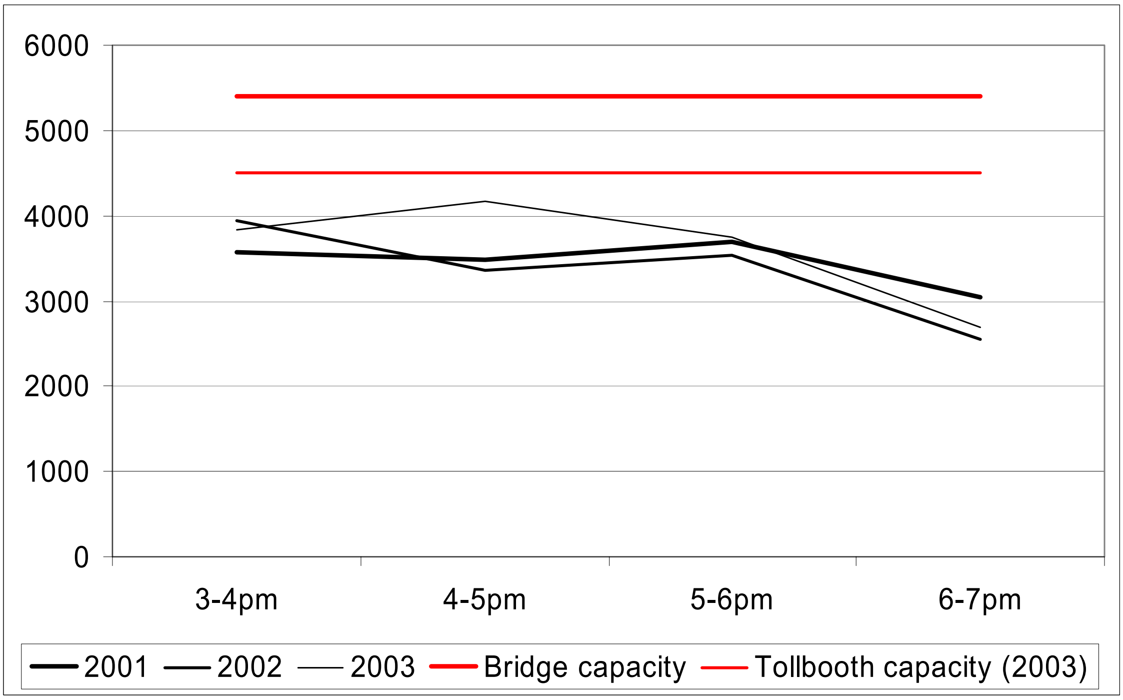
The peak hourly traffic flows crossing the Gateway Bridge itself are currently constrained by the combined toll plaza capacity and the capacity of upstream and downstream motorway sections. As a result the peak flows have spread over the past few years and Figures 5.3 and 5.4 illustrate this peak spreading on the Gateway Bridge.



Source: QML Database.

Figure 5.3 Gateway Bridge Peak Northbound Morning Traffic Flows (Average Weekday)

As shown in Figure 5.3, the Gateway Bridge is operating at close to capacity in the 7:00am to 9:00am time period. This has resulted in the majority of the morning traffic growth in the peak direction occurring earlier in the 5:00am to 7:00am time period as some users have retimed their trip to avoid excessive congestion.



Source: QML Database.

Figure 5.4 Gateway Bridge Peak Southbound Evening Traffic Flows (Average Weekday)

In the evening peak direction, Figure 5.4 shows that the evening peak traffic flows have been close to capacity since 2001 between 3:00pm and 6:00pm. In addition to the constraint of the toll plazas, the geometry and ramp interaction of the motorway section between Airport Drive and the Gateway Bridge reduces the upstream capacity to around 4,200 veh/hr.

Wider Network Peak Hourly Traffic Flows

When evaluating a road system's operation, it is useful to consider traffic flows at individual points on a street or route, and on "screenlines". A "screenline" is an imaginary line across a group of roads that collectively describe a corridor. A complete screenline around a study area is referred to as a "cordon". By considering traffic flows across a screenline, total demand along a corridor or in and out of a study area can be assessed and effects of demand transfer from one route to another can be separated from effects of general growth in demand.

For the purposes of assessment of the GUP, three major screenlines were defined as indicated on Figure E1 (in Appendix E1). These are as follows:

1. Motorway East Screenline (N-S) – running parallel and to the east of the Motorway from Nudgee Road to Mt Gravatt-Capalaba Road.

2. Motorway West Screenline (N-S) – running parallel and to the west of the Motorway from Nudgee Road to Mt Gravatt-Capalaba Road.

3. Brisbane River Crossings (E-W) – following the Brisbane River from the mouth to near Ipswich including the major city river crossings.

Screenlines in each direction are presented in Appendix E1. Information on individual roads is of interest in relation to the number of traffic lanes and comparative traffic volumes (vehicles per lane per hour). Information on screenline aggregate traffic volumes is of interest in comparing traffic along different corridors.

The volumes presented in Table E1 to Table E3 (in Appendix E1) are of interest in themselves as an indication of relative traffic levels on different corridors and different roads in the area of potential influence of the proposed upgrade.

Comparison of traffic volumes in Table E1 to Table E3 with capacities in Table 5.1 indicates that mid-block volumes on the major approach roads in the area are at, or approaching, capacity in peak periods especially in the peak travel direction.

Analysis of the river crossings screenline shows that all of the major bridges are currently operating at close to their capacities northbound in the morning peak period, particularly when intersection and other constraints are taken into account. The evening peak period is not as critical with the peak southbound direction operating at an average of 71% of capacity, mainly due to insufficient upstream road capacity constraining traffic flows.

Gateway Motorway Daily Traffic Flows

Table 5.3 indicates the available daily traffic flows on the Gateway Motorway. It also indicates the ratio of two way daily flows to morning peak hour flows. This ratio is an inverse indicator of how much vehicle travel takes place outside of the peak hour. The lower the ratio, the higher proportion of travel occurs outside of the peak hour. On a road predominantly serving local traffic, 12 to 15 per cent of daily travel takes place during a peak hour. As shown in Table 5.3, between seven and nine per cent of vehicle travel is currently taking place during the morning peak hour on the Gateway Motorway.

Table 5.3 Gateway Motorway Average Weekday Traffic Flows (both directions)

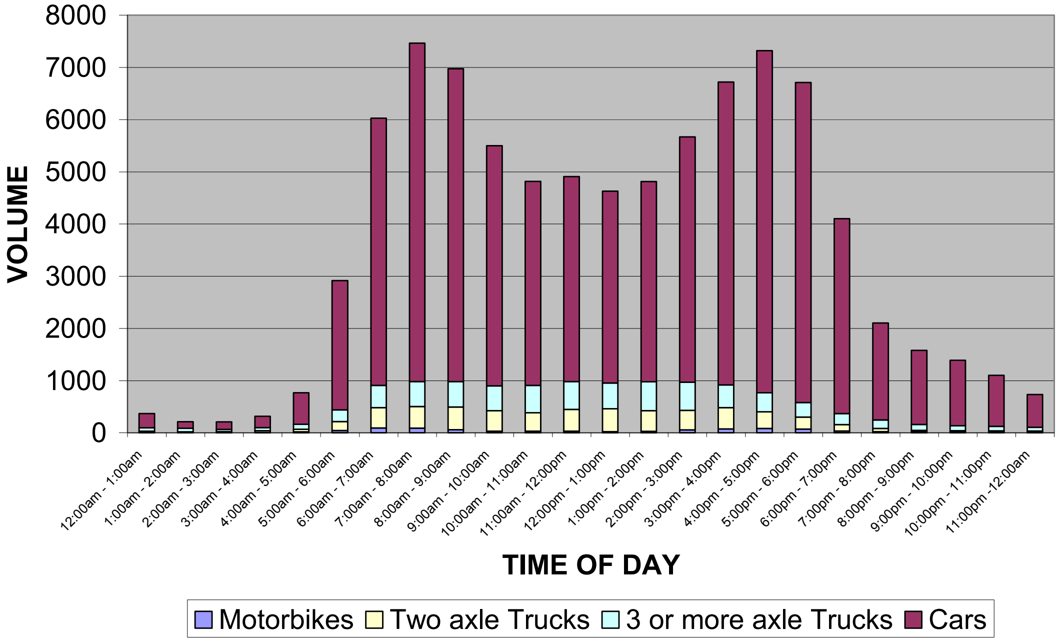
Location	24 hour Traffic Volume	Morning Peak Hour Traffic Volume (7:00am – 8:00am)	Morning Peak Hour to 24 hour Traffic Ratio
South of Airport Drive	92,995	7,396	8.0 %
At Gateway Bridge Toll Plazas	87,354	7,598	8.7 %
At Mt Gravatt-Capalaba Road	69,576	5,163	7.4 %

Source: Department of Main Roads Metropolitan District Traffic Census 2003, QML Database.

Figure 5.5 shows the hour by hour traffic flow variations on the Gateway Bridge over a representative weekday in 2003. Comparison of these shows that:

- The two-way morning peak hourly flow is similar in magnitude to the evening peak hourly flow,
- The morning peak occurs over a similar period to the evening peak. As shown, volumes greater than 6,000 vehs/hr are experienced in the morning between 6:00am and 9:00am, whereas in the evening this level of traffic extends from 3:00pm to 6:00pm;
- Relatively heavy traffic is experienced during the entire working day with traffic volumes of over 4,500 vehs/hr in the interpeak period;
- Traffic volumes for two axle trucks remained fairly constant throughout the working day at around 400 vehs/hr between 6:00am and 4:00pm; and
- Traffic volumes for trucks with three or more axles fairly constant throughout the working day ranging between 400 and 550 vehs/hr.

These traffic flow characteristics are typical of a road which is subject to high levels of non private travel and long periods of congestion.



Source: QML Database.

Figure 5.5 Gateway Bridge Daily Traffic Variations (2003)

Traffic Composition

Figure 5.5 also identifies the variation in traffic composition during an average weekday. Data obtained from QML provides information on the traffic composition currently using the Gateway Bridge. Table 5.4 summarises the observed daily traffic volumes disaggregated into selected vehicle classifications for a representative weekday in 2003.

Table 5.4 Average Weekday Traffic Volumes by Vehicle Classification – Gateway Bridge (2003)

Vehicle Classification	Two-way 24 hour Flow	Proportion of Traffic
Motorbikes	883	1.0 %
Cars and cars with trailers	74,427	85.2 %
Trucks with two axles	5,160	5.9 %
Trucks with 3 or more axles	6,884	7.9 %
Total	**87,354**	**100 %**

Source: Queensland Motorways Limited.

The proportion of trucks using the Gateway Bridge is relatively high at 13.8 per cent of total traffic. The heavy vehicle proportion is slightly lower than this during the morning and evening peaks and reduces to around 8.5 per cent in the evening peak hour. Conversely, the proportion of heavy vehicles is higher during the interpeak period at around 17 per cent of all vehicles between 9:00am and 4:00pm.

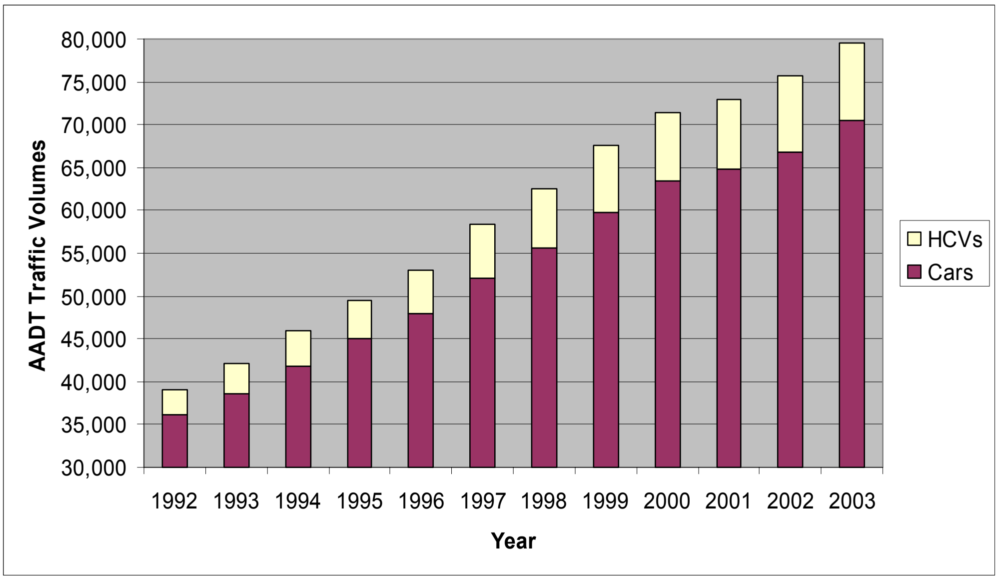
Traffic Growth

Table 5.5 and Figure 5.6 present the daily traffic data and growth rates for the Gateway Bridge, disaggregated by private vehicles (Toll classes 1 and 2) and HCVs (Toll classes 3 and 4).

Table 5.5 Gateway Bridge Historical AADT Traffic

Year	Private vehicles	HCVs	Total	Private vehicles (%pa)	HCVs (%pa)	Total (%pa)
1992	36,086	3,027	39,113			
1993	38,553	3,500	42,053	6.8	15.6	7.5
1994	41,737	4,194	45,931	8.3	19.8	9.2
1995	44,979	4,445	49,424	7.8	6.0	7.6
1996	47,910	5,075	52,985	6.5	14.2	7.2
1997	52,081	6,232	58,313	8.7	22.8	10.1
1998	55,657	6,907	62,564	6.9	10.8	7.3
1999	59,828	7,725	67,553	7.5	11.8	8.0
2000	63,446	8,014	71,460	6.0	3.7	5.8
2001	64,819	8,125	72,944	2.2	1.4	2.1
2002	66,877	8,827	75,704	3.2	8.6	3.8
2003	70,447	9,073	79,520	5.3	2.8	5.0
Average Growth Rates (%pa):						
1992-97	7.6	15.5	8.3			
1997-03	5.2	6.5	5.3			

Source: Queensland Motorways Limited.



Source: Queensland Motorways Limited.

Figure 5.6 Gateway Bridge Historical AADT Traffic

The key points from the above data are:

- Annual average daily traffic (AADT) on the bridge has grown from 39,113 (1992) to 79520 (2003), or an average of 6.7% per annum;
- During this period, AADT HCV growth averaged 10.5% pa and car growth averaged 6.3% pa;
- Total growth rates in recent years have slowed, from 8.3% pa (1992-1997) to 5.3% pa (1997-2003). The growth rates have slowed because:
  - since the late 1990s, the bridge has reached capacity for three hours (3pm to 6pm) in the southbound direction and therefore has very limited growth potential in this period;
  - the bridge will shortly reach capacity for three hours (6am to 9am) in the northbound direction and therefore has very limited growth potential in this period;
  - mandatory trips that would prefer to travel in this period either tolerate the increased levels of congestion, or use an alternative route or re-time outside the peak periods. Discretionary trips either tolerate the increased levels of congestion, use an alternative route, re-time outside the peak periods, are deferred or not made at all; and
  - The high HCV growth rate can partially be attributed to toll reductions and simplification of the toll structure during this period.

5.3.6 Tolling

Location of Tolled Sections

In the Brisbane metropolitan road network there are a number of existing toll facilities; Figure 5.7 shows the locations of these facilities on the Gateway and Logan Motorways. Queensland Motorways is the franchise owner and operator of the Gateway Bridge, the Logan Motorway and the Port of Brisbane Motorway.

Current Toll Levels

The toll charge is determined by vehicle class at the tolling locations. Table 5.6 shows the current toll levels as from July 1, 2000 (GST inclusive).

Table 5.6 Motorway Tolls

Vehicle Classification	Gateway Mwy (Gateway Bridge)	Gateway Mwy (Kuraby)	Logan Mwy (Loganlea Rd)	Logan Mwy (Staplyton Rd)
Motorbikes	$1.10	$0.60	$0.60	$0.60
Cars and cars with trailers	$2.20	$1.50	$0.90	$1.60
Trucks with two axles	$2.20	$1.50	$0.90	$1.60
Trucks with two axles and trailer	$5.50	-	-	-
Trucks with 3 or more axles	$5.50	$3.90	$2.80	$3.90

Source: Queensland Motorways Limited.

LEGEND
★ Location of Existing Toll Plazas

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FIGURE 5.7
Existing Motorway Tolling Locations

Volumes on Tolled Sections

Analysis of the daily two-way volume characteristics of the existing tolling systems in SEQ is shown in Table 5.7 for the full calendar year of 2003. The traffic model discussed in Section 5.5, is based on a typical weekday (ie the Annual Average Weekday Traffic or AAWT).

Table 5.7 Average Annual Weekday Volumes on Tolled Sections (2003)

Count	Private Vehicles	HCVs	Total
Gateway Motorway (Gateway Bridge)	75,327	12,017	87,344
Gateway Motorway (Kuraby)	18,530	4,243	22,773
Logan Motorway (Loganlea Road)	24,339	5,544	29,883
Logan Motorway (Stapylton Road)	21,814	3,873	25,687

Source: Queensland Motorways Limited.

5.3.7 Public Transport Services

Existing Rail Service Details

Queensland Rail CityTrain operates a passenger rail transport system over a network of seven lines. The study area is serviced by three of these lines:

- Airtrain – Brisbane Airport Rail Link which runs 4 services per hour during weekday peaks, 2 services per hour on Saturdays and 4 per hour on Sundays;
- Pinkenba Railbus and Doomben Rail Line – bus link from Pinkenba to Doomben or Eagle Junction with a rail link from Doomben or Eagle Junction to the CBD with 2 to 3 services per hour on weekdays; and
- Cleveland Branch Rail Line – from Cleveland and Wynnum to the CBD with up to 6 services per hour during weekday peaks.

Existing Bus Service Details

A number of bus services operate in the vicinity of the Gateway Motorway including the following:

- Great Circle Line – buses travel on the Gateway Motorway between Cannon Hill and Toombul with 2 services per hour during the peak and non peak times during the week;
- Northern Services from Nudgee to CBD via Toombul – 2 services per hour during weekday peaks;
- Southern Services from Garden City to CBD via Wishart – up to 6 services per hour during weekday peaks;
- Eastern Services from Wynnum, Tingalpa or Cannon Hill to the CBD – up to 5 services per hour during weekday peaks;
- Eastern Services from Carindale or Cribb Road to the CBD – up to 13 services per hour during weekday peaks; and
- Eagle Farm Service from the CBD – 3 services in both the morning and evening peak periods mainly used by workers in the Eagle Farm area.

Only one local bus route, the Great Circle route 598/599, travels along the Gateway Motorway. This route provides interchange with radial bus and rail routes both north and south of the Gateway Bridge. The Great Circle service has been operating for the past 18 years at the same frequency with varying performance. The route currently takes three hours to complete and is subject to large variations in travel time due to a number of delay points including the Gateway Bridge, South Pine Road and Stafford Road. The current weekday patronage on the Great Circle service is around 4,000 passengers per day and holding at this level. In addition to the Great Circle Line, there are also long distance coaches linking the Sunshine Coast and Brisbane Airport with the Gold Coast via the Gateway Motorway.

5.3.8 Pedestrian and Cycle Facilities

Details on the existing pedestrian and cycle routes in the study area are provided in Section 6.

5.4 Road Network Performance

TOR Requirements:
The performance of the existing Motorway corridor should be described in terms of:

- through traffic demand;
- travel speeds and travel times;
- intersection operation including operating level service (delays and queuing);
- interaction with public transport, walking and cycling; and
- accident history and road safety.

This section discusses the operation of the road system, particularly with reference to the Gateway Motorway corridor between Mt Gravatt-Capalaba Road and Nudgee Road.

5.4.1 Through Traffic Demand

The Gateway Motorway is part of the National Highway System and the principal orbital road connection between northern and southern metropolitan Brisbane. It also offers the principal freight connection, linking the regional road network with the ATC encompassing Brisbane Airport and the Port of Brisbane.

Longer distance travellers with both origins and destinations outside the corridor require a fast trip through the corridor with minimal stops to keep such trips off principal routes through the Brisbane CBD. The Gateway Motorway does not provide this at most times. It is particularly unsatisfactory in the morning and evening weekday peaks due to heavy congestion on the route itself, lane merging and delays caused by the existing toll plazas at Murarrie and lane merging due to major ramp traffic flows such as those experienced at the Airport Drive interchange.

The congestion experienced in this corridor will continue to deteriorate and so will the level of service for through movement. Further, delays are likely to encourage longer distance traffic to take circuitous routes on less suitable roads to provide a lower travel time. This is undesirable for safety and amenity on these alternative routes.

5.4.2 Travel Speeds and Travel Times

In the morning peak, the Gateway Motorway is under speed northbound between Wynnum Road and the Gateway Bridge and on the section south of Airport Drive. Southbound is under speed between Toombul Road and the Links Avenue ramps. Figures E2 and E3 (in Appendix E2) show the vehicle travel speeds modelled in 2003 on the road network in the study area for the morning and evening peaks.

In the evening peak, southbound traffic on the Gateway Motorway is under speed between the bridge and Wynnum Road. Northbound traffic is also under speed between Kingsford Smith Drive and Airport Drive.

The major motorways such as the Bruce Highway, Pacific Motorway, Gateway Motorway, Logan Motorway, South East Freeway and Ipswich Motorway are characterised by peak direction slow travel speeds restricting them from operating at close to their free flow speeds. This indicates that these motorways are currently carrying volumes close to their practical capacities and flow breakdowns are occurring. Arterials within inner city areas are typically operating at between 20 and 40km/h in the peak periods (refer Figures E4 and E5 in Appendix E2).

Table 5.8 shows the modelled travel times for selected routes for both peak periods for 2003.

Table 5.8 2003 Modelled Travel Times, Selected Routes, Peak Direction

Route	Morning Peak Travel Time	Evening Peak Travel Time
Nudgee – Rochedale	28	23
Rochedale – Airport	30	21
CBD – Airport	24	21
Caboolture – Port of Brisbane	54	49
Acacia Ridge – Port of Brisbane	31	26
Beenleigh – Caboolture	69	73

5.4.3 Intersection Operation

The operation of the following interchanges/intersections located in the vicinity of the Gateway Motorway have been analysed with the aaSIDRA computer program using 2003 modelled volumes and intersection characteristics to assess existing intersection performance:

- Nudgee Road;
- Toombul Road;
- East West Arterial/Airport Drive;
- Kingsford Smith Drive/Fison Avenue/Gateway northbound on ramp;
- Kingsford Smith Drive/Links Avenue/Schneider Road;
- Lytton Road;
- Wynnum Road;
- Old Cleveland Road; and
- Mt Gravatt-Capalaba Road.

The intersection operation has been assessed in terms of Degree of Saturation (DOS), Level of Service (LOS) and 95th percentile queue. The adopted upper capacity limit for acceptable operation in terms of DOS is 0.95 which is the ratio of demand to available capacity for the most critical movement at the intersection. LOS provides an indication of the operational adequacy of the intersection. Performance is characterised by six levels of LOS based on the average delay experienced per vehicle as presented in Table 5.9. The queue length has been reviewed against available Gateway Motorway off ramp storage space.

The intersections have been considered in isolation only as an analysis of signal coordination of the intersections is beyond the capabilities of aaSIDRA.

Table 5.9 Intersection Performance: Definition of LOS Criteria

Level of Service (LOS)	Average Delay per Vehicle (secs/veh)	
	Traffic Signals, Roundabouts	Give Way and Stop Signs
A	Less than 10	Less than 10
B	10 to 20	10 to 15
C	20 to 35	15 to 25
D	35 to 55	25 to 35
E	55 to 80	35 to 50
F	Greater than 80	Greater than 50

Source: Highway Capacity Manual, 2000.

The Gateway Motorway interchange intersections are generally providing adequate performance at current traffic levels. In the AM peak, intersections that are currently operating at unsatisfactory levels of performance include:

- East-West Arterial/Airport Drive roundabout;
- Lytton Road southbound off ramp signalised intersection;
- Both Wynnum Road signalised interchange intersections; and
- Both Mt Gravatt-Capalaba Road signalised interchange intersections.

Important to note is that the East-West Arterial/Airport Drive roundabout was upgraded in 2003 with the provision of left turn slip lanes on all approaches to separate these movements from the roundabout. This has significantly improved the operation of this interchange however the through demand from the East-West Arterial still exceeds the available capacity.

In the PM peak, intersections that are currently operating at unsatisfactory levels of performance include:

- Both Kingsford Smith Drive signalised intersections; and
- Both Wynnum Road signalised interchange intersections.

The assessed 95th percentile off ramp queue lengths are of levels that do not result in queuing back on to the Gateway Motorway at present. However the worst of these, the southbound Wynnum Road off ramp, is close to reaching its queuing storage capacity.

The poor performance of these intersections results in extensive and persistent queuing which creates safety and operational problems for users. It also degrades the environmental amenity for adjoining properties.

5.4.4 Interaction with Public Transport Facilities

Interaction with Rail Services

Of the existing rail services, the Airtrain is likely to be the most affected by the GUP as airport travel makes up a significant percentage of the total trips on the Gateway Motorway.

Brisbane Airport has been served by an airport rail link – 'Airtrain' – since 2001. Airtrain links the airport with the Brisbane CBD, the Gold Coast and (by interchange in Brisbane) elsewhere on the extensive Citytrain network. Airtrain is capturing approximately 2.6% of air passengers which equates to approximately 2% of all airport related travel.

Patronage figures for 2002/2003 have not been released but Airtrain is understood to have experienced a 30-40% increase in patronage in 2003. AVSTATS data for 2002/03 shows that total passenger movements through Brisbane Airport was less than 1% higher than in 2001/02, suggesting that Airtrain has substantially increased its share of airport access trips.

Interaction with Bus Services

Of the existing bus services, only one local bus route, the Great Circle route 598/599, travels along the Gateway Motorway. This route provides interchange with radial bus and rail routes both north and south of the Gateway Bridge. In addition to the Great Circle Line, there are also some long distance coaches linking the Sunshine Coast and Brisbane Airport with the Gold Coast via the Gateway Motorway.

Translink advise that the Great Circle Route provides important cross town links – including the link between Toombul and Carindale over the Gateway Bridge – and these may well be strengthened in the longer term. However, at present the service suffers from the impact of traffic congestion, especially on the motorway section, with a negative impact on the quality of the service throughout its length. Translink intend to review the operation of critical route sections over the coming year with a view to improving the reliability and timekeeping performance of the service.

5.4.5 Accident History and Road Safety

Table 5.10 shows the number of accidents recorded along the Gateway Motorway between Mt Gravatt-Capalaba Road and Nudgee Road over the five year period, 1999 to 2003 inclusive.

Table 5.10 Accidents on Gateway Motorway (1999-2003)

Location	Number of Accidents						
	Dist (km)	1999	2000	2001	2002	2003	Total
Mt Gravatt-Capalaba Rd to Bridge	10.79	81	93	89	60	88	**411**
Gateway Bridge	3.25	17	15	23	17	29	**101**
Bridge to Nudgee Road	8.38	40	56	76	71	44	**287**
Total	***22.42***	***138***	***164***	***188***	***148***	***161***	***799***

Source: Department of Main Roads ARMIS Road Crash Database

A significant feature of the analysis in the above table is that no trend in the number of accidents either increasing or decreasing over time is evident. The motorway section between Mt Gravatt-Capalaba Road and the bridge accounts for the highest proportion of accidents within the study area and also has the highest accident rate per lane kilometre at 1.9 accidents/lane km/year. Table 5.11 contains a breakdown of the severity of accidents on the Gateway Motorway over the 5 year period from 1999 to 2003.

Table 5.11 Accidents on Gateway Motorway (1999-2003)

Location	Severity						
	Dist (km)	Fatal	Hospital-isation	Medical treatment	Minor injury	Damage only	Total
Mt Gravatt-Capalaba Rd to Bridge	10.79	3	70	107	59	172	**411**
Gateway Bridge	3.25	2	11	0	46	42	**101**
Bridge to Nudgee Road	8.38	3	33	87	64	100	**287**
Total	***22.42***	***8***	***114***	***194***	***169***	***314***	***799***

Source: Department of Main Roads ARMIS Road Crash Database

Although the fatalities are spread fairly evenly between the sections analysed, the motorway section between Mt Gravatt-Capalaba Road and the bridge is shown to account for a significantly higher number of hospitalisations than the other sections.

The above tables provide aggregate statistics of the road safety performance of the Gateway Motorway. A more useful comparison of the road safety performance of individual road sections is provided by accident rates, which account for the amount of travel on each of the roads or vehicle kilometres travelled (VKT). The accident rate is a measure of exposure to a crash event. One VKT is equivalent to one vehicle travelling a distance of one kilometre or alternatively, two vehicles travelling for a distance of half a kilometre. In this study, crash rates have been expressed per 100 million vehicle kilometres travelled. A summary for the Gateway Motorway is shown in Table 5.12.

Table 5.12 Accident Rate Analysis (1999-2003) – Gateway Motorway

Road Section	Accidents	Travel	Accident Rate
	1999-2003	2003 Million VKT	Accidents per 100 million VKT
Mt Gravatt-Capalaba Road to Bridge	411	250	32.9
Gateway Bridge	101	90	22.4
Bridge to Nudgee Road	287	188	30.5
Total	***799***	***528***	***30.3***

Source: Department of Main Roads ARMIS Road Crash Database

In comparison to the above accident rates for the Gateway Motorway, the average accident rates on other regional routes have also been collated and are shown in Table 5.13.

Table 5.13 Accident Rate Analysis (2001-2003) – Selected Regional Routes

Road Section	Accidents 2001-2003	Travel 2003 Million VKT	Accident Rate Accidents per 100 million VKT
Bruce Hwy-Pine River to Boundary Road	104	248	13.9
Pacific Mwy-Coronation Dve to Gateway Mwy	484	589	26.5
Pacific Mwy-Gateway Mwy to Logan Mwy	280	539	17.3
Pacific Mwy-Logan Mwy to Oxenford I/C	65	347	18.7

Source: Department of Main Roads ARMIS Road Crash Database

As shown in the above table, the accident rates for both the Bruce Highway and Pacific Motorway are substantially lower than the section of the Gateway Motorway proposed to be upgraded as part of the GUP. These rates are supported by data from the RTA for the NSW freeway road network which has an average accident rate of 18.8 accidents per 100 million VKT based on a five year crash database (1997-2001)[1]. It can be concluded that currently the Gateway Motorway exhibits a much higher accident rate than the rate for a typical motorway section.

The accident rate on the Gateway Motorway means that motorists using the road have up to a 50/50 chance of being delayed because of an accident on any given day. The rate of accidents on the Motorway (800 over the last five years) means slower and riskier journeys for commuters using the road.

Summary

Current traffic demands on the Gateway Motorway are leading to reduced travel speeds, poor levels of service at ramps and merges, and a high rate of vehicular accidents as sections of the motorway reach their design capacities. The result of the overloading of the Gateway Motorway includes:

- Excessive delays during peak periods and unreliable travel times;
- Extensive and inappropriate use of local roads to support long distance movements;
- Reduced accessibility to the Brisbane Airport and the ATC; and
- Discouragement of bus trips in the corridor.

Overall, the traffic and transport situation along the Gateway Motorway is substandard and requires action. The present arrangements are clearly unsustainable.

[1] RTA (2004) Road Environment Safety Update 22.

5.5 Traffic Forecasting Methodology

TOR Requirements:
A description of the modelling studies undertaken for the project should be provided, with particular emphasis on:

- land use patterns – a description of the population and demographic forecasts used;
- the scope and validity of the transport models used (overview only);
- the provision of year forecasts - 2006, 2011, 2016, 2021;
- network improvements in modelling – which upgrades have been included in the modelling (eg North South Bypass Tunnel) and changes to land use resulting from urban renewal opportunities; and
- An explanation of how alternative future scenarios were modelled.

An explanation should also be provided on how to assess and deal with induced and suppressed traffic.

Traffic forecasting was undertaken to quantify the impacts of the proposed GUP in terms of:

- Trip distributional changes;
- Travel volumes, speeds and delays on GUP and the surrounding road network; and
- To support the GUP Business Case.

Computer based models prepare traffic forecasts taking into account forecasts of future land use changes (population, workforce, and employment) and use trip generation, distribution and mode choice characteristics ascertained from detailed surveys of travel behaviour in Brisbane. The models are supplemented with numerous traffic surveys including classified count surveys, travel time surveys and origin destination surveys to calibrate and validate the modelled traffic forecasts.

This section presents the forecast land-use changes used in the modelling process and then describes the traffic forecasting process in more detail. Appendix E3 contains further details on components of the traffic forecasting models. However, in brief terms, the modelling initially relies heavily on the Brisbane Strategic Transport Model (BSTM) and work conducted for the Planning Study with some specific enhancements as identified in Appendix E3.

5.5.1 Land Use and Trip Patterns

Population

As a component of the Planning Study a revision of demographics was conducted within the Gateway primary study area and updated data from recent studies was incorporated. In summary the following processes were conducted:

- The ATC area was disaggregated into a finer zone system using updated population and employment forecasts provided by the Planning, Information and Forecasting Unit (PIFU). The disaggregated demographic details within the ATC were derived with significant input from the various ATC stakeholders; and
- Revised demographic data from recent studies for the Pine Rivers and Ipswich Local Government Areas (LGAs) was incorporated.

PIFU, a section of the Department of Local Government and Planning prepares land use forecasts for the whole of Queensland including the Brisbane Statistical Division (BSD) which forms the boundary of the Brisbane Strategic Transport Model (BSTM) used in this study. A detailed model has been established which allocates growth in population and employment to Local Government Areas (LGAs) according to a predetermined likelihood of land being developed or redeveloped. Outputs from the model are validated to 2001 Australian Bureau of Statistics (ABS) Census data and forecast from 2006 to 2026 at 5 yearly increments including:

- Estimated Resident Population; and
- Estimated Age Structure.

In late 2003, PIFU released the document *Queensland's Future Population – 2003 Edition* which contains the latest available demographic projections.

The process of land use forecasting is extremely complex and data intensive. It requires a proving process before application to transport planning. In this regard, a detailed review of the forecasts previously used in the BSTM, the revisions conducted in the Planning Study and the latest forecasts from PIFU was conducted. Once this was completed and adjustments made, the PIFU forecasts for the forecast years 2006-2026 were incorporated and vehicle trip tables produced which contain estimates of private vehicle and commercial vehicles trips between origin and destination zones within and external to the BSD.

Population forecasts for the years 2006, 2011, 2016 and 2021 have been used in the traffic forecasting and analysis. In addition, population forecasts for 2003 were interpolated from the 2001 and 2006 data. Current forecasts beyond this are considered to be too uncertain to use for long term road network planning. Given this, it was considered prudent to take the trend in growth to 2021 and extrapolate it to assess years after 2021, should this be required.

Table 5.14 below summarises the population forecasts used in the GUP analysis. The summary shows the forecasts based on the 12 sector system shown in Figure E6 (Appendix E4). The population forecasts for the ATC used in this analysis are also shown in Table 5.15. The ATC sub-sector system is shown in Figure E7 (Appendix E4).

Table 5.14 Estimated Resident Populations from 2001 to 2021 by Sector

Sector	2001	2006	2011	2016	2021	Growth per annum 2001-21
Caboolture	108,680	126,033	141,396	158,600	175,700	2.4%
Redcliffe	49,891	52,171	54,179	55,760	56,893	0.7%
Pine Rivers	122,303	143,332	163,814	181,747	194,991	2.4%
Brisbane North East	246,311	263,208	272,739	277,765	284,112	0.7%
Brisbane North West	166,825	178,100	184,116	189,345	197,699	0.9%
Ipswich	114,494	127,043	143,832	162,014	181,890	2.3%
Logan/Beaudesert West	5,488	6,783	8,686	10,298	12,306	4.1%
Logan/Beaudesert South	182,931	201,611	220,868	240,148	256,896	1.7%
Redland/Gold Coast	169,986	186,386	202,961	219,587	232,281	1.6%

Sector	2001	2006	2011	2016	2021	Growth per annum 2001-21
Brisbane South East	221,513	235,720	241,197	244,474	248,539	0.6%
Brisbane South West	143,007	162,177	173,574	180,475	188,186	1.4%
Brisbane South	118,993	133,996	146,604	157,345	160,475	1.5%
Total	**1,650,422**	**1,816,561**	**1,953,966**	**2,077,559**	**2,189,968**	**1.4%**
Growth (% pa)		**1.9%**	**1.5%**	**1.2%**	**1.1%**	

Table 5.15 Estimated Resident Populations from 2001 to 2021 for the ATC

Sub-Sector	2001	2006	2011	2016	2021	Growth per annum 2001-21
Brisbane Airport	0	0	0	0	0	0.0%
Eagle Farm	38	84	128	173	217	9.1%
North	364	376	379	378	378	0.2%
North of River	402	460	507	551	595	2.0%
South	2771	2896	2824	2726	2752	0.00%
South of River	2771	2896	2824	2726	2752	0.00%
Total	**3173**	**3356**	**3331**	**3277**	**3347**	**0.3%**
Growth (% pa)		**1.1%**	**-0.1%**	**-0.3%**	**0.4%**	

These projections indicate that the resident population of the BSD is set to increase by over 500,000 or 33% above current levels between 2001 and 2021 to close to 2.2 million people. The sectors where forecast growth is highest are Caboolture, Pine Rivers, Ipswich and Logan/Beaudesert West where land is still available for development. The sectors most influenced by the GUP are Brisbane North East and Brisbane South East which are both forecast to experience moderate future population growth in the order of 0.6-0.7% pa.

The population of the ATC is not forecast to change substantially during the forecast period. This is not surprising given the industrial nature of the precinct. However, allowance has been made for some residential development in Hamilton.

Employment

Table 5.16 below summarise the employment forecasts used in the GUP analysis. The summary shows the forecasts based on the 12 sector system shown in Figure E6 (Appendix E4). The employment forecasts for the ATC used in this analysis are also shown in Table 5.17.

Table 5.16 Estimated Employment from 2001 to 2021 by Sector

Sector	2001	2006	2011	2016	2021	Growth per annum 2001-21
Caboolture	28,085	35,941	43,713	51,587	56,785	3.6%
Redcliffe	12,773	12,952	12,862	13,073	13,219	0.2%
Pine Rivers	25,426	32,057	38,687	44,086	47,985	3.2%
Brisbane North East	269,552	290,433	311,325	340,099	354,003	1.4%
Brisbane North West	80,343	85,867	91,318	102,549	106,981	1.4%
Ipswich	36,559	42,233	47,907	53,581	56,602	2.2%
Logan/Beaudesert West	295	307	319	362	382	1.3%
Logan/Beaudesert South	51,324	61,422	71,519	82,118	88,067	2.7%
Redland/Gold Coast	41,949	50,646	59,248	68,093	73,215	2.8%
Brisbane South East	89,614	101,614	111,221	123,120	128,687	1.8%
Brisbane South West	114,552	123,819	132,316	147,528	153,712	1.5%
Brisbane South	48,624	53,801	58,218	66,469	71,435	1.9%
Total	**799,095**	**891,090**	**978,653**	**1,092,666**	**1,151,074**	**1.8%**
Growth (% pa)		**2.2%**	**1.9%**	**2.2%**	**1.0%**	

Table 5.17 Estimated Employment from 2001 to 2021 for the ATC

Sub Sector	2001	2006	2011	2016	2021	Growth p/annum 2001-21
Brisbane Airport	7,347	12,905	18,505	24,020	30,200	7.3%
Eagle Farm	8,650	11,275	13,825	16,989	19,318	4.1%
North	5,257	5,774	6,963	8,224	10,138	3.3%
North of River	21,254	29,954	39,293	49,233	59,656	5.3%
South	15,116	22,720	27,456	30,739	33,822	4.1%
South of River	15,116	22,720	27,456	30,739	33,822	4.1%
Total	**36,371**	**52,675**	**66,750**	**79,973**	**93,299**	**4.8%**
Growth (% pa)		**7.7%**	**4.9%**	**3.7%**	**3.1%**	

The number of jobs in the ATC is forecast to increase from 36,400 in 2001 to more than 93,000 in 2021, an increase of 4.8% pa, compared with an average increase of around 1.8% pa for the BSD. This also implies that background growth in Brisbane north east and south east outside of the ATC is quite low, consistent with low population growth of 0.6% - 0.7% pa. The ATC share of total jobs in the Brisbane Statistical District (SD) is forecast to increase from 4.6% to 8.1% over the same period. The forecasts shown in the above tables for the ATC are “consensus” forecasts developed in consultation with the major stakeholders in the Planning

Study and updated by MWT. These employment forecasts could be even higher if the Brisbane Airport 2003 Master Plan forecasts are realised.

The Brisbane Airport and Port of Brisbane are special generators as jobs alone do not determine the total amount of traffic. To the employment, generated traffic must be added including air passenger related traffic, airside services, retail driven traffic and container movements. Therefore the traffic generation was determined exogenously and the BSTM was constrained to these volumes.

For the ATC, it is important to understand that the level of development adopted up to 2021 does not represent full development of the ATC. The Port of Brisbane will expand beyond 2021 by full development of existing sites. The 2021 forecasts do not include full take up of industrial land in the areas south and north of the river. BCC has recently indicated growth at Pinkenba/Myrtletown will proceed well beyond 2021. BAC plans for 2021 also do not represent full development of their lands and are based on the existing two terminal arrangement. A second runway and third terminal are part of longer term plans. Large areas of vacant land on the BAC site will also be available past 2021.

These facts differentiate the forecasts up to 2021 from a circumstance where the forecasts relate to full development of a land parcel. This then gives some comfort that the levels of development which have been adopted will at some point be achieved. The possibility that the timing could be slower than anticipated is more likely than growth falling short of levels adopted.

External Cordon

Crossings of the outer Brisbane Strategic Transport Model (BSTM) boundary area have been represented within the BSTM as travel to and from a series of cordon zones (16 locations). The characteristics governing the amount and distribution of external travel via the cordon points is controlled by a series of parameters, including:

- Total 24 hour target vehicle volumes;
- Proportion of through trips (ie travel non-stop to another external cordon);
- Proportion by aggregated trip purposes (including heavy commercial vehicle proportion) at the cordon; and
- Internal sector distribution for groups of external cordon points.

These cordon characteristics have been used to divide the external traffic at the cordon point into specific markets, and origin destination distribution patterns. The cordon control totals were originally based on 1996 traffic counts. Growth in traffic entering and exiting the study area at the 16 external cordon locations was based on a compounding growth rate derived from analysis of the ABS population (medium) forecast data for 2001 and 2011.

The external cordon data has been updated to incorporate the latest data available. Initially the 2001 24 hour target vehicle volumes were validated to match 2001 traffic counts. Then using the latest PIFU forecast population data for the surrounding LGAs, the compounding growth rate for each five year interval was updated to better represent the forecast growth in external cordon crossings.

5.5.2 Overview of the Traffic Modelling Process

The process used to forecast traffic flows on the road system involved a number of steps using the BSTM, a set of computer based models and proprietary software. Figure 5.8 shows the general steps involved in the process.

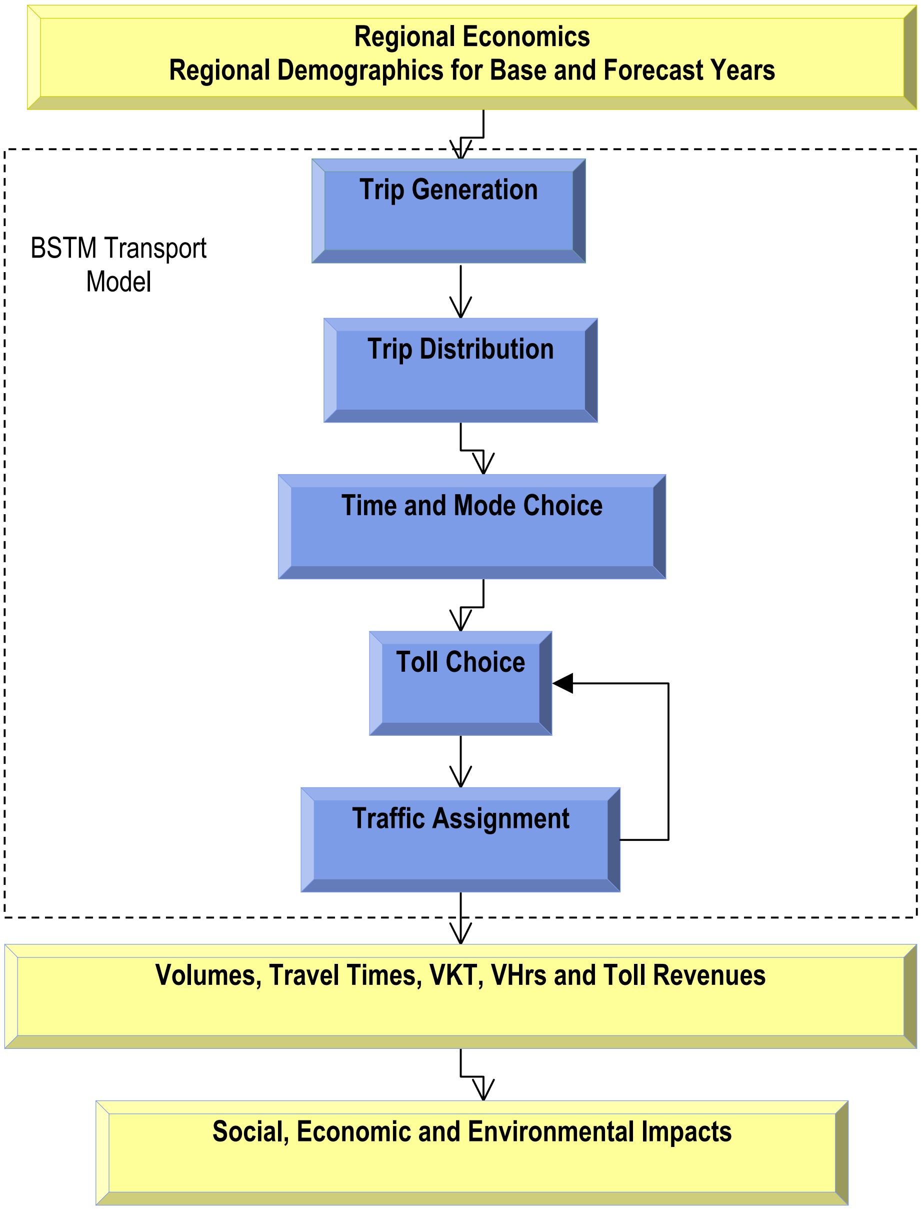

Figure 5.8 BSTM Modelling Framework

The steps can broadly be described as:

1. **Trip Generation -** The objective of the trip generation step is to relate the intensity of trip making to, and from, land use parcels (zones) to measures of the type and intensity of land use. This involves developing a relationship between the number of trips attracted to, or produced by, a zone and the characteristics of the zone. That relationship can then be used to predict the future number of trips. When speaking of trip generation, a "trip" is defined as travel between two places of activity. In this step the zonal productions and attractions by purpose are produced for the base and each forecast year.

2. **Trip Distribution** – The aim of trip distribution is to distribute the trips originating in each zone across all destination zones. This amounts to linking the zonal trip productions (P_i) and zonal trip attractions (A_j) estimated from the trip generation models. Essentially this corresponds to the stage of travellers choosing a destination for their trips. The gravity model is the most common form of trip distribution model and is used in the BSTM. In this step the metropolitan wide levels of traffic origin–destination patterns for existing and future conditions was estimated based on land use forecasts. The output from this step is a person trip table by purpose which provides an estimate of the number of person trips between origin and destination zones in Brisbane for the base and forecast years.

3. **Time Period and Mode Choice** – In the mode choice phase of the analysis the aim is to predict how many people, travelling between a particular origin and destination would use each of the available modes (eg car, train, bus). The BSTM model in its current form does not explicitly model mode choice. Mode choice modelling is replaced by a sector based set of separate factors for walk/cycle proportions and private vehicle proportions. Conversion of person vehicle trips to vehicle trips is carried out globally using vehicle occupancy factors applied by trip purpose. Time period factors are used to separate the daily vehicle trips into the three analysis time periods; morning peak period (7:00am to 9:00am), evening peak period (4:00pm to 6:00pm) and off peak (remainder of the day).

4. **Toll Choice** – The toll choice model aims to split the vehicle demand into those using a tolled facility and those preferring the free alternative. There are two broad approaches to forecasting demand for toll roads, either behavioural route choice (BRC) methods or assignment with toll incorporated into the generalised cost (TDP). In the former, a toll choice logit model calculates for each origin-destination pair, the generalised cost (time, distance and toll costs converted to common units) to travel via the toll road or not, and determines the proportion of trips which are prepared to pay the toll. The tolled trips are assigned to the whole network (which has no toll penalties) concurrently with the non tolled trips, which are assigned to a network where links containing toll plazas are banned. The procedure continues iteratively with updated travel times input to the toll choice model, until the predicted toll road traffic converges. In the latter, tolls are represented in a road network by adding a penalty to any link that includes a toll plaza. If time alone is the basis for the generalised costs used in choosing a route, the equivalent time penalty can be calculated from the toll price using an average value of time adjusted for any tollroad route bias. This penalty is than included in the generalised cost of the toll route and the assignment algorithm is used to allocate trips between the toll route and the alternative non toll road.

5. **Traffic Assignment** - In the traffic assignment phase, the aim is to determine the flows on each link in the network. Fundamentally, traffic assignment deals with the problem of route choice through a network with the volumes and travel times on each link as outputs of this process. Traffic assignment for the GUP is conducted using a multiclass equilibrium assignment using separate generalised costs for each vehicle class (private vehicles and HCVs) and using Passenger Car Units (PCU) factors to convert the heavy commercial vehicles (HCVs) class.

The traffic modelling for the GUP uses the assignment with toll incorporated into the generalised cost as the main method for forecasting tollroad demand. This approach has been used extensively in the BSTM. However, the behavioural route choice method was also implemented as a sensitivity test.

The toll choice model is implemented in EMME/2 as an equilibrium assignment with generalised cost, where the generalised cost is the “Effective Time” added to each toll plaza. The “Effective Time” is defined as:

- Effective Time (min) = Toll Penalty (min/$) [Toll ($) - Route constant ($)]

Where:

- “Effective Time” is the additional time added to the tolled link to reflect the influence of the toll on drivers’ route choice;
- “Toll Penalty” is the inverse of the Value of time;
- “Route Constant” is an adjustment to the toll at a particular location, to reflect the influence of other variables. The Constant is typically positive for tolled routes, reflecting a basic ‘attractiveness’ of the tolled route, sometimes called the toll bonus.

This method has two main weaknesses, neither of which applies to the single point toll on the Gateway Bridge:

- there can be excessive sensitivity of demand responses as a tolled route changes from being the shortest (generalised cost) route to the “second best” route as toll levels are increased. The use of a balanced probability based consumer choice function removes some of this excessive sensitivity; and

- conventional link based models using generalised costs cannot predict demand under the more complex tolling strategies permitted by electronic tolling such as:
  - distance based or section based tolls with toll caps;
  - discounts if more than two tollroads are used in a single trip; and
  - evaluation of the impacts of multiple tolls

With the introduction of ETC and proposed tunnel proposals, it is clear that the behavioural route choice method will be required in the future.

5.5.3 Provision of Future Traffic Forecasts

Modelling output for the EIS has been provided for 2011, the projected year of opening of the project and also 2021.

The underlying growth in population and employment within the BSD shown in Tables 5.14 and 5.16 is forecast to drive a significant increase in vehicle trips in the future. Table 5.18 presents the forecast vehicle trips in the forecast years and the corresponding per annum growth rates over the preceding interval.

Table 5.18 Forecast BSD Weekday Vehicle Trip Growth from 2001 to 2021

Year	Trips	% pa
2001	3,925,300	
2003	4,095,600	2.1%
2006	4,351,100	2.0%
2011	4,697,700	1.5%
2016	5,060,400	1.5%
2021	5,377,900	1.2%

5.5.4 Road Network Improvements for Modelling Purposes

A number of proposed road network improvements were included in the base future year road networks for analysis. These projects are over and above the proposed GUP. The proposed North South Bypass Tunnel (NSBT) and the BCC TransApex initiative were not included in these base future year road networks; instead these have been included as sensitivity tests as discussed in Section 5.5.5. Appendix E5 summarises the projects included in the future year analyses. These projects are also shown diagrammatically in Figure 5.9.

It should be noted that Table E4 (in Appendix E5) is not a committed list of projects. It is merely a list of projects identified by the study team as possible future improvements to the road network. This process of project identification is required in order to present a proper comparison of the road network in the future for when the GUP is considered. Failure to do this would overstate the benefits or otherwise of GUP.

5.5.5 Modelling of Alternative Future Scenarios

The traffic forecasting process as described in Section 5.5.2 provides a baseline estimate of traffic conditions for future years. It needs refinement to take into account implications of the proposed stages of BCC's NSBT and the TransApex initiative and of possible induced traffic arising from the provision of increased road capacity.

Forecasts taking into account these aspects were undertaken as sensitivity tests. The process used to produce them is presented in the following sections.

North South Bypass Tunnel

In 2000, BCC launched the Strategic Transport Opportunities for Brisbane (STOB) project to identify major infrastructure that could be delivered and financed by the private sector and would address deficiencies in the orbital road network. The STOB project identified the following major tolled road tunnels (Figure 5.10):

- **North South Bypass Tunnel Stage 1** - connecting Ipswich Road and the Pacific Motorway from the south at Woolloongabba to Lutwyche Road and the Inner City Bypass at Bowen Hills in the north. Links to and from Shafston Avenue at Kangaroo Point would allow traffic from the eastern suburbs to access the tunnel; and

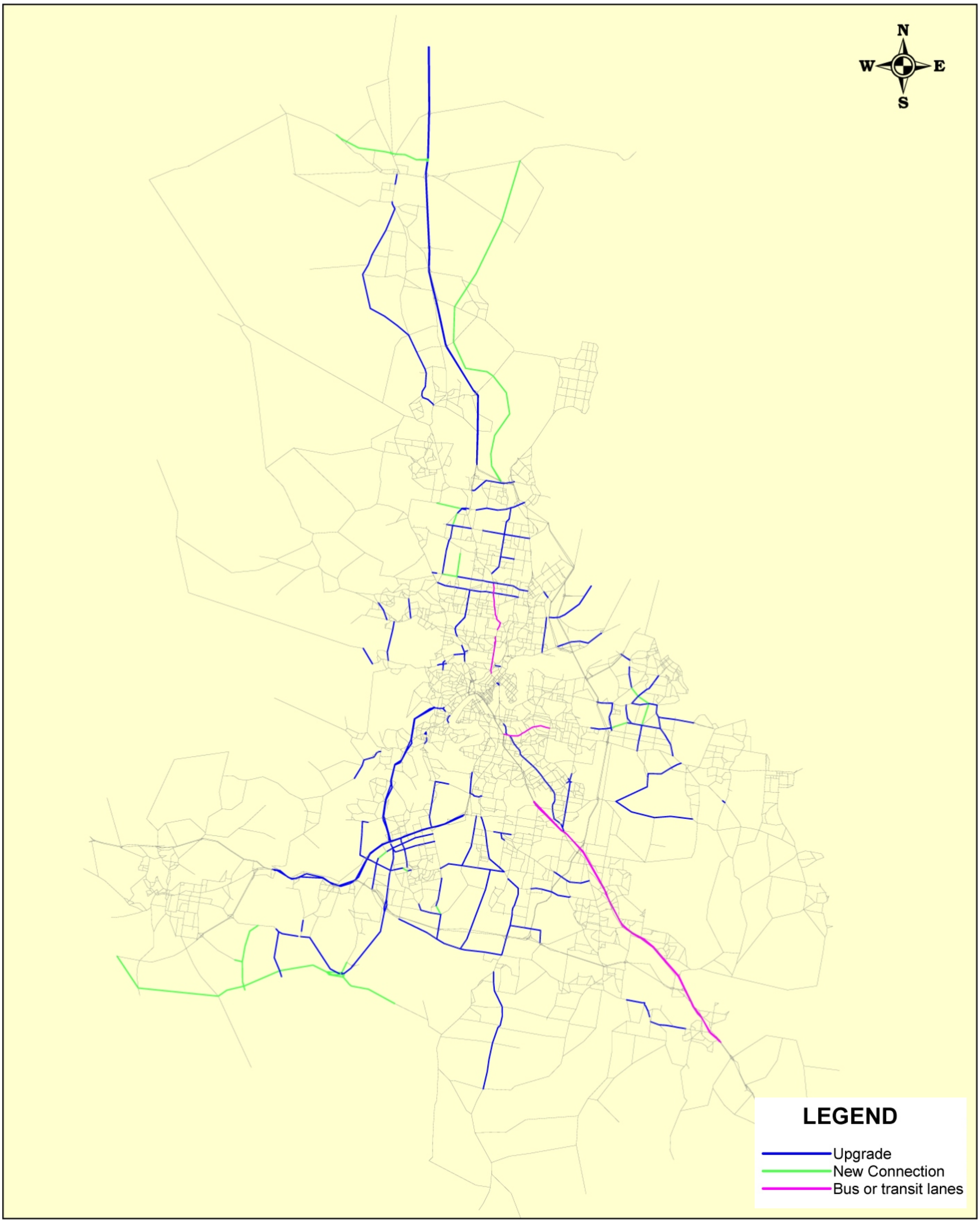

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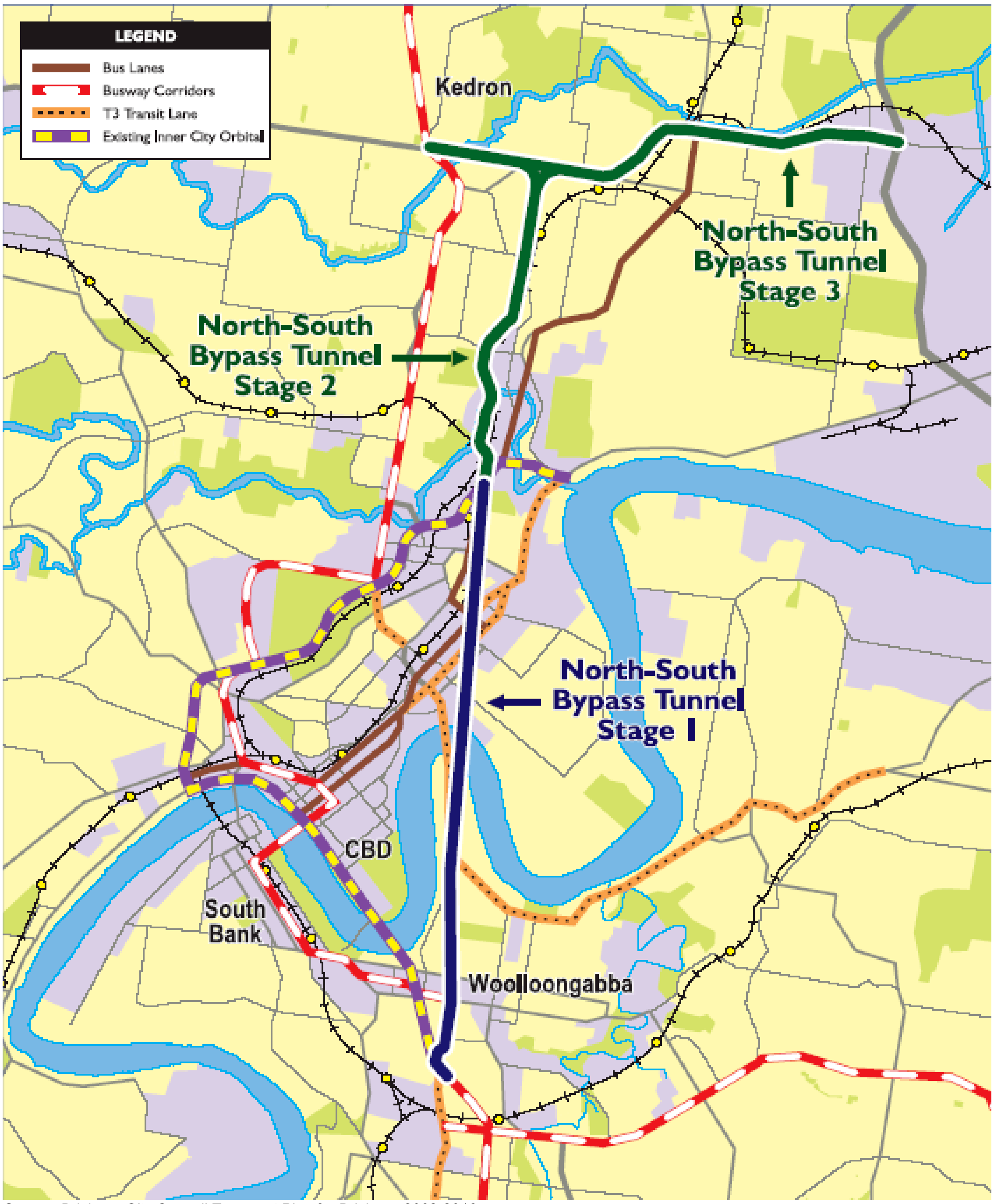
FIGURE 5.9
Road Network Improvements
For Modelling Purposes (Compared to Base Year Network)

- **North South Bypass Tunnel Stages 2 and 3** – connecting the Inner City Bypass to Gympie Road and Stafford Road and to East-West Arterial.



Source: Brisbane City Council Transport Plan for Brisbane 2002-2016.

Figure 5.10 Approximate Location of NSBT Proposal

The 2004 local government elections resulted in the introduction of a new vision for the future transport network of Brisbane known as TransApex discussed in the following section. NSBT Stage 1 is seen as a key element of TransApex, and is being progressed by the BCC as the first stage in its TransApex initiative, with the Detailed Feasibility Phase of planning currently occurring.

The individual and combined effect of all three stages of NSBT has been evaluated as part of this EIS. For modelling purposes NSBT Stage 1 was assumed to be complete by 2011 and NSBT Stages 2 and 3 complete by 2016. The tunnels were assumed to utilise electronic toll collection, have operating speed limits of 80km/h and lane capacities of approximately 1,900 passenger vehicles per hour.

BCC is now is in the process of conducting a detailed feasibility including a business case study for the NSBT where toll levels and mechanisms will be evaluated. It is not for this EIS to make a judgement on what toll levels will be chosen. However, some assumptions about the toll level on the NSBT need to be made, simply for the purpose of assessing the impact of the NSBT on traffic using the Gateway Bridge. The evaluated toll assumptions are:

- An Untolled NSBT. This case results in maximum traffic diversions away from the Gateway Bridge and therefore forms the upper limit of possible impacts; and
- A Like-for-like Toll on the NSBT. This case gives an indication of the relative impacts on traffic using the Gateway Bridge (ie $2.20 toll in each direction on the NSBT, indexed to CPI from 2011 onwards).

Forecasts of changes in the traffic flows resulting from the diversion of private vehicle and HCV drivers to the tunnels and the impacts on traffic volumes in the Gateway Motorway corridor were assessed.

The impact of NSBT on traffic volumes on the Gateway Bridge is largely dependent on the tolling regime introduced. In the scenario where the NSBT is untolled, the traffic diversion away from the Gateway Bridge in 2011 would be as high as eight per cent in 2011 with the NSBT Stage 1 in place. This impact on Gateway would reduce to six per cent by 2021 as congestion levels increased on the NSBT and surrounding road network. If all three stages of the NSBT were in place by 2021 then the traffic diversion away from the Gateway Bridge would be as high as 11 per cent under this untolled scenario.

At a like-for-like tolls scenario as assessed above, traffic diversions away from the Gateway Bridge are assessed as being around two per cent in 2011 and four per cent in 2021 if only NSBT Stage 1 was constructed. The possible impact on traffic volumes on the Gateway Bridge under this tolling scenario is a reduction of eight per cent if all three stages of NSBT were constructed by 2021.

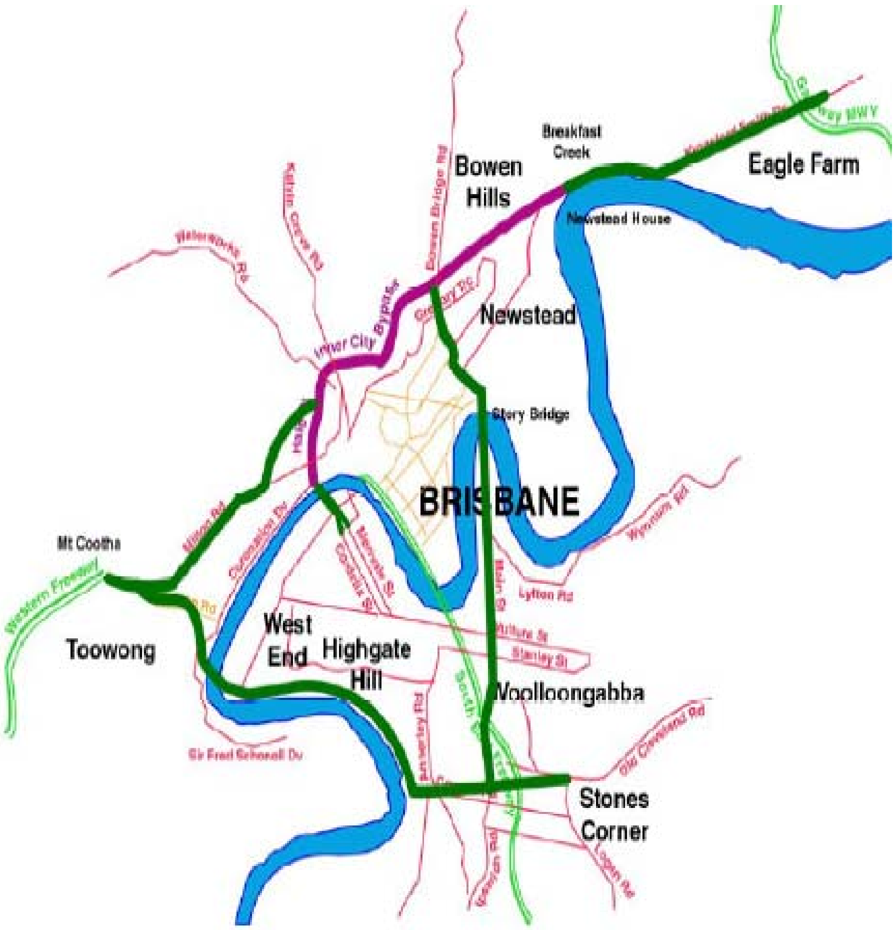
In terms of traffic analysis, the forecast reduction in flows on the Gateway Bridge are marginal, highly dependent on the relative tolling scenarios and does not significantly affect the road design features of the proposed GUP.

TransApex Tunnels

TransApex is a $4 billion proposal to enhance Brisbane city's road network. It involves the construction of five tolled road tunnels, three of which will cross the river, to form an inner orbital road network and provide connections to the city's main arterial roads. The proposed NSBT, discussed in the previous section, is seen as a key element of TransApex and as such is being progressed by the BCC as the first stage in its TransApex initiative.

The other proposed components of TransApex are (Figure 5.11):

- **The East/West Distributor:** a 5.8km, four lane tunnel (including a river tunnel) linking Logan Road and Old Cleveland Road at Stones Corner, the Pacific Motorway and Ipswich Road at Woolloongabba and the Western Freeway at Toowong.
- **The Northern Link:** a 3.6km, four lane tunnel connecting the Western Freeway with the Hale Street Inner City Bypass route. This tunnel will also serve as a link between the East/West Distributor and the North/South Distributor, completing Brisbane's first inner ring road system.
- **The Hale Street/South Brisbane Connection:** a 600m, four lane tunnel linking Hale Street with Merivale and Cordelia Streets at South Brisbane. This tunnel represents a pre-emptive move against an expected growth in traffic in the area caused by the West End Urban Renewal Program.
- **The Kingsford Smith Drive Duplication:** a 3.9km tunnel linking the Inner City Bypass at the Breakfast Creek Hotel with the new alignment of the Gateway Motorway. This tunnel ensures that each of the city's main arterial roads is directly connected to the inner ring road system.



Source: The Newman Liberal Team, Moving Brisbane document.

Figure 5.11 Approximate Location of TransApex Proposal

The combined effect of TransApex has been evaluated as part of this EIS. For modelling purposes, NSBT was assumed to be complete by 2011, the Kingsford Smith Drive duplication by 2021 and the remaining tunnels completed by 2016. The tunnels were assumed to utilise electronic toll collection, have operating speed limits of 80 km/h and lane capacities of approximately 1,900 passenger vehicles per hour.

As is the case with the NSBT assessment conducted in the previous section, it is not for this EIS to make a judgement on what toll levels will be chosen. However, some assumptions about the toll level on the TransApex need to be made, simply for the purpose of assessing the impact of the TransApex on traffic using the Gateway Bridge. The evaluated toll assumptions are:

- An Untolled TransApex. This case results in maximum traffic diversions away from the Gateway Bridge and therefore forms the upper limit of possible impacts; and
- A Like-for-like Toll on the TransApex. This case gives an indication of the relative impacts on traffic using the Gateway Bridge (ie $2.20 toll in each direction on each segment of the TransApex, indexed to CPI from 2011 onwards).

Forecasts of changes in the traffic flows resulting from the diversion of private vehicle and HCV drivers to the tunnels and the impacts on traffic volumes in the Gateway Motorway corridor were assessed.

The impact of TransApex on traffic volumes on the Gateway Bridge is also largely dependent on the tolling regime introduced. In the untolled scenario assessed above, the traffic diversion away from the Gateway Bridge in 2011 would be as high as eight per cent in 2011 with the TransApex in place. This impact on Gateway would reduce to five per cent by 2021 with the complete TransApex in place including the Kingsford Smith Drive duplication which is complementary to the GUP as it would reduce congestion and improve travel times in this corridor and provide better connectivity to the Gateway Motorway.

At a like-for-like tolls scenario as assessed above, traffic volumes on the Gateway Bridge would reduce by two per cent in 2011 and by three per cent in 2021 with the complete TransApex in place.

In terms of traffic analysis, the assessed reduction in flows on the Gateway Bridge that would result from the construction of TransApex are marginal, highly dependent on the relative tolling scenarios and does not significantly affect the road design features of the proposed GUP.

5.5.6 Induced and Suppressed Traffic

When capacity increases are implemented in a road network, additional trips that would otherwise not have occurred may result. This additional traffic results from one or more of the following responses:

1. Rerouting of traffic onto different roads to take advantage of travel time savings;
2. Redistribution of trips so that some traffic switches to destinations that are now more easily accessed;
3. Retiming of trips (particularly into peak periods);
4. Mode shifts from public transport or from car passenger to car driver;
5. Additional trips that would otherwise have not been undertaken; and
6. Changes in land use patterns in response to the improved accessibility resulting in additional trips within an area.

Responses 1, 3 and 5 generally occur at or shortly after the time of the increased capacity, whereas responses 2, 4 and 6 generally occur over time after the capacity is increased.

These responses/factors can result in an increase in vehicle kilometres of travel. This is known as induced traffic.

Suppressed traffic, on the other hand, is travel demand that is currently not occurring due to limitations in the road system. Over time, if the road network capacity is not increased in line with population increases, then some traffic associated with the population increase would be suppressed (all other things being equal).

Additional road capacity can act to "release" some proportion of this suppressed demand. Demand released in this way would form a component of induced traffic. There has been limited research in Australia on the implications of induced traffic. Cursory consideration of induced traffic in the Australian context is contained in *Induced Demand and Road Investment – An Initial Appraisal*[2] prepared by the Australian Road Research Board. The report examines studies from the US and UK and a case study from Melbourne. The Melbourne case study did not identify a significant level of induced demand apart from rerouting of trips onto different roads to take advantage of travel time savings. This component of induced traffic has usually formed part of Australian road network modelling studies. Generalisations about the level of expected induced traffic are not directly transferable from one situation to another.

The assessment of the potential for induced traffic as a result of the proposed GUP has been based on guidelines from the UK[3]. These guidelines arose from recommendations contained in advice prepared by the UK government's Standing Advisory Committee on Trunk Road Assessment (SACTRA). A report titled *Trunk Roads and the Generation of Traffic* was published by SACTRA in 1994. The SACTRA report recommended that induced traffic effects should be taken into consideration in the assessment of new highway projects in the UK.

The UK Induced Traffic Appraisal guidelines indicate that the level of analysis that should be undertaken of induced traffic will depend on the complexity of the scheme in terms of its impacts on traffic conditions. An initial elasticity assessment is recommended to identify whether the potential for induced traffic is high, prior to moving onto more detailed modelling.

Initial Elasticity Assessment

Based on the population and employment projections discussed in Section 5.5.1, and current trip characteristics, weekday vehicle trips using the seven main bridge crossings are forecast to increase from 446,000 in 2001 to 556,000 in 2021, an increase of 110,000 or 25 percent.

The average weekday cross river trip is currently 24.0kms, or more than twice as long as the average weekday other trip, and is expected to increase to 26.6kms by 2021, an increase of 11 percent. This is purely a consequence of the distribution of the population and employment forecasts, as the BSTM model currently assumes the 2001 travel costs remain unchanged over the forecasting period. The average trip lengths (and hence VKT) are increasing because the forecast distribution of the new population and new jobs results in longer trip making than is the current situation. In particular, there is significant employment growth in and around the ATC, which is located such that people may need to travel further to access these jobs.

[2] James Luk and Edward Chung (1997) ARR Research Report 229: Induced Demand and Road Investment – An Initial Appraisal, ARRB Transport Research Ltd.
[3] HMSO (1997) Design Manual for Roads & Bridges, Volume 12 Section 2 Part 2 – Induced Traffic Appraisal.

An elasticity formulation can then be applied which compares the travel costs in a future year with existing travel costs and calculates potential increases or decreases in trips based on the elasticity value. The basic formula is:

$$T_{ij} = G_{ij} \times T_{ij}{}^{p} \times (C_{ij} / C_{ij}{}^{p})^{B}$$

Where:

T_{ij} = the forecast trips in the future year including induced trips between travel zones i,j
G_{ij} = the forecast growth rate from the pivot (initial) year (2001)
T_{ij}^{p} = the number of trips in the pivot year (2001)
C_{ij} = the forecast travel costs in the future year
C_{ij}^{p} = the travel costs in the pivot year (2001)
B = the elasticity value (assume -0.25 for this analysis)

For the initial assessment, the average generalised travel costs and total weekday cross-river trips can be used rather than a more detailed analysis for each origin-destination pair.

For weekday cross-river vehicle trips from 2001 to 2021:

- There are around 110,000 additional trips, assuming the 2001 costs remain unchanged;
- The population and employment forecasts lead to an increase in both average trip lengths and travel costs, which in turn lead to a demand response whereby around 11,000 trips could be suppressed;
- The Base networks have still higher average costs than those from purely the landuse effect, leading to a demand response whereby a further 8,000 trips could be suppressed; and
- The GUP Reference Case networks lead to travel time savings compared with the Base networks, but average costs which are still slighter higher than those from purely the landuse effect, leading to a demand response whereby only 3,000 trips could be suppressed.

In summary, the levels of cross river trip suppression from 2001 to 2021 are presented in Table 5.19.

Table 5.19 Levels of Cross River Trip Suppression (2001 to 2021)

	Total Additional	**Suppressed**
BSTM trips (2001 costs)	110,000	
Landuse effects	99,000	11,000
Base networks	91,000	19,000
GUP Reference Case networks	96,000	14,000

The salient feature to emerge from the analysis is the projected suppression of future levels of cross river traffic due to the population and employment projections as well as general increases in network congestion. This result indicates that induced demand is of minor consequence to the overall proposed GUP.

Based on the initial assessment above, the level of induced demand resulting from the project is estimated to be less than changes in VKT resulting from reassignment of traffic. Indeed, the projected increase in network costs over time leads the elasticity approach to suppress some of the travel demand projected for the future years. Consequently, the component of induced traffic resulting from demand responses has been excluded from further analysis. However, the component of induced traffic resulting from reassignment of traffic is kept in the analysis in accordance with general practice in Brisbane and Sydney. The traditional fixed trip table analysis is the appropriate method as it incorporates the only positive estimate of induced traffic and as such, is likely to be slightly conservative.

5.6 Future Base Traffic Conditions

TOR Requirements:
Future conditions on the Motorway corridor should be outlined for at least two model years (2011, 2021), without the GUP in place, in terms of:

- traffic patterns – volumes, speeds;
- network performance – intersection operation (eg degree of saturation, delays and queues); and
- road safety assessment.

This section discusses increased traffic demands and resulting traffic conditions likely to occur in the absence of the provision of increased capacity in the Gateway Motorway corridor. This section also describes changes to conditions in the surrounding transport network and impacts on regional travel demands.

5.6.1 Future Base Traffic Patterns

The traffic model described in Section 5.5 was used to forecast base traffic conditions (ie without the proposed GUP) for 2006, 2011, 2016 and 2021. These conditions represent the expected outcome on the assumption that no further transport improvements in the immediate area beyond those outlined in Section 5.5.4 are to take place. Thus they provide a baseline against which effects of the proposed GUP can be assessed.

This subsection discusses changed traffic flows to 2011 in some detail as changes will be most noticeable in this period at the time of opening. The following subsection indicates changes to 2021 in base conditions. Modelled 2011 traffic volumes are compared to modelled 2003 traffic volumes at selected locations in Table 5.20.

Table 5.20 Future Base Modelled Daily Traffic Volumes (2003 and 2011)

Location	2003	2011	% Change
Pacific Mwy-Mt Gravatt-Capalaba Rd	77,731	97,043	25%
Mt Gravatt-Capalaba Rd-Old Cleveland Rd	74,481	92,458	24%
Old Cleveland Rd-Wynnum Rd	77,809	97,184	25%
Wynnum Rd-POB Mwy	70,999	90,841	28%
Gateway Bridge	87,438	117,412	34%
Kingsford-Smith Dve-Airport Dve	86,283	110,551	28%
Airport Dve-Toombul Rd	73,309	92,052	26%

Location	2003	2011	% Change
Toombul Rd-Nudgee Rd	55,329	68,135	23%
Bicentennial Rd-Nudgee Rd	55,503	68,453	23%

The most notable changes are:

- The Gateway Motorway corridor is forecast to experience significant growth in average weekday traffic volumes by 2011. Daily traffic on the Gateway Bridge is predicted to increase by 30,000 vehicles to over 117,000 vehicles per day; and
- Other corridors forecast to experience significant growth include the Western Freeway, Bruce Highway and the Pacific Motorway.

The implications of this projected increase in traffic volumes for the efficiency of the road network are demonstrated below in Tables 5.21 and 5.22 with reference to average speeds on arterial roads within the Gateway cordon and the entire Brisbane Metropolitan Area. It can be seen that a deterioration in average speeds is expected by 2011, with a much larger deterioration by 2021.

Table 5.21 Traffic Speeds on Arterial Roads and Motorways in Metropolitan Brisbane

Period	Average Speed (km/hr)		Change in Average Speeds (2003-2011) (km/hr)	Average Speed (km/hr)	Change in Average Speeds (2003-2021) (km/hr)
	2003	2011		2021	
Morning Peak	53	52	-1	38	-14
Evening Peak	57	58	+1	49	-9

Table 5.22 Traffic Speeds within the Gateway Cordon

Period	Average Speed (km/hr)		Change in Average Speeds (2003-2011) (km/hr)	Average Speed (km/hr)	Change in Average Speeds (2003-2021) (km/hr)
	2003	2011		2021	
Morning Peak	51	39	-12	16	-35
Evening Peak	59	48	-11	30	-29

As shown in the above results, the average speeds on arterial roads and motorways in metropolitan Brisbane are fairly stable over the period 2003 to 2011. This is primarily due to a number of planned infrastructure improvements such as the upgrade of the Bruce Highway from Bald Hills to Caboolture resulting in significant improvements on these sections of the network which in turn offsets the gradual deterioration of travel speeds on other parts of the network due to increasing congestion levels.

Between 2011 and 2021 there is forecast to be a significant reduction in the average travel speeds on the arterial roads and motorways in metropolitan Brisbane in the peak periods. This indicates that the proposed transport infrastructure provision over this period is unable to satisfy the demands due to population and employment growth. This in turn leads to changes in driver behaviour such as re-timing of trips resulting in increased peak spreading and the suppression of discretionary trips.

Within the Gateway cordon it can be seen that a deterioration in average speeds is expected by 2011, with a much larger deterioration by 2021. This would also translate to a reduced level of service in the area and increased emissions and exposure to accidents.

5.6.2 Future Base Traffic Patterns in 2021

Modelled 2021 traffic volumes are compared to modelled 2003 existing traffic volumes at selected locations in Table 5.23. Figures showing the volume changes for 2021 equivalent to those shown for 2011 have not been produced because those for 2011 already demonstrated the need for action in the corridor. Average travel speeds in the Brisbane metropolitan region and in the Gateway cordon were reported for 2021 in Tables 5.21 and 5.22 above.

Table 5.23 Future Base Modelled Daily Traffic Volumes (2003 and 2021)

Location	Daily Flows		
	2003	2021	% Change
Pacific Mwy-Mt Gravatt-Capalaba Rd	77,731	113,396	46%
Mt Gravatt-Capalaba Rd-Old Cleveland Rd	74,481	106,499	43%
Old Cleveland Rd-Wynnum Rd	77,809	110,205	42%
Wynnum Rd-Port of Brisbane Mwy	70,999	106,933	51%
Gateway Bridge	87,438	#	
Kingsford-Smith Dve-Airport Dve	86,283	119,231	38%
Airport Dve-Toombul Rd	73,309	110,914	51%
Toombul Rd-Nudgee Rd	55,329	80,656	46%
Bicentennial Rd-Nudgee Rd	55,503	82,012	48%

Table Note:
\# Commercial-in-confidence information currently being considered by the Business Case.

These projected increases in traffic would have similar types of impacts on the area within the Gateway cordon as those described in Section 5.6.1. However, the magnitude of these impacts is expected to be larger by 2021.

5.6.3 Effects on Road Network Performance

To illustrate the road network performance, particularly the areas under pressure, Figures 5.12 and 5.13 show the volume/capacity (V/C) ratios for the road network in both the morning and evening peak periods in 2011. The V/C ratios highlighted are those operating at close to or exceeding the capacity of the road section. The most notable features are:

- In the morning peak in 2011, northbound on the Gateway Motorway the section between the Pacific Motorway and Airport Drive is continuously operating at or exceeding the capacity of the road. Southbound the Gateway Motorway is operating at or exceeding its capacity from the Deagon Deviation to Kingsford Smith Drive and from Old Cleveland Road to the Pacific Motorway. The Gateway Bridge is not at capacity southbound because traffic cannot reach it in sufficient quantities due to upstream constriction on the motorway. Other areas of the road network under pressure, exceeding operating

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FIGURE 5.12
Future Base Traffic (Without GUP) - 2011 Network
AM Volume/Capacity Ratios

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FIGURE 5.13
Future Base Traffic (Without GUP) - 2011 Network
PM Volume/Capacity Ratios

capacities include the Pacific Motorway, Storey Bridge, Kingsford Smith Drive, East-West Arterial and the other major corridors in to the CBD.

- In the evening peak in 2011, northbound on the Gateway Motorway exceeds its capacity between Kingsford Smith Drive and Toombul Road. Southbound the Gateway Motorway is operating at or exceeding its capacity from Kingsford Smith Drive to the Pacific Motorway. Other areas of the road network under pressure, exceeding operating capacities include the Riverside Expressway and Pacific Motorway, Nudgee Road and the other major corridors out of the CBD.

Figures 5.14 and 5.15 show the V/C ratios for the road network in both the morning and evening peak periods in 2021. These figures show similar characteristics as those presented for 2011, however it can be seen that the number of areas of the road network under pressure or exceeding capacity has increased substantially and worsened in magnitude.

5.6.4 Intersection Performance

Consistent with the analysis conducted in Section 5.4.3, the operation of intersections has been assessed in terms of Degree of Saturation (DOS), Level of Service (LOS) and 95th percentile off ramp queue lengths. This analysis is indicative only and aims to provide a broad appreciation of the likely traffic operation of intersections at 2011 and 2021. It is difficult to be definitive about the operation and final intersection form when projecting to a 20 year timeframe and many aspects of the intersection and surrounding road network cannot be fully known.

The projected volumes on the arterial roads in some cases rely on upgrades of the capacities along these arterial roads to feed the traffic volumes to the intersections. Capacity deficiencies on other intersections along these arterial roads may determine the actual volumes that arrive at the motorway interchanges. Both MR and BCC have responsibilities for parts of these arterial networks and therefore any upgrade of the intersections associated with the interchanges has to occur in the context of upgrading of the arterial roads rather than upgrading of the Motorway. The upgrading of the intersections suggested by aaSIDRA are indications of the layout of the intersections which will achieve the capacities to meet the volume demands and are not included in the GUP proposed works.

From a Motorway operations perspective, it is important that sufficient vehicle storage is provided in the Motorway off ramps so that exiting vehicles do not queue into the general Motorway lanes, which would lead to unsafe and inefficient operation of the Motorway. In the short to medium term, the length of the offramp queues can be managed by adjusting the signal settings of each intersection. Ultimately, upgrading of some intersections with the Motorway may be required.

5.6.5 Public Transport Services

IRTP Targets and Planned Public Transport Infrastructure

The Queensland Government has set IRTP modal share targets for SEQ consistent with a significant switch from private car to sustainable transport. IRTP transport targets to achieve by 2011 are:

- Public transport use to increase by 50%, from 7.0% to 10.5% of all trips;
- Walking trips to increase from 13% to 15%;
- Cycling trips to increase from 2% to 8%; and
- Vehicle occupancy increase from 1.3 to 1.4 persons.

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FIGURE 5.14
Future Base Traffic (Without GUP) - 2021 Network
AM Volume/Capacity Ratios

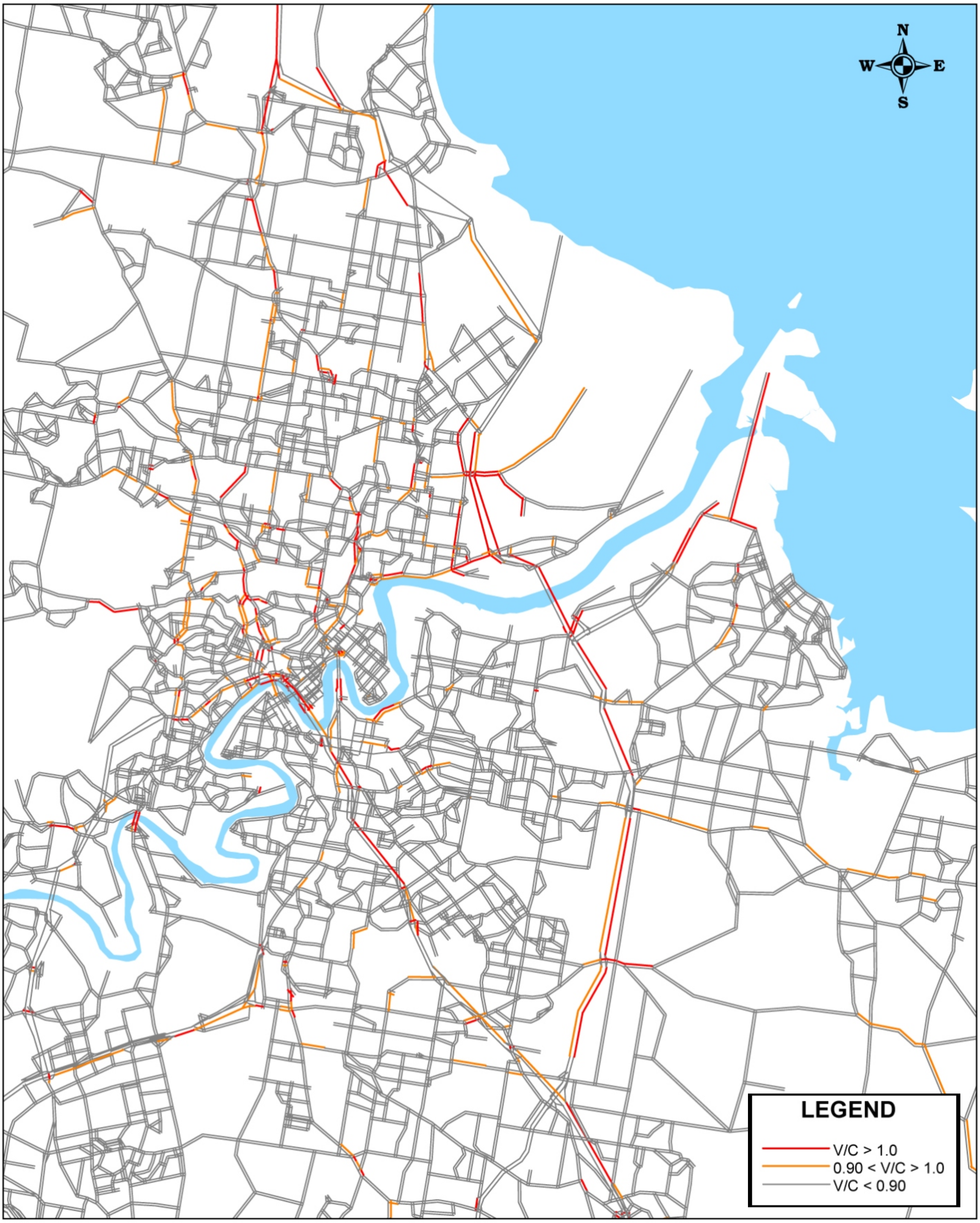

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FIGURE 5.15
Future Base Traffic (Without GUP) - 2021 Network
PM Volume/Capacity Ratios

However, journey to work census data shows declining use of public transport between 1992 and 2001 and road infrastructure improvements are likely to consolidate the trend away from public transport.

The Government and BCC have announced a range of major public transport infrastructure developments, policies and services to support the IRTP objectives. Future major public transport infrastructure development in the Brisbane metropolitan area, designed to support the achievement of the IRTP targets include the following:

- Inner Northern Busway between Queen Street Bus Station and Royal Brisbane Hospital;
- Cultural Centre Busway Station upgrade (near the Victoria Bridge);
- Springwood Bus Interchange upgrade;
- Bus link between Buranda bus/rail interchange and Green Bridge;
- Northern busway for Lutwyche Rd corridor between Royal Brisbane Hospital, Kedron and Chermside (planning stages);
- Eastern busway between Buranda bus/rail interchange and Carindale (planning stages);
- Rail extension of Caboolture rail line from Petrie to Kippa-Ring; and
- Capacity improvements on the Caboolture Rail Line through the construction of a 3rd track from Northgate to Petrie.

Of these, the only project in close proximity to the Gateway Motorway is the proposed Eastern Busway terminus at Carindale.

Brisbane Airport Transport Objectives

BAC has stated its transport objectives for the Brisbane Airport to include the following:

- The provision of adequate transport services to ensure airport capacity is not constrained;
- Increase the utilisation of public transport services in accordance with the IRTP for SEQ;
- Minimise the impact of vehicle traffic (through transport planning and increased public transport); and
- Ensure the surface transport system is compatible with airside operations and airport efficiency.

Key elements of the airport transport system plan outlined in the Brisbane Airport 2003 Master Plan are:

- Construction of a third railway station on Airtrain servicing the Number 1 Airport Drive and Export Park precincts and employees;
- Introduction of an on-airport circulating bus shuttle system servicing all precincts and remote carparks;
- Construction of a new northern airport interchange providing efficient terminal access; and
- Planned widening (4 to 6 lanes) and upgrade of Airport Drive of which the first stage was completed in early 2004.

Airtrain Patronage Projections

Airtrain will remain the primary public transport service for the Brisbane Airport in the future and also the most affected by the performance of the road network in the Gateway Motorway corridor.

Based on the limited information available on existing Airtrain patronage, a calculation of Airtrain patronage forecasts was conducted taking into account the following:

- Ongoing ramp up of demand;
- The Brisbane Airport Development Strategy 2001 and Brisbane Airport 2003 Master Plan;
- Demand estimates for 2006 to 2021; and
- Continued increase in modal share of trips to and from the airport in line with the IRTP.

Airport passenger volumes have been below forecast since 2001 due to a number of factors affecting the level of demand for air travel, both domestic and international. This correction has also impacted on the Airtrain passenger volumes since the service commenced. A slightly lower annual growth rate than previously assumed for air passenger movements is likely to be appropriate, leading to six per cent fewer passengers in 2021 than BAC estimates in the 2001 Development Strategy. BAC has made a similar adjustment in the Brisbane Airport 2003 Master Plan.

These lower airport passenger volumes will lead to lower demand for airport access. However, assuming Airtrain captures one quarter of its originally forecast mode share by 2021, road traffic volumes on Airport Drive are expected to be in the order of 175,000 vehicles per day in 2021, 7% higher than the 164,000 vehicles per day forecast in the 2001 Brisbane Airport Development Strategy, and comparable with the 178,000 vehicles per day forecast in the Brisbane Airport 2003 Master Plan.

Other Public Transport Services

As discussed in Section 5.3.7, the Great Circle route 598/599, is the only public transport service that currently travels along the Gateway Motorway. Translink intend to review the operation of critical route sections over the coming year with a view to improving the reliability and timekeeping performance of this service. The congestion levels forecast in the future without GUP in place will have adverse impacts on the reliability and journey times on this service. No other substantial changes to public transport services are planned within the Gateway Motorway corridor within the forecast period.

5.6.6 Road Safety Assessment

The accident rates calculated in Table 5.11 were used to provide an estimate of accident numbers in future years, in the absence of the proposed GUP. The analysis assumes that the rates of accident risk on each selected section of the Gateway Motorway remains constant overtime, with changes in accident numbers reflecting changes in the amount of traffic (VKT) on the particular road. This is a conservative approach, as there is substantial evidence suggesting that the rate of accidents increases as both the level and duration of congestion increases. Additionally, the accident numbers on lower order roads within the vicinity of the Gateway Motorway would also increase with the forecast increases in VKT on these roads in the future, however, this has not been assessed in this analysis. Table 5.24 provides estimates of accident numbers in each of 2011 and 2021, as well as the net and percentage change from 2003.

Table 5.24 Projected Road Safety Performance, Base Case, 2011 and 2021

Motorway Section	1999-2003		2011		2021	
	Average Annual Accidents	Accident Rate*	Base Case Accidents	Change - Number & % (2003-2011)	Base Case Accidents	Change - Number & % (2003-2011)
Mt Gravatt-Capalaba Rd to Bridge	82	32.9	103	21 (26%)	119	37 (45%)
Gateway Bridge	20	22.4	27	7 (36%)	31	11 (57%)
Bridge to Nudgee Rd	58	30.5	72	14 (24%)	82	24 (42%)
Total	***160***	***30.3***	***203***	***43 (27%)***	***233***	***73 (46%)***

Table Note:
Accident rate is accidents per 100 million VKT.

The above table indicates a projected increase in the number of accidents on these motorway sections of about 27 per cent to 2011 and 46 per cent to 2021 over the existing level. By 2021, the accident rate on the Gateway Motorway without the GUP would mean that motorists using the road would be delayed regularly with 4.5 accidents per week.

The projected increase in accidents on the Gateway Motorway in Table 5.24 is a significant cause for concern and results from the forecast traffic growth in this corridor from employment and population growth placing considerable pressure on the existing Motorway due to insufficient capacity.

5.6.7 Summary

The base case is characterised by erosion of the performance of the road network from existing average levels of operation. Volumes on the Motorway and other routes are expected to grow, with a disproportionate amount of the increased travel in the Gateway cordon taking place, not on the strategic road network, but on lower order roads as the capacity of the Gateway Motorway is exceeded and travellers are forced to make use of lower order roads.

In addition to the delay this would impose on long distance road users, who face few alternatives to the Gateway corridor, local access traffic would be expected to experience further problems and deteriorated performance.

Road network performance is projected to deteriorate from existing levels, with the Gateway Motorway particularly badly affected. Even for roads with poor levels of service at present, their performance is projected to deteriorate, increasing delays. There is little scope to increase the performance of the Gateway Motorway without the provision of additional traffic lanes. Accident numbers are projected to increase substantially above the existing levels, resulting in slower, riskier and more unreliable journeys for travellers forced to use the corridor.

Airtrain will remain the primary public transport service for the Brisbane Airport in the future and is unlikely to reach the originally forecast mode share of airport related trips, placing further pressure on the road network. The reliability of the bus service (Great Circle route 598/599) currently using the motorway, already very poor, would be expected to deteriorate further, with this unreliability. This is a direct consequence of traffic congestion. Options to improve this without the provision of additional road capacity would lead to problems for buses and traffic elsewhere in the road network.

The projected substandard performance of the road network in the Gateway Motorway corridor would impose a heavy cost on Brisbane and Queensland as a whole, with residents and businesses in the corridor likely to bear these costs more heavily than other groups within the community. The analysis indicates that the situation in 2011 and 2021 would be significantly worse than the existing unsatisfactory situation.

5.7 Potential Impacts and Mitigation Measures

TOR Requirements:
The potential impacts of the proposed works, including any changes to existing tolling arrangements, should be demonstrated for future model years, as follows:

- traffic volumes –with and without the new bridge and Motorway upgrade;
- traffic on the local road network;
- regional route traffic implications;
- effects of the Motorway upgrade in the immediate area and extending along the main feeder routes;
- intersection performance;
- car movements (eg travel times, vehicle kilometres travelled, trip diversions);
- commercial vehicle movements (eg travel times, vehicle kilometres travelled and trip diversions);
- aggregate road network performance – VKT, VHT, average vehicle speeds;
- impacts on access to properties and existing roads;
- impacts on rail network; and
- road Safety Accidents.

Options available to monitor and mitigate potential transportation effects should be discussed.

This section presents and discusses modelled effects of the proposed GUP. Traffic forecasting was undertaken to quantify the impacts in terms of volumes, speeds and delays on roads using a set of computer based models.

5.7.1 Traffic Volumes

Table 5.25 summarises the modelled weekday two way volumes on the section of the Gateway Motorway between Mt Gravatt-Capalaba Road and Nudgee Road, in 2011 and 2021, with and without the upgrade in place.

Table 5.25 Modelled Future Daily Traffic Volumes With and Without the GUP (2011 and 2021)

Location	Daily Flows		
	Base	With GUP	% Change
2011			
Pacific Mwy- Mt Gravatt-Capalaba Rd	97,043	98,359	1%
Mt Gravatt-Capalaba Rd-Old Cleveland Rd	92,458	100,087	8%
Old Cleveland Rd-Wynnum Rd	97,184	108,882	12%
Wynnum Rd-POB Mwy	90,841	102,226	13%
Kingsford Smith Dve-Airport Dve	110,551	71,381	-35%

Location	Daily Flows		
	Base	With GUP	% Change
Airport Dve-Toombul Rd	92,052	49,279	-46%
Toombul Rd-Airport Deviation	68,135	23,092	-66%
Gateway Bridge-Northern BAC access	0	52,068	-
Northern BAC access-existing alignment	0	52,633	-
Airport Deviation-Nudgee Rd	68,135	75,725	11%
Bicentennial Rd-Nudgee Rd	68,453	74,628	9%
2021			
Pacific Mwy-Mt Gravatt-Capalaba Rd	113,396	117,188	3%
Mt Gravatt-Capalaba Rd-Old Cleveland Rd	106,499	120,263	13%
Old Cleveland Rd-Wynnum Rd	110,205	128,566	17%
Wynnum Rd-POB Mwy	106,933	126,511	18%
Kingsford Smith Dve-Airport Dve	119,231	87,271	-27%
Airport Dve-Toombul Rd	110,914	60,818	-45%
Toombul Rd-Airport Deviation	80,656	26,459	-67%
Gateway Bridge-Northern BAC access	0	68,012	-
Northern BAC access-existing alignment	0	69,677	-
Airport Deviation-Nudgee Rd	80,656	96,136	19%
Bicentennial Rd- Nudgee Rd	82,012	94,598	15%

From Table 5.25 it can be seen that the proposed airport deviation would relieve the pressure on the existing motorway between the bridge and Nudgee Road to more sustainable levels, particularly during the peak periods. South of the river the proposed increased motorway capacity through additional traffic lanes would increase the traffic using these sections throughout the day. With the proposed upgrades in place, these sections would operate at levels within their theoretical capacities in 2011, 2021 and beyond.

5.7.2 Traffic Flows at Screenlines

A summary of the modelled aggregate traffic flows at the three major screenlines is provided below in Table 5.26.

Table 5.26 Summary of Aggregate Modelled Future Screenline Traffic Volumes

Screenline	Direction	% Change in daily flows	
		2011	2021
Motorway East	Eastbound	1.0%	0.5%
	Westbound	0.4%	0.9%
Motorway West	Eastbound	0.0%	-0.5%
	Westbound	-0.7%	-1.0%

Screenline	Direction	% Change in daily flows	
		2011	2021
Brisbane River Crossings	Northbound	0.1%	0.5%
	Southbound	0.1%	0.3%

5.7.3 Traffic Volumes on the Local Road Network

As presented in Section 5.7.1, the GUP is forecast to result in a significant increase in traffic using the Gateway Bridge and Motorway sections. The forecast changes to traffic flows at the screenlines evaluated in Section 5.7.2 shows that the distributional effect of this change to the transport network is complex. This section evaluates in further detail the forecast impacts on lower order or local roads in the surrounding road network.

Overall it can be concluded that the GUP brings substantial relief to the surrounding road network, moving through traffic back to higher order roads where these trips ideally should be.

5.7.4 Regional Route Traffic Implications

As the Gateway Motorway is a strategic north south road corridor in the Brisbane road network, the proposed GUP would also result in changes to other regional routes. Table 5.27 summarises the traffic flows on selected regional routes.

Table 5.27 Effects of the GUP on Daily 2-way Traffic on Other Regional Routes

Location			
	Base	With GUP	% Change
2011			
Bruce Hwy-sth of Anzac Av	111,250	111,061	-0.2%
Centenary Hwy-nth of Ipswich Mwy	94,726	93,691	-1.1%
Gympie Rd-sth of Westfield Chermside	31,507	30,257	-4.0%
Gympie Rd-sth of Gateway Mwy merge	75,530	73,753	-2.4%
ICB-at Victoria Park	47,454	46,771	-1.4%
ICB-west of Abbotsford Rd	38,158	38,153	0.0%
Ipswich Mwy-sth of Granard Rd	87,330	87,664	0.4%
Kelvin Grove Rd-sth of Newmarket Rd	80,628	78,231	-3.0%
Logan Mwy-west of Gateway Mwy	79,117	79,133	0.0%
Lutwyche Rd-sth of Newmarket Rd	37,670	36,079	-4.2%
North-South Arterial	6,189	6,490	4.9%
Pacific Mwy-at Logan River	151,338	151,406	0.0%
Pacific Mwy-sth of Gateway Mwy	143,369	143,275	-0.1%
Pacific Mwy-sth of Marshall Rd	92,650	89,921	-2.9%
Sandgate Rd-sth of Zillmere Rd	33,636	32,092	-4.6%
Sandgate Rd-sth of EW Art	45,840	44,878	-2.1%
Wardell St-at Kedron Brook	39,596	39,733	0.3%

Location			
	Base	With GUP	% Change
2021			
Bruce Hwy-sth of Anzac Av	133,272	132,726	-0.4%
Centenary Hwy-nth of Ipswich Mwy	94,048	92,177	-2.0%
Gympie Rd-sth of Westfield Chermside	34,257	31,464	-8.2%
Gympie Rd-sth of Gateway Mwy merge	93,337	88,570	-5.1%
ICB-at Victoria Park	52,299	51,932	-0.7%
ICB-west of Abbotsford Rd	43,581	43,283	-0.7%
Ipswich Mwy-sth of Granard Rd	96,902	96,883	0.0%
Kelvin Grove Rd-sth of Newmarket Rd	86,805	82,510	-4.9%
Logan Mwy-west of Gateway Mwy	101,572	101,333	-0.2%
Lutwyche Rd-sth of Newmarket Rd	37,472	34,601	-7.7%
North-South Arterial	13,232	13,791	4.2%
Pacific Mwy-at Logan River	188,933	189,016	0.0%
Pacific Mwy-sth of Gateway Mwy	158,598	157,777	-0.5%
Pacific Mwy-sth of Marshall Rd	102,656	96,824	-5.7%
Sandgate Rd-sth of Zillmere Rd	38,710	35,017	-9.5%
Sandgate Rd-sth of EW Art	51,496	51,048	-0.9%
Wardell St-at Kedron Brook	39,298	37,478	-4.6%

The main implications that emerge from the provision of the proposed GUP for regional routes is that, in terms of daily traffic, GUP would relieve the majority of the regional routes analysed with daily reductions in traffic of up to five per cent in 2011 and up to ten per cent in 2021.

5.7.5 Intersection Performance

This section assesses the predicted performance of the Gateway Motorway interchange intersections with the proposed GUP in place in 2011. Comparison of these results with those for the intersections under future base demands shows that:

- In general, the GUP would place slightly higher demands on the interchanges and result in a marginal reduction in operating performance;
- The intersection upgrades identified to accommodate future base demands are also required with the GUP in place with the exception of the Lytton Road southbound motorway off ramp intersection where traffic demand would be relieved by the addition of the southbound Port of Brisbane Motorway off ramp which is part of the GUP works; and
- the Old Cleveland Road southbound motorway offramp will require additional intersection approach flaring to increase the vehicle storage capacity of the ramp. In the short to medium term, the length of the ramp can be managed by adjusting the signal settings at the intersection.

The GUP would also have the effect of significantly reducing the pressure on the Airport Drive/East West Arterial interchange through the addition of the Northern Airport Access which would operate as a major alternative access to the Airport precinct. Airport Drive would still form the primary access for CBD based airport trips and as such the through movements from the East-West Arterial will continue to increase in the future in line with the growth of the airport precinct. Ultimately, the current roundabout interchange will need to be upgraded to accommodate these flows.

5.7.6 Travel Times

Table 5.28 shows the modelled travel times for selected routes projected for both peak periods, with and without the GUP, for 2011 and 2021. It is important to note that these travel times may not fully capture the delay experienced at intersections and should be used as a guide to the relative change in travel times attributable to the GUP.

Table 5.28 Effects of GUP on Travel Times, Selected Routes, Peak Direction

Route	Morning Peak Travel Time			Evening Peak Travel Time		
	Base (mins)	With GUP (mins)	Change (mins)	Base (mins)	With GUP (mins)	Change (mins)
2011						
Nudgee – Rochedale	30	24	-6	28	24	-4
Rochedale – Airport	38	22	-16	25	21	-4
CBD – Airport	23	23	0	24	23	-1
Caboolture – Port of Brisbane	65	53	-12	59	50	-9
Acacia Ridge – Port of Brisbane	33	38	+5	35	32	-3
Beenleigh - Caboolture	79	66	-13	69	63	-6
2021						
Nudgee – Rochedale	45	22	-23	44	25	-19
Rochedale – Airport	81	42	-39	46	21	-25
CBD – Airport	27	24	-3	31	25	-6
Caboolture – Port of Brisbane	91	74	-17	73	69	-4
Acacia Ridge – Port of Brisbane	42	42	0	45	39	-6
Beenleigh - Caboolture	101	92	-9	93	82	-11

As a general feature, travel times are forecast to be higher in the morning than the evening peak with and without the proposed GUP. Travel times in 2021 are higher than in 2011, reflecting projected increasing congestion levels. The quantum and proportion of the projected travel time savings is therefore generally higher in 2021 than 2011.

The movement from Acacia Ridge to the Port of Brisbane is expected to experience an increase in travel times in the morning peak in 2011. This is due to increased traffic volumes and therefore congestion on Mt Gravatt-Capalaba Road as a result of the GUP as discussed in Section 5.7.3. By 2021, this travel time increase has dissipated such that travel times with or without the GUP would be the same.

Travel time savings between the CBD and Airport are shown to be marginal. This is because this movement would not travel on the upgraded sections or the proposed deviation and the benefits derived are mostly from a reduction in congestion on Airport Drive.

Larger distance movements in the corridor, such as Beenleigh to Caboolture, would be expected to experience substantial travel time savings and as shown the GUP would provide a substantial travel time saving to these movements as well as increasing the travel time reliability.

5.7.7 Heavy Commercial Vehicle Movements

Heavy commercial vehicles, being those vehicles Class 3 and above in the Austroads classification system, are a major user component of the Gateway Motorway. In 2003 these trucks accounted for 3.291 million transactions, comprising 11.4 percent of the traffic.

Historical and forecast HCV growth rates on the Gateway Bridge are shown in Table 5.29.

Table 5.29 Gateway Bridge Historical and Forecast Weekday Truck Growth Rates

Period	HCV Growth Rates	Notes
Historical:		
1992 – 1997	15.5% pa	Toll reductions and simplification of the tolling system during this period
1997 – 2003	6.5 % pa	
Forecast:		
2003 – 2021	3.9 % pa	

The key point from the above table is the forecast HCV growth rates are lower than those historically observed on the Gateway Bridge.

The Gateway Motorway is currently and would remain classified as a “dangerous goods” route under the GUP. Since the majority of these vehicles would use the Gateway Motorway anyway in the absence of an upgrade, the capacity expansion and safety improvements resulting from GUP would reduce the risk associated with regional movements of dangerous goods.

In terms of system efficiency, the upgraded Gateway Motorway provides faster travel (at a cost) than the present congested surface route. Every commercial vehicle using the upgraded Gateway Motorway will achieve time savings worth as much as or more than the toll, otherwise they would remain on the surface route. Hence the efficiency of the freight system would be improved by the proposed GUP.

5.7.8 Aggregate Road Network Performance

In aggregate, the effect of the GUP relative to the base case, in both 2011 and 2021, is to reduce both vehicle kilometres of travel (VKT) and vehicle hours of travel (VHT) in both the areas enclosed by the Gateway cordon and the wider network. This is demonstrated in Tables E5 and E6 (Appendix E6). The net effect is an increase in average speed in the cordon and in the wider network as shown in Table 5.30.

Table 5.30 Future Road Network Average Vehicle Speeds (kilometres per hour)

Year	Vehicle Class	No GUP	With GUP	Percentage Change
Whole of Brisbane Statistical Division				
2003	Private Vehicles	54		
	HCVs	61		
2011	Private Vehicles	55	56	1.6%
	HCVs	62	63	2.1%
2021	Private Vehicles	50	53	4.8%
	HCVs	56	59	5.1%
Within Gateway Cordon				
2003	Private Vehicles	61		
	HCVs	65		
2011	Private Vehicles	56	63	12.0%
	HCVs	60	65	8.8%
2021	Private Vehicles	37	52	40.7%
	HCVs	43	52	20.7%

Table Note:
Average Weekday data.

The aggregate impact of GUP is also the redistribution of traffic from BCC Controlled roads back on to the State Controlled road network within Brisbane City, as shown in Tables E7 and E8 (Appendix E6). The key points from these tables with respect to the effects of the GUP are:

- Vehicle kilometres travelled for both private vehicles and HCVs are forecast to be reduced by two to six per cent on the BCC Controlled road network with a subsequent but lower in magnitude increase in vehicle kilometres travelled on the State Controlled road network. This also indicates that GUP would reduce the average length of trips;
- Vehicle hours travelled for both private vehicles and HCVs are also forecast to be reduced by the order of three to ten per cent on the BCC Controlled road network and by two to five per cent on the State Controlled road network within Brisbane City;
- Average travel speeds are forecast to increase as a result of the GUP, with aggregate improvements of between one and eight per cent on the BCC Controlled road network and three to eight per cent on the State Controlled road network within Brisbane City; and
- The effects of the GUP on the aggregate road network statistics for roads outside of Brisbane City are marginal.

5.7.9 Public Transport Network Impacts

The Queensland Government's overall transport strategy, the IRTP for SEQ, recognises the importance of cross town links in providing an attractive public transport alternative for a wider range of trips. The Gateway Motorway is potentially a significant link in the network, connecting the radial bus and rail corridors on both sides of the Brisbane River and linking with the airport and employment opportunities in the ATC. However, as discussed in Section 5.3.7, only one local bus route uses this link at present (Great Circle Routes 598/599). Delays experienced by buses due to traffic congestion on the routes crossing the Gateway Bridge have had a negative impact on service reliability and attractiveness.

Although improvements to cross town links are important, other IRTP projects have a higher priority. The GUP corridor crosses seven major public transport corridors serving the Brisbane CBD. The project therefore provides the opportunity to improve bus access between interchanges on these east-west corridors and reduce the impact of traffic delays on the Great Circle Route buses using the motorway and crossing the bridge.

Another area where the GUP can be of benefit to the public transport network is to improve private car access to 'Park and Ride' stations on the Cleveland Branch Rail Line at stations adjacent to the road corridor, the nearby Carindale terminus of the proposed Eastern Busway and the Toombul bus and rail interchanges.

These measures will improve the attractiveness of the public transport developments proposed in the IRTP and help in the achievement of the mode share targets.

Additionally, the construction of GUP does not lock out the future provision of road space for public transport or high occupancy vehicles on the Gateway Motorway or its feeder corridors. In fact without the additional road space proposed in the GUP, the options to do this in the future would be extremely limited due to excessive congestion levels. The reduced congestion on the motorway resulting from the GUP also provides the opportunity for the provision of new or additional bus services to operate along the corridor. Public transport provision is currently low along the corridor and if this changes in the future, then the provision of road space can also be reviewed to ensure priority is provided to more sustainable forms of transport.

Ramp access priority is another measure that may be appropriate in the future to reduce delays to public transport services. The construction of GUP does not preclude these types of changes to interchange forms to improve bus access between interchanges of the major east west public transport corridors. These measures in the major feeder corridors, such as the Eastern Busway, to better service the population catchments to the east of the Gateway Motorway.

The geometric design of the GUP is also complementary to capacity expansions to the Airtrain rail spur via the duplication of the rail spur and the construction of additional stations if warranted by demand in the future.

5.7.10 Pedestrian and Cycle Network Impacts

The impacts of the project on pedestrian and cycle networks are assessed in Section 6.

5.7.11 Road Safety and Accidents

Tables 5.10 and 5.11 showed the accident history of the Gateway Motorway, whilst Table 5.12 and 5.13 provided a comparative analysis of road safety on these motorway sections using accident rates.

Using the accident rates calculated in Table 5.12 as a guide to the relative safety of these sections, the safety advantages of the proposed upgrade are likely to be more significant than those indicated simply by the change of exposure as measured by VKT. Table 5.31 estimates projected accident numbers with and without the GUP. It does this by using the existing accident rate calculated in Table 5.12 for the section of the motorway between the Bridge and Nudgee Road not upgraded as part of GUP and applying a lower accident rate to the sections upgraded and the proposed airport deviation consistent with other high-standard motorways carrying similar traffic volumes, as presented in Table 5.13. Average annual accidents for the years 1999 to 2003 are included in the table for comparison.

Table 5.31 Projected Road Safety Performance, With GUP, 2011 and 2021

Motorway Section	1999-2003		2011		2021	
	Average Annual Accidents	Accident Rate*	With GUP Accidents	Change - Number and % (2003-2011)	With GUP Accidents	Change - Number and % (2003-2011)
Mt Gravatt-Capalaba Rd to Bridge	82	32.9	63	-19 (-24%)	75	-7 (-8%)
Gateway Bridge	20	22.4	21	1 (5%)	26	6 (31%)
Bridge to Nudgee Rd	58	30.5	44	-14 (-24%)	54	-4 (-6%)
Airport Deviation	-	-	22	22 (-)	28	28 (-)
Total	***160***	***30.3***	150	-10 (-7%)	183	23 (15%)

Table Note:
Accident rate is accidents per 100 million VKT.

The proposed GUP is projected to reduce the number of accidents on these links by approximately 27 per cent and 21 per cent respectively in 2011 and 2021 when compared to the base case for the same years. When this is compared to the existing accident situation, the GUP is projected to reduce accidents below current levels in 2011, by seven per cent, and above current levels by 15 per cent by 2021.

This is largely due to the amount of traffic drawn into the upgraded motorway sections and the increased cross river capacity proposed. Although not quantified in this analysis, the GUP would also result in a much decreased exposure to accidents on the lower order roads in the Gateway cordon due to the traffic relief it provides when compared to the base future networks.

Vehicles carrying dangerous goods would use the Gateway Motorway in either case as the motorway is a nominated “dangerous goods” route. Commercial vehicles carrying hazardous goods are required to use the motorway when passing through or servicing the area. Risks associated with these vehicles are likely to be similar in the cases with and without the GUP.

5.7.12 Sensitivity of GUP tolls

For this EIS, the GUP toll level has been conservatively chosen to be equal to the current toll operating on the Gateway Bridge, indexed at CPI from 2011. This approach results in higher traffic volumes using the Gateway Motorway and is thus an appropriate scenario for the various environmental assessments – noise, air quality and benefit-cost.

The TOR requires the EIS to investigate the potential impacts of the proposed work including any changes to existing tolling arrangements. As the Government's decision on a toll strategy is subject to the feasibility of the Business Case that is presently underway, the EIS has investigated the sensitivity of arbitrary toll levels to assess the impact of tolls on traffic.

Imposition of a toll or increasing toll levels tends to discourage use of a road facility by potential users who do not perceive that the package of road user benefits (mainly travel time savings but also other benefits such as comfort, safety and improved reliability) they may derive from the use of the facility would equal or exceed the cost of the toll. The extent of toll avoidance is directly related to the cost and the attractiveness of alternative routes. In the case of the GUP, there are minimal areas of avoidance of the Gateway Bridge toll as the closest river crossing is the Storey Bridge which is located approximately 11.5 kilometres away.

The toll amounts discussed in this section are in 2011 dollars and include GST. Future year tolls beyond 2011 are assumed to be maintained in real terms by indexing to the Consumer Price Index (CPI) commonly known as the cost of living from 2011. If this was not the case, then the toll would gradually erode in real price terms, resulting in additional traffic using the tolled sections and drawing more traffic into the Gateway Motorway corridor than indicated by the analysis.

Figure 5.16 shows the predicted performance of the road system in 2021 for the three toll scenarios.

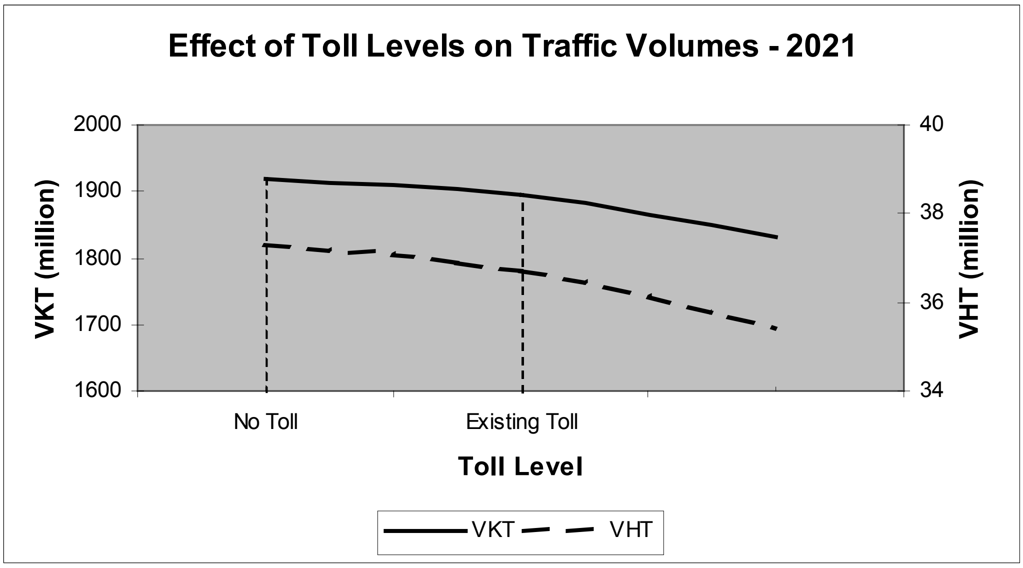

Figure 5.16 Effect of Tolls Levels on Traffic Volumes in 2021

Figure 5.16 demonstrates that the effect of the toll on the total VKT and VHT on the Gateway cordon is minimal and highlights that there is a very low level of diversions over a range of tolls. It can be seen that removing the existing toll results in more vehicle kilometres and vehicle hours of travel in the cordon in 2021, which will result in a slightly slower average speed.

It can also be seen that increasing the proposed toll results in less vehicle kilometres and less vehicle hours of travel in total at a slower average speed in 2011. This is due to the toll's effect of 'pushing' traffic off the bridge and high standard Motorway and on to lower standard roads within the cordon.

5.7.13 Summary of Impacts of GUP

The proposed GUP would provide additional road capacity in areas where it is needed, relieving congestion, increase accessibility to the Brisbane Airport and ATC, improve the connectivity of the arterial road network and remove traffic from lower order roads. It would form a critical element of the transport system in Brisbane City for many years to come.

GUP brings significant relief to the surrounding BCC and State road networks with substantial reductions in traffic volumes, moving through traffic back to higher order roads where these trips ideally should be. A small number of roads are projected to experience a slight increase in demand. This will require monitoring and may require treatments to improve the management of any increased traffic volumes.

Regional routes would also experience substantial reductions in traffic volumes with the proposed GUP. Reductions in daily traffic are forecast to be up to five per cent in 2011 and up to ten per cent by 2021 when compared to the no GUP base case. This illustrates the critical role the Gateway Motorway performs in the regional road network, particularly with regard to north-south movements.

The existing interchanges of the Gateway Motorway proposed in the design of GUP are projected to be well used and this use is consistent with expectations about the weight of travel demand by time of day. They are however expected to operate at satisfactory levels of performance beyond 2021 with only a minor modification required at the Old Cleveland Road interchange above those required if the GUP does not go ahead.

Changes to travel times that would result from the GUP vary considerably depending on the particular trip's origin and destination. For longer distance trips in the corridor, savings would be substantial.

Commercial vehicle movements would be attracted to the proposed GUP, and this would reduce the projected levels of commercial vehicles using alternative roads such as Nudgee Road and travelling through the Brisbane CBD. This would benefit the environmental amenity of these routes and the areas through which they pass.

The aggregate performance of the road network would be positively affected by the GUP which would reduce both vehicle kilometres travelled and vehicle hours and have the net effect of increasing average travel speeds.

The GUP would be consistent with the objectives of the Queensland Government's overall transport strategy, the IRTP, by improving this important cross town link and could provide the opportunity to improve bus access between interchanges and reduce the delays experienced by the existing bus service.

The effects of various tolls on the total VKT and VHT on the Gateway cordon is minimal and highlights that there is a very low level of diversions between a “No-toll” and an "Existing toll + 50%" range.

The proposed upgrades would make GUP much safer and result in significant accident savings, with analysis on selected links indicating a drop in accident numbers to levels in 2011 below those prevailing in 2003. By 2021, GUP is expected to reduce the number of accidents on the Motorway by 21 per cent compared to the base case for the same year.

Average speeds in the Gateway corridor will continue to deteriorate until the opening of GUP, which will restore the average speeds to those observed in 2003. With the opening of the GUP, the average cost of travel in the corridor will be the same as it is today. As the projected traffic demand assumes that 2003 travel costs are maintained, it is therefore unlikely that there will be any further induced demand resulting from traffic demand response as a result of GUP. However, the component of induced traffic resulting from re-assignment of traffic has been kept in the analysis in accordance with general practice in Brisbane.

5.8 Conclusions

5.8.1 The Transport Task

There is a significant demand for travel to and from the ATC as well as through trips bypassing the Brisbane CBD. The amount of travel is driven by employment and population levels and distribution in the Brisbane metropolitan area which are expected to increase by 44 and 33 per cent respectively above 2001 levels by 2021.

The Gateway Motorway currently provides the only major high-quality north-south orbital road corridor bypassing the Brisbane CBD and is integral to the efficient regional movement of goods and people.

5.8.2 Existing Traffic Conditions

The Gateway Bridge currently carries over 85,000-100,000 vehicles per day. It is a very busy arterial throughout the day with a high proportion of heavy commercial vehicles in the traffic stream. Traffic growth between 1992 and 2003 averaged 6.7% per annum.

The section of Gateway Motorway north of the Brisbane River between the bridge and Toombul Road is heavily congested during peak periods. Traffic growth in peak periods on this section are close to zero as there is no further potential for increased throughput. South of the river the existing two lane carriageways are rapidly becoming over congested during peak periods. Substantial delays are becoming a regular occurrence on these sections of the Gateway Motorway.

There were 799 vehicular accidents reported on the Gateway Motorway between Mt Gravatt-Capalaba Road and Nudgee Road in the five years up to and including 2003. Of these, eight were fatal and 114 required hospitalisation

The Gateway Motorway route is currently inadequate for the task it is asked to perform.

5.8.3 Future Conditions in Absence of Action

Increasing demand for the use of the Gateway Motorway will add to congestion and slow it down further, leading to increased delays, slower and more unreliable journeys and the continued use of alternative routes such as the Storey Bridge, Nudgee Road and Creek Road.

Travel speeds in the Gateway cordon generally will fall on average by 18 to 23 per cent, in peak periods, by 2011. If conditions are allowed to deteriorate further to 2021, the fall will be between 50 and 70 per cent. There will also be a general worsening of ramp and merging area performance.

The growth in congestion would result in higher accident numbers. If nothing is done, the Gateway Motorway will deteriorate further and this section of the national highway system will greatly impair regional accessibility and movement of people and freight.

5.8.4 Impacts of the GUP

The proposed GUP would provide additional road capacity in areas where it is needed, relieving congestion, increase accessibility to the Brisbane Airport and ATC, improve the connectivity of the arterial road network and remove traffic from lower order roads. It would form a critical element of the transport system in Brisbane City for many years to come.

Lower order roads are expected to benefit from substantial reductions in traffic volumes with the proposed GUP. Regional routes would also experience substantial reductions in traffic volumes with the proposed GUP. Reductions in daily traffic are forecast to be up to five per cent in 2011 and up to ten per cent by 2021 when compared to the no GUP base case. This illustrates the critical role the Gateway Motorway performs in the regional road network, particularly with regard to north-south movements.

The proposed ramps and merge areas of the Gateway Motorway proposed in the design of GUP are projected to be well used and this use is consistent with expectations about the weight of travel demand by time of day. They are however expected to operate at satisfactory levels of service beyond 2021 with no modifications required.

Changes to travel times that would result from the GUP vary considerably depending on the particular trip's origin and destination. For longer distance trips in the corridor, savings would be substantial.

Commercial vehicle movements would be attracted to the proposed GUP, and this would reduce the projected levels of commercial vehicles using alternative roads such as Nudgee Road and travelling through the Brisbane CBD. This would benefit the environmental amenity of these routes and the areas through which they pass.

The proposed upgrades would make GUP much safer and result in significant accident savings, with analysis on selected links indicating a drop in accident numbers to levels in 2011 below those prevailing in 2003. By 2021, GUP is expected to reduce the number of accidents on the Motorway by 21 per cent compared to the base case for the same year.

The aggregate performance of the road network would be positively affected by the GUP which would reduce both vehicle kilometres travelled and vehicle hours and have the net effect of increasing average travel speeds.

The GUP would be consistent with the objectives of the Queensland Government's overall transport strategy, the IRTP by improving this important cross town link and could provide the opportunity to review future public transport provision in the corridor, improve bus access between interchanges and reduce the delays experienced by the existing bus service.