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Demand Projections for AusLink Non-Urban Corridors: Methodology and Projections

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DEMAND PROJECTIONS FOR AUSLINK NON-URBAN CORRIDORS: METHODOLOGY AND PROJECTIONS

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FOREWORD

The Australian Government's AusLink initiative represents a new approach to planning and funding Australia's land transport infrastructure. Under AusLink the Australian Government will fund projects that have the greatest contribution to Australia's long-term economic prosperity, irrespective of the transport mode. AusLink will involve an integrated approach to planning, with three complementary levels of analysis: (i) strategic network assessment; (ii) corridor assessments and (iii) detailed project assessments.

Projections of future transport demand are a critical input into these assessments. In order to undertake more informed strategic network assessments, the BTRE has developed two models for projecting future non-urban passenger and freight transport demand:

- OZPASS—non-urban passenger travel forecasting model; and
- FreightSim—inter-regional freight forecasting model.

This paper outlines the structure of these models and demonstrates their application to projecting future passenger and freight movements across the non-urban sections of the AusLink National Network. Readers should note that the road traffic projections presented in this paper are based on passenger travel and freight movement data for 1999 and road traffic data for various years between 1993 and 1996. These data sets were the most up-to-date data available to the BTRE when the analysis was undertaken. The BTRE intends to update these projections, using more current passenger and freight movements data, more recent regional population estimates and, in cooperation with the States and Territories, more recent road traffic data, when this data becomes available.

This paper was prepared by David Mitchell, with assistance from Adam Sidebottom initially and latterly Carlo Santangelo. David Gargett led the development of the OZPASS and FreightSim models. The BTRE also acknowledges the assistance of Tourism Research Australia and FDF Pty Ltd through the provision of the passenger travel and freight movement data.

Phil Potterton
Executive Director
February 2006

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EXECUTIVE SUMMARY

This report outlines the BTRE OZPASS and FreightSim models, which are designed to project future non-urban passenger travel and freight movements, and presents a base case set of traffic growth projections across the non-urban links of the AusLink National Network. It represents part of the BTRE input to the AusLink land transport initiative.

AUSLINK

The Australian Government's AusLink initiative represents a new approach to planning, decision-making and funding of Australian land transport infrastructure. Under AusLink the Australian Government will fund transport projects that have the greatest impact on Australia's long-term economic prosperity, irrespective of the transport mode.

Key elements of the AusLink initiative are an integrated approach to planning and a consistent assessment methodology. The AusLink White Paper (DOTARS 2004) identifies a three tier approach to planning and assessing projects:

- Corridor strategies
- Link assessments
- Project assessments

Presently, DOTARS is engaged in facilitating the development of separate corridor strategies for each of the urban and non-urban corridors in the AusLink National Network. The first four pilot corridor studies are to cover the Melbourne–Sydney, Adelaide–Perth, Brisbane–Cairns and Adelaide urban corridors.

The projections presented in this paper provide a base set of projections of passenger and freight vehicle traffic growth across all non-urban corridors of the AusLink National Network for use in the development of the AusLink corridor strategies.

OZPASS AND FREIGHTSIM—AN OVERVIEW

The BTRE has previously undertaken several corridor-type studies, including economic analyses of the Sydney–Melbourne and Sydney–Brisbane transport corridors (BTCE 1993 and 1994), an analysis of the future infrastructure needs across all four major transport modes for the National Transport Planning Taskforce (NTPT 1995) and an economic analysis of future spending needs on the National Highway System (NHS) (BTE 1997).

Over the course of these previous corridor-type studies, the BTRE has developed the OZPASS and FreightSim models, which are designed to provide consistent projections of future non-urban traffic growth across the whole of the Australian non-urban road network. In brief, OZPASS and FreightSim project base year origin-destination (OD) movements, of passengers and freight, using growth in regional populations, economic activity and travel costs.

OZPASS

OZPASS is designed to project future OD passenger travel between over 90 separate regions in Australia. The model uses travel data from Tourism Research Australia (TRA)—formerly the Bureau of Tourism Research—National Visitor Survey (NVS) and International Visitor Survey (IVS) for the base year level and pattern of passenger travel. The NVS includes overnight and day trips for business, leisure and personal purposes to a destination at least 25 kilometres from home. The NVS and IVS, together, provide a measure of all long-distance domestic passenger trips, not part of a regular commute, in Australia by all major transport modes—private car, bus, rail, air, and ferry—and all trip purposes.

In OZPASS, future inter-regional passenger travel is projected using a gravity-type model that relates growth in inter-regional passenger travel to growth in regional populations, household incomes and aggregate travel costs.

OZPASS also includes an algorithm for projecting local light vehicle travel on local rural roads—that component of traffic on rural roads generated by residents of the local region. Rural light vehicle travel is projected using growth in regional populations and projected trends in average light vehicle ownership and average vehicle utilisation.

FreightSim

FreightSim is a model for projecting inter-regional OD freight movements across six transport modes: road, rail, sea, air, pipeline and conveyer. The model was developed jointly by the BTRE and FDF Pty Ltd under the auspices of Austroads. FreightSim comprises 132 separate regions—123 Statistical Subdivisions and eight capital city Statistical Divisions (ABS 1996), one region comprising the rest of the world—and 16 commodity classes—15 bulk commodity groups and one non-bulk group. Austroads (2003) provides a short introduction to FreightSim.

Projected future inter-regional transport flows are derived from projected growth in domestic regional production, regional consumption and international imports. The base year production, consumption and inter-regional transport flows used in this report are based on FDF Pty Ltd *FreightInfo*™ 1999 national database of Australian freight movements.

The *FreightInfo*™ 1999 data appears to significantly under-estimate the total inter-capital non-bulk road freight task. For the projections presented in this paper, the *FreightInfo*™ 1999 data was augmented by non-bulk road freight movement estimates, between capital city Statistical Divisions and major provincial urban centres, drawn from the ABS (2002a) Freight Movements Survey (FMS).

TRAVEL DEMAND PROJECTIONS

Chapters 2 and 3 present projections of future non-urban passenger travel and freight movements, and the corresponding levels of light and heavy vehicle traffic, to 2025, for the non-urban corridors of the AusLink National Network. These projections build from base year passenger travel and freight movement data for 1999 and road traffic data for various years between 1993 and 1996. These data sets represent the most up-to-date data available to the BTRE at the time these projections were undertaken.

Geographic scope

OZPASS and FreightSim provide passenger travel and freight movement projections across Australia. Because of the size of the geographic regions underlying the NVS and IVS passenger data and the *FreightInfo™* freight movements data, the models are best suited to providing projections of non-urban passenger travel and freight movements. The BTRE has assigned the passenger travel and freight movement projections to the non-urban Australian (road) transport network to provide projections of future road traffic growth. In this paper, the traffic projections are presented only for the non-urban links of the AusLink National Network, but it is possible to provide projections of traffic growth for other non-urban roads.

OZPASS and FreightSim are not designed to provide projections for passenger travel and freight movements in urban areas and, consequently, this paper does not provide any urban traffic growth projections. For urban traffic growth, the BTRE has separately projected aggregate growth in the urban passenger (BTRE 2003c) and freight (BTRE forthcoming) transport tasks for each State and

Territory capital city, which may be used to inform the urban corridor strategies. Ultimately, however, analysis of future traffic growth across the urban AusLink corridors may require more detailed city specific transport-network models. In this area, the OZPASS and FreightSim-based projections may be used to provide estimates of future traffic growth into and out of each of the capital city regions.

Key input assumptions

The key factors underlying the passenger and freight projections produced by OZPASS and FreightSim are population growth, growth in household income (OZPASS) or economic activity (FreightSim) and trends in passenger and freight transport costs. For passenger travel, growth in domestic travel by international visitors is influenced by total international visitor arrivals.

Future population growth is based on the ABS Series II SLA-level population projections. The ABS population projections range from 1999 to 2019. The BTRE has extended the ABS projections to 2025 using the implied trends in population growth in each SLA. Between 1999 and 2025, the total population is projected to grow by 0.85 per cent per annum. Population growth is projected to be highest in the major mainland State capital cities and coastal areas, and is projected to be slower, or even decline, in many inland regional areas.

Projected GDP growth is based on the Australian Treasury (2002) long-term GDP growth projections, released as part of the 2002–03 Australian Government Budget. The Australian Treasury (2002) GDP growth projections imply slowing annual GDP growth over the period to 2025, with annual average GDP growth of 2.6 per cent per annum between 1999 and 2025.

Household incomes, proxied by growth in average weekly earnings (AWE), are projected to grow by 1.4 per cent per annum between 1999 and 2025, consistent with historical growth in AWE over the thirty years to 2001.

Real passenger travel costs are projected to remain constant over the projection period.

Real freight transport costs are projected to decline by 0.5 per cent per annum over the projection period.

International visitors are assumed to grow by 9 per cent per annum in 1999–2000 declining linearly to 3.9 per cent per annum in 2025. These assumptions imply an average rate of growth in short-term international visitor arrivals of approximately 5.8 per cent per annum between 1999 and 2025.

Mode choice assumptions

The future transport mode shares are controlled in OZPASS and FreightSim by separate mode share competitiveness indexes.

In OZPASS the mode share competitiveness indexes are set according to some simple 'rules of thumb'. These rules assume that air travel is more attractive than other modes for travel over distances between 400 and 800 km, and significantly more attractive for travel over distances above 800 km, while car is more attractive over distances of less than 400 km. In effect these assumptions imply private car transport increases as a share of total short distance trips, while air travel's share increases for long-distance trips. Rail and long-distance coach mode shares generally decline across all distances.

In FreightSim, like OZPASS, the mode share competitiveness indexes for freight are set using some simple rules of thumb about future trends in mode shares for each commodity type. For all but non-bulk freight, these mode share competitiveness indexes are independent of distance. For non-bulk freight, the mode share competitiveness indexes do vary by distance. There, for OD pairs less than 1500km apart, road freight is assumed to increase in share relative to rail and coastal shipping, where they are viable alternative transport modes. On longer distance routes, rail is assumed to capture mode share from road and, to a lesser extent, coastal shipping. The implications of these assumptions are discussed below.

Future infrastructure investment

Importantly, these projections abstract from planned future infrastructure investment in road and rail. For example, the Australian Rail Track Corporation has plans to spend up to $1.8 billion on track maintenance and renewal on the Defined Interstate Rail Network and in the Hunter Valley. It is expected that this investment will improve rail service levels and reduce rail operating costs, thereby improving rail's competitiveness in the inter-modal freight transport task. Similarly, continued investment in the inter-capital road network such as, for example, the continuing upgrade of the Pacific Highway, will also help to improve the service quality of road transport. In deriving the projections presented here, the BTRE has not explicitly accounted for future infrastructure changes, the implication being that the projections implicitly assume preservation of the relative performance levels provided by the current infrastructure.

Passenger travel projections

These assumptions imply growth in total inter-regional passenger trips of 2.6 per cent per annum between 1999 and 2025. Air travel is projected to grow most strongly, by 3.9 per cent per annum. Long-distance car trips, not part of a regular commute to work, are projected to grow 2.6 per cent per annum between 1999 and 2025. Bus trips are projected to grow by 1.7 per cent per annum, boosted by foreign tourist visitors who tour Queensland and the Northern Territory by coach. Rail trips are projected to grow by 0.8 per cent per annum between 1999 and 2025.

Across the non-urban AusLink corridors, end-to-end OD passenger trips are projected to grow by 2.7 per cent per annum, with end-to-end OD air trips projected to grow by 3.8 per cent across all non-urban AusLink corridors. Consistent with the input mode share assumptions, the projections imply declining passenger car travel between cities located more than 800km apart and reasonably strong growth in car travel between OD pairs within 400km.

These projections are broadly consistent with other BTRE non-urban passenger travel projections.

Freight movement projections

The aggregate FreightSim inter-regional freight task projections imply growth in the total domestic freight task, measured in tonnes moved, of 2.75 per cent per annum over the period 1999 to 2025. Total road freight tonnages are projected to grow by 3.0 per cent per annum and total rail freight tonnages are projected to grow by 2.4 per cent per annum over the period 1999 to 2025. The coastal shipping freight task is projected to grow by approximately 1.5 per cent per annum between 1999 and 2025. Air freight is projected to grow by 6.1 per cent per annum, albeit from a very low base.

The FreightSim total road and rail freight task projections are slightly lower than earlier BTRE (2002) projections due partly to differences in the projected rate of economic growth—the BTRE (2002) projections assumed average annual GDP growth of 3.25 per cent per annum to 2020, whereas these projections assume average GDP growth of 2.6 per cent per annum between 1999 and 2025—and partly to differences in modelling approach—the BTRE (2002) projections use a single equation models for projecting growth in total freight activity, whereas FreightSim projects growth separately for each of 16 commodity groups. The assumptions used here result in slightly more conservative projected growth in total road freight, due to slower projected growth in bulk freight. However, across the AusLink corridors the projected freight task growth is very similar to previous BTRE (2003a) corridor projections.

Across the non-urban AusLink corridors, end-to-end OD freight is projected to grow 3.0 per cent per annum between 1999 and 2025. The end-to-end OD road freight task, in total tonnage terms, is projected to grow by 3.4 per cent per annum between 1999 and 2025. End-to-end OD rail freight movements are projected to grow by 2.4 per cent per annum. Coastal shipping is projected to grow by 1.3 per cent per annum and air freight by 3.5 per cent per annum.

In terms of inter-capital non-bulk freight flows, the projected growth in the overall freight task is similar to previous BTRE projections, such as BTRE (2003b). However, the projections presented here differ from the BTRE (2003b) projections in terms of their future mode share implications. In short, the gravity model input assumptions and mode share competitiveness assumptions used here imply declining rail mode shares but more or less constant rail volumes on shorter distance inter-capital OD pairs—for example, Sydney–Melbourne, Sydney–Brisbane, Melbourne–Adelaide and Sydney–Adelaide, which is consistent with more recent market trends. In BTRE (2003b) rail mode shares and volumes were projected to decline on these shorter OD pairs. On the longer inter-capital OD pairs—Melbourne–Brisbane and Eastern State capitals–Perth—rail is projected to increase its volumes and mode share, consistent with recent market trends and BTRE (2003b).

AusLink National Network non-urban road traffic projections

The OZPASS passenger travel and FreightSim freight movement projections are then converted to equivalent road vehicle movements and assigned to the road network in order to derive estimates of growth in total traffic across different segments of the AusLink National Network. For passenger vehicles, the BTRE assumes an average vehicle occupancy of 1.8 persons per vehicle for non-urban trips. For freight vehicles, the BTRE has used FDF Pty Ltd's *FreightTrucks™* model to convert freight movements into equivalent vehicle movements. The BTRE uses the traffic assignment algorithms in *TransCAD* to assign passenger and freight vehicle movements to the road network.

Importantly, the version of the *FreightTrucks™* model used to derive the heavy vehicle traffic growth projections presented here does not explicitly account for changes in vehicle type mix and average loads over time. Previous BTRE freight task projections, for example BTRE (2002), have assumed both an increase in the proportion of freight carried by larger trucks and an increase in average payloads. To the extent that heavy vehicles become larger and average loads increase, the projections presented here will overstate total heavy vehicle traffic growth.

Using the projected growth in passenger travel and freight movements implied by OZPASS and FreightSim, total light (passenger) vehicle traffic across the non-urban AusLink National Network is projected to growth by 2.1 per cent per annum and heavy vehicle traffic is projected to grow by approximately 2.5 per cent per annum. Total traffic growth is projected to be strongest on those parts of the non-urban AusLink National road Network in the Northern Territory, Queensland and Western Australia. Growth in passenger and freight traffic is also projected to be reasonably strong in Victoria, reflecting stronger growth in traffic on the shorter Melbourne–Geelong corridor and possibly between Geelong and western Victoria along the Melbourne–Adelaide corridor.

Interstate corridors over which traffic growth is projected to be most strong include: Sydney–Brisbane via the Pacific Highway, Perth–Darwin, Adelaide–Darwin and Melbourne–Adelaide. Overall traffic growth is also projected to be quite strong on some of the intrastate links, such as Brisbane–Cairns, Perth–Bunbury, and Melbourne–Geelong. Heavy vehicle traffic growth is projected to strongest on these shorter intrastate corridors. On the major inter-capital AusLink corridors, such as Sydney–Melbourne and Sydney–Brisbane (inland), freight vehicle traffic is projected to grow at around 2.4 per cent per annum and 2.6 per cent per annum.

In general, heavy vehicle traffic growth is projected to exceed light vehicle traffic growth on most of the non-urban AusLink National Network corridors. The main exceptions are on the corridors of more than 2000km in length, such as Adelaide–Perth and Adelaide–Darwin where rail is more likely to capture most of the additional freight traffic growth.

Readers should note that projected growth in total passenger kilometre and freight tonne-kilometres will differ from the projected growth in light and heavy vehicular traffic across different parts of the road network because of differing rates of growth and, for freight vehicles, different vehicle type mix and average vehicle loads for short- and long-distance trips. Generally, long-distance inter-regional freight is growing faster than shorter-distance inter-regional freight, and average vehicle loads are generally higher for long-distance trips, so that total heavy vehicle movements across the country will be less than total tonne-kilometre freight growth.

Traffic growth projections are provided separately, and in more detail, for each non-urban corridor. More detailed results from the modelling can be provided separately.

Augmenting the projections

OZPASS and FreightSim models are designed to provide projections of non-urban traffic levels Australia-wide, using a consistent methodology. The strength of the models is in projecting growth in long-distance inter-regional freight movements between major population centres. The breadth of OZPASS and FreightSim, however, mean that they necessarily abstract from some of the small-area, local-level influences that may affect growth in local traffic along parts of the AusLink National Network. It is perfectly reasonable to augment the OZPASS and FreightSim projections with more detailed local-level information where that is available.

FURTHER RESEARCH

Modelling and data issues

This paper represents the first attempt by the BTRE to use both OZPASS and FreightSim jointly to project growth in total traffic across the non-urban AusLink National Network. Not surprisingly, then, this research has revealed some modelling and data issues associated with both models that warrant further attention. The main issues identified in this report are:

- Under-enumeration of inter-regional freight movements—*FreightInfo™* 1999.
- Under-estimation of average truck loads and growth in truck size—*FreightTrucks*™.
- Exogenous mode share assumptions.
- Linking FreightSim to CGE model projections of regional goods movements.
- Travel propensity of an aging population.

The first two issues are partly addressed in the methods used to derive the projections presented here and are presently being addressed in the current BTRE research programme. The last three issues represent desirable improvements to OZPASS and FreightSim.

Updating the projections

The BTRE intends to update these projections, using more current passenger and freight movements data and more recent road traffic volume data, when such data becomes available. The BTRE has engaged FDF Pty Ltd to update the *FreightInfo*™ data to 2003–04. This dataset should be available early-2006. Traffic count data for years around 2003–04 is required from State and Territory road authorities to update the light and heavy commercial vehicle traffic projections.

CHAPTER 1 INTRODUCTION

The Australian Government's AusLink initiative represents a new approach to planning, decision-making and funding of Australian land transport infrastructure. Under AusLink the Australian Government will fund projects that have the greatest impact on Australia's long-term economic prosperity, irrespective of the transport mode. This represents a change from previous arrangements under which the Australian Government funded road and rail infrastructure from separate funding allocations, wholly funded maintenance and provision of National Highway System roads and provided grants to local councils for road spending.

An integrated approach to planning and a consistent assessment methodology are key elements of the AusLink initiative. The AusLink White Paper (DOTARS 2004) identifies a three tier approach to planning and assessing projects, using a rigorous assessment system, as the basis for selecting the highest yielding projects in terms of net national benefit. The three tier approach encapsulates:

- Corridor strategies
- Link assessments
- Project assessments

STRATEGIC CORRIDOR ANALYSIS

The BTRE has previously undertaken several corridor-type studies. Previous BTRE corridor-type analysis, includes an economic analysis the Sydney–Melbourne and Sydney–Brisbane transport corridors (BTCE 1993 and 1994), an analysis of the future infrastructure needs across all four major transport modes for the National Transport Planning Taskforce (NTPT 1995) and an economic analysis of future spending needs on the National Highway System (NHS) (BTE 1997).

Over the course of these previous corridor-type studies, the BTRE has developed three models designed to forecast future non-urban traffic growth and assess economically warranted non-urban road infrastructure maintenance and investment expenditure needs. These models are:

- OZPASS—a model for projecting long-term growth inter-regional passenger travel, including inter-regional passenger travel by road.
- FreightSim (with FDF Pty Ltd)—a model for projecting long-term growth in inter-regional freight movements, including heavy vehicle freight movements by road.
- Road Infrastructure Assessment Model (RIAM)—designed to evaluate the optimal maintenance and investment expenditure on non-urban roads

OZPASS and FreightSim cover all transport modes—car, bus, air, train and ferry for passengers and road, rail, coastal shipping, air, pipeline and conveyer for freight—and so have wider application than just projecting future road vehicle movements. They can also be used to project future inter-regional passenger travel and freight movements for other transport modes.

This report demonstrates the application of OZPASS and FreightSim to projecting future inter-regional passenger travel and freight movements Australia-wide, and to projecting future light and heavy road vehicle movements across the non-urban sections of the AusLink National Network. The latter task involves applying the OZPASS and FreightSim projections to base road traffic data collected by State and Territory road authorities. The light and heavy vehicle traffic projections are reported herein by segment for each corridor. More detailed projection outputs can be provided—the level of detail is limited only by the geographic classification used in OZPASS and FreightSim and the level of detail available for State and Territory road traffic data.

Relationship to previous BTRE analysis

The OZPASS model has been used in previous BTRE research (BTE 1997 and BTRE 2003a) for projecting inter-regional passenger movements and applying the projections to transport networks. This report, however, represents the first time the BTRE has used the FreightSim model to project inter-regional freight movements and apply the results to road traffic. Prior to the development of FreightSim, growth in inter-regional road freight vehicle traffic was not separately modelled, and was assumed to grow at a uniform rate across the entire non-urban road network—for example, in NTPT (1995) and BTE (1997) non-urban heavy vehicle road vehicles movements were assumed to grow by 3 per cent per annum.

In this paper, the projection period extends to 2025. In previous BTRE analysis the projection horizon extended to 2015 (NTPT 1995) or 2020 (BTRE 1997) and the scope of the analysis covers all major non-urban roads with particular focus on the AusLink non-urban road corridors.

The remainder of this chapter covers some of the key aspects of the study.

GEOGRAPHIC SCOPE

AusLink Land Transport Network

The analysis presented in this paper relates primarily to the non-urban road and rail links on the AusLink national network. The AusLink national network comprises 19 inter-city corridors, illustrated in figure 1.1, and specified urban corridors in Sydney, Melbourne, Brisbane, Adelaide and Perth. Two road routes are included for the Sydney–Brisbane corridor—the coastal route, via the Pacific Highway, and the inland route, via the New England and Cunningham Highways. Table 1.1 lists the non-urban road and rail links that are part of the AusLink national network.

While the results presented in this paper are restricted to the inter-city corridors on the AusLink national network, OZPASS and FreightSim have much broader application. Because they can be used to project future passenger and freight traffic between all regions in Australia, the results can be applied to other non-urban transport corridors.

OZPASS and FreightSim are not designed to provide projections for passenger travel and freight movements on the urban links of the AusLink National Network and, consequently, this paper does not provide any urban traffic growth projections. For urban traffic growth, the BTRE has separately projected aggregate growth in the urban passenger (BTRE 2003c) and freight (BTRE forthcoming) transport tasks for each State and Territory capital city, which may be used to inform the urban corridor strategies. Ultimately, however, analysis of future traffic growth across the urban AusLink corridors may require more detailed city-specific transport-network models. In this area, the OZPASS and FreightSim-based projections do provide estimates of future traffic growth into and out of each of the capital cities which may be input to city-specific transport models.

OZPASS AND FREIGHTSIM—A BRIEF OVERVIEW

The BTRE models OZPASS and FreightSim were developed specifically to provide long-term trend projections in passenger (light) vehicle and freight (heavy) vehicle traffic for the assessment of future road infrastructure requirements. Key features of the models are outlined here. The models are described in greater detail in chapter 2 and some further details of the models are outlined in appendices I, II and VIII.

OZPASS

OZPASS enables users to project future origin–destination (OD) passenger travel between over 90 separate regions in Australia. The model uses travel data from Tourism Research Australia (TRA)—formerly the Bureau of Tourism Research—National Visitor Survey (NVS) and International Visitor Survey (IVS) for the base year level and pattern of passenger travel. The NVS includes overnight and day trips for business, leisure and personal purposes to a destination at least 25 kilometres from home. The NVS and IVS, together, provide a measure of all long-distance domestic passenger trips in Australia by all major transport modes—private car, bus, rail, air, and ferry.

In OZPASS, future passenger travel is projected using a gravity-type model that relates growth in inter-regional passenger travel to growth in regional populations, household incomes and aggregate travel costs.

OZPASS also includes an algorithm for projecting local light vehicle travel in rural areas—that component of traffic on non-urban roads generated by residents of the local region. Rural light vehicle travel is projected using growth in regional populations and projected trends in average light vehicle ownership and average vehicle utilisation.

FreightSim

FreightSim is a model for projecting inter-regional OD freight movements across six transport modes: road, rail, sea, air, pipeline and conveyer. The model was developed jointly by the BTRE and FDF Pty Ltd under the auspices of Austroads. Austroads (2003) provides a short introduction to FreightSim. FreightSim comprises 132 separate regions—123 Statistical Subdivisions and eight capital city Statistical Divisions (ABS 1996) and one region comprising the rest of the world—and 16 commodity classes—15 bulk commodity groups and one non-bulk group.

Projected future inter-regional transport flows are derived from projected growth in domestic regional production, regional consumption and international imports. The base year production, consumption and inter-regional transport flows are based on FDF Pty Ltd *FreightInfo*™ 1999 national database of Australian freight movements. For the analysis presented in this paper, the *FreightInfo*™ 1999 data was augmented by non-bulk road freight movement estimates, between capital city Statistical Divisions and major provincial urban centres, drawn from the ABS (2002a) Freight Movements Survey (FMS). The *FreightInfo*™ and FMS data sets are described further in appendix VII. The process used to augment the *FreightInfo*™ use the FMS data is described in chapter 2.

TABLE 1.1 AUSLINK NETWORK NON-URBAN CORRIDORS

Corridor	*Road links*	*Rail link*
Interstate links		
Sydney–Melbourne	Hume Highway	Sydney–Melbourne (SG)
Canberra connectors	Barton and Federal Highways	Goulburn–Canberra (SG)
Sydney–Brisbane (inland route)	F3, New England and Cunningham Highways	..
Sydney–Brisbane (coastal route)	F3, Pacific Highway	Sydney–Brisbane (SG)
Sydney–Adelaide	Hume and Sturt Highways	Sydney–Broken Hill–Crystal Brook–Adelaide (SG)
Melbourne–Adelaide	Western and Dukes Highways	Melbourne–Adelaide (SG)
Melbourne–Brisbane	Hume, Goulburn Valley, Murray Valley, Newell, Leichhardt and Gore Highways	..
Brisbane–Darwin	Warrego, Landsborough, Barkly and Stuart Highways	..
Adelaide–Perth	Great Eastern, Coolgardie–Esperance, Eyre and Princes Highways	Adelaide–Tarcoola–Perth (SG)
Adelaide–Darwin	Princes and Stuart Highways	Tarcoola–Alice Springs–Darwin (SG)
Perth–Darwin	Great Northern, Victoria and Stuart Highways	..
Intrastate links		
Brisbane–Cairns	Bruce Highway	Brisbane–Cairns (NG)
Hobart–Burnie	Midland and Bass Highways	Hobart–Launceston–Burnie (NG)
Sydney–Wollongong	Princes Highway and Southern Freeway	..
Melbourne–Geelong	Princes Freeway	Melbourne–Adelaide (SG)
Townsville–Mt Isa	Flinders and Landsborough Highways	Townsville–Mt Isa (NG)
Sydney–Dubbo	Great Western and Mitchell Highways	..
Perth–Bunbury	South Western Highway	Perth–Bunbury (NG)
Melbourne–Mildura	Calder and Sturt Highways	Melbourne–Mildura (BG)
Melbourne–Sale	Princes Freeway	..

BG = Broad Gauge, NG = Narrow Gauge, SG = Standard Gauge.

.. not applicable.

Sources DOTARS (2004, table 4, pp. 69-70).

FIGURE 1.1 AUSLINK LAND TRANSPORT NETWORK

Sources DOTARS (2004, figure 7, p. 18).

Other analytical tools

FreightTrucks™

FreightSim provides estimates of inter-regional movements of tonnages of freight. For application to transport networks it is necessary to convert movement of tonnages into vehicle movements. FDF Pty Ltd's *FreightTrucks™* model is designed to convert freight tonnages into heavy vehicle road movements. In *FreightTrucks™*, a series of algorithms are used to convert freight to truck movements, which depend on the trip end locations and the type of commodity, for nine different truck type. Inter-capital trips are generally assumed to have higher load factors than trips to and/or from non-capital city regions. The BTRE has used the *FreightTrucks™* model in the analysis presented in this paper to convert freight movements to vehicle movements, albeit with some adjustments to the assumed average load for trips to and/or from non-capital city regions.

TransCAD: Transportation GIS Software

Translating inter-regional passenger and freight vehicle movements into on-road vehicle movements requires assignment of OD passenger and freight movements to the transport network. There are various software packages available for assigning traffic to transport networks. The BTRE uses the traffic assignment algorithms embedded in *TransCAD*—the transportation geographic information systems (GIS) software package. The traffic assignment results presented in this paper were derived using the road layer from the AUSLIG (1993) TOPO-10M vector topographic data set. More recent TOPO-10M data is freely available from Geoscience Australia website (for example, Geoscience Australia 2004), as is the TOPO-250K data set. More up-to-date geographic data has not been used for the analysis presented in this paper due to resource constraints.

PASSENGER AND FREIGHT MOVEMENT PROJECTIONS

The report provides a set of projections of passenger travel and freight movements for the period 1999 to 2025. The BTRE has used the projected growth in road passenger and road freight movements to project future road vehicle traffic growth across the AusLink National Network to 2025. Significantly, these projections have been derived using 1996, and earlier, base year road traffic volume data, 1999 inter-regional passenger movements data and 1999 inter-regional freight movements data. These data sets represent the latest data available to the BTRE to undertake these projections.

Updating the projections

Updating the projections is a relatively straightforward but labour intensive exercise that will only be possible when more up-to-date OD freight data and traffic volume data is available. Current inter-regional passenger travel data is available from the NVS and IVS up to June 2004. The BTRE has commissioned FDF Pty Ltd to update their *FreightInfo™* database of national freight flows to 2003–04. This is due to be available in mid-2006. Traffic volume data for the road network is collected by State and Territory road agencies. The BTRE is currently negotiating with State and Territory road agencies for more current traffic volume data on the non-urban road network. Updating the projections, using more up-to-date passenger, freight and traffic volume data, would also involve upgrading to the latest geographic data and re-constructing the necessary cross-references between the more current passenger travel, freight movements and road traffic data using the current Australian Standard Geographical Classification (ASGC, ABS 2001b).

OUTLINE OF THE REPORT

The remainder of the paper describes the OZPASS and FreightSim models and provides an illustrative application of the models. The results are translated into projected traffic levels on the non-urban roads of the AusLink National Network.

Chapter 2 describes in more detail the OZPASS and FreightSim models, and presents projections of total passenger and freight movements across Australia and for the AusLink corridors.

Chapter 3 briefly outlines the steps involved in assigning the inter-regional passenger travel and freight movement projections to the AusLink National Network, using the traffic assignment algorithms in *TransCAD*. The chapter provides summary level traffic projections for each of the 19 non-urban corridors identified as part of the AusLink National Network.

Chapter 4 identifies areas for further development of OZPASS and FreightSim and outlines the information requirements for updating the traffic projections.

Several appendices provide further details with respect to the analytical models and the passenger, freight and vehicle traffic projections.

CHAPTER 2 TRAVEL DEMAND PROJECTIONS

Future traffic levels are a critical element of any assessment of the economic benefits of transport infrastructure spending proposals. For example, among the benefits from improvements to transport infrastructure are savings in travel time, reduced accident risk and savings in operating costs, such as fuel and maintenance. In economic evaluation of transport projects, savings in these unit resource costs are multiplied by the number of users (level of traffic) to compute total user benefits.

OVERVIEW OF THE OZPASS AND FREIGHTSIM PROJECTION MODELS

The BTRE has, over several years, developed separate models for projecting future light (i.e. passenger) vehicle and heavy (i.e. freight) vehicle traffic on non-urban roads—OZPASS and FreightSim.

OZPASS projects growth in inter-regional passenger travel based on growth in regional populations, household incomes and travel costs. FreightSim uses projected growth in regional production, consumption and imports to project growth in inter-regional freight movements for 16 commodity types—15 bulk commodity types and a single category for non-bulk (manufactures) freight.

Recognising that traffic on any road will comprise a mix of both short-distance ('local') and long-distance ('through') traffic, OZPASS includes separate algorithms to project through and local passenger traffic. For freight, long-distance freight traffic growth is based on growth in inter-regional freight movements. Local freight vehicle traffic growth is based on projected growth in total freight movements within each region.[1]

The output from OZPASS—origin–destination (OD) passenger movements—and FreightSim—OD freight movements—are then converted to vehicle movements and subsequently assigned to the road network.

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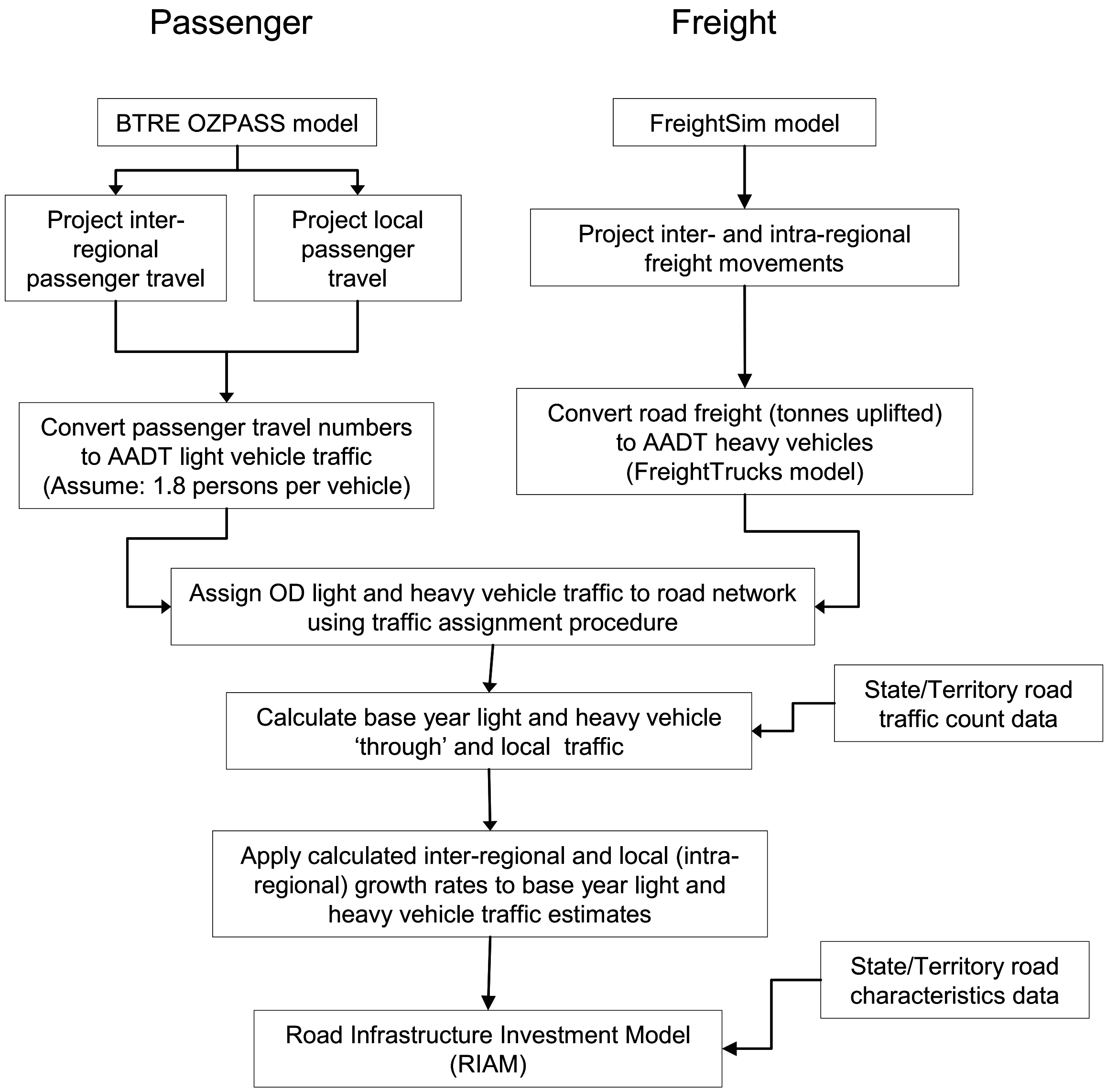
1 Regional (geographic) classifications are generally determined by the underlying base year data—the National Visitor Survey (NVS) and International Visitor Survey (IVS) in the case of passenger movements and *FreightInfo*™ for freight. These classifications are defined in appendixes I and II.

Separate growth factors, derived from OZPASS and FreightSim, are applied to each of these four separate traffic components. Growth in total traffic (AADT) on each road section is then the share weighted average of growth in each of these four separate traffic components. Figure 2.1 provides a schematic outline of the processes involved in generating the traffic projections.

FIGURE 2.1 BTRE NON-URBAN PASSENGER AND FREIGHT TRAFFIC PROJECTION METHODOLOGY



The remainder of this chapter outlines the OZPASS and FreightSim models and presents the input assumptions and a base case set passenger and freight projections derived using the models. Assignment of the passenger and freight traffic projections to the road network, and the resulting vehicle traffic projections, are described in chapter 3.

PASSENGER TRAVEL PROJECTIONS

OZPASS

OZPASS is a 'sketch-planning' tool that is designed to provide indicative trends in long-distance non-urban passenger travel patterns for five different transport modes: air, coach, rail, ferry and private car.

Inter-regional domestic resident passenger travel

OZPASS uses a constrained gravity-model relationship to project growth in total domestic resident inter-regional passenger travel. In a general gravity model formulation, growth in passenger travel between each origin–destination pair is usually modelled as a function of the relative attractive forces between the two regions—usually a function of population and income growth—and inversely related to the distance between the two regions. In the constrained gravity-model formulation used in OZPASS, a general gravity model formulation is used, but total passenger trips out of any region are constrained to not exceed the 'trip generating capacity' of that region. In other words, growth in passenger travel out of any region is a function of the growth in the population of that region, and growth in national incomes and travel costs.

The inter-regional passenger travel projections include both trips by domestic residents and international visitors. The base trip data is drawn from the BTR's National Visitor Survey (NVS) and International Visitor Survey (IVS) datasets. The BTRE has data from the 1998, 1999 and 2000 NVS and IVS. Passenger movements are converted into vehicle trips by assuming an average non-urban vehicle occupancy rate of 1.8 persons per vehicle.

Equation (2.1) outlines the gravity model formulation for growth in total passenger travel between any two regions *i* and *j*.

$$\hat{T}_{ij} = 0.5 \times \left(\hat{P}_i + \hat{P}_j\right) - 1.25 \times \left(\hat{C} - \hat{Y}\right) \qquad (2.1)$$

where $\hat{T}_{ij}$ is growth in total trips from region *i* to region *j*;

$\hat{P}_i$ and $\hat{P}_j$ is growth in total population in region *i* and region *j*;

$\hat{C}$ is the growth in the real generalised cost of travel; and

$\hat{Y}$ is the growth in real average weekly earnings.

The gravity-model parameters were derived from estimates of origin–destination (O–D) passenger travel between 10 intercity pairs over a 25-year period (1970 to 1995). The methods used to derive the parameter estimates are described in BTE (1998).

However, these initial calculations of future passenger travel are 're-based' to ensure that the growth in total passenger trips by residents of any one region do not exceed the 'trip-generating capacity' of that region. In other words, because the gravity model gives equal weight to the population of both the origin and destination region, it is possible for total inter-regional passenger trips by residents of any region *i*, to grow at a rate incompatible with the growth in the underlying population and income. The growth in the trip-generating capacity of any region is assumed to be a function of the growth in the resident population and growth in average weekly earnings and average travel costs (shown in equation 2.2):

$$\hat{T}_{i\bullet} = \hat{P}_i + 1.25 \times \left(\hat{Y} - \hat{C}\right) \qquad (2.2)$$

where $\hat{T}_{i\bullet}$ is growth in total trips by residents of region *i*.

The 're-based' level of passenger travel between any two regions is then given by equation (2.3):

$$T_{ij}^* = \frac{T_{ij} \times T_{i\bullet}}{\sum_j T_{ij}}, \text{ for all } i \text{ and } j, \qquad (2.3)$$

where T_{ij}^* is re-based number of passenger trips between region *i* and region *j*;

T_{ij} is the gravity model-based estimate of the number of passenger trips between region *i* and region *j*; and

$T_{i\bullet}$ is the projected total number of trips by residents of region *i*, from equation 2.2.

The constrained gravity model provides projections of total passenger trips between each OD pair, but says nothing about modal share. In OZPASS, changes in the mode share of passenger travel are determined by logistic substitution equations.[2] The logistic substitution equations are recursive formulae that assume the change in mode share is a function of the relative 'competitiveness' (or 'attractiveness') of each mode. The passenger model contains simple distance-based 'rules of thumb', based on previous research (BTE 1998), for the relative 'competitiveness' of different transport modes. Equation (2.4) shows the mode share recursion formula, derived from the logistic substitution model, used to determine changes in the proportion of passengers carried by mode *i*.

$$s_{k,t+1} = \frac{c_k}{\sum_m c_m s_{m,t}} s_{k,t} \qquad (2.4)$$

where c_k is the competitiveness index of mode *k*; and

$s_{k,t}$ is the passenger travel share of mode *k* at time *t*.

2 See Marchetti & Nakicenovic (1979), Gruebler (1990), and Kwasnicki & Kwasnicka (1996) for a description of logistic substitution models.

The simple 'rules of thumb', upon which the competitiveness indices are based, assume:

- Air is more attractive than other modes for travel over distances between 400 and 800 km, and significantly more attractive for travel of distances above 800 km;
- Car is more attractive over shorter distance routes, below 400 km in length, where it gains market share at the expense of all other modes; and
- Coach and rail are less attractive than both car and, for longer distance routes, air travel.

Table 2.1 presents the mode share competitiveness indices assumed for domestic passenger trips. Car is the reference mode, so its competitiveness index is set to one.

TABLE 2.1 MODE SHARE COMPETITIVENESS INDICES FOR DOMESTIC RESIDENT PASSENGER TRIPS

	Distance (km)			
Mode	*0–200*	*200–400*	*400–800*	*>800*
Air	0.96	0.967	1.019	1.05
Car	1	1	1	1
Coach	0.98	0.98	0.98	0.98
Rail	0.98	0.97	0.98	0.98
Ferry	1	1	1	1
Other	0.98	0.98	0.98	0.99

Source BTRE estimates.

Inter-regional international visitor passenger travel

In OZPASS, total domestic passenger trips by international visitors are assumed to grow in proportion to growth in total international visitor arrivals. In lieu of more detailed modelling results, the geographic pattern of domestic trips by international is assumed to remain unchanged over the projection period in OZPASS. Hence, total trips by international visitors between each OD pair will grow at a rate equal to the growth in total international visitor arrivals. In reality, some tourist destinations will be more popular than others and it might be expected that international visitor trips between different OD pairs will grow at different rates. In terms of total travel, however, because international visitors represent less than 3 per cent of all domestic passenger trips this simplification will not have a significant impact on the travel projections for most OD pairs.

In terms of mode share trends for international visitor trips, the BTRE has applied the domestic passenger mode share indices, with some minor modifications to the mode share indices for coach and rail. For coach travel, which is a significant transport mode for domestic travel by international visitors, the BTRE has assumed a competitiveness index of one, equal to that of car travel, for trips of less than 400km. For coach trips greater than 400km in length, the mode share competitiveness index for coaches is assumed the same as that for domestic resident trips. For rail, the mode share competitiveness indexes for international visitors are assumed to be the same as for domestic residents, except for very long distance trips (>800km), where the mode share competitiveness index is assumed to be 0.98. The mode share competitiveness indexes for international visitor trips are shown in table 2.2.

TABLE 2.2 MODE SHARE COMPETITIVENESS INDICES FOR INTERNATIONAL VISITOR PASSENGER TRIPS

	Distance (km)			
Mode	*0–200*	*200–400*	*400–800*	*>800*
Air	0.98	0.967	1.019	1.03
Car	1	1	1	0.99
Coach	1	0.99	0.99	0.99
Rail	0.98	0.97	0.98	0.98
Ferry	1	1	1	1
Other	0.98	0.98	0.97	0.99

Source BTRE estimates.

Rural local passenger travel

OZPASS also includes a module to project growth in rural local passenger travel. In the model, growth in non-urban local passenger travel is proportional to growth in the local population (for each SLA) and growth in national light vehicle ownership.

Base year non-urban local vehicle traffic is calculated as the residual of total traffic (measured in AADT) and the assigned base year inter-regional light vehicle traffic levels. The rural local passenger travel growth rates for each SLA are then applied to the base year local rural local light vehicle traffic to derive projections of future rural local light vehicle travel.

Base case assumptions

The projections presented here assume a 'business-as-usual' scenario for the future characteristics of presently existing transport modes and assume no significant change to existing regulatory and assistance arrangements. The base case assumptions required for OZPASS include growth in real national average weekly earnings, growth in the real weighted average generalised cost of travel cost across all modes, growth in international visitor arrivals and changes in the estimated resident population, by geographic area.

Base year travel patterns

The base year for the projections is 1999. The base year passenger travel patterns and mode shares are based on a three year average of total travel activity derived from the 1998, 1999 and 2000 NVS, and the pooled 18-month average level of travel as measured by the 1999 and 2000 IVS.

Real average weekly earnings

In the base case projections, real average weekly earnings are assumed to grow by 1.4 per cent per annum over the projection period. This assumption is based on the long-term historical trend in real average weekly earnings. Over the period 1971 to 2001, real average weekly earnings grew by just under 1.4 per cent per annum, on average.

Real average travel costs

In the base case, it is assumed that the real weighted average cost of travel does not change over the projection period.

This assumption is based on historical information for trends in the cost of travel between city pairs. In particular, between 1971 and 1995, the average real generalised cost of travel between city pairs, across all modes of transport (including private car), increased by an average of 0.25 per cent per annum. This increase reflects both changes in the underlying cost of travel and changes in the mode shares. For example, growth in the share of transport by air will have increased the weighting of the cost of air travel in the average cost of travel. As air travel is generally a higher cost, this would have increased the weighted average generalised cost of transport.

The evidence presented in BTRE (2003a) suggested that trends in the cost of regional passenger travel had increased for rail, but it was not clear whether the average cost of regional air travel and coach travel had increased or decreased over the past decade and a half. Although it is likely that the overall cost of car travel to and from regional areas has decreased slightly, in the absence of clearer information on the trends in the cost of regional passenger travel, an assumption that the overall cost of travel does not change in real terms over the projection period seemed the most reasonable assumption. Varying this assumption would, of course, affect the total projected level of passenger travel.

International visitors

Since 1983 short-term foreign visitor arrivals have grown by more than 9 per cent per annum. It is not clear whether such a high rate of growth will continue indefinitely. In the base case projections, growth in international inbound tourists is assumed to decline linearly from 9 per cent per annum in 2000 to 3.9

per cent per annum by 2025. These assumptions imply growth in international visitor trips of over 5.8 per cent per annum, over the projection period, and an increase in international visitor trips as a proportion of all travel.

The impacts of these assumptions on road passenger traffic would, in most cases, be only minor. International visitors make up less than 3.0 per cent of total inter-regional passenger journeys in Australia. Of those inter-regional movements, less than 67 per cent are by car or bus. Where the international visitor travel growth projections are most likely to have any significant effect on total travel is along Bruce Highway in Queensland and the Stuart and Lasseter Highways in the Northern Territory, where international visitors make up a higher proportion of surface passenger travel movements.

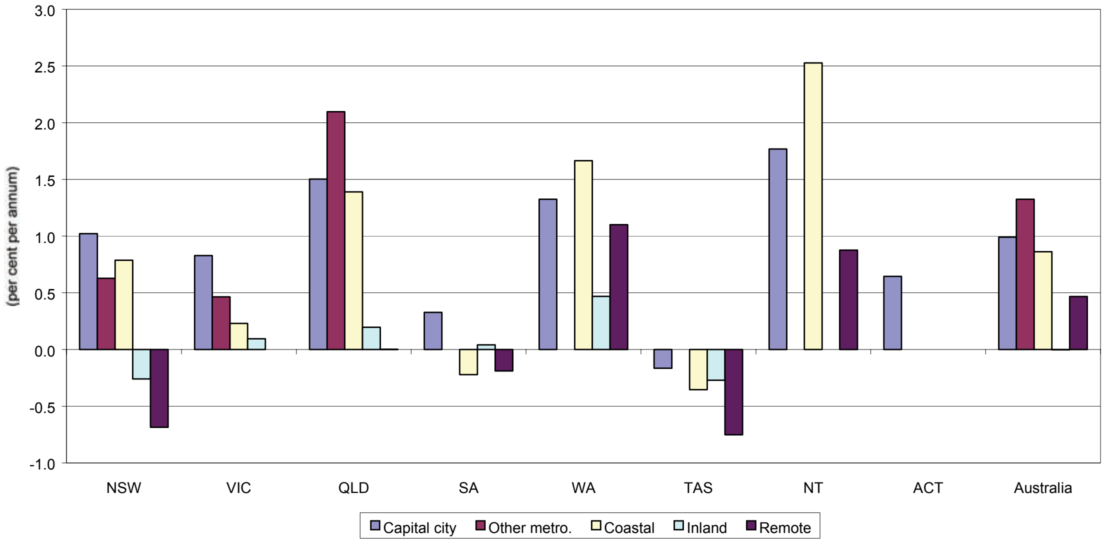
Projected population growth

OZPASS uses population projections provided at the Statistical Local Area (SLA) level. The population projections assumed for the base case projections are based on the ABS population projections 1999–2101 (Series II), outlined in ABS (2000). The baseline population projections forecast national population growth of just under 0.9 per cent per annum over the period 1999 to 2020. Population growth is projected to be strongest in Queensland, Western Australia and Northern Territory, while South Australia is projected to have the lowest population growth of all mainland States. Tasmania’s population is projected to decline by 0.25 per cent per annum over that period. Figure 2.2 shows the projected rates of population growth between 1999 and 2020, by State/Territory and regional area. The data underlying figure 2.2 are listed in table 2.3.

The major trends in the projected population growth include:

- Above national average projected population growth in Queensland, Western Australia and Northern Territory.
- Below national average projected population growth in Victoria and South Australia, and declining population levels in Tasmania.
- Generally, slower population growth in inland and remote areas across Australia. Growth in population across coastal regions is projected to be mixed—with strong growth in coastal Queensland, Western Australia, Northern Territory and, to a lesser extent, NSW, but slower growth in Victoria, and declining population levels in coastal regions in South Australia and Tasmania.

FIGURE 2.2 BASE CASE POPULATION GROWTH PROJECTIONS, 1999–2020



Sources ABS (2001a) and BTRE estimates.

TABLE 2.3 AVERAGE ANNUAL GROWTH IN PROJECTED POPULATION, BY STATE / TERRITORY BY REGION, 1999–2020

(per cent per annum)

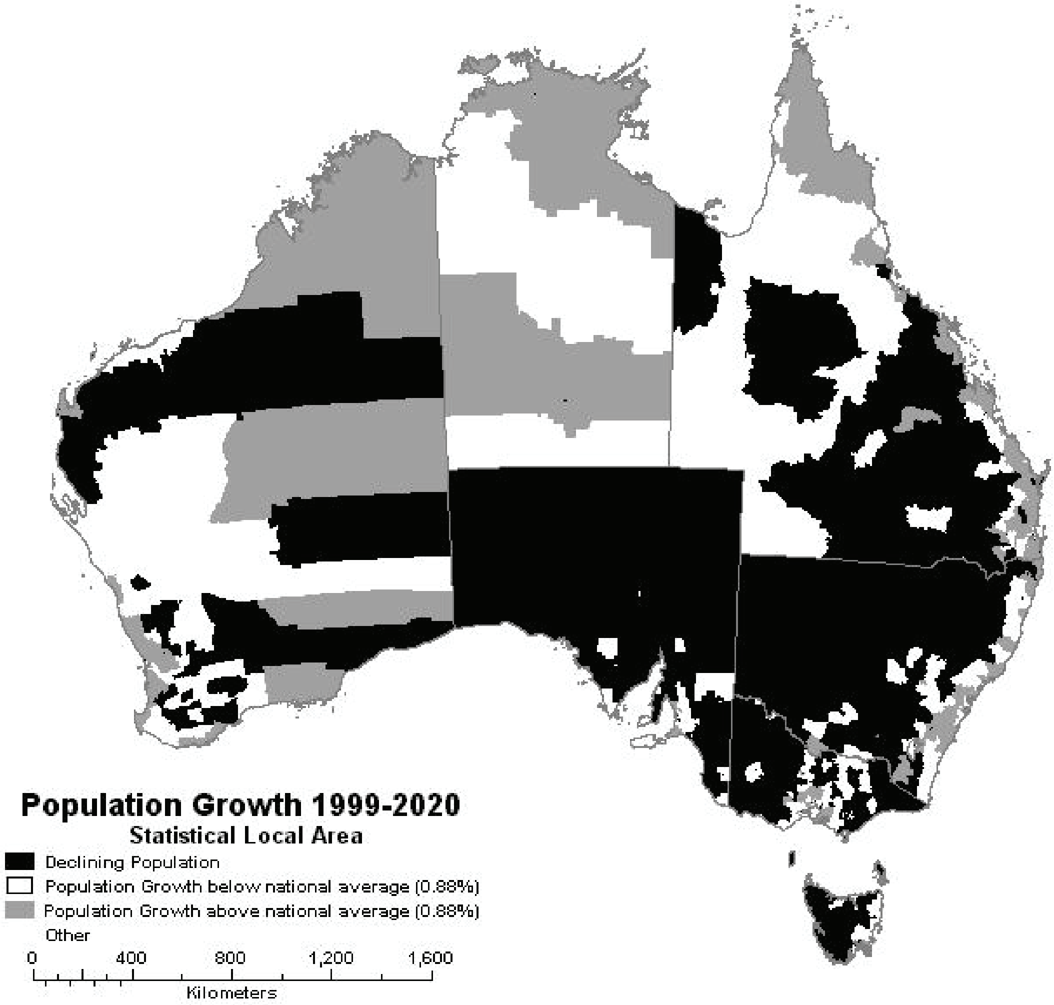
	Region					
State/Territory	*Capital city*	*Other metro.*	*Coastal*	*Inland*	*Remote*	*All regions*
NSW	1.02	0.63	0.79	–0.26	–0.69	0.79
Victoria	0.83	0.46	0.23	0.09	..	0.65
Queensland	1.50	2.10	1.39	0.20	0.00	1.45
SA	0.33	..	–0.22	0.04	–0.19	0.22
WA	1.32	..	1.66	0.47	1.10	1.30
Tasmania	–0.17	..	–0.35	–0.27	–0.75	–0.27
NT	1.77	..	2.53	..	0.88	1.46
ACT	0.64	..	..	..	..	0.64
Australia	0.99	1.32	0.86	0.00	0.47	0.88

.. not applicable.

Sources ABS (2001a) and BTRE estimates.

Not shown in table 2.3, but also significant, is that the population of larger towns and regional centres is projected to grow at a much faster rate than smaller population centres. For example, the strong growth in remote areas of Western Australia is mainly confined to the larger centres above 10 000 persons. A similar situation is also forecast for inland areas of NSW. In contrast, in the coastal areas of Queensland the projected growth for smaller regions (> 2000 and < 10 000 persons) is much stronger than that of the larger centres. The general picture, though, shows stronger projected population growth in larger regional centres. Figure 2.3 illustrates the variation in projected population growth by SLA across different regional areas.

FIGURE 2.3 PROJECTED POPULATION GROWTH BY STATISTICAL LOCAL AREA, 1999–2020



Sources ABS (2001a) and BTRE estimates.

Inter-regional passenger travel projections

These assumptions imply total growth in total inter-regional passenger trips of 2.6 per cent per annum between 1999 and 2025. Air travel is projected to grow most strongly, by 3.9 per cent per annum. Car trips, which constitute 86 per cent of total long-distance passenger trips—that is, trips to a place 50 kilometres or more from the traveller's place of residence for a duration of 4 hours or more—are projected to grow 2.6 per cent per annum between 1999 and 2025. Bus trips are projected to grow by 1.7 per cent per annum, boosted by foreign tourist visitors who tour Queensland and the Northern Territory by coach. Rail trips are projected to grow by 0.8 per cent per annum between 1999 and 2025. Express bus and inter-urban rail services are used by disproportionately more persons between 15 and 24 years of age and over 64 years of age, and persons living in households with an income of less than $16 000 per annum (BTRE

2003a). Table 2.4 lists the projected growth in inter-regional passenger trips by transport mode between 1999 and 2025.

TABLE 2.4 INTER-REGIONAL PASSENGER TRAVEL PROJECTIONS, 1999–2025

	Mode						
Year	*Air*	*Bus*	*Car*	*Ferry*	*Other*	*Rail*	*All modes*
	(million passenger journeys)						
1999	26.5	17.5	404.5	0.9	2.9	18.7	471.0
2000	27.9	18.0	420.6	1.0	2.9	19.1	489.5
2005	33.6	19.0	475.2	1.1	3.0	19.7	551.6
2010	41.3	20.8	544.2	1.3	3.2	20.6	631.4
2015	50.3	22.9	620.0	1.6	3.4	21.4	719.6
2020	60.6	25.0	703.6	1.8	3.5	22.2	816.7
2025	72.0	27.0	796.0	2.1	3.7	22.9	923.7
	Average annual growth						
	Mode						
Year	*Air*	*Bus*	*Car*	*Ferry*	*Other*	*Rail*	*All modes*
	(per cent per annum)						
2000–2005	3.79	1.09	2.47	1.92	0.68	0.62	2.42
2005–2010	4.21	1.83	2.75	3.40	1.30	0.90	2.74
2010–2015	4.02	1.94	2.64	4.24	1.22	0.76	2.65
2015–2020	3.80	1.77	2.56	2.38	0.58	0.74	2.56
2020–2025	3.51	1.55	2.50	3.13	1.12	0.62	2.49
1999–2025	3.92	1.68	2.64	3.31	0.94	0.78	2.62

Source BTRE projections.

Inter-regional passenger travel projections – AusLink corridors

Table 2.5 lists 1999 actual and projected 2025 origin–destination passenger travel, by AusLink corridor and mode of transport, as well as the implied annual rate of growth. The growth rates for each corridor and each transport mode are illustrated in figure 2.4.

TABLE 2.5 ACTUAL AND PROJECTED ORIGIN–DESTINATION PASSENGER TRAVEL BY AUSLINK CORRIDOR AND TRANSPORT MODE, 1999 AND 2025

('000 passenger journeys)

Corridor	*Air*	*Bus*	*Car*	*Other[a]*	*Rail*	*All modes*
			1999			
Sydney–Melbourne	4284.1	201.3	1024.9	22.9	129.8	5663.1
Sydney–Canberra	538.0	409.4	3370.9	3.5	158.5	4480.3
Sydney–Brisbane	1717.8	87.4	507.8	37.6	49.5	2400.0
Sydney–Adelaide	838.6	45.5	253.6	24.1	19.2	1181.0
Melbourne–Adelaide	879.0	158.9	559.2	7.3	57.2	1661.6
Melbourne–Brisbane	838.2	15.6	132.6	3.5	3.1	992.9
Brisbane–Darwin	47.4	0.5	8.1	0.1	..	56.0
Adelaide–Perth	201.3	9.1	47.9	15.2	14.1	287.5
Adelaide–Darwin	66.6	2.3	13.3	..	..	82.1
Perth–Darwin	55.5	1.3	6.9	4.1	0.0	67.9
Brisbane–Cairns	278.4	45.2	187.3	8.9	40.2	560.0
Hobart–Burnie	3.0	40.1	600.6	1.2	..	645.0
Sydney–Wollongong	2.9	407.4	10717.8	15.6	1434.7	12578.4
Melbourne–Geelong	0.2	112.2	7026.4	38.3	324.1	7501.3
Townsville–Mt Isa	46.5	18.4	149.8	2.7	0.1	217.5
Sydney–Dubbo	161.9	120.1	2849.5	26.4	114.9	3272.7
Perth–Bunbury	0.5	193.5	5504.7	19.2	24.0	5742.0
Melbourne–Mildura	84.1	60.6	556.3	10.2	36.7	747.8
Melbourne–Sale	2.1	137.4	5069.7	7.3	239.1	5455.6
Total	10046.2	2066.1	38587.1	248.1	2645.1	53592.7

TABLE 2.5 ACTUAL AND PROJECTED ORIGIN–DESTINATION PASSENGER TRAVEL BY AUSLINK CORRIDOR AND TRANSPORT MODE, 1999 AND 2025 (CONTINUED)

('000 passenger journeys)

Corridor	*Air*	*Bus*	*Car*	*Other*[a]	*Rail*	*All modes*
			2025			
Sydney–Melbourne	11494.5	220.3	780.6	24.2	81.2	12600.8
Sydney–Canberra	589.9	782.8	7573.3	7.8	178.4	9132.2
Sydney–Brisbane	5053.1	80.2	410.5	30.3	34.3	5608.4
Sydney–Adelaide	2259.8	34.5	183.8	13.3	13.1	2504.6
Melbourne–Adelaide	2252.6	197.8	850.7	11.5	63.1	3375.7
Melbourne–Brisbane	2086.8	10.1	91.4	2.8	2.4	2193.6
Brisbane–Darwin	140.7	0.8	6.1	0.1	..	147.8
Adelaide–Perth	572.2	11.4	38.9	7.4	20.4	650.2
Adelaide–Darwin	174.0	1.5	10.5	..	..	185.9
Perth–Darwin	179.5	2.3	5.7	3.2	0.1	190.7
Brisbane–Cairns	1144.9	66.0	251.4	9.5	27.7	1499.4
Hobart–Burnie	1.0	38.5	848.0	1.7	..	889.4
Sydney–Wollongong	3.7	494.3	21421.0	34.0	1711.6	23664.5
Melbourne–Geelong	0.7	134.2	13498.4	53.5	368.7	14055.5
Townsville–Mt Isa	123.3	20.6	212.9	4.4	0.2	361.5
Sydney–Dubbo	137.2	145.4	5370.7	29.3	100.6	5783.3
Perth–Bunbury	1.3	309.6	14093.0	32.6	40.1	14476.6
Melbourne–Mildura	250.2	66.1	991.5	10.3	39.7	1357.7
Melbourne–Sale	1.3	142.1	8410.1	7.9	233.2	8794.6
All corridors	26466.6	2758.4	75048.4	283.9	2915.0	107472.3

TABLE 2.5 ACTUAL AND PROJECTED ORIGIN–DESTINATION PASSENGER TRAVEL BY AUSLINK CORRIDOR AND TRANSPORT MODE, 1999 AND 2025 (CONTINUED)

	Mode					
Corridor	*Air*	*Bus*	*Car*	*Other*[a]	*Rail*	*All modes*
	Average annual growth (per cent per annum)					
Sydney–Melbourne	3.9	0.3	–1.0	0.2	–1.8	3.1
Sydney–Canberra	0.4	2.5	3.2	3.1	0.5	2.8
Sydney–Brisbane	4.2	–0.3	–0.8	–0.8	–1.4	3.3
Sydney–Adelaide	3.9	–1.1	–1.2	–2.3	–1.4	2.9
Melbourne–Adelaide	3.7	0.8	1.6	1.8	0.4	2.8
Melbourne–Brisbane	3.6	–1.6	–1.4	–0.8	–0.9	3.1
Brisbane–Darwin	4.3	2.0	–1.1	1.9	..	3.8
Adelaide–Perth	4.1	0.9	–0.8	–2.7	1.4	3.2
Adelaide–Darwin	3.8	–1.6	–0.9	..	..	3.2
Perth–Darwin	4.6	2.3	–0.8	–1.0	1.3	4.1
Brisbane–Cairns	5.6	1.5	1.1	0.2	–1.4	3.9
Hobart–Burnie	–4.1	–0.2	1.3	1.5	..	1.2
Sydney–Wollongong	0.9	0.7	2.7	3.0	0.7	2.5
Melbourne–Geelong	3.9	0.7	2.5	1.3	0.5	2.4
Townsville–Mt Isa	3.8	0.4	1.4	1.8	4.5	2.0
Sydney–Dubbo	–0.6	0.7	2.5	0.4	–0.5	2.2
Perth–Bunbury	3.8	1.8	3.7	2.0	2.0	3.6
Melbourne–Mildura	4.3	0.3	2.2	0.1	0.3	2.3
Melbourne–Sale	–1.8	0.1	2.0	0.3	–0.1	1.9
All corridors	3.8	1.1	2.6	0.5	0.4	2.7

a. Mode ‘Other’ includes trips where the main mode of transport is not air, car, rail or coach. This category includes trips that are undertaken using a combination of modes, such air and car.

.. not applicable.

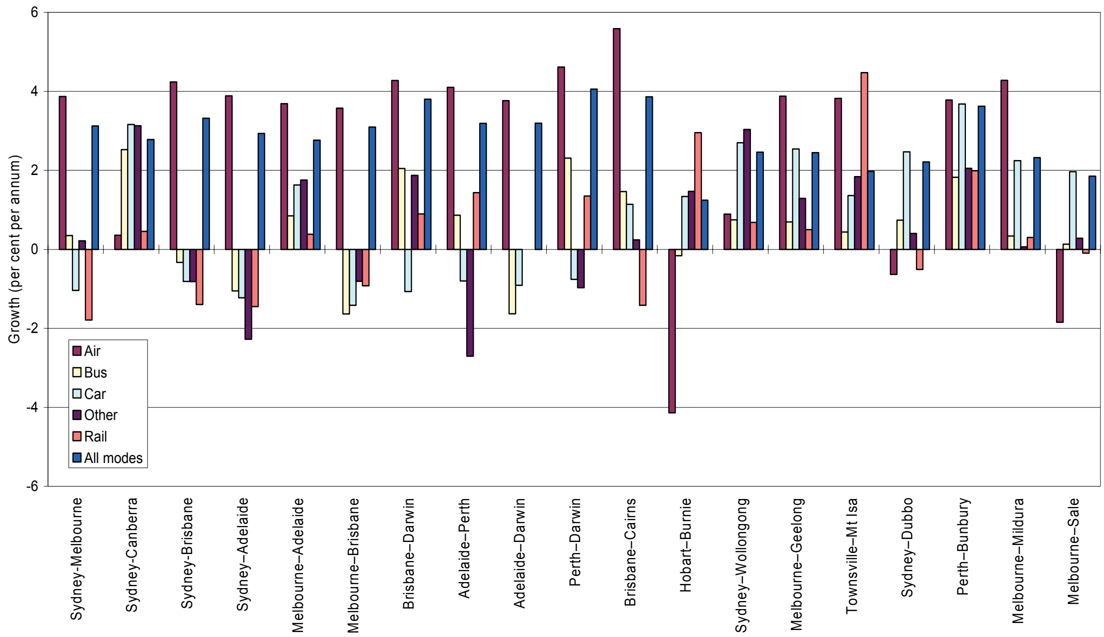
Source BTRE estimates.

Some of the notable features of the origin–destination level projections are:

- Strong growth in air travel between most major capital city pairs, with the exception of Sydney–Canberra. Brisbane–Cairns, Sydney–Brisbane, Perth–Darwin and Brisbane–Darwin are projected to exhibit the strongest growth in air travel, reflecting strong populations growth and international visitor movements.
- Declining passenger car travel between cities located more than 800km apart and reasonably strong growth in car travel between cities within 400km—reflecting the mode share input assumptions.
- Strong growth in bus trips for the Sydney–Canberra, Brisbane–Darwin, Perth–Darwin and Brisbane–Cairns OD pairs, variously reflecting the assumed mode share competitiveness assumptions in the case of Sydney–Canberra and the growth in international visitor trips in Queensland, Western Australia and the Northern Territory.

- Absolute declines in rail travel between most OD pairs. (The strong projected growth in rail trips between Townsville and Mt Isa, of 4.5 per cent per annum, appears exceptionally strong and is probably caused by international visitors accounting for a large share of rail trips in the base data.)

FIGURE 2.4 PROJECTED GROWTH IN ORIGIN–DESTINATION PASSENGER TRAVEL BY AUSLINK CORRIDOR AND TRANSPORT MODE, 1999–2025



Source BTRE estimates.

Rural local light vehicle travel projections

Table 2.6 shows the projected growth in rural local light vehicle travel—that is, light vehicle travel outside the State/Territory capital city—by jurisdiction between 2000 and 2025. Rural local light vehicle travel is projected to grow most strongly in Queensland, Western Australia and the Northern Territory, in line with the stronger projected growth in population in those jurisdictions. Total rural local travel is projected to decline in Tasmania.

TABLE 2.6 PROJECTED GROWTH IN RURAL LOCAL LIGHT VEHICLE TRAVEL, 1999–2025

Year	State/Territory								
	NSW	*Vic.*	*Qld*	*SA*	*WA*	*Tas.*	*NT*	*ACT*	*Total*
	(per cent per annum)								
2000–2005	1.28	1.13	2.34	0.78	2.11	0.57	2.06	0.77	1.57
2005–2010	0.62	0.38	1.70	0.18	1.54	–0.07	1.45	0.23	0.93
2010–2015	0.44	0.20	1.49	0.00	1.36	–0.26	1.30	0.15	0.76
2015–2020	0.34	0.12	1.35	–0.12	1.23	–0.41	1.23	0.12	0.66
2020–2025	0.18	0.05	1.11	–0.35	1.00	–0.66	1.09	0.03	0.50
1999–2025	0.63	0.44	1.66	0.15	1.50	–0.11	1.48	0.31	0.94

Source BTRE projections.

Comparison with other BTRE passenger travel projections

As part of its greenhouse gas emissions projections research (BTRE 2002), the BTRE has projected total non-urban passenger travel using aggregate non-urban passenger travel models. These projections were derived independently of OZPASS. The latest published BTRE aggregate non-urban passenger travel projections (DOTARS 2004) imply growth in non-urban passenger kilometres travelled of 2.1 per cent per annum between 2000 and 2020, listed by transport mode in table 2.7. Among the different transport modes, air travel is projected to grow fastest, at a rate of 4.5 per cent per annum. Car travel is projected to growth by 1.0 per cent per annum. Bus and rail travel are projected to grow by 0.7 and 0.5 per cent per annum, respectively.

TABLE 2.7 BTRE AGGREGATE MODEL-BASED PROJECTED GROWTH IN NON-URBAN PASSENGER KILOMETRES TRAVELLED, 2000–2020

(per cent per annum)

	Mode					
	Air	Car	Bus	Rail	Other	All modes
Growth	4.5	1.0	0.7	0.5	1.0	2.1

Source DOTARS (2004).

Applying the road distance between regional pairs to total inter-regional passenger trips, and adding in the projected growth in rural local light vehicle travel, enables estimation of the growth in passenger kilometres travelled implied by OZPASS. Table 2.8 shows the projected growth in passenger kilometres travelled, between 1999 and 2025, derived from the OZPASS results.

TABLE 2.8 PROJECTED GROWTH IN NON-URBAN PASSENGER KILOMETRES TRAVELLED, 1999–2025

(per cent per annum)

	Mode					
	Air	Car	Bus	Rail	Other	All modes
Growth	4.1	1.7	1.7	0.3	0.5	2.3

Source BTRE unpublished estimates.

Comparing tables 2.7 and 2.8, it can be seen total projected non-urban passenger travel is slightly higher under the OZPASS model, 2.3 per cent per annum, than the BTRE aggregate model projections. The OZPASS projections imply slightly slower growth in total air travel than the aggregate BTRE projections—4.1 per cent per annum in OZPASS versus 4.5 per cent per annum—but stronger growth in total non-urban car travel—1.7 per cent per annum in OZPASS versus 1.0 per cent per annum. Bus travel is projected to grow more strongly under the OZPASS assumptions—1.7 per cent per annum in OZPASS as opposed to 0.7 per cent per annum in the aggregate BTRE projections. The non-urban rail passenger travel projections are similar—0.3 per cent per annum in OZPASS as opposed to 0.5 per cent per annum in the aggregate BTRE projections.

Overall, apart from the higher growth in car and bus passenger travel, the OZPASS projections are reasonably similar to previous aggregate BTRE projections of total non-urban passenger travel.

FREIGHT MOVEMENT PROJECTIONS

FreightSim

FreightSim is a ‘sketch-planning’ tool for projecting the freight transport implications of alternative economic development scenarios. FreightSim generates projections of the future freight task using a ‘mass-balance’ equilibrating process for each of the 16 separate commodity classes—15 bulk commodity classes and one non-bulk commodity class. Under the mass-balance approach, the total production plus regional imports (inflows), for each commodity class, must equal the sum of total consumption and regional exports (outflows) for each of 132 separate regions.

Bulk commodity base year movements and production projections

For the 15 bulk freight commodity classes, FreightSim includes base year estimates of production, consumption and imports for each of the 132 separate regions, as well as the base year freight transport flows across six major transport modes: road, rail, sea, air, pipeline and conveyor. Additionally, FreightSim includes a set of business as usual bulk commodity production projections, which are generally based on the latest available commodity projections from authoritative sources. For example, the grain production projections are based on CSIRO (2002). The default production projections used in the base case simulations are listed in table 2.9.

TABLE 2.9 FREIGHTSIM COMMODITY PRODUCTION FORECASTS

Commodity		*Year*			
Code	*Description*	*1999*	*2020*	*2025*	*Growth 1999–2025*
		(million tonnes)			*(per cent pa)*
2	Grains and oilseeds	38.6	49.2	50.6	1.05
3	Sheep live	1.2	1.5	1.5	0.82
4	Cattle live	4.9	5.5	5.6	0.46
5	Meat	6.6	8.0	8.2	0.80
6	Agricultural products	83.6	102.4	105.7	0.91
7	Coal and coke	290.7	523.7	599.6	2.82
8	Metallic minerals	182.5	276.7	304.9	1.99
9	Non-metallic minerals	690.8	1047.0	1153.9	1.99
10	Oil and petroleum products	22.6	22.6	22.6	0.00
11	Gas	25.8	62.4	75.9	4.24
12	Steel and metals	14.7	22.3	24.6	1.99
13	Fertilisers	1.3	2.0	2.2	1.99
14	Cement	7.3	18.2	21.3	4.22
15	Timber and timber products	18.4	31.4	33.1	2.27
16	Other bulk freight	2.5	3.8	4.2	1.99

Source FreightSim and BTRE estimates.

FreightSim projects future consumption and imports for each commodity and each region based on the projected growth in output/income in each region—the product of projected growth in national per capita GDP and regional populations. Projected freight task movements are computed as the level of freight transport necessary to transport commodities from regions where there is net excess production—that is, where production plus imports exceeds consumption—to regions where there is net excess demand, along *existing* freight movement paths.[3] The model iterates until excess consumption demands are satisfied. Any remaining net excess production for any commodity is then transported to the nearest suitable port for export.

3 FreightSim only assigns freight along an existing commodity path. If, in the future, a region begins to export a particular commodity, the model will not be able to assign the exports unless there is a previously assigned export path from that region for that particular commodity. The practical implication of this is that if the production projections lead to the development of a new set of exports in the future, FreightSim will not assign the potential exports if there is no pre-existing export path. In these cases, users will need to define a new export path by designating a very small (e.g. 0.001 thousand tonnes) level of exports in the base year.

The model then assigns the total OD flow of each commodity to a transport mode. The projected modal assignment is based on national historical trends in freight transport mode share by commodity. FreightSim, like OZPASS, uses logistic substitution type relationships to project trends in freight transport mode share (see equation 2.4). Table 2.10 lists the mode share competitiveness indexes for bulk freight movements, by commodity type, used in the simulations. Where no mode share competitiveness indexes are specified for a particular bulk commodity, the 'default' mode share competitiveness indices, shown in the first row of table 2.10, are applied.

TABLE 2.10 MODE SHARE COMPETITIVENESS INDEXES FOR DOMESTIC BULK FREIGHT TRANSPORT

Commodity		*Mode*					
Code	*Description*	*Road*	*Rail*	*Coastal shipping*	*Pipeline*	*Conveyer*	*Air*
0	Default	1	1	1	1	1	1
2	Grains	1	0.99	1			
4	Cattle (live)	1	0.95	1			
7	Coal & coke	1	1.01	1		1.01	
13	Fertilisers	1	0.92	1			
14	Cement	1	0.97	1			
15	Timber & timber products	1	0.94	1			

Source BTRE estimates.

Non-bulk commodity projections

In contrast to the bulk commodity projections, the non-bulk (manufactured goods) freight task projections are based on a gravity model formulation. In the gravity model formulation, growth in inter-regional non-bulk freight is assumed to be proportional to growth in regional populations, national average per capita GDP growth and changes in real average freight rates. The projected freight task is assigned to different modes based on observed historical trends in non-bulk interstate mode shares. The assumed mode share competitiveness indices for non-bulk freight, listed in table 2.11, vary by distance reflecting the differing propensity for future mode shift by distance.

In general, these mode share competitiveness indexes imply:

- Road is more attractive than rail or coastal shipping for non-bulk freight transport for distances up to 1500km;
- Rail transport is more attractive than road or coastal shipping for non-bulk freight movements over distances over 1500km.
- Coastal shipping is more attractive than road for non-bulk freight movements over distances above 2200km.

TABLE 2.11 MODE SHARE COMPETITIVENESS INDEXES FOR DOMESTIC NON-BULK FREIGHT

	Distance (km)				
Mode	*0–400*	*400–700*	*700–1500*	*1500–2200*	*>2200*
Road	1	1	1	1	1
Rail	0.9	0.925	0.965	1.005	1.015
Coastal shipping	0.75	0.7625	0.95	1	1.01
Pipeline	1	1	1	1	1
Conveyor	1	1	1	1	1
Air	0.98	1	1	1	1

Source BTRE estimates.

The practical impact of these mode share competitiveness index assumptions is that on shorter distance inter-capital routes, such as Sydney–Melbourne, Sydney–Brisbane and Melbourne–Adelaide, rail's share is projected to decline but inter-capital non-bulk rail volumes are projected to remain relatively unchanged to 2025.

Future infrastructure investment

Importantly, these mode share competitiveness indices abstract from planned future infrastructure investment in road and rail. For example, the Australian Rail Track Corporation has plans to spend up to $1.8 billion on track maintenance and renewal on the Defined Interstate Rail Network and in the Hunter Valley. It is expected that this investment will improve rail service levels and reduce rail operating costs, thereby improving rail's competitiveness in the inter-modal freight transport task. Similarly, continued investment in the inter-capital road network such as, for example, the continuing upgrade of the Pacific Highway, will also help to improve the service quality of road transport. In deriving the projections presented here, the BTRE has not explicitly accounted for future infrastructure changes, the implication being that the projections are based on preservation of the current infrastructure standards.

Adjustments to the FreightSim base year non-bulk freight task estimates

In undertaking this analysis, the BTRE investigated the reliability of the base freight flows in the *FreightInfo*™ 1999 dataset, the results of which is described in appendix VII. That analysis revealed that the *FreightInfo*™ 1999 data under-estimates the inter-capital non-bulk road freight task quite significantly, accounting for less than half of the total non-bulk road freight tonnages moved between the six mainland capital cities. This would have implications for the projected growth in heavy vehicle traffic across the AusLink National Network—as inter-capital non-bulk freight is one of the fastest growing freight markets, so understating the base year inter-capital non-bulk freight task would under-estimate the growth in total heavy vehicle traffic.

In order to provide more reliable projections, the BTRE substituted the inter-capital and within capital non-bulk road freight estimates from the ABS (2002a) Freight Movements Survey (FMS), appropriately scaled to account for rigid trucks and apparent under-enumeration in the FMS, for the *FreightInfo*™ 1999 inter-capital and within capital manufactured product road freight estimates. This substitution provided a much more realistic estimate of total inter-capital road freight movements than the raw *FreightInfo*™ 1999 estimates.[4]

The BTRE has commissioned FDF Pty Ltd to update their *FreightInfo™* database of national freight flows to 2003–04. As part of that update, the BTRE has asked FDF Pty Ltd to address the apparent under-enumeration of inter-capital non-bulk road freight.

Freight task projections

This section provides an overview of the aggregate freight task projections. Most of the discussion focuses on the road, rail and costal shipping tasks, which account for over 90 per cent of the domestic freight task measured in total tonnes uplifted. Of the other transport modes, air freight accounts for a negligible share of the total domestic freight task, conveyers are mainly used for short distance transport of particular bulk commodities and pipelines are largely used in the transport of oil, gas and water.

The aggregate base case FreightSim projections, which are listed in table 2.12, imply growth in the total domestic freight task, measured in tonnes moved, of 2.75 per cent per annum over the period 1999 to 2025. Total road freight tonnages are projected to grow by 3.0 per cent per annum over that period. The total rail freight task is projected to grow by 2.4 per cent per annum over the period 1999 to 2025. The coastal shipping freight task is projected to grow by approximately 1.5 per cent per annum between 1999 and 2025. Air freight is projected to grow by 6.1 per cent per annum, albeit from a very low base.

Table 2.13 lists the actual 1999 and projected 2025 road and rail freight tasks by commodity. Considering first the projected growth in the rail freight task by commodity, according to *FreightInfo*™ metallic minerals and coal comprise approximately 80 per cent of the total rail freight task, by mass, in 1999. Consequently, the projected growth in the total rail freight task, by mass, reflects the projected growth in coal and metallic minerals output. Growth in

4 The urban regions for which the FMS non-bulk freight movements were substituted into *FreightInfo™*1999 included the capital city regions: Sydney (Region 210), Melbourne (310), Brisbane (410), Adelaide (510) and Canberra (110); and other urban centres: Gosford (215), Newcastle (221), Wollongong (231), Tweed Heads (241), Geelong (321), Gold Coast (421), Sunshine Coast (423), Townsville (471) and Cairns (481). Perth, Darwin and Hobart were excluded as the *FreightInfo™*1999 data appears to adequately measure non-bulk freight to and from these cities.

non-bulk (manufactured products) rail freight movements are projected to be 1.4 per cent per annum between 1999 and 2025.

By contrast, the road freight task is predominated by non-metallic minerals and non-bulk goods. The non-bulk road freight task is projected to grow by 3.4 per cent per annum between 1999 and 2025. Road freight movements of non-metallic minerals are projected to grow by 3.2 per cent per annum.

TABLE 2.12 PROJECTED INTER-REGIONAL FREIGHT MOVEMENTS, BY TRANSPORT MODE, 1999–2025

	Mode						
Year	*Road*	*Rail*	*Coastal shipping*	*Air*	*Pipeline*	*Conveyer*	*All modes*
	(million tonnes)						
1999	1318.4	420.9	45.2	0.3	54.6	104.1	1943.5
2000	1378.7	432.7	46.1	0.4	55.8	107.5	2021.2
2005	1662.9	498.3	50.4	0.5	61	124.6	2397.7
2010	1957.7	573.9	54.6	0.7	66.2	141.9	2795
2015	2246.2	647.1	58.8	0.9	70.3	157.7	3181
2020	2535.5	717.9	62.8	1.2	73.8	172.3	3563.5
2025	2831.2	776.2	66.7	1.4	76.1	185.4	3937

Average annual growth

	Mode						
Year	*Road*	*Rail*	*Coastal shipping*	*Air*	*Pipeline*	*Conveyer*	*All modes*
	(per cent per annum)						
2000–2005	3.82	2.86	1.80	4.56	1.80	3.00	3.48
2005–2010	3.32	2.87	1.61	6.96	1.65	2.63	3.11
2010–2015	2.79	2.43	1.49	5.15	1.21	2.13	2.62
2015–2020	2.45	2.10	1.32	5.92	0.98	1.79	2.30
2020–2025	2.23	1.57	1.21	3.13	0.62	1.48	2.01
1999–2025	2.98	2.38	1.51	6.10	1.29	2.24	2.75

Source BTRE estimates.

Inter-regional freight projections

Inter-regional freight, that is freight moved from an origin to a destination in different freight regions, accounts for approximately 30 per cent of all tonnes uplifted. Table 2.14 shows the actual and projected inter-regional road and rail freight task from FreightSim. The inter-regional freight task is generally projected to grow more strongly than local freight. For both modes, the total tonnes uplifted are projected to grow by 3.0 per cent per annum between 1999 and 2025. The inter-regional road freight task is projected to grow by 3.3 per cent per annum between 1999 and 2025, the inter-regional rail freight task by 2.4 per cent per annum over the same period.

TABLE 2.13 ACTUAL AND PROJECTED TOTAL ROAD AND RAIL FREIGHT TASK BY COMMODITY, 1999 AND 2025

Commodity		*Road*			*Rail*			*Road & Rail*		
Code	*Description*	*1999*	*2025*	*Growth 1999–2025*	*1999*	*2025*	*Growth 1999–2025*	*1999*	*2025*	*Growth 1999–2025*
		(million tonnes)	*(million tonnes)*	*(per cent pa)*	*(million tonnes)*	*(million tonnes)*	*(per cent pa)*	*(million tonnes)*	*(million tonnes)*	*(per cent pa)*
1	Manufactured products	209.7	498.3	3.4	13.4	19.0	1.4	223.1	517.3	3.3
2	Grains and oilseeds	49.0	83.3	2.1	13.5	21.5	1.8	62.5	104.8	2.0
3	Sheep live	2.5	4.1	1.9	0.0	0.0	NA	2.5	4.1	1.9
4	Cattle live	4.8	9.5	2.7	0.2	0.3	1.6	5.0	9.8	2.6
5	Meat	7.1	14.0	2.6	0.3	0.5	2.0	7.4	14.5	2.6
6	Agricultural products	92.1	180.8	2.6	41.2	82.3	2.7	133.3	263.1	2.6
7	Coal and coke	16.7	37.7	3.2	139.4	275.4	2.7	156.1	313.1	2.7
8	Metallic minerals	14.1	28.9	2.8	190.0	329.6	2.1	204.1	358.5	2.2
9	Non-metallic minerals	753.1	1707.1	3.2	7.2	25.5	5.0	760.3	1732.6	3.2
10	Oil and petroleum products	48.5	69.2	1.4	2.4	3.2	1.1	50.9	72.4	1.4
11	Gas	2.7	3.9	1.4	0.0	0.0	NA	2.7	3.9	1.4
12	Steel and metals	57.3	89.8	1.7	4.7	6.8	1.4	62.0	96.6	1.7
13	Fertilisers	9.3	15.2	1.9	1.0	1.0	0.0	10.3	16.2	1.8
14	Cement	7.8	15.1	2.6	2.6	3.5	1.1	10.4	18.6	2.3
15	Timber and timber products	40.5	69.1	2.1	2.1	2.1	0.0	42.6	71.2	2.0
16	Other bulk	3.1	5.3	2.1	2.8	5.5	2.6	5.9	10.8	2.4
	Total	1318.3	2831.3	3.0	420.8	776.2	2.4	1739.1	3607.5	2.8

Source BTRE estimates.

TABLE 2.14 ACTUAL AND PROJECTED INTER-REGIONAL ROAD AND RAIL FREIGHT MOVEMENTS BY COMMODITY, 1999 AND 2025

Commodity		*Road*			*Rail*			*Road & Rail*		
Code	*Description*	*1999*	*2025*	*Growth 1999–2025*	*1999*	*2025*	*Growth 1999–2025*	*1999*	*2025*	*Growth 1999–2025*
		(million tonnes)	*(million tonnes)*	*(per cent pa)*	*(million tonnes)*	*(million tonnes)*	*(per cent pa)*	*(million tonnes)*	*(million tonnes)*	*(per cent pa)*
1	Manufactured products	49.5	129.6	3.8	12.9	18.9	1.5	62.4	148.5	3.4
2	Grains and oilseeds	5.6	9.4	2.0	9.5	14.9	1.7	15.1	24.3	1.8
3	Sheep live	1.0	1.5	1.6	0.0	0.0	NA	1.0	1.5	1.6
4	Cattle live	2.1	4.1	2.6	0.2	0.3	1.6	2.3	4.4	2.5
5	Meat	3.5	6.4	2.3	0.3	0.5	2.0	3.8	6.9	2.3
6	Agricultural products	31.6	61.8	2.6	15.1	28.8	2.5	46.7	90.6	2.6
7	Coal and coke	6.7	20.9	4.5	71.5	132.3	2.4	78.2	153.2	2.6
8	Metallic minerals	3.4	6.0	2.2	13.8	25.6	2.4	17.2	31.6	2.4
9	Non-metallic minerals	76.9	221.9	4.2	5.2	22.1	5.7	82.1	244.0	4.3
10	Oil and petroleum products	12.8	17.7	1.3	2.3	3.2	1.3	15.1	20.9	1.3
11	Gas	1.0	1.5	1.6	0.0	0.0	NA	1.0	1.5	1.6
12	Steel and metals	12.9	19.8	1.7	4.7	6.8	1.4	17.6	26.6	1.6
13	Fertilisers	2.4	3.5	1.5	1.0	1.0	0.0	3.4	4.5	1.1
14	Cement	3.5	7.1	2.8	2.6	3.5	1.1	6.1	10.6	2.1
15	Timber and timber products	15.6	25.2	1.9	2.0	2.1	0.2	17.6	27.3	1.7
16	Other bulk	0.7	1.1	1.8	2.0	3.7	2.4	2.7	4.8	2.2
	Total	229.2	537.5	3.3	143.1	263.7	2.4	372.3	801.2	3.0

Source BTRE estimates.

Tables 2.13 and 2.14 also show that the freight task is projected to grow at different rates across the different commodity groups, reflecting the differing rates of growth in production and consumption of the difference commodities.

AusLink corridor road freight task growth

Table 2.15 shows the actual and projected origin–destination (OD) freight task, as well as the implied growth on each of the AusLink National Network corridors, plus Melbourne–Perth and Sydney–Perth, for road and rail transport. Across all corridors, the OD road freight task, in total tonnage terms, is projected to grow by 3.4 per cent per annum between 1999 and 2025. The OD rail freight task is projected to grow by 2.4 per cent per annum. Coastal shipping is projected to grow by 1.3 per cent per annum and air freight by 3.5 per cent per annum. Figure 2.5 illustrates the growth in the OD freight task shown in table 2.15.

TABLE 2.15 ACTUAL AND PROJECTED ORIGIN–DESTINATION FREIGHT MOVEMENTS BY AUSLINK CORRIDOR AND TRANSPORT MODE, 1999 AND 2025

('000 tonnes)

Corridor	*Road*	*Rail*	*Coastal shipping*	*Air*	*All modes*
			1999		
Sydney–Melbourne	7310.7	1462.1	2727	96	11595.8
Sydney–Canberra	1848	168	0	7	2023
Sydney–Brisbane	4275.2	860	159.3	53	5347.5
Sydney–Adelaide	1527.8	251	169	17	1964.8
Melbourne–Adelaide	3361.5	2570	782.1	17	6730.6
Melbourne–Brisbane	2129.9	629.2	845.5	19	3623.6
Brisbane–Darwin	35.9	0	10.8	4	50.7
Adelaide–Perth	213	633.5	149.3	6	1001.8
Adelaide–Darwin	32.5	0	0	4	36.5
Perth–Darwin	4.5	0	335	0	339.5
Brisbane–Cairns	317.5	277	252.3	7	853.8
Hobart–Burnie	294.8	174	295	0	763.8
Sydney–Wollongong	10615.1	1183.2	8.8	0	11807.1
Melbourne–Geelong	4361.4	333.8	271.9	0	4967.1
Townsville–Mt Isa	32.6	2125.9	0	0	2158.5
Sydney–Dubbo	671.6	147	0	0	818.6
Perth–Bunbury	1482.2	1565	19.2	0	3066.4
Melbourne–Mildura	215.8	253.1	0	0	468.9
Melbourne–Sale	1020.6	49	0	0	1069.6
Melbourne–Perth	641.6	1630.4	221.9	21	2514.9
Sydney–Perth	659.3	236	31.9	23	950.2
All corridors	41051.5	14548.2	6279	274	62152.7

TABLE 2.15 ACTUAL AND PROJECTED ORIGIN–DESTINATION FREIGHT MOVEMENTS BY AUSLINK CORRIDOR AND TRANSPORT MODE, 1999 AND 2025 (CONTINUED)

('000 tonnes)

Corridor	*Road*	*Rail*	*Coastal shipping*	*Air*	*All modes*
			2025		
Sydney–Melbourne	17673.9	1570.1	3234.2	244.7	22722.9
Sydney–Canberra	4063.2	224.4	0	11.4	4299.0
Sydney–Brisbane	11577.6	983.6	936.4	147.3	13644.9
Sydney–Adelaide	3238.8	250.9	254.8	40.5	3785.0
Melbourne–Adelaide	8838.3	3036.1	1076.9	47.7	12999.0
Melbourne–Brisbane	4782.4	1395.3	975.8	44.4	7197.9
Brisbane–Darwin	85.5	0	16.3	12.2	114.0
Adelaide–Perth	339.6	1355.2	222.1	8.6	1925.5
Adelaide–Darwin	58.9	0[a]	0	8.7	67.6
Perth–Darwin	10.8	0	589.3	0	600.1
Brisbane–Cairns	685.7	769.2	327.1	18.7	1800.7
Hobart–Burnie	568.5	129.7	377.3	0	1075.5
Sydney–Wollongong	24108.6	3657.8	11.7	0	27778.1
Melbourne–Geelong	10706.2	507.8	331.7	0	11545.7
Townsville–Mt Isa	44.3	3132.2	0	0	3176.5
Sydney–Dubbo	1125.7	191.3	0	0	1317.0
Perth–Bunbury	5721.4	4615.1	52.3	0	10388.8
Melbourne–Mildura	423.2	494.7	0	0	917.9
Melbourne–Sale	2516	43.2	0	0	2559.2
Melbourne–Perth	1134.8	3604.9	272.6	37.9	5050.2
Sydney–Perth	1315.4	701.3	49.5	50	2116.2
All corridors	99018.8	26662.8	8728	672.1	135081.7

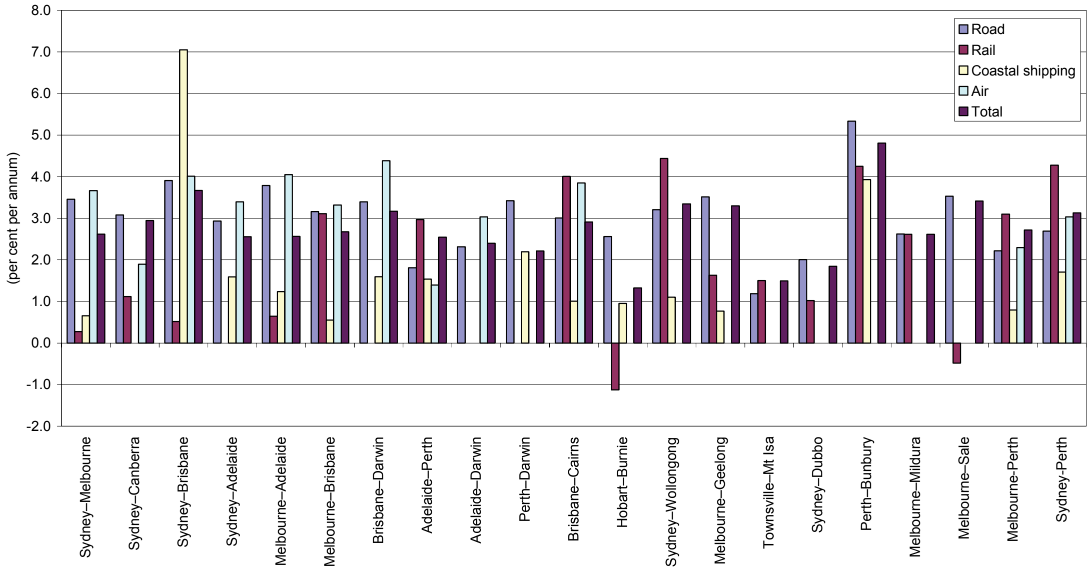
TABLE 2.15 ACTUAL AND PROJECTED ORIGIN–DESTINATION FREIGHT MOVEMENTS BY AUSLINK CORRIDOR AND TRANSPORT MODE, 1999 AND 2025 (CONTINUED)

Corridor	*Road*	*Rail*	*Coastal shipping*	*Air*	*All modes*
	Average annual growth (per cent per annum)				
Sydney–Melbourne	3.5	0.3	0.7	3.7	2.6
Sydney–Canberra	3.1	1.1	na	1.9	2.9
Sydney–Brisbane	3.9	0.5	7.0	4.0	3.7
Sydney–Adelaide	2.9	0.0	1.6	3.4	2.6
Melbourne–Adelaide	3.8	0.6	1.2	4.0	2.6
Melbourne–Brisbane	3.2	3.1	0.6	3.3	2.7
Brisbane–Darwin	3.4	na	1.6	4.4	3.2
Adelaide–Perth	1.8	3.0	1.5	1.4	2.5
Adelaide–Darwin	2.3	na	na	3.0	2.4
Perth–Darwin	3.4	na	2.2	na	2.2
Brisbane–Cairns	3.0	4.0	1.0	3.9	2.9
Hobart–Burnie	2.6	–1.1	1.0	na	1.3
Sydney–Wollongong	3.2	4.4	1.1	na	3.3
Melbourne–Geelong	3.5	1.6	0.8	na	3.3
Townsville–Mt Isa	1.2	1.5	na	na	1.5
Sydney–Dubbo	2.0	1.0	na	na	1.8
Perth–Bunbury	5.3	4.2	3.9	na	4.8
Melbourne–Mildura	2.6	2.6	na	na	2.6
Melbourne–Sale	3.5	–0.5	na	na	3.4
Melbourne–Perth	2.2	3.1	0.8	2.3	2.7
Sydney–Perth	2.7	4.3	1.7	3.0	3.1
All corridors	3.4	2.4	1.3	3.5	3.0

a. The FreightSim Adelaide–Darwin rail freght projection is based on projecting from 1999 rail freight traffic levels, which was prior to the completion of the Adelaide–Darwin rail line. The BTRE has not separately projected rail freight traffic growth between Adelaide and Darwin for this exercise, but the extent to which Adelaide–Darwin rail freight traffic grows by 2025 will subtract from growth in the road freight growth. In updating the projections, using 2003–04 freight data, the BTRE will address issues such as this.

Source BTRE estimates.

FIGURE 2.5 PROJECTED GROWTH IN ORIGIN–DESTINATION FREIGHT TRAFFIC BY AUSLINK CORRIDOR AND TRANSPORT MODE, 1999–2025



Source BTRE estimates.

Table 2.16 shows the actual and projected origin–destination (OD) non-bulk (manufactured products) freight task, as well as the implied growth, on each of the AusLink National Network corridors, plus Melbourne–Perth and Sydney–Perth, for road and rail transport. Across all corridors, the OD non-bulk road freight task is projected to grow by 3.6 per cent per annum between 1999 and 2025. The OD rail freight task is projected to grow by 1.8 per cent per annum. Coastal shipping is projected to grow by –0.2 per cent per annum and air freight by 3.5 per cent per annum.

TABLE 2.16 ACTUAL AND PROJECTED ORIGIN–DESTINATION NON-BULK FREIGHT MOVEMENTS BY AUSLINK CORRIDOR AND TRANSPORT MODE, 1999 AND 2025

('000 tonnes)

Corridor	*Road*	*Rail*	*Coastal shipping*	*Air*	*All modes*
			1999		
Sydney–Melbourne	6270.6	1218.1	0.4	96	7585.1
Sydney–Canberra	1205.7	8	0	7	1220.7
Sydney–Brisbane	3845.5	848	5.3	53	4751.8
Sydney–Adelaide	1104.5	229	0	17	1350.5
Melbourne–Adelaide	2899.8	2048.1	3.4	17	4968.3
Melbourne–Brisbane	1803.9	421.8	0.8	19	2245.5
Brisbane–Darwin	14.1	0	0	4	18.1
Adelaide–Perth	129.2	617.5	2.8	6	755.5
Adelaide–Darwin	16.1	0	0	4	20.1
Perth–Darwin	3.3	0	3	0	6.3
Brisbane–Cairns	114.1	246	12.1	7	379.2
Hobart–Burnie	201.3	94	18.6	0	313.9
Sydney–Wollongong	1934.2	2	0	0	1936.2
Melbourne–Geelong	1721.8	0	37.9	0	1759.7
Townsville–Mt Isa	1.1	18	0	0	19.1
Sydney–Dubbo	155.6	13	0	0	168.6
Perth–Bunbury	205	117	0	0	322
Melbourne–Mildura	13.9	253.1	0	0	267
Melbourne–Sale	59.9	49	0	0	108.9
Melbourne–Perth	461.9	1117.9	16.4	21	1617.2
Sydney–Perth	450.4	226	0	23	699.4
All corridors	22611.9	7526.5	100.7	274	30513.1

TABLE 2.16 ACTUAL AND PROJECTED ORIGIN–DESTINATION NON-BULK FREIGHT MOVEMENTS BY AUSLINK CORRIDOR AND TRANSPORT MODE, 1999 AND 2025

('000 tonnes)

Corridor	*Road*	*Rail*	*Coastal shipping*	*Air*	*All modes*
			2025		
Sydney–Melbourne	16013.8	1232.2	0.3	244.7	17491.0
Sydney–Canberra	3110.7	1.2	0	11.4	3123.3
Sydney–Brisbane	10861.4	963	3.7	147.3	11975.4
Sydney–Adelaide	2580.3	220.6	0	40.5	2841.4
Melbourne–Adelaide	8122.9	2273.3	2.6	47.7	10446.5
Melbourne–Brisbane	4226.9	1096.5	2	44.4	5369.8
Brisbane–Darwin	43.1	0	0	12.2	55.3
Adelaide–Perth	193.3	1331.9	5.1	8.6	1538.9
Adelaide–Darwin	34.6	0	0	8.7	43.3
Perth–Darwin	8.7	0	9.8	0	18.5
Brisbane–Cairns	315	716.3	37.7	18.7	1087.7
Hobart–Burnie	453.9	13.8	0	0	467.7
Sydney–Wollongong	4109.2	0.3	0	0	4109.5
Melbourne–Geelong	3967.3	0	0.1	0	3967.4
Townsville–Mt Isa	4.2	27.9	0	0	32.1
Sydney–Dubbo	397.8	1.9	0	0	399.7
Perth–Bunbury	807.9	44.8	0	0	852.7
Melbourne–Mildura	103.7	494.7	0	0	598.4
Melbourne–Sale	116.3	43.2	0	0	159.5
Melbourne–Perth	834.6	2857.8	35.5	37.9	3765.8
Sydney–Perth	972.7	684.8	0	50	1707.5
All corridors	57278.3	12004.2	96.8	672.1	70051.4

TABLE 2.16 ACTUAL AND PROJECTED ORIGIN–DESTINATION NON-BULK FREIGHT MOVEMENTS BY AUSLINK CORRIDOR AND TRANSPORT MODE, 1999 AND 2025

Corridor	*Road*	*Rail*	*Coastal shipping*	*Air*	*All modes*
	Average annual growth (per cent per annum)				
Sydney–Melbourne	3.7	0.0	–1.1	3.7	3.3
Sydney–Canberra	3.7	–7.0	na	1.9	3.7
Sydney–Brisbane	4.1	0.5	–1.4	4.0	3.6
Sydney–Adelaide	3.3	–0.1	na	3.4	2.9
Melbourne–Adelaide	4.0	0.4	–1.0	4.0	2.9
Melbourne–Brisbane	3.3	3.7	3.6	3.3	3.4
Brisbane–Darwin	4.4	na	na	4.4	4.4
Adelaide–Perth	1.6	3.0	2.3	1.4	2.8
Adelaide–Darwin	3.0	na	na	3.0	3.0
Perth–Darwin	3.8	na	4.7	na	4.2
Brisbane–Cairns	4.0	4.2	4.5	3.9	4.1
Hobart–Burnie	3.2	–7.1	–100.0	na	1.5
Sydney–Wollongong	2.9	–7.0	na	na	2.9
Melbourne–Geelong	3.3	na	–20.4	na	3.2
Townsville–Mt Isa	5.3	1.7	na	na	2.0
Sydney–Dubbo	3.7	–7.1	na	na	3.4
Perth–Bunbury	5.4	–3.6	na	na	3.8
Melbourne–Mildura	8.0	2.6	na	na	3.2
Melbourne–Sale	2.6	–0.5	na	na	1.5
Melbourne–Perth	2.3	3.7	3.0	2.3	3.3
Sydney–Perth	3.0	4.4	na	3.0	3.5
All corridors	3.6	1.8	–0.2	3.5	3.2

Source BTRE estimates.

Local road freight task projections

Finally, base year local road freight traffic is calculated as the residual of total heavy vehicles and the base year inter-regional freight traffic. Projected local freight vehicle traffic growth is derived from the FreightSim estimate of growth in the intra-regional freight task. (An alternative method, not undertaken for this analysis, would be to project growth in local freight traffic task from projected growth in local economic activity, a function of growth in GDP per capita and regional population growth.) The growth in local freight traffic is assumed to be uniformly distributed across all road segments within each SLA.

Comparison with other BTRE freight task projections

The FreightSim freight task projections presented here are broadly similar to previous BTRE freight task projections, provided in BTRE (2002 and 2003a), albeit with some slight differences in the overall rate of growth, due to different a longer projection horizon, and differences in the assumed future modal split.

Total freight task

The BTRE uses several different models for projecting the growth in the total domestic Australian freight task and various subsets of the domestic freight task. BTRE (forthcoming) provides a description of the various BTRE freight projection models. At the national level, the BTRE uses national-level single mode econometric models to project growth in the total road, rail and coastal shipping freight tasks. BTRE (2002), which provides the latest published national level freight task projections, projected growth in the total tonne-kilometre road freight task of approximately 4.0 per cent per annum, between 2000 and 2020, and growth in the total rail freight task of 2.8 per cent per annum, over the same period. By way of comparison, the FreightSim projections presented here imply growth in the tonne-kilometre road freight task of 2.9 per cent per annum between 1999 and 2025 and growth in the total rail freight task of 2.2 per cent per annum. The difference between the earlier BTRE (2002) projections and the FreightSim projections is due partly to differences in the projected rate of economic activity—the BTRE (2002) projections assumed average annual GDP growth of 3.25 per cent per annum to 2020, whereas these projections assume declining economic growth between 2003 and 2025, averaging 2.6 per cent between 1999 and 2025—and partly to the differences in modelling approach—the BTRE (2002) projections use a single equation models for projecting growth in total freight activity, whereas FreightSim projects growth separately for each of 16 commodity groups. The assumptions used here result in slightly more conservative projected growth in total road freight, due to slower projected growth in bulk freight. For the

AusLink corridors, however, the projected freight task growth is very similar to previous BTRE (2003a) projections.

Inter-capital non-bulk freight task

The BTRE (2003a) has also published projections of inter-capital non-bulk freight using a gravity model type econometric relationship for non-bulk freight movements between seven inter-capital city pairs. BTRE (2003a) projected that the total inter-capital non-bulk freight task, in tonnage terms, would grow by approximately 3.4 per cent per annum between 2001 and 2020, with the road non-bulk freight task projected to grow by 4.0 per cent per annum and the inter-capital rail non-bulk freight task projected to grow by 0.8 per cent per annum over that same period. The projected growth in the inter-capital non-bulk freight task implied by the BTRE (2003a) projections is reproduced in table 2.17.

TABLE 2.17 BTRE (2003a) PROJECTED GROWTH IN INTER-CAPITAL OD FREIGHT, 2001–2020

Corridor	Mode			
	Road	*Rail*	*Sea*	*All modes*
	(per cent per annum)			
Mel–Syd	3.7	–2.1	–16.9	3.2
Syd–Bne	4.8	–6.1	–3.6	3.8
Mel–Bne	3.3	3.7	–10.7	3.4
Syd–Adl	4.1	–3.0	–100.0	3.2
Mel–Adl	4.1	–9.9	2.9	3.0
ES–Per[a]	3.0	3.6	5.4	3.8
Syd–Cbr	4.0	na	na	4.0
All corridors	4.0	0.8	4.3	3.4

a. Eastern Capitals to Perth (Sydney, Melbourne, Adelaide and Brisbane)

Source BTRE (2003a).

TABLE 2.18 FREIGHTSIM PROJECTED GROWTH IN INTER-CAPITAL OD FREIGHT, 1999–2025

Corridor	Mode			
	Road	*Rail*	*Sea*	*All modes*
	(per cent per annum)			
Mel–Syd	3.7	0.0	-1.1	3.3
Syd–Bne	4.1	0.5	-1.4	3.6
Mel–Bne	3.3	3.7	3.6	3.4
Syd–Adl	3.3	-0.1	na	2.9
Mel–Adl	4.0	0.4	-1.0	2.9
ES–Per[a]	2.5	3.6	2.9	3.2
Syd–Cbr	3.7	-7.0	na	3.7
All corridors	3.7	1.8	2.0	3.3

a. Eastern State Capitals to Perth (Sydney, Melbourne, Adelaide and Brisbane)

Source BTRE estimates.

Table 2.18 summarises the inter-capital non-bulk freight growth implied by this FreightSim simulation, for the same seven inter-capital OD pairs. The FreightSim projections imply growth in the inter-capital freight task of 3.2 per cent per annum between 1999 and 2025, slightly less than the projected growth, of 3.4 per cent per annum in BTRE (2003a). This slight difference is partly explained by the slightly longer projection horizon used for this FreightSim simulation, as population growth and national GDP growth are projected to slow over the projection period. The projected growth for each of the inter-capital OD pairs is very similar to the BTRE (2003a) projections, except for the Eastern State Capitals–Perth OD pairs where the total projected growth is 3.1 per cent per annum in the FreightSim projections compared to 3.8 per cent per annum in BTRE (2003a).

The most significant difference between the BTRE (2003a) projections and these FreightSim projections is the projected growth in the inter-capital non-bulk rail freight task. In BTRE (2003a), the inter-capital non-bulk rail freight task was projected to decline in absolute terms for the shorter OD pairs—Sydney–Melbourne, Sydney–Brisbane, Melbourne–Adelaide and Sydney–Adelaide—but grow in absolute terms on the longer OD pairs—Melbourne–Brisbane and Eastern State capitals–Perth. These mode share competitiveness assumptions used in these FreightSim projections, however, imply constant inter-capital non-bulk rail freight volumes on the shorter inter-capital OD pairs over the projection period. The FreightSim non-bulk road freight projections imply similar long-term growth as the BTRE (2003a) projections.

SUMMARY

- The OZPASS and FreightSim models are designed to project future growth in inter-regional passenger travel and freight movements across Australia.
- OZPASS projects passenger travel for five transport modes—air, car, rail, bus and ferry. OZPASS uses the National Visitor Survey (NVS) and International Visitor Survey (IVS) estimates for the base year passenger travel patterns. The NVS and IVS essentially cover all long-distance trips undertaken in Australia by adults (persons aged 15 years and above).
- FreightSim provides projections for 16 separate commodity classes, using six transport modes—air, rail, road, coastal shipping, pipeline and conveyer. FreightSim uses FDF Pty Ltd *FreightInfo™* database of national freight flows for the base year freight flows.
- The *FreightInfo™* database appears to under-estimate total non-bulk road freight movements (see also appendix VII). For the freight task projections provided here, the BTRE has substituted the 2001 Freight Movements Survey (ABS 2002a) non-bulk inter-capital road freight estimates for the *FreightInfo™* inter-capital non-bulk road freight estimates.
- The OZPASS passenger travel projections presented here imply growth in total inter-regional passenger travel of 2.6 per cent per annum between 1999 and 2025. Rural local car travel is projected to grow by 0.9 per cent per annum between 1999 and 2025. These projections are based on projected population growth of 0.9 per cent per annum between 1999 and 2025 and household income growth of 1.4 per cent per annum.
- The FreightSim freight movement projections presented here imply growth in total inter-regional freight of 2.75 per cent per annum between 1999 and 2025. Inter-capital OD non-bulk freight movements are projected to grow by 3.2 per cent per annum between 1999 and 2025. These projections are based on the Treasury Inter-Generational Report (Australian Treasury 2002) GDP growth projections, which imply average GDP growth of 2.75 per cent per annum between 1999 and 2025.

CHAPTER 3 ROAD TRAFFIC PROJECTIONS

INTRODUCTION

Economic evaluation of warranted road infrastructure maintenance and investment expenditure requires estimates of the benefits, in terms of reduced road user costs, travel time savings and reduction in external costs, generally in terms of the savings per vehicle movement. Consequently, the output from OZPASS and FreightSim, which provide projections of origin–destination (OD) passenger trips in terms of passengers, and freight movements in terms of tonnes, have to be converted into equivalent vehicle movements over the road network for use in economic evaluation.

The BTRE projection method, illustrated in figure 2.1 in the previous chapter, separates total traffic, on any non-urban road section, into four separate components:

- inter-regional (through) passenger traffic
- rural local passenger traffic
- inter-regional (through) freight traffic
- rural local freight traffic.

Growth in total traffic on any one section of highway is then equal to the share weighted average of growth in each of the four traffic components, above.

The results reported in chapter 2 provide estimates of growth in inter-regional passenger travel (measured by growth in passenger trips), growth in rural local car travel, inter-regional freight movements and growth in rural local freight (the last two measured by growth in freight tonnes). What remains to be done, in order to compute total traffic growth, is to derive the base year traffic shares of the four different traffic components. This is done by assigning the base year inter-regional passenger trips and inter-regional freight tasks to the road network using traffic assignment procedures. The BTRE uses the traffic assignment algorithms embedded in *TransCAD*—the Transportation GIS software package for this step.

In assigning the inter-regional passenger and freight tasks to the road network it is first necessary to convert inter-regional passenger trips to light vehicle movements, which is achieved by use of a simple assumption, and inter-regional freight movements to heavy vehicle movements, which is done using FDF Pty Ltd's *FreightTrucks™*. Inter-regional light vehicle movements are set equal to the assigned inter-regional light vehicle movements or total light vehicle AADT, measured from road authority traffic count data, if the latter is lower. Rural local passenger vehicle traffic is derived as the residual of total light vehicle traffic and the estimated inter-regional passenger vehicle traffic. Inter-regional heavy vehicle traffic is derived in a similar manner—equal to assigned inter-regional heavy vehicle movements or total heavy vehicle AADT, measured from road authority traffic count data, if the latter is lower. And rural local freight vehicle traffic is the residual of total commercial vehicle traffic and inter-regional freight traffic.

This chapter provides an outline of the two steps involved in converting the OD passenger and freight transport movement estimates to road vehicle movements. The remainder of the chapter presents the traffic projections derived using OZPASS and FreightSim, and the assumptions in chapter 2, across the non-urban AusLink National Network. Separate projections are provided for each of the non-urban AusLink National Network corridors.

PASSENGER TRAFFIC ASSIGNMENT

Conversion to vehicle numbers

In assigning inter-regional passenger movements to vehicle movements, the BTRE assumes the average vehicle occupancy for long-distance inter-regional passenger vehicle trips is 1.8 persons per vehicle. This is consistent with evidence from the 1985 Survey of Motor Vehicle Use (SMVU, ABS 1986, table 28, p. 31), the last SMVU to ask respondents for information on vehicle occupancy. For passenger car use outside metropolitan areas, the 1985 SMVU estimates imply average vehicle occupancy of approximately 1.8 to 1.9 persons per vehicle kilometre travelled.[5]

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5 The exact estimate depends on assumptions about the average occupancy for vehicle use where vehicle occupancy is reported as 3 or more persons. If it is assumed that average vehicle occupancies for these vehicle operations are close to 3 persons, then the average is around 1.8 persons per vehicle kilometre. If it is assumed that average occupancy for these vehicle operations is close to 3.5 persons, then the average is around 1.9 persons per vehicle kilometre.

Assignment of the passenger task to the road network

Assignment of the road passenger travel projections, and also the road freight task projections, to the road network was undertaken using the traffic assignment procedures in *TransCAD*—the transportation GIS software package (Caliper 2004). The BTRE used the stochastic user equilibrium (SUE) traffic assignment algorithm embedded in *TransCAD*. The SUE algorithm generally assumes that most users will travel via the least cost path, but some users, who either do not have perfect information or may perceive travel costs in different ways, will travel via non-least cost paths. The SUE method allocates a small proportion of all trips to alternative, non-least cost paths (e.g. longer routes or lower standard roads). In assigning traffic to non-urban road links, capacity restrictions have not been considered. Any such capacity restrictions are likely to be negligible on these non-urban corridors.

As mentioned in chapter 1, the road network used in the traffic assignment is the road layer in the AUSLIG (1993) TOPO-10M vector topographic data set. The AUSLIG (1993) road layer covers all non-urban corridors in the AusLink National Network.

The inter-regional road passenger vehicle traffic assignment results produced by *TransCAD* are listed in appendix VI. Figures 3.1 and 3.2 illustrate the assignment results for 1999 and 2025.

Calculation of inter-regional and local passenger vehicle traffic

The inter-regional passenger travel estimates only provide an indication of the level of long-distance road passenger movements. Much of the local passenger vehicle travel is unlikely to be captured in the NVS and IVS data. Consequently, the assigned inter-regional passenger vehicle traffic for the base year is subtracted from the total traffic on each section of road to derive an estimate of the local traffic component.

Importantly, where the assigned inter-regional passenger vehicle traffic exceeds the total light vehicle traffic count, the inter-regional passenger traffic is constrained to equal the total light vehicle traffic count and local passenger vehicle traffic is assumed to be zero. In this way, the base year traffic projections derived from the model match total on-road traffic levels, for each road section, measured by the road authorities.

The inter-regional and local passenger vehicle traffic projections on the non-urban links of the AusLink National Network are presented in greater detail, below.

FIGURE 3.1 INTER-REGIONAL ROAD PASSENGER VEHICLE TRAFFIC ASSIGNMENT, 1999

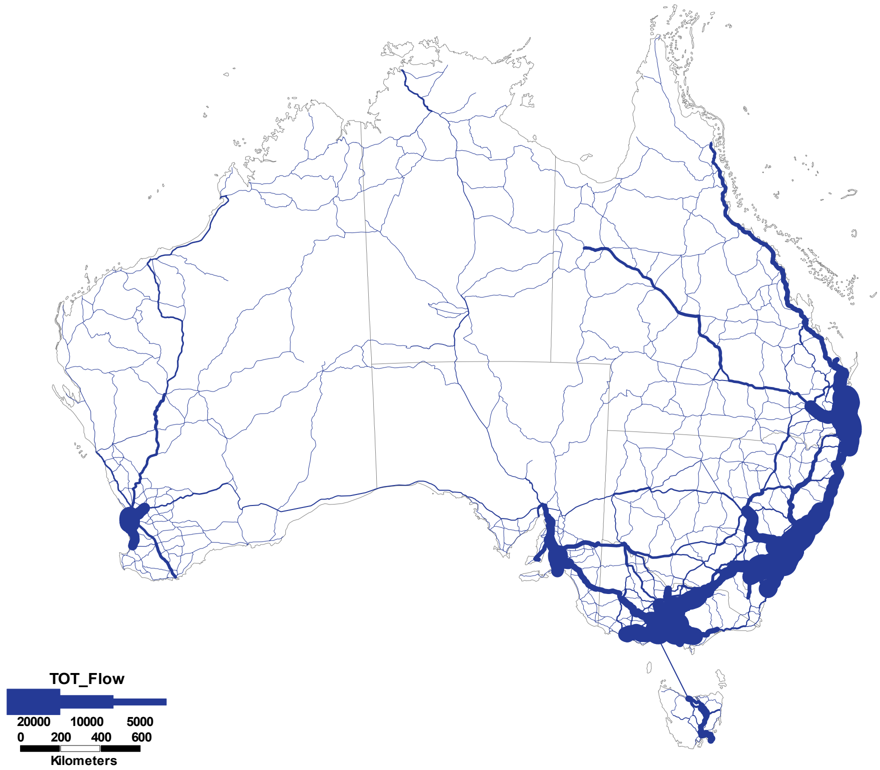
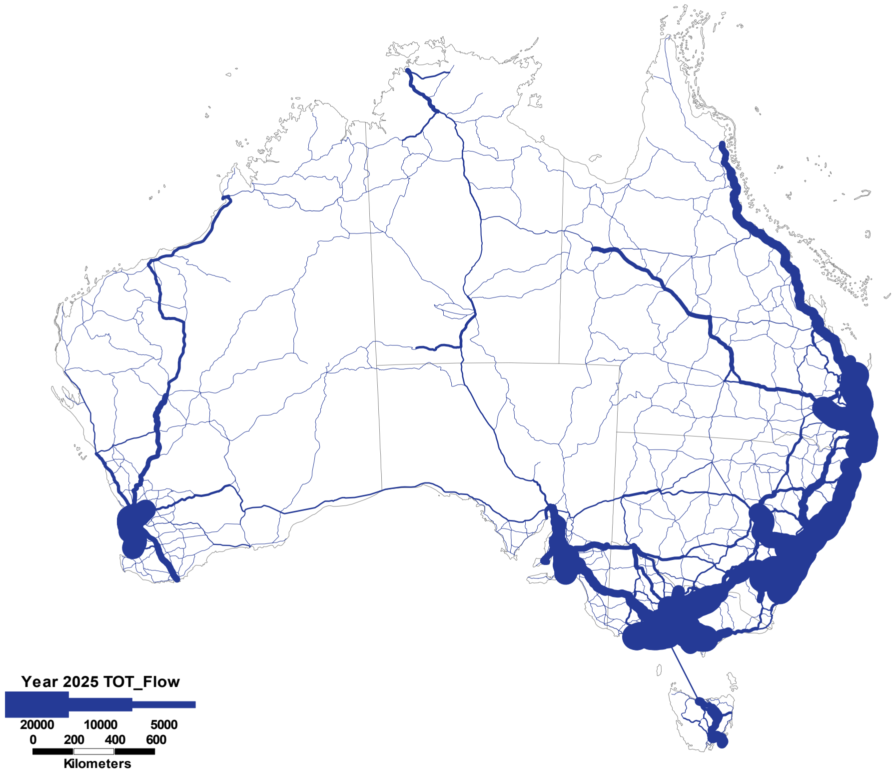


FIGURE 3.2 INTER-REGIONAL ROAD PASSENGER VEHICLE TRAFFIC ASSIGNMENT, 2025



FREIGHT TRAFFIC ASSIGNMENT

Conversion to freight vehicles using the *FreightTrucks™* model

Conversion of OD freight movements to freight vehicle movements is undertaken using FDF Pty Ltd's *FreightTrucks™* model.

FreightTrucks™ includes algorithms for assigning the commodity specific OD road freight task across nine different freight vehicle classes, depending on the commodity and trip type. The freight vehicle classes are:

- 2-axle rigid trucks (H2)
- 3-axle rigid trucks (H3)
- Semi-trailers (ST)
- Car carriers (CC)
- Dry bulk tankers (DB)
- Liquid tankers (FT)
- LPG tankers (GT)
- B-doubles (BD)
- Road trains (RT).

FreightTrucks™ specifies five different trip types:

- Inter-capital (OCDC)
- Within capital (WC)
- Rural inter-regional (ORDR)
- Rural–Capital (ORDC)
- Capital–Rural (OCDR).

For each vehicle class and each trip type, the model specifies an average load. The average load assumptions allow for unladen trips between each OD pair. FDF (2003) describes in more detail the algorithms and assumptions underlying *FreightTrucks™*.

Adjustments to FreightTrucks™

The *FreightTrucks™* output provides estimates of the average number of daily freight vehicle movements required to undertake the road freight task. In the original *FreightTrucks™* model, vehicle traffic is averaged over the number of working days in a year—260 days. However, road authority traffic count data is generally specified in terms of average annual daily traffic (AADT)—that is, total annual traffic is average over the total number of days in the year—365 days. The BTRE adjusted to *FreightTrucks*™ output to produce AADT estimates of freight vehicle movements.

Additionally, the BTRE initially found that *FreightTrucks*™ appeared to overstate the number of trucks on the road for a given task. For this analysis, the BTRE increased the assumed average load for rural inter-regional (ORDR), rural–capital (ORDC) and capital–rural (OCDR) trips for commodity types: manufactured products, agricultural products, timber and timber products and other bulk freight.

FreightTrucks™ average loads and vehicle mix over time

Importantly, *FreightTrucks*™ does not incorporate any change in vehicle average loads or vehicle mix over time. The BTRE (2002) has previously assumed that the road freight task would be undertaken by larger and more heavily laden vehicles. However, the current version of *FreightTrucks*™ assumes a fixed average vehicle load and fixed vehicle mix over time. Consequently, the heavy vehicle traffic projections provided in this report may slightly overstate future growth if larger, more heavily laden vehicles increase as a proportion of total heavy vehicle traffic.

Assignment of the road freight task to the road network

Assignment of the road freight task to the road network is undertaken using essentially the same procedures as those used in assigning the passenger traffic task, outlined above. Again, no capacity constraints are imposed on the assignment process. The inter-regional road freight vehicle assignment results produced by *TransCAD* are listed in appendix VI. Figures 3.3 and 3.4 illustrate the freight vehicle assignment results for 1999 and 2025.

Calculation of inter-regional and local freight vehicle traffic

The inter-regional freight vehicle traffic assignment results provide only an indication of the level of long-distance inter-regional road freight vehicle movements. Much of the local freight vehicle travel is likely to be left out of the assignment process. Consequently, the assigned inter-regional freight vehicle traffic in the base year is subtracted from the total freight vehicle traffic on each section of road to derive an estimate of the local freight vehicle traffic component. Where the assigned inter-regional freight vehicle traffic exceeds the commercial vehicle traffic count, the inter-regional freight traffic is constrained to equal the total commercial vehicle traffic count and local freight vehicle traffic is assumed to be zero.

FIGURE 3.3 INTER-REGIONAL ROAD FREIGHT VEHICLE TRAFFIC ASSIGNMENT, 1999

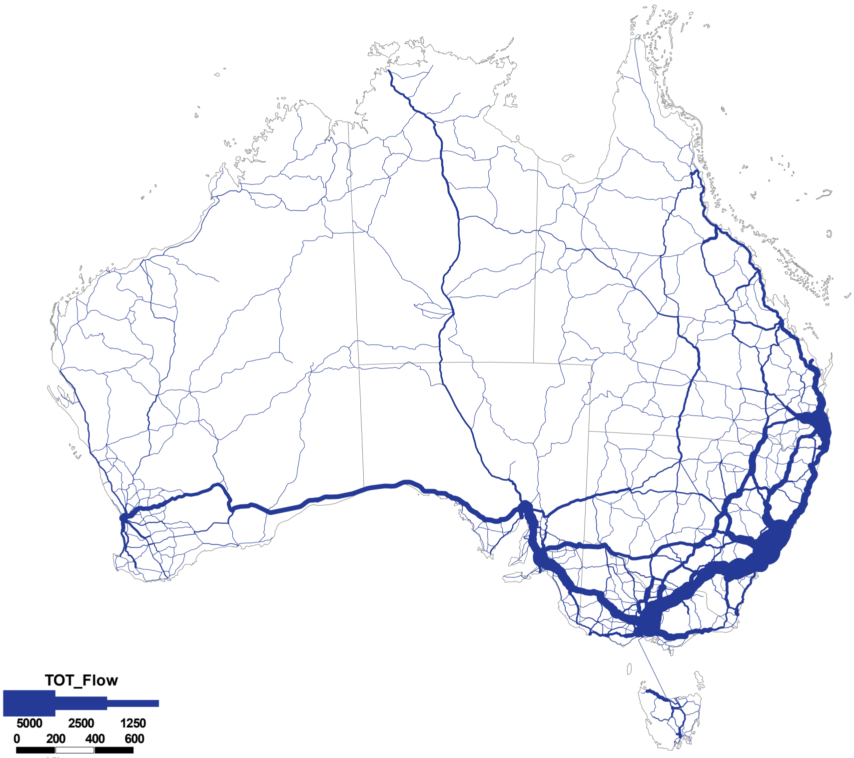
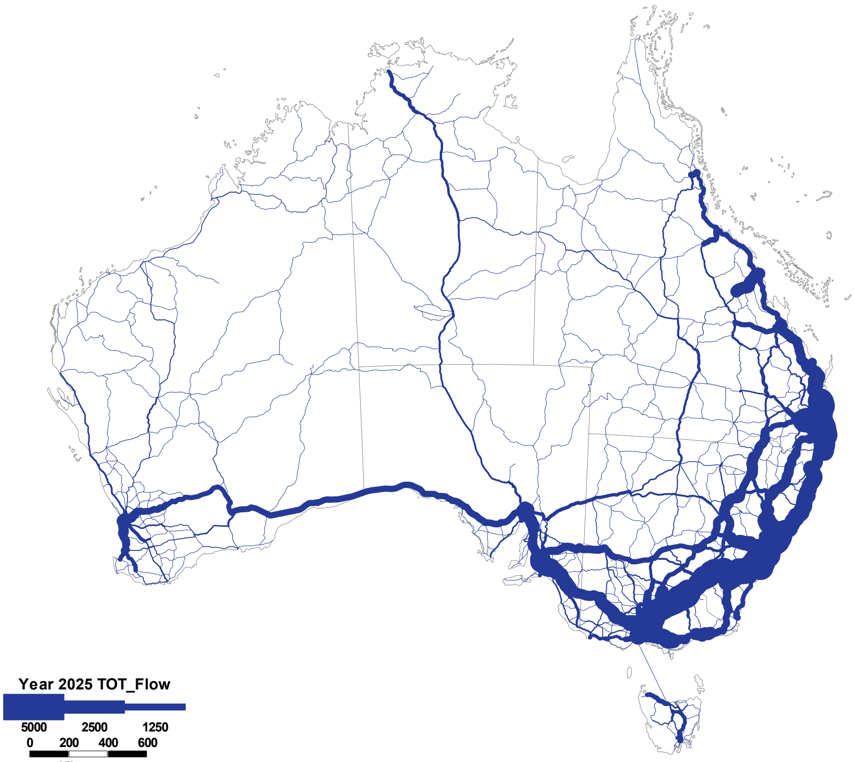


FIGURE 3.4 INTER-REGIONAL ROAD FREIGHT VEHICLE TRAFFIC ASSIGNMENT, 2025



Eyre Highway heavy vehicle traffic levels

The Eyre Highway is a case where the estimated inter-regional heavy vehicle traffic exceeds the measured heavy vehicle traffic volume. In this case, the combination of high road freight task estimates in *FreightInfo™* 1999 and assumptions in the *FreightTrucks™* model—the model assumes the same mix of six-axle articulated, B-double and road trains as for other inter-capital pairs whereas on the Eyre Highway road trains are a much higher proportion of all heavy vehicles—results in an over-estimate of the number of heavy vehicles on the Eyre Highway. Under the modelling approach, inter-regional heavy vehicle traffic is constrained to be no greater than total heavy vehicle traffic. The implication is that there is no local heavy vehicle traffic on these road sections. Fortunately, this would indeed by the case over much of the Eyre Highway.

These findings do suggest areas for further work on both the *FreightInfo™* database and *FreightTrucks™* model.

COMBINED TRAFFIC PROJECTIONS

The passenger and freight traffic projections may be combined to derive estimate of total traffic growth across the non-urban links of AusLink National Network. This section presents a summary of the base case passenger and freight vehicle traffic projections. The passenger vehicle traffic projections are similar to those derived as part of BTRE (2003a). The road freight vehicle traffic projections are new.

Table 3.1 shows the projected growth light vehicle and freight traffic for AusLink non-urban roads by State/Territory. Under the simulation assumptions described in chapter 2, total light (passenger) vehicle traffic is projected to growth by 2.1 per cent per annum and heavy vehicle traffic is projected to grow by approximately 2.5 per cent per annum across the AusLink non-urban road network. The results show that traffic growth is projected to be strongest on roads in the Northern Territory, Queensland and Western Australia. Growth in passenger and freight traffic is also projected to be reasonably strong in Victoria, reflecting stronger growth in traffic on the shorter Melbourne–Geelong corridor and possibly between Geelong and western Victoria along the Melbourne–Adelaide corridor. New South Wales and Victoria have the highest average traffic levels across the AusLink non-urban network, and total traffic on the AusLink corridor roads in these States are also projected to grow by 1.9 and 2.2 per cent per annum, respectively.

Table 3.2, and figures 3.5, 3.6 and 3.7, present the road traffic projections for each of the defined AusLink National Network non-urban corridors. Interstate corridors with strong traffic growth include Sydney–Brisbane via the Pacific Highway, Perth–Darwin, Adelaide–Darwin and Melbourne–Adelaide. Overall traffic growth is projected to be strongest on some of the intrastate links, such as

Brisbane–Cairns, Perth–Bunbury, and Melbourne–Geelong. Heavy vehicle traffic growth, in particular, is projected to strongest on these shorter intrastate corridors. On the major inter-capital AusLink corridors, such as Sydney–Melbourne and Sydney–Brisbane (inland), freight vehicle traffic is projected to grow at around 2.4 per cent per annum and 2.6 per cent per annum.

Light vehicle traffic growth is projected to grow most strongly on the Perth–Bunbury, Brisbane–Cairns, Adelaide–Darwin and Perth–Darwin corridors, albeit for the last two corridors from a relatively low base.

In general, heavy vehicle traffic growth is projected to exceed light vehicle traffic growth on most of the non-urban AusLink National Network corridors. The main exceptions are on the corridors of more than 2000km in length, such as Adelaide–Perth and Adelaide–Darwin where rail is more likely to capture most of the additional freight traffic growth.

Corridor definitions

The traffic projections results are presented below on a road corridor basis. The road corridor definitions represent distinct non-overlapping road sections that are not part of another defined corridor. Consequently, some corridors will be named in terms of their origin and destination but will exclude part of the full corridor. For example, the Melbourne–Sydney corridor is defined here as the whole of the Hume Highway linking Melbourne and Sydney. The Sydney–Adelaide corridor, however, is defined here as the whole of the Sturt Highway from Adelaide to the Hume Highway turnoff. The section of the Hume Highway between Sydney and the Sturt Highway is not included, having been included as part of the Sydney–Melbourne corridor.

AADT definition

The traffic level projection results presented in tables 3.1 to 3.22 are defined as the number of vehicles per day in both directions. These traffic levels are derived from the base year AADT and percentage commercial vehicle estimates provided to the BTRE by State and Territory road authorities for the BTE (1997) analysis of future expenditure requirements on the then National Highway System. Some jurisdictions variously record traffic levels in terms of vehicle counts or axle pair counts. As far as the BTRE is aware, all the AADT data provided by the State and Territory road authorities was in terms of average annual vehicles per day.

TABLE 3.1 PROJECTED VEHICLE TRAFFIC GROWTH ON AUSLINK NATIONAL NETWORK HIGHWAYS, BY STATE/TERRITORY

		Corridor average traffic levels (vehicles per day)						*Average annual traffic growth (per cent per annum)*		
	Length	*Light vehicles*		*Heavy vehicles*		*All vehicles*		*Light vehicles*	*Heavy vehicles*	*All vehicles*
Corridor	*(km)*	*1999*	*2025*	*1999*	*2025*	*1999*	*2025*			
NSW	4144.1	7293	11358	1924	3650	9216	15008	1.72	2.49	1.89
Vic.	1798.9	8177	14184	1473	2660	9650	16844	2.14	2.30	2.17
Qld	5006.3	3706	7435	524	1184	4230	8619	2.71	3.18	2.78
SA	2733.8	2105	3038	470	674	2575	3713	1.42	1.40	1.42
WA	4746.8	1116	2101	161	282	1277	2383	2.46	2.18	2.43
Tas.	426.6	5606	6448	1293	1997	6899	8445	0.54	1.69	0.78
NT	2688.9	396	852	110	155	506	1007	3.00	1.31	2.68
ACT	18.9	13367	18101	791	1732	14158	19833	1.17	3.06	1.30
Australia	21564.3	3628	6190	749	1406	4378	7596	2.08	2.45	2.14

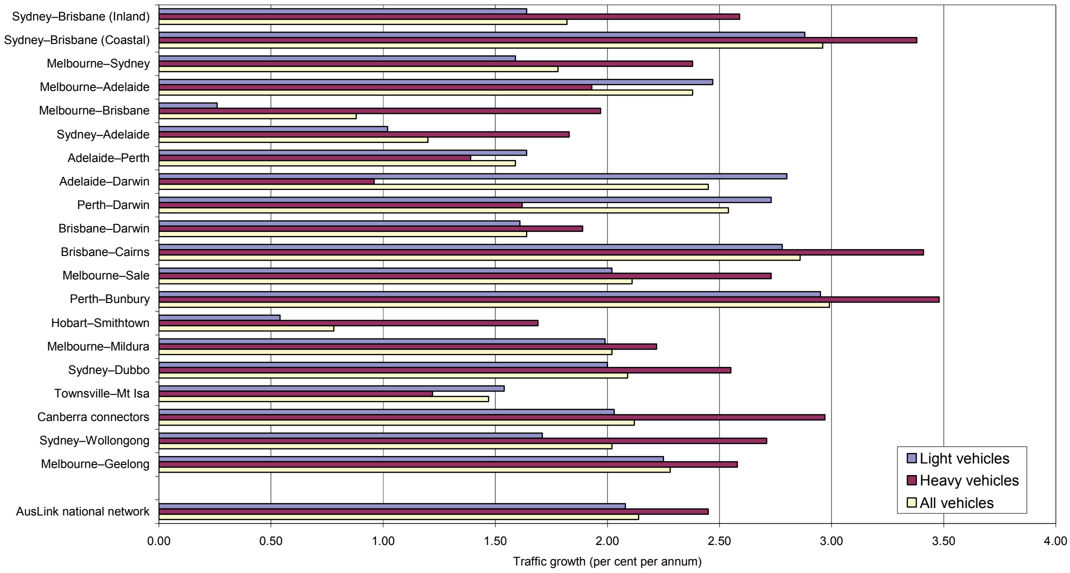
Source BTRE estimates.

TABLE 3.2 PROJECTED GROWTH IN VEHICLE TRAFFIC ON AUSLINK NATIONAL NETWORK NON-URBAN LINKS, BY CORRIDOR

		Corridor average traffic levels (vehicles per day)						Average annual traffic growth (per cent per annum)		
	Length	Light vehicles		Heavy vehicles		All vehicles		Light vehicles	Heavy vehicles	All vehicles
Corridor	(km)	1999	2025	1999	2025	1999	2025			
Sydney–Brisbane (Inland)	946.8	9108	13906	1957	3803	11066	17708	1.64	2.59	1.82
Sydney–Brisbane (Coastal)	795.7	14235	29798	2312	5494	16547	35293	2.88	3.38	2.96
Melbourne–Sydney	832	11109	16755	3115	5748	14224	22503	1.59	2.38	1.78
Melbourne–Adelaide	712.8	6537	12333	1442	2372	7980	14705	2.47	1.93	2.38
Melbourne–Brisbane	1445.4	2462	2634	1114	1853	3577	4487	0.26	1.97	0.88
Sydney–Adelaide	995.2	3126	4075	804	1288	3930	5363	1.02	1.83	1.20
Adelaide–Perth	2692.8	1448	2208	329	470	1776	2678	1.64	1.39	1.59
Adelaide–Darwin	2712.5	434	892	130	167	565	1059	2.80	0.96	2.45
Perth–Darwin	3629.6	349	702	84	128	433	830	2.73	1.62	2.54
Brisbane–Darwin	2432.2	1378	2086	191	311	1569	2396	1.61	1.89	1.64
Brisbane–Cairns	1699	5432	11093	716	1710	6147	12803	2.78	3.41	2.86
Melbourne–Sale	173.2	16003	26951	1936	3899	17939	30850	2.02	2.73	2.11
Perth–Bunbury	144.8	13826	29434	1070	2605	14896	32039	2.95	3.48	2.99
Hobart–Smithtown	426.6	5606	6448	1293	1997	6899	8445	0.54	1.69	0.78
Melbourne–Mildura	547.3	4099	6847	541	956	4640	7804	1.99	2.22	2.02
Sydney–Dubbo	327.9	8825	14787	1605	3085	10430	17872	2.00	2.55	2.09
Townsville–Mt Isa	763.1	496	737	131	180	627	917	1.54	1.22	1.47
Canberra connectors	122.4	9860	16633	872	1868	10732	18501	2.03	2.97	2.12
Sydney–Wollongong	93.2	21410	33232	8637	17315	30047	50546	1.71	2.71	2.02
Melbourne–Geelong	71.7	40710	72528	4656	9035	45366	81563	2.25	2.58	2.28
AusLink national network	21564.3	3628	6190	749	1406	4378	7596	2.08	2.45	2.14

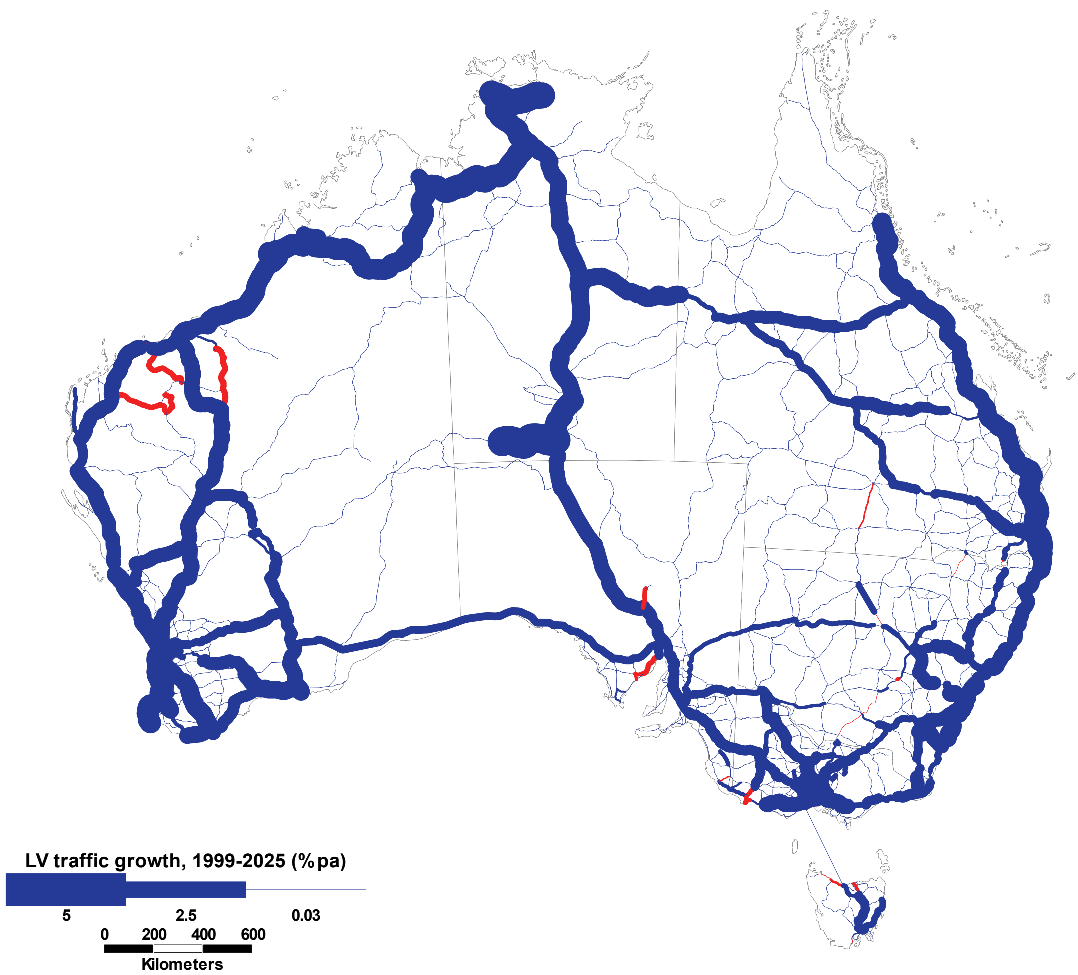
Source BTRE estimates.

FIGURE 3.5 PROJECTED TRAFFIC GROWTH AUSLINK NON-URBAN ROAD NETWORK



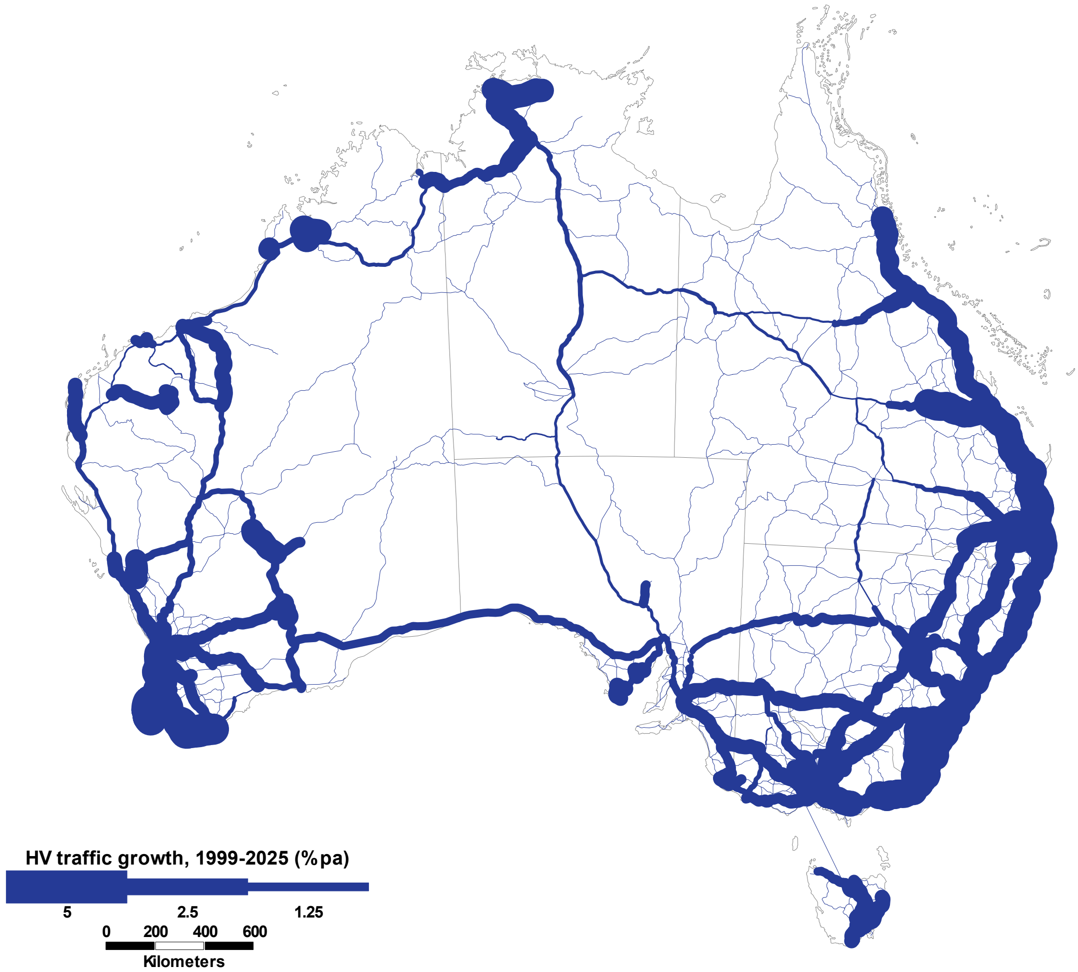
Source BTRE estimates.

FIGURE 3.6 PROJECTED GROWTH IN LIGHT VEHICLE TRAFFIC, 1999-2025



Source BTRE estimates.

FIGURE 3.7 PROJECTED GROWTH IN HEAVY VEHICLE TRAFFIC, 1999–2025



Note Red links denote declining traffic levels between 1999 and 2025.
Source BTRE estimates.

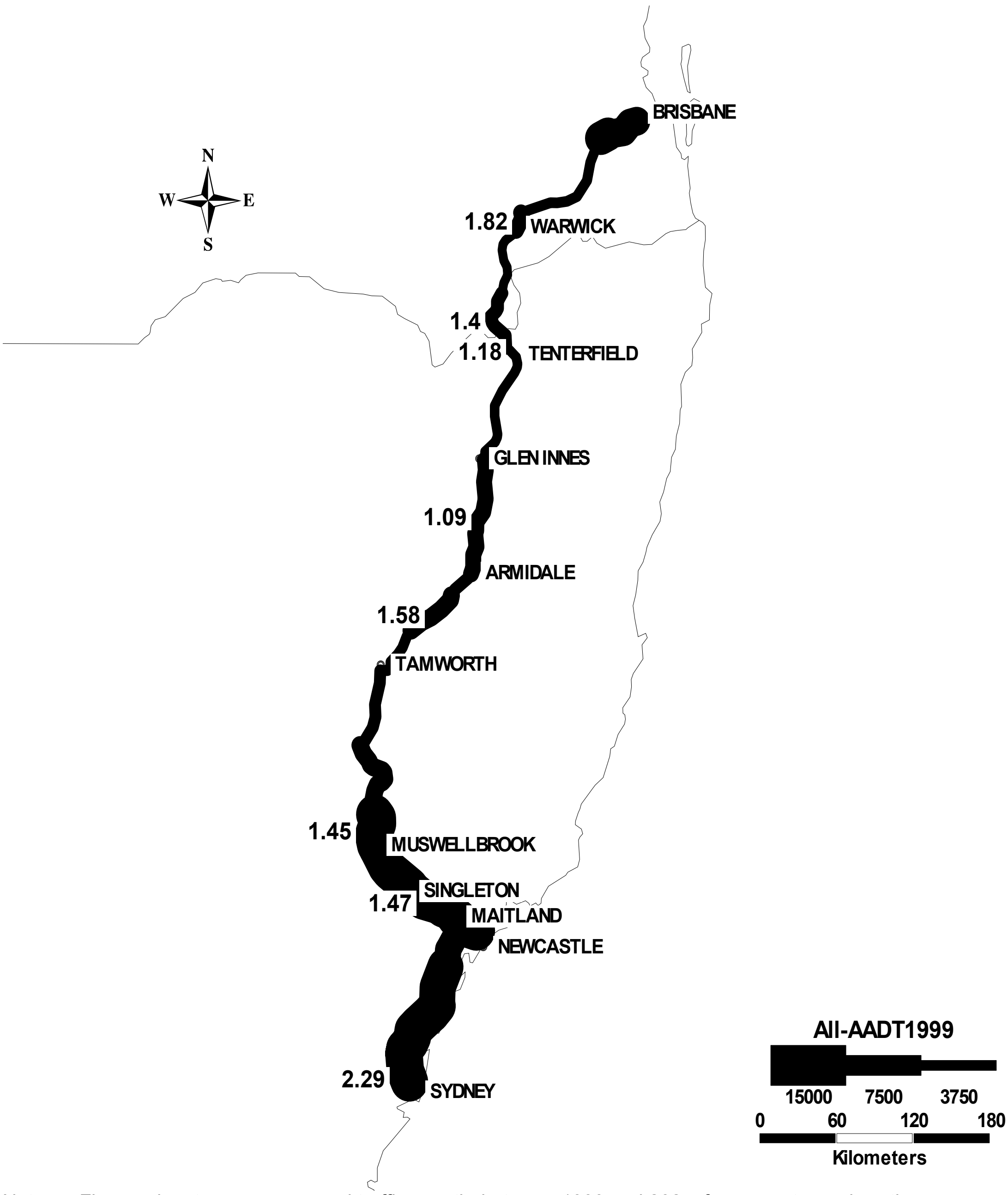
Corridor specific projections

The following section provides more detailed results of projected light and heavy vehicle traffic growth for each of the 19 non-urban corridors on the AusLink National Network. The results provide estimates of average traffic levels between selected population centres or major junctions on each of the corridors as well as an illustration of total traffic levels in 1999 and the projected growth in total traffic. Appendix IX provides some further illustrations of the projected growth in traffic, for the 10 interstate corridors and the Brisbane–Cairns corridor, between the base year and 2015.

1. Sydney–Brisbane (Inland) corridor

Table 3.3 lists the base year and projected traffic levels in 2025 and figure 3.8 illustrates the base year and projected traffic growth on the Sydney–Brisbane (inland) corridor. Total traffic on the Sydney–Brisbane route, which comprises the F3 and the New England Highway, is projected to grow by 1.8 per cent per annum between 1999 and 2025 across the corridor in the base case projections. Light vehicle traffic is projected to grow by around 1.6 per cent per annum and heavy vehicle traffic is projected to grow by 2.6 per cent per annum.

FIGURE 3.8 SYDNEY–BRISBANE (INLAND) CORRIDOR: BASE YEAR TRAFFIC LEVELS AND PROJECTED TRAFFIC GROWTH 1999–2025



Note Figures denote average annual traffic growth, between 1999 and 2025, for separate road sections,

Source BTRE estimates.

TABLE 3.3 SYDNEY–BRISBANE (INLAND) CORRIDOR: BASE YEAR AND PROJECTED TRAFFIC LEVELS, 1999 AND 2025

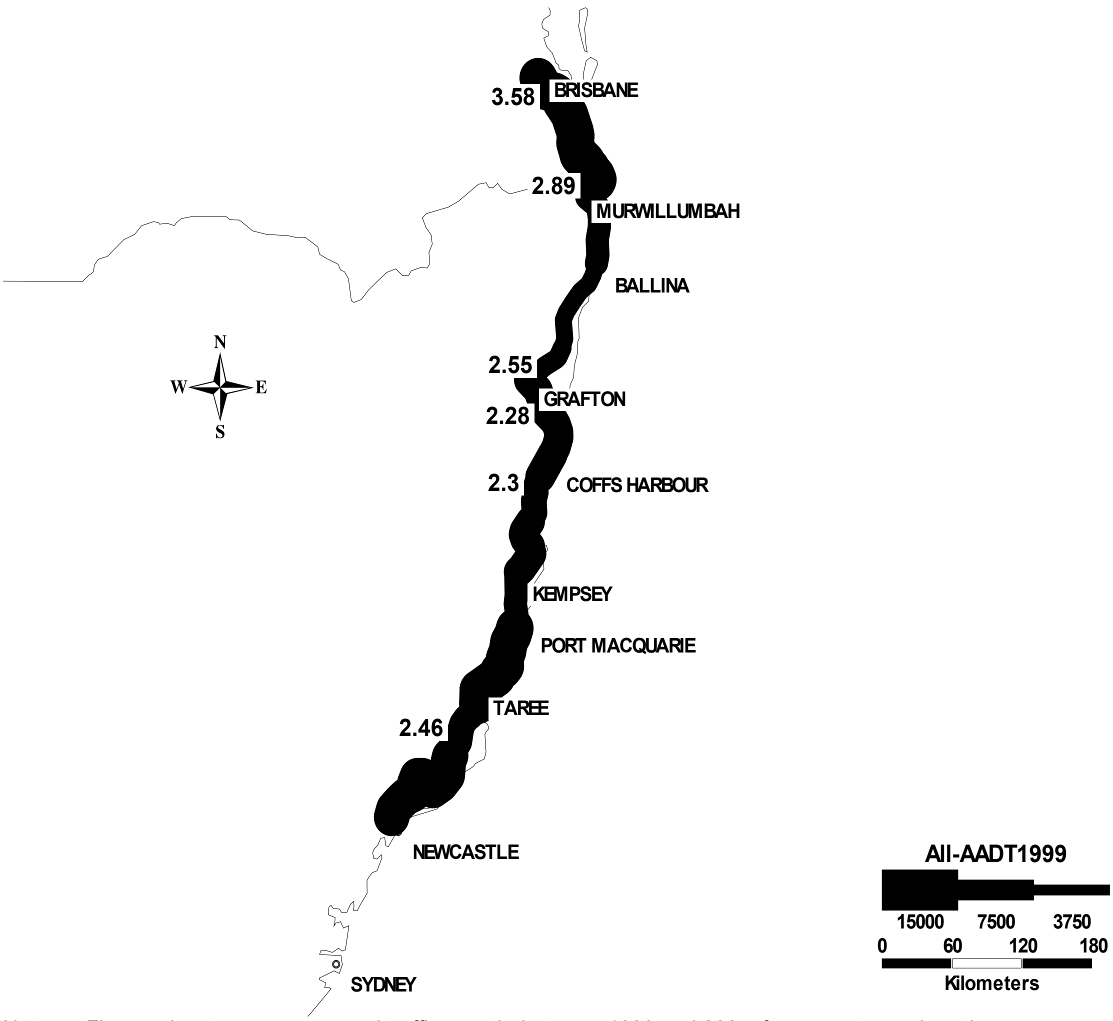
		Average traffic levels (vehicles per day)						Average annual traffic growth (per cent per annum)		
	Length	Light vehicles		Heavy vehicles		All vehicles		Light	Heavy	All
Section	*(km)*	*1999*	*2025*	*1999*	*2025*	*1999*	*2025*	*vehicles*	*vehicles*	*vehicles*
Sydney–Newcastle	135.0	30337	54088	1513	3255	31850	57343	2.25	2.99	2.29
Newcastle–Maitland	17.2	31588	43812	5452	10460	37040	54272	1.27	2.54	1.48
Maitland–Singleton	46.2	15716	21496	3584	6702	19300	28198	1.21	2.44	1.47
Singleton–Scone	73.1	11396	13805	6799	12668	18195	26473	0.74	2.42	1.45
Scone–Tamworth	160.2	4069	5662	1216	2274	5285	7936	1.28	2.44	1.58
Tamworth–Armidale	58.6	4095	5655	1094	2149	5189	7804	1.25	2.63	1.58
Armidale–Glenn Innes	70.2	4948	5844	1360	2514	6309	8358	0.64	2.39	1.09
Glenn Innes–Tenterfield	138.7	3202	3861	1139	2027	4340	5888	0.72	2.24	1.18
Tenterfield–Warwick	120.5	2340	2799	1356	2502	3696	5302	0.69	2.38	1.40
Warwick–Ipswich	127.0	3617	4609	1709	3904	5326	8514	0.94	3.23	1.82
Total	946.7	9108	13906	1958	3803	11066	17709	1.64	2.59	1.82

Sources BTRE estimates.

2. *Sydney–Brisbane (Coastal) corridor*

Table 3.4 lists the base year and projected traffic levels in 2025 and figure 3.9 illustrates base year traffic and projected traffic growth on the Sydney–Brisbane (coastal) corridor. Traffic along the corridor, which comprises the Pacific Highway from Newcastle to Brisbane, is projected to grow by approximately 3.0 per cent per annum between 1999 and 2025, with the growth strongest near the major population centres of Tweed Heads, Gold Coast and Brisbane. Light vehicle traffic is projected to grow by 2.9 per cent per annum, consistent with the relatively strong population and economic growth projected for south east Queensland. Heavy vehicle growth is projected to grow by 3.4 per cent per annum, reflecting strong population and economic growth within and at each end of this corridor.

FIGURE 3.9 SYDNEY–BRISBANE (COASTAL) CORRIDOR: BASE YEAR TRAFFIC LEVELS AND PROJECTED TRAFFIC GROWTH 1999–2025



Note Figures denote average annual traffic growth, between 1999 and 2025, for separate road sections,

Source BTRE estimates.

TABLE 3.4 SYDNEY–BRISBANE (COASTAL) CORRIDOR: BASE YEAR AND PROJECTED TRAFFIC LEVELS, 1999 AND 2025

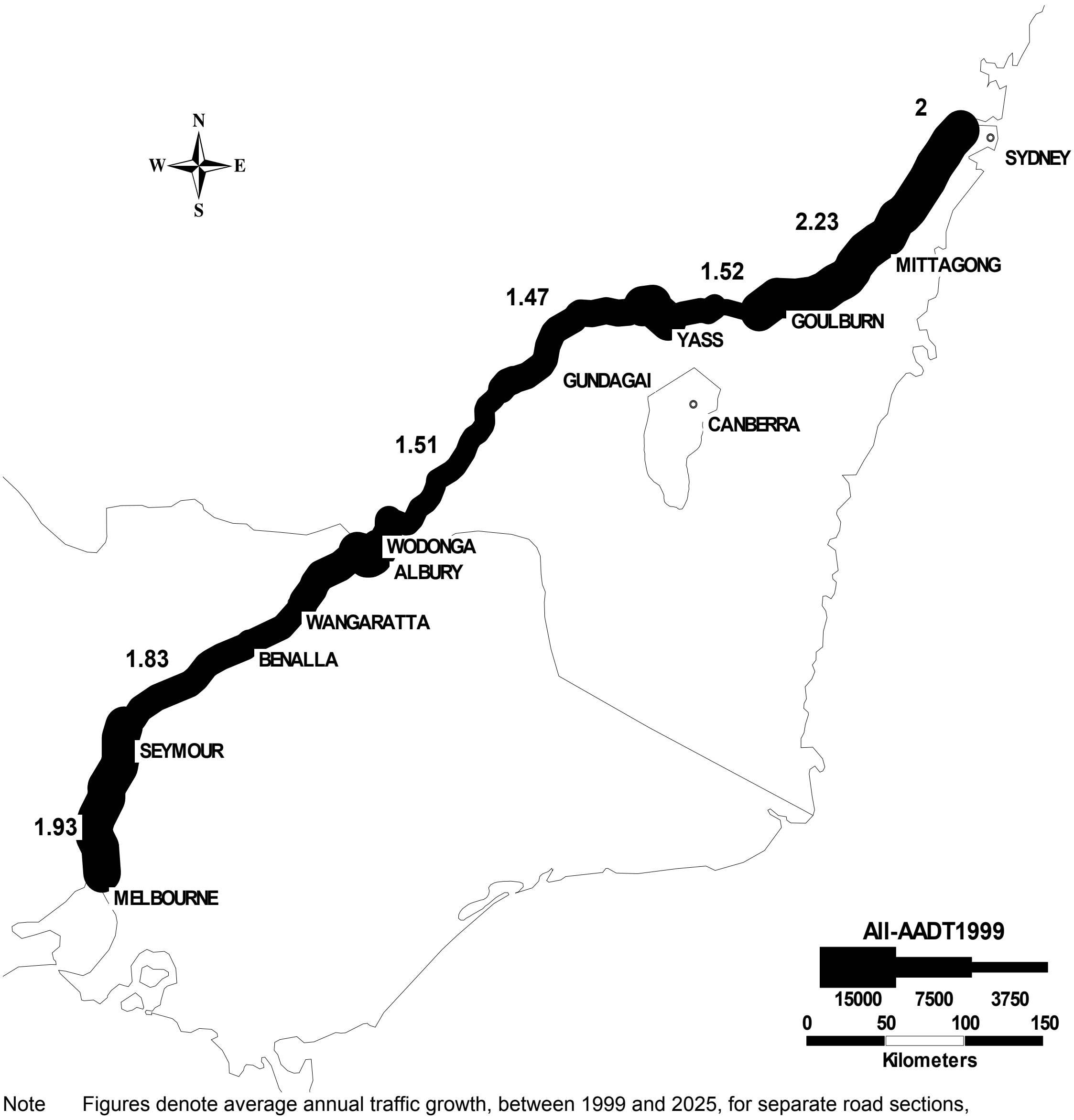
		Average traffic levels (vehicles per day)						Average annual traffic growth (per cent per annum)		
	Length	Light vehicles		Heavy vehicles		All vehicles		Light vehicles	Heavy vehicles	All vehicles
Section	*(km)*	*1999*	*2025*	*1999*	*2025*	*1999*	*2025*			
Newcastle–Taree	152.9	10887	20091	2421	4940	13308	25031	2.38	2.78	2.46
Taree–Coffs Harbour	227.5	9602	16400	2193	4899	11794	21299	2.08	3.14	2.30
Coffs Harbour–Grafton	75.6	8962	15076	2056	4718	11018	19794	2.02	3.25	2.28
Grafton–Ballina	127.6	5912	10982	1320	2943	7232	13925	2.41	3.13	2.55
Ballina–Tweed Heads	116.6	10912	22131	2462	5894	13373	28025	2.76	3.42	2.89
Tweed Heads–Gold Coast	32.8	28758	70082	2820	8709	31578	78791	3.49	4.43	3.58
Gold Coast–Brisbane	62.8	61013	151129	4265	12693	65278	163822	3.55	4.28	3.60
Total	795.8	14235	29799	2313	5494	16547	35293	2.88	3.38	2.96

Sources BTRE estimates.

3. *Sydney–Melbourne corridor*

Table 3.5 lists the base year and projected traffic levels in 2025 and figure 3.10 illustrates base year traffic and projected traffic growth on the Sydney–Melbourne corridor. The Sydney–Melbourne corridor, comprising exclusively the Hume Highway, shows relatively moderate overall forecast annual growth rate of 1.8 per cent per annum between 1999 and 2025, with the greatest projected growth occurring nearer to the major population centres of Sydney and Melbourne. Heavy vehicle growth is projected to be 2.4 per cent per annum, stronger than projected light vehicle growth, or 1.6 per cent per annum, across most of the corridor.

FIGURE 3.10 SYDNEY–MELBOURNE CORRIDOR: BASE YEAR TRAFFIC LEVELS AND PROJECTED TRAFFIC GROWTH 1999–2025



Note Figures denote average annual traffic growth, between 1999 and 2025, for separate road sections,
Source BTRE estimates.

TABLE 3.5 SYDNEY–MELBOURNE CORRIDOR: BASE YEAR AND PROJECTED TRAFFIC LEVELS, 1999 AND 2025

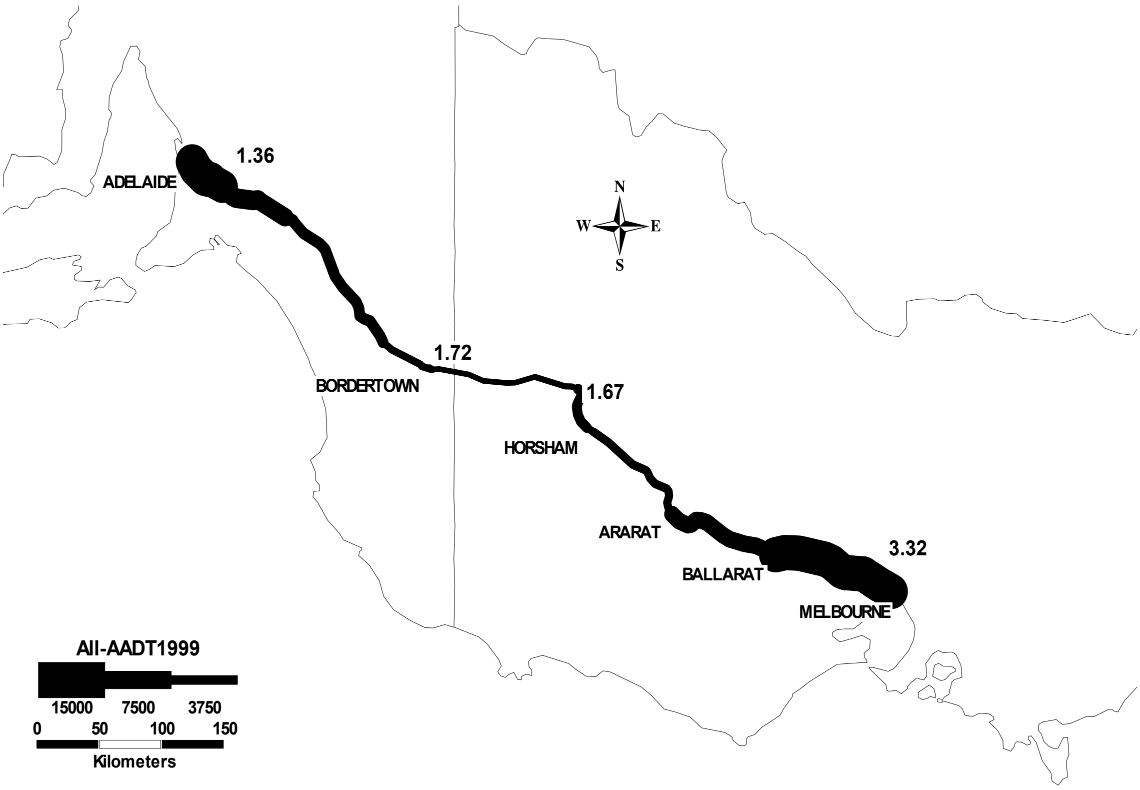
		Average traffic levels (vehicles per day)						Average annual traffic growth (per cent per annum)		
	Length	Light vehicles		Heavy vehicles		All vehicles		Light	Heavy	All
Section	*(km)*	*1999*	*2025*	*1999*	*2025*	*1999*	*2025*	*vehicles*	*vehicles*	*vehicles*
Sydney–Outskirts	15.4	46092	75759	2914	6340	49006	82099	1.93	3.04	2.00
Sydney–Mittagong	53.3	26569	40610	2730	6002	29299	46612	1.65	3.08	1.80
Mittagong–Goulburn	94.6	14996	25807	2867	5928	17863	31736	2.11	2.83	2.23
Goulburn–Yass	87.3	8105	10852	3157	5835	11262	16687	1.13	2.39	1.52
Yass–Gundagai	99.2	6858	9083	3256	5706	10114	14790	1.09	2.18	1.47
Gundagai–Holbrook	92.1	4066	5039	3748	6384	7814	11423	0.83	2.07	1.47
Holbrook–Albury	90.3	8126	10361	4394	7874	12520	18235	0.94	2.27	1.46
Wodonga–Wangaratta	91	8528	11674	2648	4832	11176	16506	1.21	2.34	1.51
Wangaratta–Euroa	68	7110	10926	2305	4158	9415	15084	1.67	2.30	1.83
Euroa–Seymour	40.8	7344	11284	2313	4196	9657	15480	1.67	2.32	1.83
Seymour–Melbourne	100.1	16415	26516	2975	5359	19390	31875	1.86	2.29	1.93
Total	832.1	11108	16754	3115	5748	14223	22502	1.59	2.38	1.78

Sources BTRE estimates.

4. *Melbourne–Adelaide corridor*

Table 3.6 lists the base year and projected traffic levels in 2025 and figure 3.11 illustrates base year traffic and projected traffic growth on the Sydney–Adelaide corridor. Traffic along the Melbourne–Adelaide corridor, comprising the Western and Dukes Highways, is projected to grow at 2.4 per cent per annum between 1999 and 2025. But this masks significant variations along the corridor, with by far the greatest projected growth predicted to occur on the Melbourne-Ballarat segment. Light vehicle growth is also notably higher along this segment of the corridor, reflecting the close proximity of Melbourne and Ballarat Heavy vehicles comprise a higher share of the growth in traffic along the corridor west of Ballarat. Across the whole of the corridor, heavy vehicle traffic is projected to grow by 1.9 per cent per annum and light vehicle traffic by 2.5 per cent per annum. Excluding the section between Melbourne and Ballarat, heavy vehicle traffic is projected to grow faster than light vehicle traffic.

FIGURE 3.11 MELBOURNE–ADELAIDE CORRIDOR: BASE YEAR TRAFFIC LEVELS AND PROJECTED TRAFFIC GROWTH 1999–2025



Note Figures denote average annual traffic growth, between 1999 and 2025, for separate road sections,

Source BTRE estimates.

TABLE 3.6 MELBOURNE–ADELAIDE CORRIDOR: BASE YEAR AND PROJECTED TRAFFIC LEVELS, 1999 AND 2025

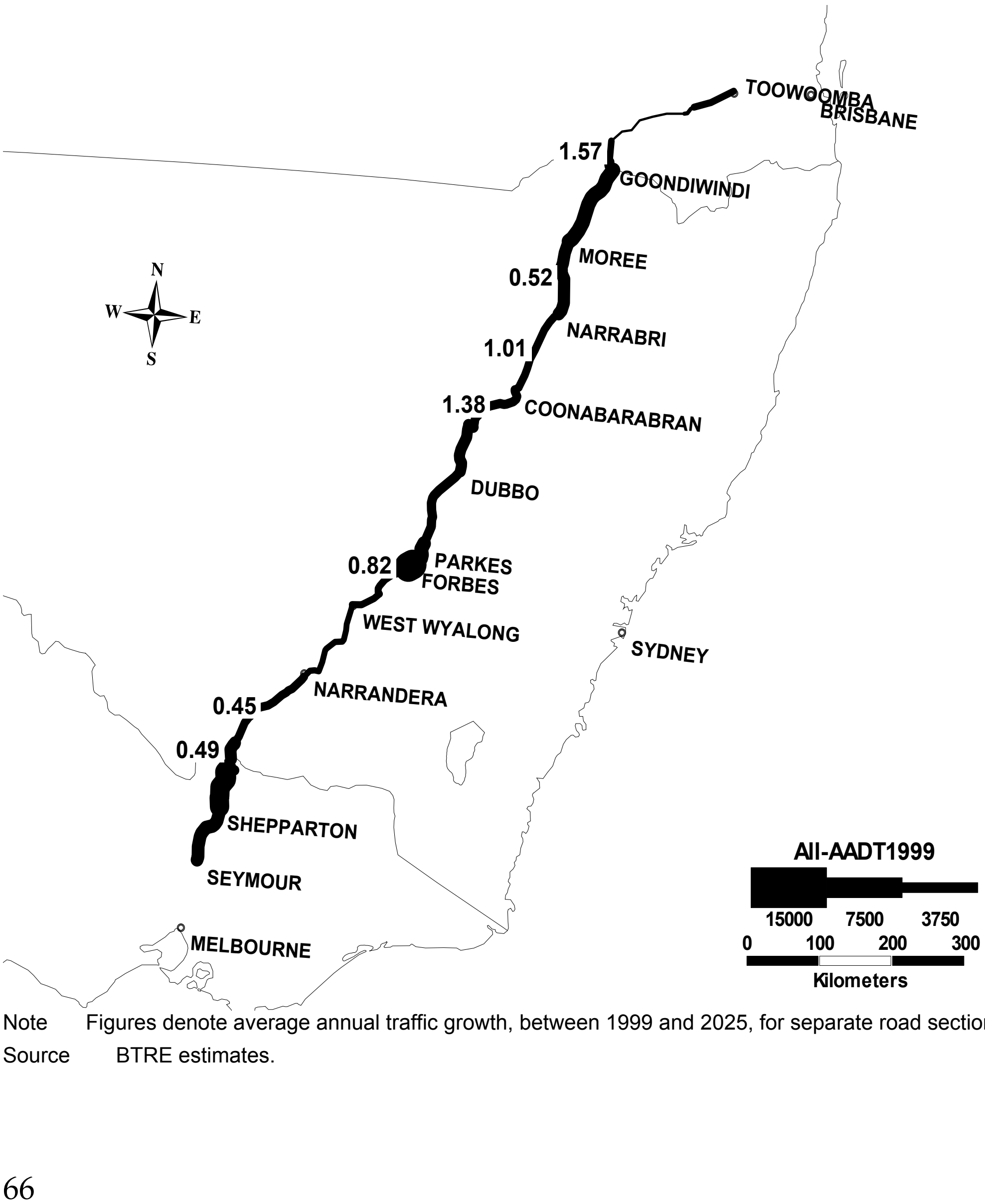
		Average traffic levels (vehicles per day)						*Average annual traffic growth (per cent per annum)*		
	Length	*Light vehicles*		*Heavy vehicles*		*All vehicles*		*Light*	*Heavy*	*All*
Section	*(km)*	*1999*	*2025*	*1999*	*2025*	*1999*	*2025*	*vehicles*	*vehicles*	*vehicles*
Melbourne–Ballarat	116.1	17693	42940	2811	4956	20504	47895	3.47	2.20	3.32
Ballarat–Horsham	178.4	2859	4230	1141	1795	3999	6025	1.52	1.76	1.59
Horsham–Bordertown	152	1889	2816	951	1553	2840	4368	1.55	1.90	1.67
Bordertown–Tailem Bend	173.5	3490	5418	1146	1808	4636	7227	1.71	1.77	1.72
Tailem Bend–Adelaide	93	12947	18128	1669	2643	14617	20771	1.30	1.78	1.36
Total	713	6537	12334	1443	2372	7979	14705	2.47	1.93	2.38

Sources BTRE estimates.

5. *Melbourne–Brisbane corridor*

Table 3.7 lists the base year and projected traffic levels in 2025 and figure 3.12 illustrates base year traffic and projected traffic growth on the Melbourne–Brisbane corridor. Traffic along the Melbourne-Brisbane corridor, which comprises primarily of the Newell Highway but also parts of the Goulburn Valley and Cunningham Highways, is projected to grow at 0.9 per cent per annum between 1999 and 2025 under the assumptions outlined in chapter 2. Light vehicle traffic growth is projected to be relatively low along the entirety of the corridor, and particularly along the southern NSW segments. Heavy vehicle traffic is projected to grow by 2.0 per cent per annum more across the whole corridor. Note that the corridor definition used here excludes the Hume Highway between Melbourne–Seymour and the Warrego Highway between Brisbane–Toowoomba. These links are included in the Melbourne–Sydney and Brisbane–Darwin corridors.

FIGURE 3.12 MELBOURNE–BRISBANE CORRIDOR: BASE YEAR TRAFFIC LEVELS AND PROJECTED TRAFFIC GROWTH 1999–2025



Note Figures denote average annual traffic growth, between 1999 and 2025, for separate road sections,

Source BTRE estimates.

TABLE 3.7 MELBOURNE–BRISBANE CORRIDOR: BASE YEAR AND PROJECTED TRAFFIC LEVELS, 1999 AND 2025

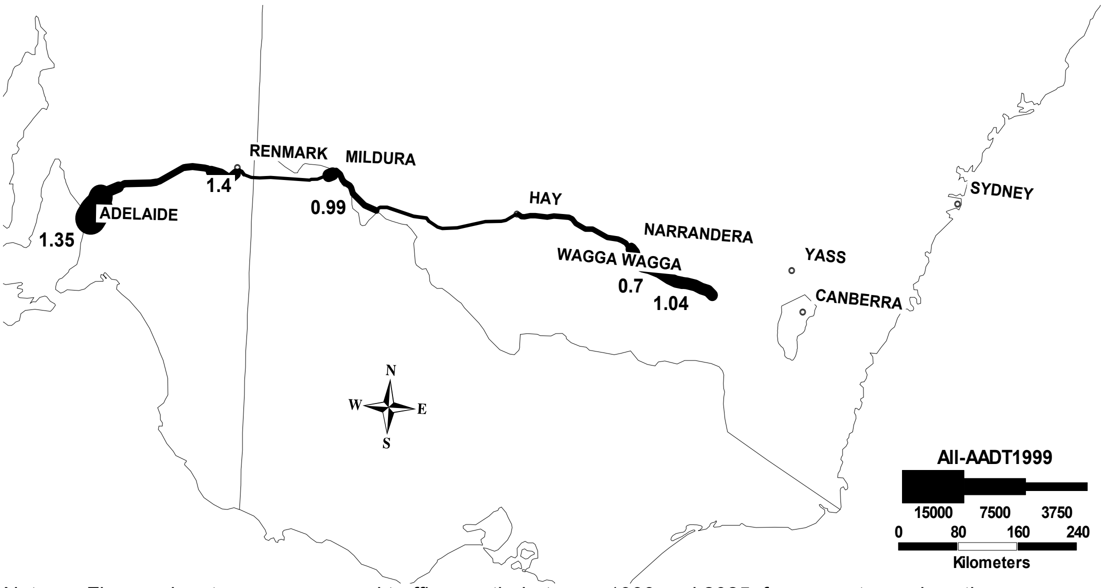
		Average traffic levels (vehicles per day)						*Average annual traffic growth (per cent per annum)*		
	Length	*Light vehicles*		*Heavy vehicles*		*All vehicles*		*Light vehicles*	*Heavy vehicles*	*All vehicles*
Section	*(km)*	*1999*	*2025*	*1999*	*2025*	*1999*	*2025*			
Seymour–Shepparton	79.4	3990	4553	1317	2343	5307	6895	0.51	2.24	1.01
Shepparton–Tocumwal	84	4037	4442	911	1546	4948	5988	0.37	2.05	0.74
Tocumwal–Narrandera	162.4	2461	2437	907	1388	3369	3825	–0.04	1.65	0.49
Narrandera–West Wyalong	138.5	1804	1760	661	1012	2465	2772	–0.09	1.65	0.45
West Wyalong–Dubbo	259.6	2696	2936	1145	1812	3841	4748	0.33	1.78	0.82
Dubbo–Coonabarabran	140.9	2382	2911	1202	2211	3584	5122	0.77	2.37	1.38
Coonabarabran–Narrabri	131.5	2015	2147	1018	1789	3033	3936	0.24	2.19	1.01
Narrabri–Moree	100.3	4063	3939	1808	2781	5871	6720	–0.12	1.67	0.52
Moree–Goondiwindi	132.4	2663	2791	1968	3033	4631	5825	0.18	1.68	0.89
Goondiwindi–Toowoomba	216.3	892	986	685	1381	1577	2367	0.39	2.73	1.57
Total	1445.3	2462	2634	1114	1853	3577	4487	0.26	1.98	0.88

Sources BTRE estimates.

6. *Sydney–Adelaide corridor*

Table 3.8 lists the base year and projected traffic levels in 2025 and figure 3.13 illustrates base year traffic and projected traffic growth on the Sydney–Adelaide corridor. Traffic along the Sydney–Adelaide corridor, which comprises the Sturt Highway, is projected to grow by 1.2 per cent per annum between 1999 and 2025. Projected traffic growth is consistently low along the entire length of the corridor, particularly between Wagga Wagga and the Victorian border. Heavy vehicle traffic is projected to grow by 1.8 per cent per annum, more quickly than light vehicle traffic growth across the corridor, of 1.0 per cent per annum. Note that the corridor definition used here excludes the Hume Highway between Sydney and the Sturt Highway turn-off. These sections are included with the Sydney–Melbourne corridor results.

FIGURE 3.13 SYDNEY–ADELAIDE CORRIDOR: BASE YEAR TRAFFIC LEVELS AND PROJECTED TRAFFIC GROWTH 1999–2025



Note Figures denote average annual traffic growth, between 1999 and 2025, for separate road sections,
Source BTRE estimates.

TABLE 3.8 SYDNEY–ADELAIDE CORRIDOR: BASE YEAR AND PROJECTED TRAFFIC LEVELS, 1999 AND 2025

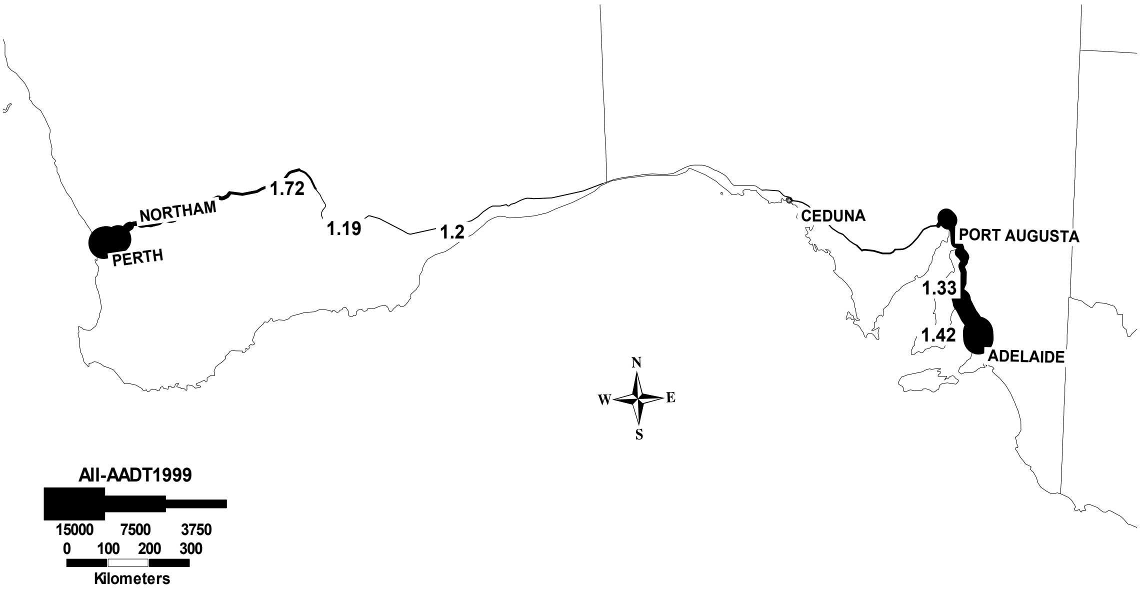
		Average traffic levels (vehicles per day)						Average annual traffic growth (per cent per annum)		
	Length	Light vehicles		Heavy vehicles		All vehicles		Light	Heavy	All
Section	*(km)*	*1999*	*2025*	*1999*	*2025*	*1999*	*2025*	*vehicles*	*vehicles*	*vehicles*
Hume Hwy–Wagga Wagga	47.1	5889	7433	1691	2476	7580	9909	0.90	1.48	1.04
Wagga Wagga–Narrandera	93.2	2464	2618	1047	1591	3511	4208	0.23	1.62	0.70
Narrandera–Hay	180.7	1013	1178	616	1013	1629	2191	0.58	1.93	1.15
Hay–Mildura	287.6	1602	1858	715	1134	2316	2992	0.57	1.79	0.99
Mildura–Renmark	144.5	1359	1796	496	791	1856	2588	1.08	1.81	1.29
Renmark–Elizabeth	214.6	3485	4835	742	1233	4227	6068	1.27	1.97	1.40
Elizabeth–Adelaide	27.5	36910	51465	2742	4683	39652	56148	1.29	2.08	1.35
Total	995.2	3125	4073	804	1288	3929	5361	1.02	1.83	1.20

Sources BTRE estimates.

7. *Adelaide–Perth corridor*

Table 3.9 lists the base year and projected traffic levels in 2025 and figure 3.14 illustrates base year traffic and projected traffic growth on the Adelaide–Perth corridor. Traffic along the Adelaide–Perth corridor, comprising the Princes (between Adelaide and Port Augusta), Eyre and Great Eastern Highways, is projected to grow at a relatively moderate rate of 1.6 per cent per annum between 1999 and 2025. Unsurprisingly, traffic growth is projected to be relatively stronger closer to Perth, reflecting relatively strong projected population and economic growth for Perth and surrounds. Light vehicle traffic is projected to grow slightly faster than heavy vehicle traffic.

FIGURE 3.14 ADELAIDE–PERTH CORRIDOR: BASE YEAR TRAFFIC LEVELS AND PROJECTED TRAFFIC GROWTH 1999–2025



Note Figures denote average annual traffic growth, between 1999 and 2025, for separate road sections,

Source BTRE estimates.

TABLE 3.9 ADELAIDE–PERTH CORRIDOR: BASE YEAR AND PROJECTED TRAFFIC LEVELS, 1999 AND 2025

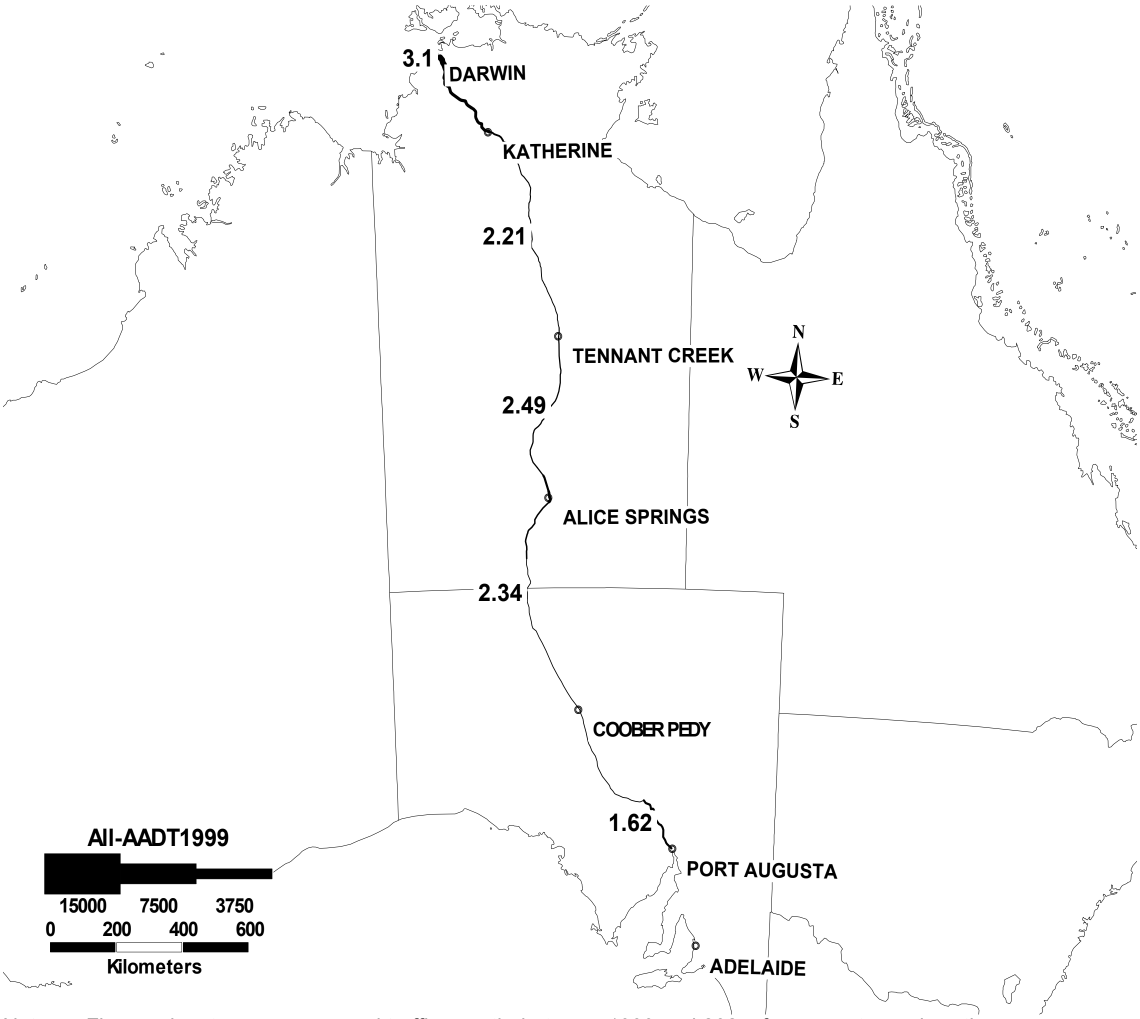
		Average traffic levels (vehicles per day)						*Average annual traffic growth (per cent per annum)*		
	Length	*Light vehicles*		*Heavy vehicles*		*All vehicles*		*Light*	*Heavy*	*All*
Section	*(km)*	*1999*	*2025*	*1999*	*2025*	*1999*	*2025*	*vehicles*	*vehicles*	*vehicles*
Adelaide–Port Wakefield	89.5	9947	14493	1829	2503	11775	16996	1.46	1.21	1.42
Port Wakefield–Port Augusta	210.5	2973	4352	797	963	3769	5315	1.48	0.73	1.33
Port Augusta–Ceduna	467.6	459	641	297	388	756	1029	1.29	1.04	1.19
Ceduna–Eucla	489.5	144	198	142	188	286	387	1.24	1.09	1.17
Eucla–Balladonia	510.2	340	469	114	152	455	620	1.24	1.09	1.20
Balladonia–Norseman	204.7	341	466	115	155	456	620	1.21	1.14	1.19
Norseman–Coolgardie	165.8	527	757	45	62	571	819	1.41	1.24	1.40
Coolgardie–Southern Cross	189.4	1116	1752	226	337	1342	2090	1.75	1.54	1.72
Southern Cross–Northam	270.6	1624	2299	295	443	1919	2741	1.35	1.57	1.38
Northam–Perth	95	11744	20230	1401	2772	13145	23002	2.11	2.66	2.18
Total	2692.8	1448	2208	329	470	1776	2678	1.64	1.38	1.59

Sources BTRE estimates.

8. Adelaide–Darwin corridor

Table 3.10 lists the base year and projected traffic levels in 2025 and figure 3.15 illustrates base year traffic and projected traffic growth on the Adelaide–Darwin corridor. Traffic growth along the Stuart Highway, between Adelaide–Darwin, is projected to grow at a rate of 2.5 per cent per annum between 1999 and 2025, with a higher average projected growth along the section within the Northern Territory, particularly between Katherine–Darwin, reflecting relatively strong population and economic growth projections for Darwin and the NT generally. Light vehicle traffic growth is projected to grow much more strongly than freight vehicle traffic along the corridor.

FIGURE 3.15 ADELAIDE–DARWIN CORRIDOR: BASE YEAR TRAFFIC LEVELS AND PROJECTED TRAFFIC GROWTH 1999–2025



Note Figures denote average annual traffic growth, between 1999 and 2025, for separate road sections,
Source BTRE estimates.

TABLE 3.10 ADELAIDE–DARWIN CORRIDOR: BASE YEAR AND PROJECTED TRAFFIC LEVELS, 1999 AND 2025

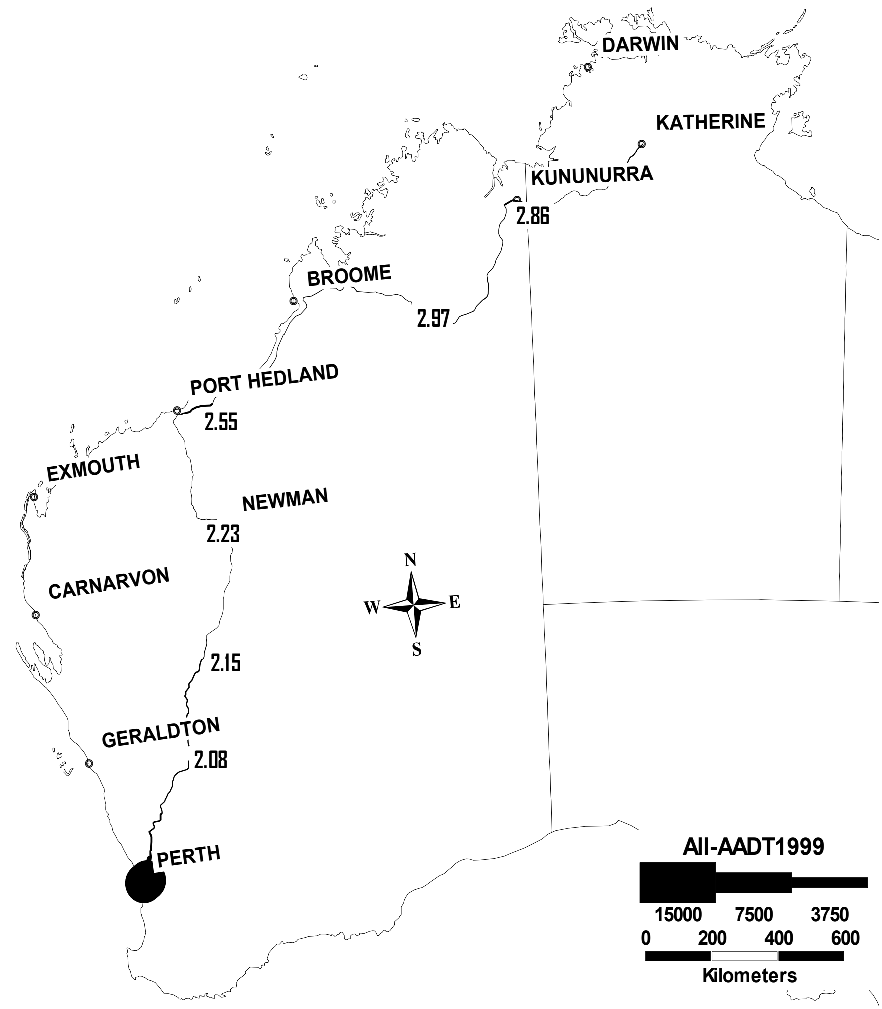
		Average traffic levels (vehicles per day)						*Average annual traffic growth (per cent per annum)*		
	Length	*Light vehicles*		*Heavy vehicles*		*All vehicles*		*Light*	*Heavy*	*All*
Section	*(km)*	*1999*	*2025*	*1999*	*2025*	*1999*	*2025*	*vehicles*	*vehicles*	*vehicles*
Port Augusta–Coober Pedy	536.2	331	563	145	161	476	723	2.06	0.39	1.62
Coober Pedy–Alice Springs	747.4	315	653	107	118	422	772	2.85	0.37	2.34
Alice Springs–Tennant Creek	121.2	513	1046	103	121	616	1167	2.78	0.64	2.49
Tennant Creek–Three Ways	311.3	408	828	90	107	498	935	2.76	0.67	2.45
Three Ways–Katherine	706.3	320	638	130	155	450	793	2.69	0.69	2.21
Katherine–Darwin	290	1208	2734	217	418	1425	3153	3.19	2.55	3.10
Total	2712.4	434	891	130	167	565	1059	2.81	0.97	2.45

Sources BTRE estimates.

9. *Perth–Darwin corridor*

Table 3.11 lists the base year and projected traffic levels in 2025 and figure 3.16 illustrates base year traffic and projected traffic growth on the Perth–Darwin corridor. In this analysis, the Perth–Darwin corridor was assumed to follow the old National Highway route along the Great Northern Highway. The coastal route, the North West Coastal Highway was not considered in this analysis. Traffic along this corridor is projected to grow by 2.5 per cent per annum between 1999 and 2025. Light vehicle traffic is projected to grow more quickly than heavy vehicle traffic, reflecting relatively strong projected population and economic growth and the influence of foreign visitor arrivals. It should be noted, however, that these growth rates apply to very low daily traffic levels, typically around 300 vehicles or less. Note also that the corridor definition used here excludes the section of the Stuart Highway between Katherine and Darwin, which is included in the Adelaide–Darwin corridor.

FIGURE 3.16 PERTH–DARWIN CORRIDOR: BASE YEAR TRAFFIC LEVELS AND PROJECTED TRAFFIC GROWTH 1999–2025



Note Figures denote average annual traffic growth, between 1999 and 2025, for separate road sections,

Source BTRE estimates.

TABLE 3.11 PERTH–DARWIN CORRIDOR: BASE YEAR AND PROJECTED TRAFFIC LEVELS, 1999 AND 2025

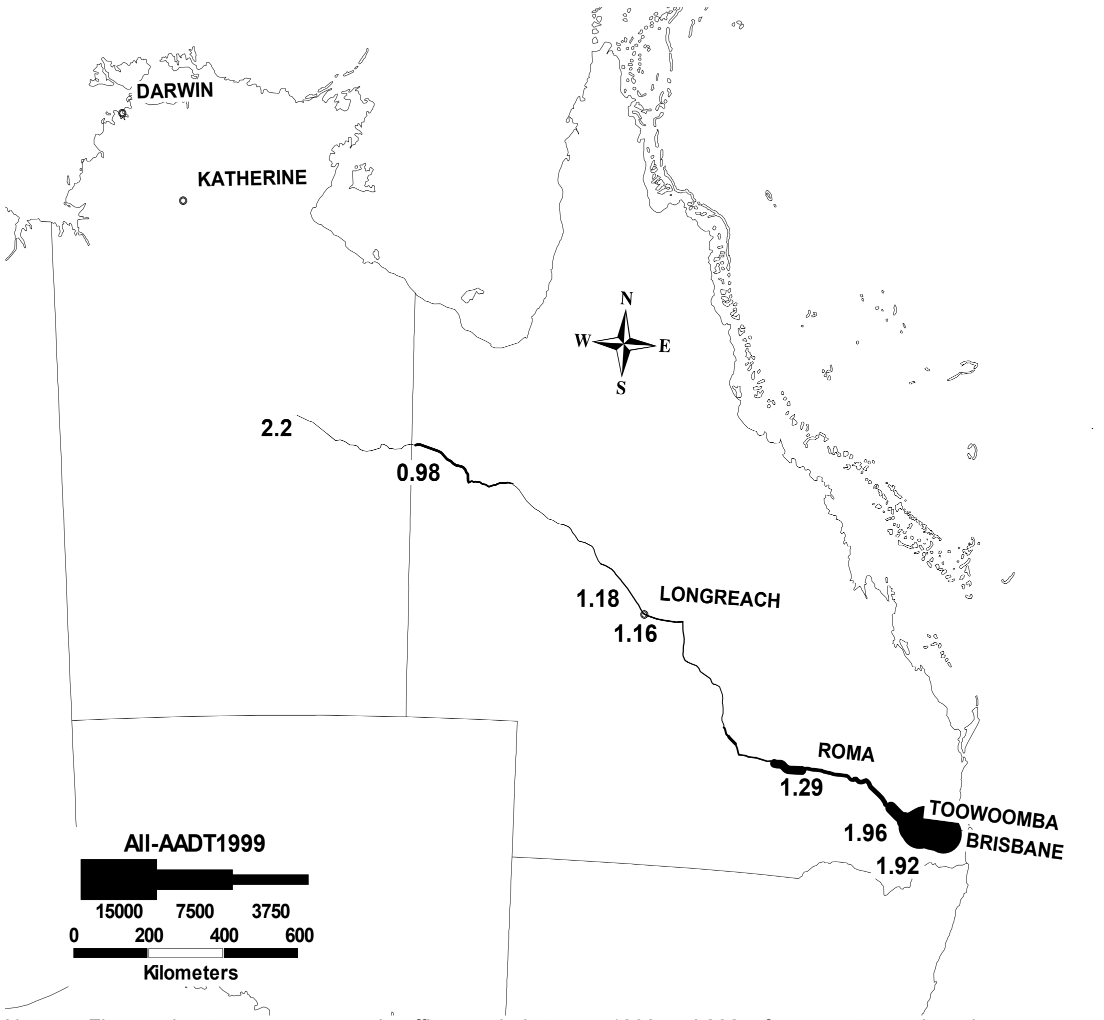
		Average traffic levels (vehicles per day)						*Average annual traffic growth (per cent per annum)*		
	Length	*Light vehicles*		*Heavy vehicles*		*All vehicles*		*Light vehicles*	*Heavy vehicles*	*All vehicles*
Section	*(km)*	*1999*	*2025*	*1999*	*2025*	*1999*	*2025*			
Perth–Bindoon	180.8	2339	4434	523	1013	2862	5446	2.49	2.57	2.51
Bindoon–Mount Magnet	367.4	380	696	106	134	486	829	2.35	0.91	2.08
Mount Magnet–Meekatharra	193.2	449	817	76	96	525	914	2.33	0.93	2.15
Meekatharra–Newman	406.5	106	197	26	31	132	228	2.40	0.77	2.13
Newman–Port Hedland	451.8	204	384	42	52	246	436	2.46	0.84	2.23
Port Hedland–Roebuck	546.1	248	526	72	89	320	614	2.94	0.82	2.55
Roebuck–Fitzroy Crossing	388.3	226	523	42	50	268	573	3.28	0.67	2.97
Fitzroy Crossing–Kununurra	584.4	295	653	46	58	342	711	3.10	0.85	2.86
Kununurra–Katherine	510.9	167	408	90	149	257	558	3.50	1.95	3.02
Total	3629.4	349	702	84	128	433	830	2.72	1.63	2.53

Sources BTRE estimates.

10. Brisbane–Darwin corridor

Table 3.12 lists the base year and projected traffic levels in 2025 and figure 3.17 illustrates base year traffic and projected traffic growth on the Brisbane–Darwin corridor. Traffic on the Brisbane-Darwin corridor, comprising the Warrego, Landsborough, Flinders and Barkly Highways is projected to grow by 1.6 per cent per annum between 1999 and 2025. Light vehicle traffic is projected to grow more quickly than heavy vehicle traffic along most sections of the corridor. Total traffic growth is projected to be greatest near to the sections around Brisbane and Toowoomba, and near the Stuart Highway turn-off in the Northern Territory. Note that the corridor definition used here excludes the section of the Stuart Highway between Three Ways and Darwin, which is included in the Adelaide–Darwin corridor.

FIGURE 3.17 BRISBANE–DARWIN CORRIDOR: BASE YEAR TRAFFIC LEVELS AND PROJECTED TRAFFIC GROWTH 1999–2025



Note Figures denote average annual traffic growth, between 1999 and 2025, for separate road sections,

Source BTRE estimates.

TABLE 3.12 BRISBANE–DARWIN CORRIDOR: BASE YEAR AND PROJECTED TRAFFIC LEVELS, 1999 AND 2025

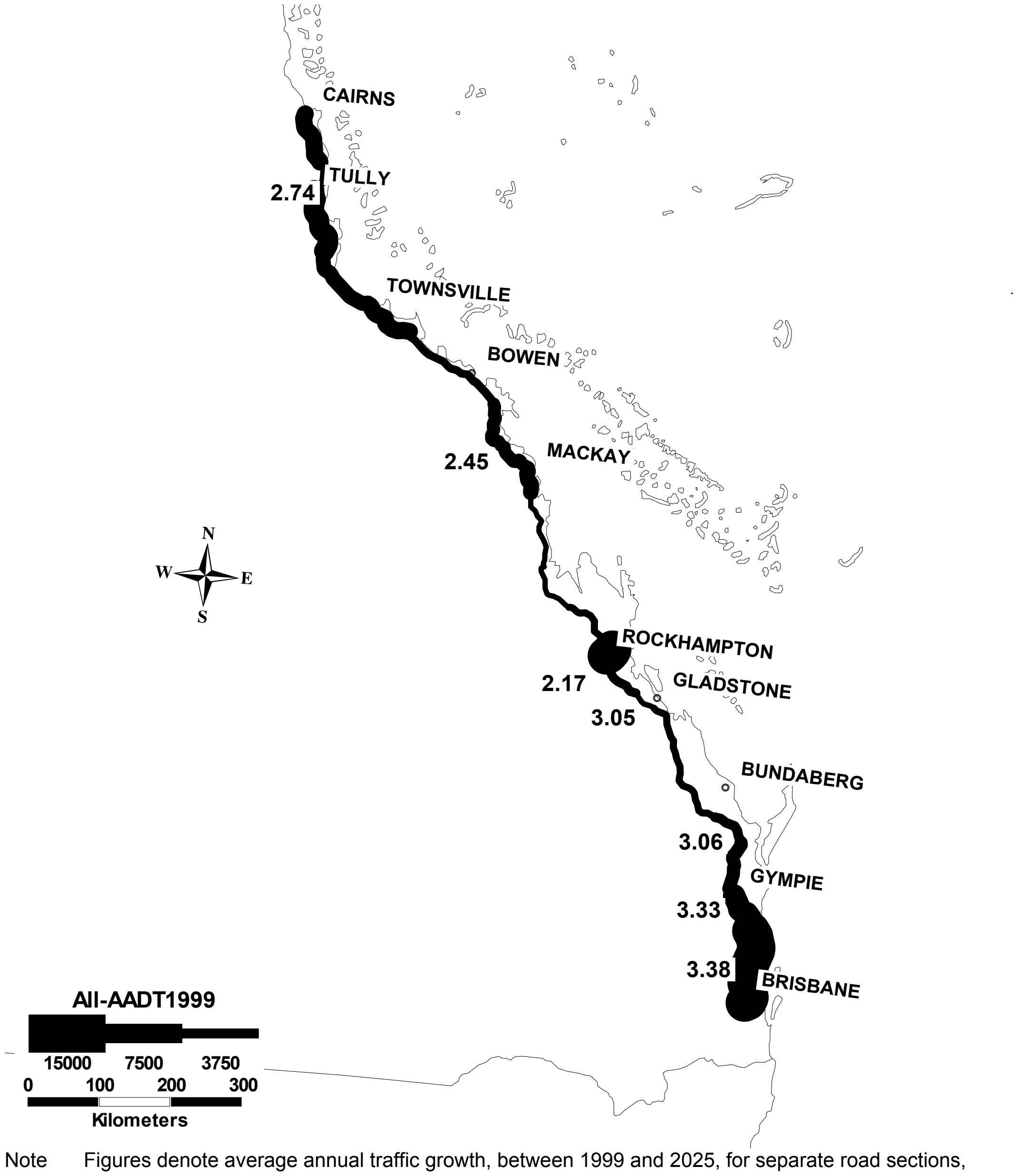
		Average traffic levels (vehicles per day)						*Average annual traffic growth (per cent per annum)*		
	Length	*Light vehicles*		*Heavy vehicles*		*All vehicles*		*Light vehicles*	*Heavy vehicles*	*All vehicles*
Section	*(km)*	*1999*	*2025*	*1999*	*2025*	*1999*	*2025*			
Brisbane–Toowoomba	98	15062	23752	1531	3484	16592	27236	1.77	3.21	1.92
Toowoomba–Miles	212.3	3167	5259	517	846	3684	6105	1.97	1.91	1.96
Miles–Roma	143.4	1024	1454	223	288	1247	1742	1.36	0.99	1.29
Roma–Morven	175.9	1863	2211	159	188	2022	2399	0.66	0.64	0.66
Morven–Blackall	309	487	675	68	75	555	750	1.26	0.38	1.16
Blackall–Longreach	212.1	480	654	89	97	569	751	1.20	0.31	1.07
Longreach–Winton	177.9	411	574	82	91	493	665	1.30	0.40	1.16
Winton–Cloncurry	349.9	301	421	46	51	347	472	1.29	0.40	1.18
Cloncurry–Mt Isa	120.4	767	939	165	187	933	1127	0.78	0.48	0.73
Mt Isa–Camooweal	186	702	928	146	165	848	1093	1.08	0.48	0.98
Camooweal–Three Ways	447.3	167	333	60	66	227	399	2.68	0.41	2.20
Total	2432.2	1378	2086	191	311	1569	2397	1.61	1.89	1.64

Sources BTRE estimates.

11. Brisbane–Cairns corridor

Table 3.13 lists the base year and projected traffic levels in 2025 and figure 3.18 illustrates base year traffic and projected traffic growth on the Brisbane–Cairns corridor. Traffic along the Brisbane–Cairns corridor, the Bruce Highway, is projected to grow by 2.0 per cent per annum between 1999 and 2025. Light vehicle traffic is projected to grow by 2.8 per cent per annum over the whole corridor and freight vehicle traffic by 3.4 per cent per annum. Growth in light and heavy vehicle traffic is projected to be strongest between Brisbane and Gympie.

FIGURE 3.18 BRISBANE–CAIRNS CORRIDOR: BASE YEAR TRAFFIC LEVELS AND PROJECTED TRAFFIC GROWTH 1999–2025



Note Figures denote average annual traffic growth, between 1999 and 2025, for separate road sections,

Source BTRE estimates.

TABLE 3.13 BRISBANE–CAIRNS CORRIDOR: BASE YEAR AND PROJECTED TRAFFIC LEVELS, 1999 AND 2025

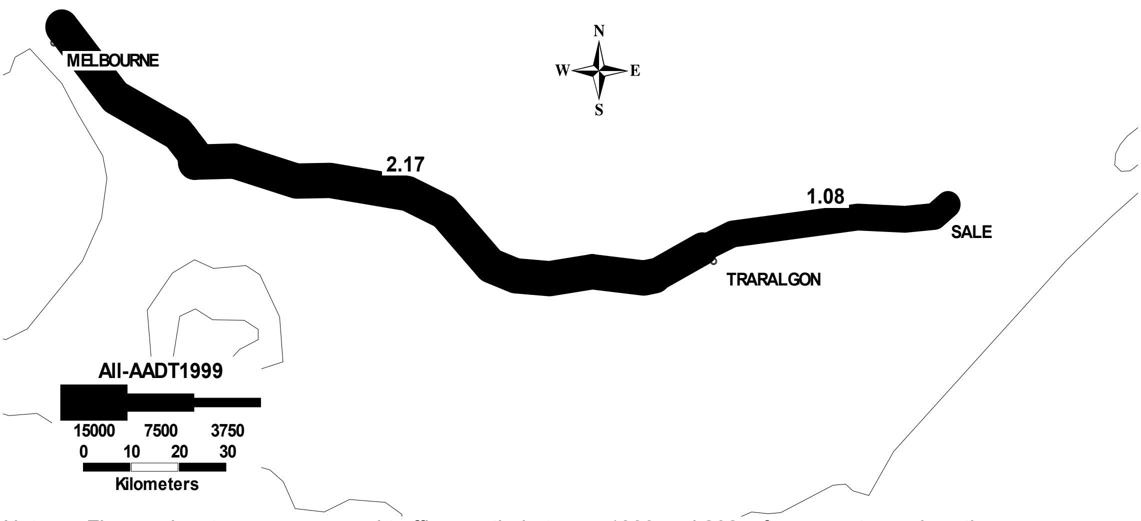
		Average traffic levels (vehicles per day)						Average annual traffic growth (per cent per annum)		
	Length	*Light vehicles*		*Heavy vehicles*		*All vehicles*		*Light*	*Heavy*	*All*
Section	*(km)*	*1999*	*2025*	*1999*	*2025*	*1999*	*2025*	*vehicles*	*vehicles*	*vehicles*
Brisbane–Maroochydore	103.8	24526	55525	2905	8783	27431	64308	3.19	4.35	3.33
Maroochydore–Gympie	46.8	8612	19911	1264	3550	9877	23462	3.28	4.05	3.38
Gympie–Maryborough	98	4822	11016	808	2177	5630	13193	3.23	3.88	3.33
Maryborough–Bundaberg	139.7	2401	5165	745	1718	3146	6883	2.99	3.27	3.06
Bundaberg–Gladstone	149.2	2189	4572	608	1538	2796	6110	2.87	3.63	3.05
Gladstone–Rockhampton	82.7	4900	8215	605	1410	5505	9625	2.01	3.31	2.17
Rockhampton–Mackay	332.5	3174	5353	378	718	3552	6071	2.03	2.50	2.08
Mackay–Townsville	399.8	4094	7677	526	996	4620	8673	2.45	2.49	2.45
Townsville–Cairns	346.5	5908	11945	563	1128	6471	13074	2.74	2.71	2.74
Total	1699	5431	11092	716	1710	6147	12803	2.78	3.41	2.86

Sources BTRE estimates.

12. *Melbourne–Sale corridor*

Table 3.14 lists the base year and projected traffic levels in 2025 and figure 3.19 illustrates base year traffic and projected traffic growth on the Melbourne–Sale corridor. Traffic along the Princes Highway between Melbourne and Sale is projected to grow by 2.11 per cent per annum between 1999 and 2025, with substantially greater projected growth on the Melbourne–Traralgon segment of the corridor, due mainly to higher forecast population growth for Melbourne. The projections show noticeably higher growth in light vehicle traffic on the Melbourne–Traralgon section but significantly higher growth in heavy vehicle growth along the Traralgon–Sale section.

FIGURE 3.19 MELBOURNE–SALE CORRIDOR: BASE YEAR TRAFFIC LEVELS AND PROJECTED TRAFFIC GROWTH 1999–2025



Note Figures denote average annual traffic growth, between 1999 and 2025, for separate road sections,

Source BTRE estimates.

TABLE 3.14 MELBOURNE–SALE CORRIDOR: BASE YEAR AND PROJECTED TRAFFIC LEVELS, 1999 AND 2025

		Average traffic levels (vehicles per day)						Average annual traffic growth (per cent per annum)		
	Length	Light vehicles		Heavy vehicles		All vehicles		Light	Heavy	All
Section	*(km)*	*1999*	*2025*	*1999*	*2025*	*1999*	*2025*	*vehicles*	*vehicles*	*vehicles*
Melbourne–Traralgon	151.6	17100	29255	2081	4250	19181	33505	2.09	2.78	2.17
Traralgon–Sale	21.6	8286	10739	916	1437	9202	12176	1.00	1.75	1.08
Total	173.2	16001	26946	1936	3899	17937	30845	2.02	2.73	2.11

Sources BTRE estimates.

TABLE 3.15 PERTH–BUNBURY CORRIDOR: BASE YEAR AND PROJECTED TRAFFIC LEVELS, 1999 AND 2025

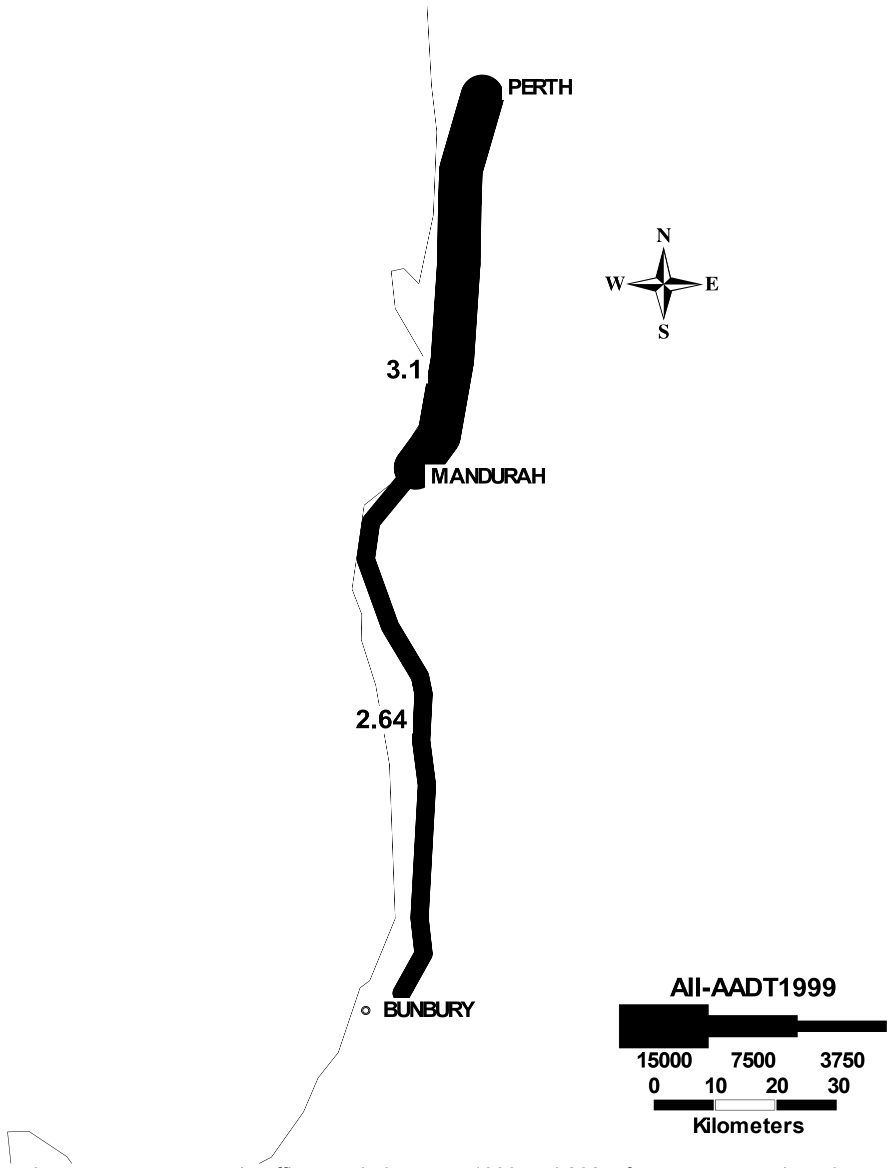
		Average traffic levels (vehicles per day)						Average annual traffic growth (per cent per annum)		
	Length	Light vehicles		Heavy vehicles		All vehicles		Light	Heavy	All
Section	*(km)*	*1999*	*2025*	*1999*	*2025*	*1999*	*2025*	*vehicles*	*vehicles*	*vehicles*
Perth to Outskirts	40.3	26495	58311	1704	4096	28199	62406	3.08	3.43	3.10
Perth to Mandurah	20.9	21338	46816	1388	3387	22726	50203	3.07	3.49	3.10
Mandurah to Bunbury	83.7	5853	11196	685	1693	6538	12889	2.53	3.54	2.64
Total	144.9	13828	29437	1070	2606	14897	32043	2.95	3.48	2.99

Sources BTRE estimates.

13. *Perth–Bunbury corridor*

Table 3.15 lists the base year and projected traffic levels in 2025 and figure 3.20 illustrates base year traffic and projected traffic growth on the Perth–Bunbury corridor, which follows the Old Coast Road between Perth and Bunbury. Total traffic is projected to grow by 2.99 per cent per annum between 1999 and 2025, fuelled mainly by growth in light vehicle traffic. Traffic growth is projected to be strongest on the sections between Perth and the growing population centre at Mandurah, approximately 80 km south of Perth CBD. Light vehicle traffic growth is projected to outstrip heavy vehicle growth along the length of the corridor.

FIGURE 3.20 PERTH–BUNBURY CORRIDOR: BASE YEAR TRAFFIC LEVELS AND PROJECTED TRAFFIC GROWTH 1999–2025



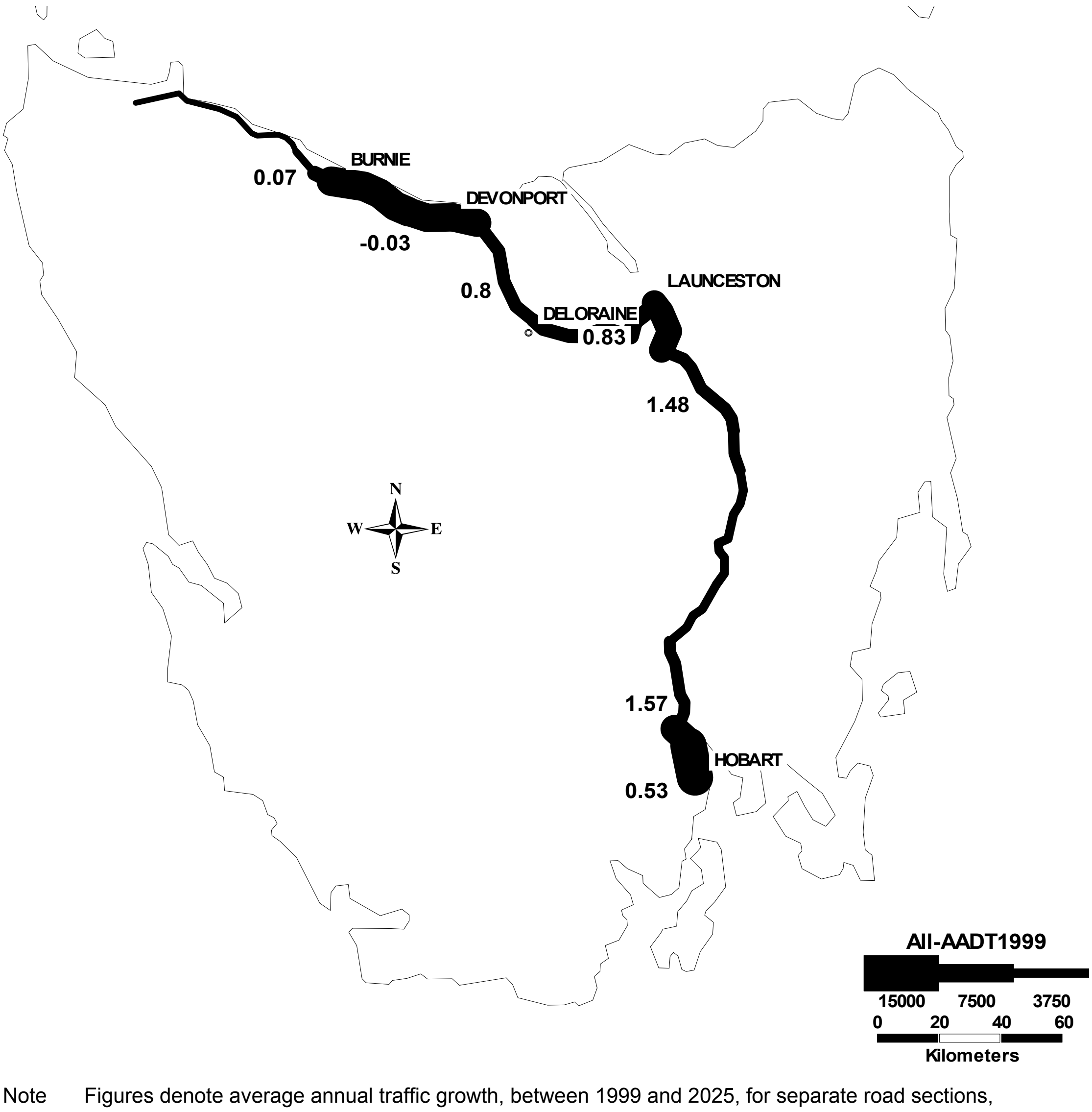
Note Figures denote average annual traffic growth, between 1999 and 2025, for separate road sections,

Source BTRE estimates.

14. Hobart–Smithton corridor

Table 3.16 lists the base year and projected traffic levels in 2025 and figure 3.21 illustrates base year traffic and projected traffic growth on the Hobart–Smithton corridor. Traffic growth along the Hobart–Smithton corridor, comprising the Midland and Bass Highways, is projected to grow by approximately 0.8 per cent per annum between 1999 and 2025. This is a relatively slow rate of traffic growth compared with that projected for the other major corridors, reflecting relatively low projected population and economic growth for Tasmania over the projection period. Projected heavy vehicle traffic growth exceeds projected light vehicle growth along all corridor sections. Based on the population assumptions, light vehicle traffic is projected to decline along the Devonport–Burnie and Burnie–Smithton sections of the corridor.

FIGURE 3.21 HOBART–SMITHTON CORRIDOR: BASE YEAR TRAFFIC LEVELS AND PROJECTED TRAFFIC GROWTH 1999–2025



Note Figures denote average annual traffic growth, between 1999 and 2025, for separate road sections,

Source BTRE estimates.

TABLE 3.16 HOBART–SMITHTON CORRIDOR: BASE YEAR AND PROJECTED TRAFFIC LEVELS, 1999 AND 2025

		Average traffic levels (vehicles per day)						Average annual traffic growth (per cent per annum)		
	Length	Light vehicles		Heavy vehicles		All vehicles		Light	Heavy	All
Section	(km)	1999	2025	1999	2025	1999	2025	vehicles	vehicles	vehicles
Hobart–Bridgewater	18.3	23673	25571	3234	5340	26908	30912	0.30	1.95	0.53
Bridgewater–Campbelltown	112.7	3465	4875	1009	1831	4474	6706	1.32	2.32	1.57
Campbelltown–Launceston	57	4513	6369	1254	2084	5767	8454	1.33	1.97	1.48
Launceston–Deloraine	36.2	6211	7380	1472	2151	7683	9531	0.67	1.47	0.83
Deloraine–Devonport	74.3	5342	6336	1262	1789	6604	8125	0.66	1.35	0.80
Devonport–Burnie	45.3	9498	8651	2053	2820	11551	11471	–0.36	1.23	–0.03
Burnie–Smithton	82.9	3116	2904	810	1091	3926	3995	–0.27	1.15	0.07
Total	426.7	5604	6447	1293	1996	6897	8444	0.54	1.68	0.78

Sources BTRE estimates.

TABLE 3.17 MELBOURNE–MILDURA CORRIDOR: BASE YEAR AND PROJECTED TRAFFIC LEVELS, 1999 AND 2025

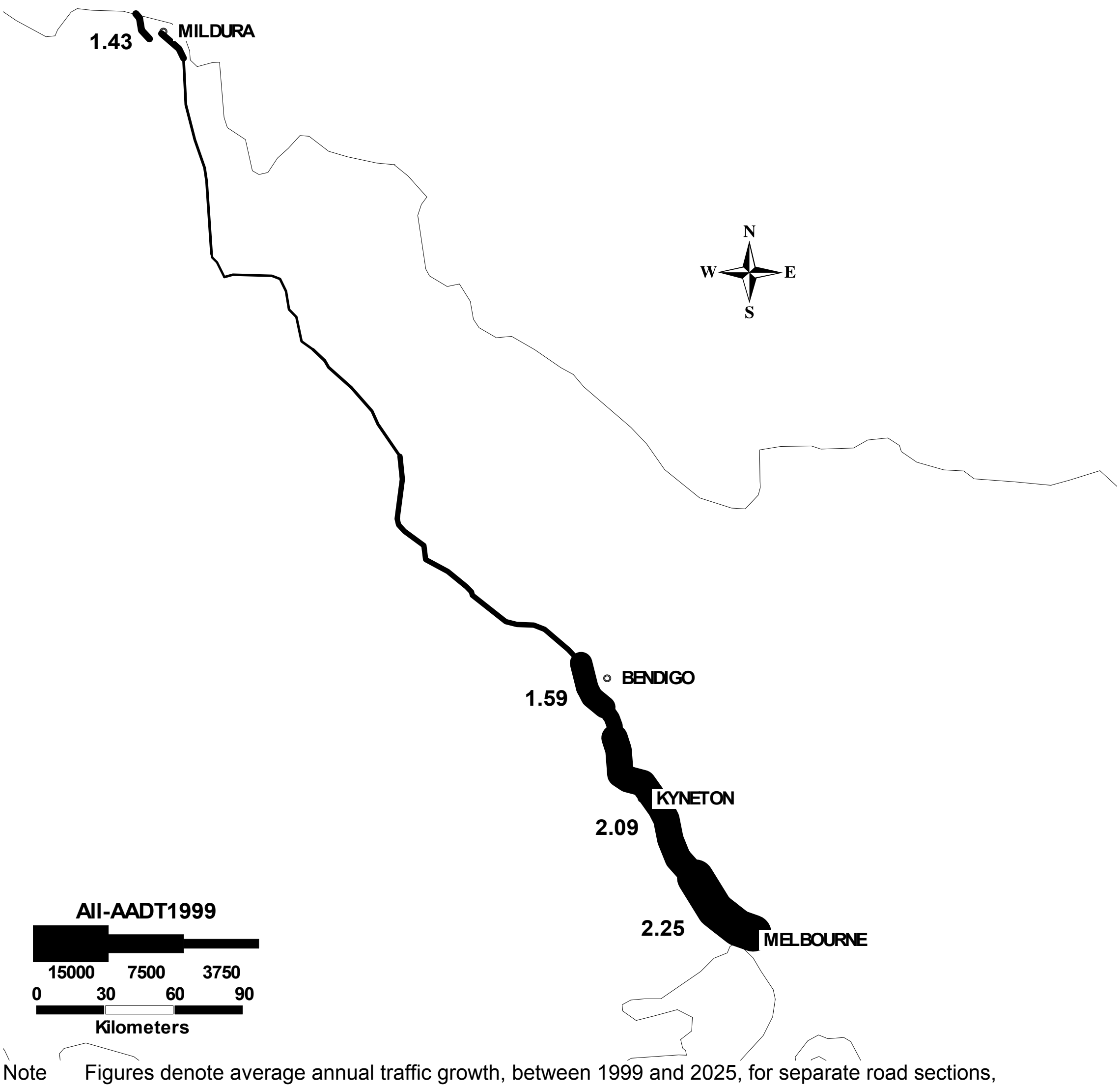
		Average traffic levels (vehicles per day)						Average annual traffic growth (per cent per annum)		
	Length	Light vehicles		Heavy vehicles		All vehicles		Light	Heavy	All
Section	(km)	1999	2025	1999	2025	1999	2025	vehicles	vehicles	vehicles
Melbourne–Kyneton	90	14214	24925	1715	3473	15930	28397	2.18	2.75	2.25
Kyneton–Bendigo	42	5904	10167	978	1618	6882	11784	2.11	1.95	2.09
Bendigo–Ouyen	305.8	1788	2715	247	355	2035	3070	1.62	1.40	1.59
Ouyen–Mildura	109.5	1544	2251	229	314	1773	2565	1.46	1.22	1.43
Total	547.3	4098	6846	541	956	4639	7803	1.99	2.21	2.02

Sources BTRE estimates.

15. *Melbourne–Mildura corridor*

Table 3.17 lists the base year and projected traffic levels in 2025 and figure 3.22 illustrates base year traffic and projected traffic growth along the Melbourne–Mildura corridor. Traffic levels along the Melbourne–Mildura corridor, which is defined as the Calder Highway between Melbourne and Mildura, are projected to grow by 2.0 per cent per annum between 1999 and 2025, with the most significant growth projected to occur along those sections closest to Melbourne. This is in line with similar patterns observed around capital cities along all other corridors and reflects the stronger projected population and economic growth in the capital cities. Projected growth in heavy vehicle traffic exceeds that of light vehicles along all corridor sections.

FIGURE 3.22 MELBOURNE–MILDURA CORRIDOR: BASE YEAR TRAFFIC LEVELS AND PROJECTED TRAFFIC GROWTH 1999–2025

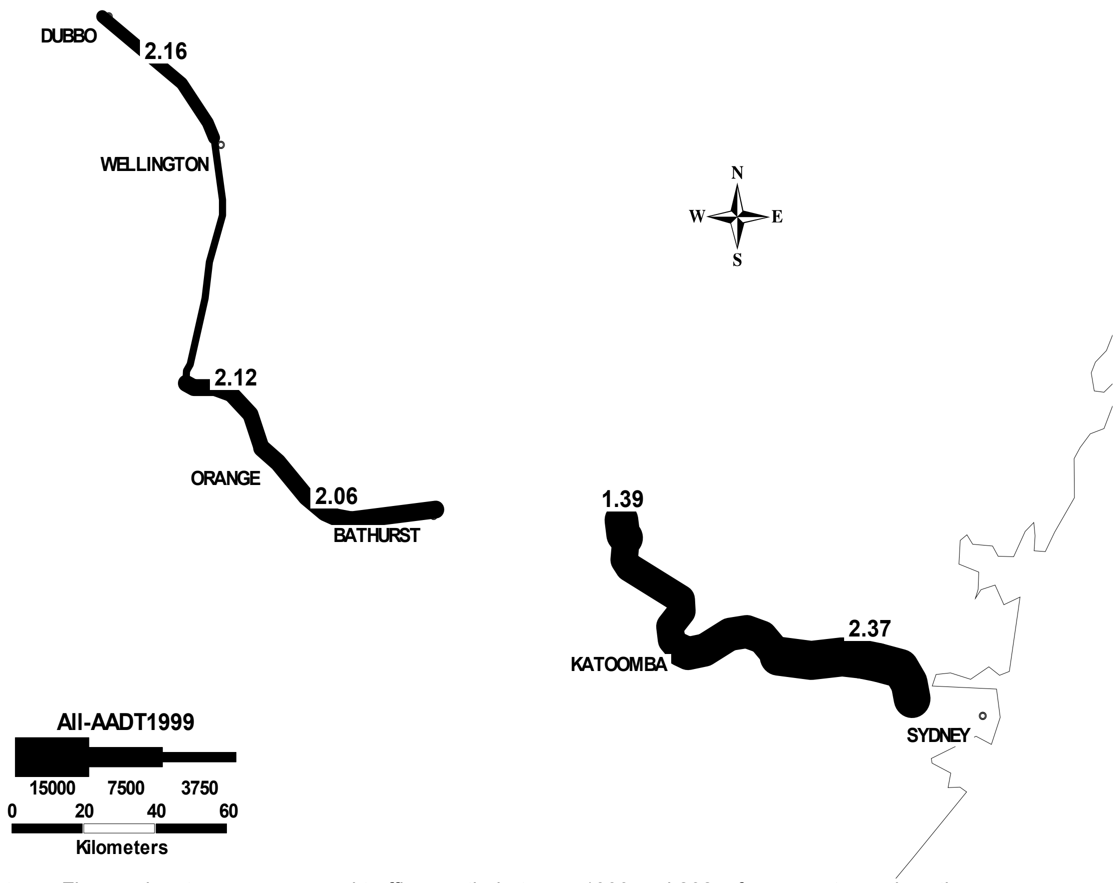


Note Figures denote average annual traffic growth, between 1999 and 2025, for separate road sections,
Source BTRE estimates.

16. Sydney–Dubbo corridor

Table 3.18 lists the base year and projected traffic levels in 2025 and figure 3.23 illustrates base year traffic and projected traffic growth along the Sydney–Dubbo corridor. The Sydney–Dubbo corridor comprises the Great Western and Mitchell Highways. Traffic along the corridor is projected to grow by approximately 2.1 per cent per annum between 1999 and 2025. Projected traffic growth is fairly consistent along the length of the corridor, albeit with slightly higher growth projected for the Great Western Highway section of the corridor, closer to Sydney, than along the Mitchell Highway. Heavy vehicle traffic is projected to grow slightly faster than light vehicle traffic on all segments of the corridor. Note that the section of the Great Western Highway between Lithgow and Bathurst is not included in the analysis due to missing data. The BTRE does not expect that its inclusion would substantially alter the overall results.

FIGURE 3.23 SYDNEY–DUBBO CORRIDOR: BASE YEAR TRAFFIC LEVELS AND PROJECTED TRAFFIC GROWTH 1999–2025



Note Figures denote average annual traffic growth, between 1999 and 2025, for separate road sections, No base year road traffic volume data available for section between Lithgow and Bathurst.

Source BTRE estimates.

TABLE 3.18 SYDNEY–DUBBO CORRIDOR: BASE YEAR AND PROJECTED TRAFFIC LEVELS, 1999 AND 2025

		Average traffic levels (vehicles per day)						Average annual traffic growth (per cent per annum)		
	Length	Light vehicles		Heavy vehicles		All vehicles		Light	Heavy	All
Section	(km)	1999	2025	1999	2025	1999	2025	vehicles	vehicles	vehicles
Sydney–Katoomba	87.3	17044	30719	3103	6334	20147	37052	2.29	2.78	2.37
Katoomba–Bathurst	62.8	10554	14549	1936	3319	12490	17868	1.24	2.10	1.39
Bathurst–Orange	54.7	6382	10819	1157	1993	7540	12813	2.05	2.11	2.06
Orange–Wellington	103.3	3045	5111	546	1080	3591	6190	2.01	2.66	2.12
Wellington–Dubbo	20	4047	6801	723	1510	4770	8311	2.02	2.87	2.16
Total	328.1	8824	14786	1605	3085	10430	17870	2.01	2.55	2.09

Sources BTRE estimates.

TABLE 3.19 TOWNSVILLE–MT ISA CORRIDOR: BASE YEAR AND PROJECTED TRAFFIC LEVELS, 1999 AND 2025

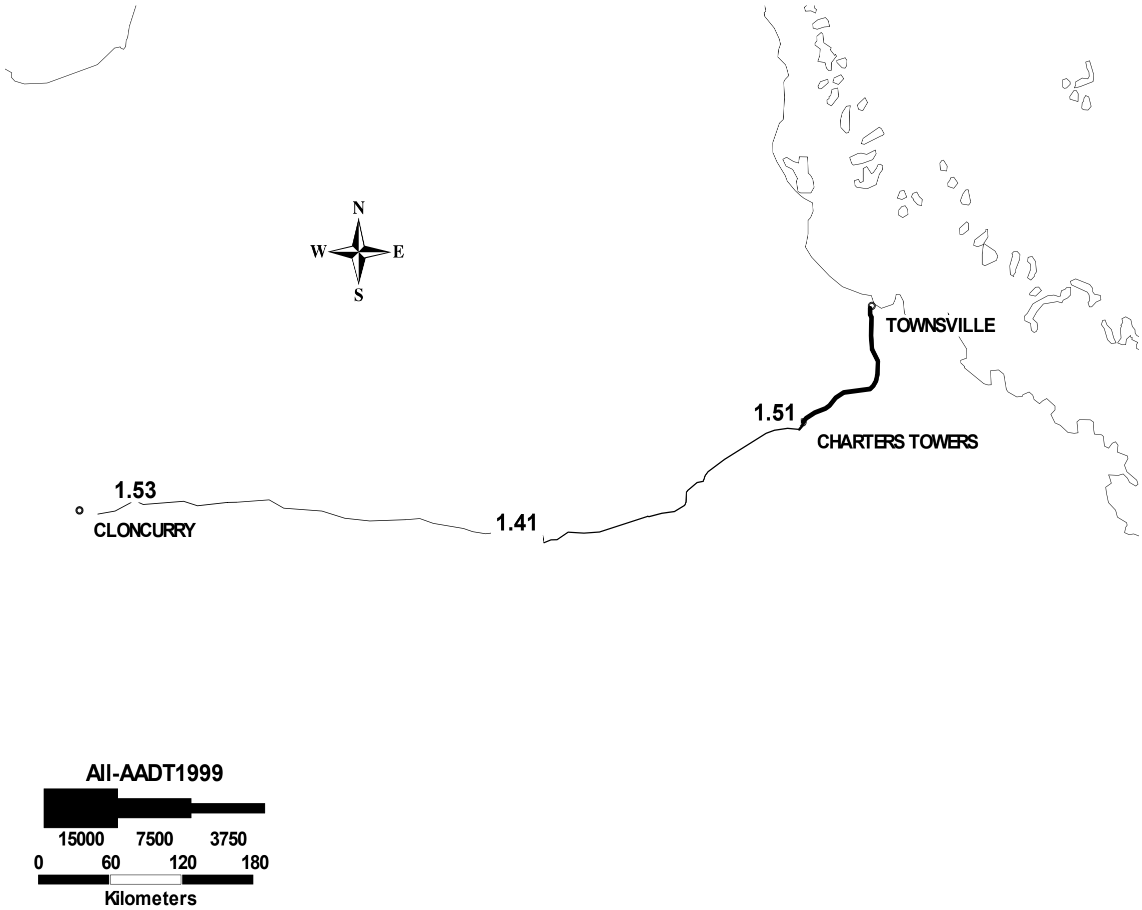
		Average traffic levels (vehicles per day)						Average annual traffic growth (per cent per annum)		
	Length	Light vehicles		Heavy vehicles		All vehicles		Light	Heavy	All
Section	(km)	1999	2025	1999	2025	1999	2025	vehicles	vehicles	vehicles
Townsville–Charters Towers	132.8	1590	2264	268	475	1857	2739	1.37	2.23	1.51
Charters Towers–Hughenden	242.9	373	559	127	162	499	721	1.57	0.95	1.42
Hughenden–Julia Creek	264.2	178	292	88	91	266	383	1.92	0.12	1.41
Julia Creek–Landsborough Hwy	123.1	241	398	85	87	326	484	1.95	0.07	1.53
Total	763	496	737	131	180	627	917	1.53	1.23	1.47

Sources BTRE estimates.

17. Townsville–Mt Isa corridor

Table 3.19 lists the base year and projected traffic levels in 2025 and figure 3.24 illustrates base year traffic and projected traffic growth along the Townsville–Mt Isa corridor. Total traffic along the Townsville–Mt Isa corridor, comprising the Flinders and Barkly Highways, is projected to grow by 1.8 per cent per annum between 1999 and 2025, albeit from a low base. Traffic levels west of Charters Towers are between 200 and 500 vehicles per day and are projected to not exceed 1000 vehicles per day by 2025. Light vehicle traffic is projected to grow more quickly than heavy vehicles traffic, except over the Townsville–Charters Towers segment of the corridor.

FIGURE 3.24 TOWNSVILLE–MT ISA CORRIDOR: BASE YEAR TRAFFIC LEVELS AND PROJECTED TRAFFIC GROWTH 1999–2025

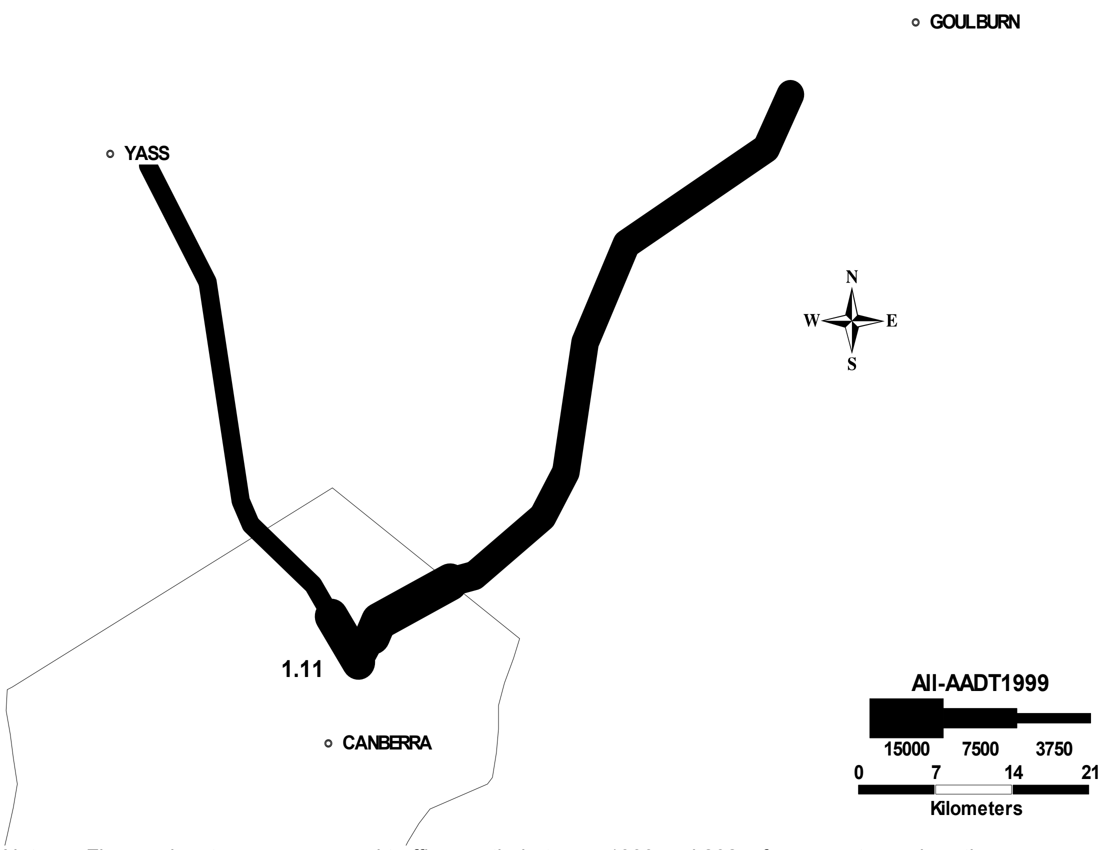


Note Figures denote average annual traffic growth, between 1999 and 2025, for separate road sections,
Source BTRE estimates.

18. Canberra connectors

Table 3.20 lists the base year and projected traffic levels in 2025 and figure 3.25 illustrates base year traffic and projected traffic growth on the Canberra connectors. The Canberra connectors comprise the Barton Highway and the Federal Highway, and link Canberra with the Hume Highway. Traffic levels on the Barton Highway are projected to grow by 1.1 per cent per annum between 1999 and 2025, with heavy vehicle traffic projected to grow faster than light vehicle traffic. Traffic on the Federal Highway, the connector for travel between Sydney and Canberra is projected to grow more quickly, by 2.5 per cent per annum, again with heavy vehicle traffic projected to grow more quickly than light vehicle traffic.

FIGURE 3.25 CANBERRA CONNECTORS: BASE YEAR TRAFFIC LEVELS AND PROJECTED TRAFFIC GROWTH 1999–2025



Note Figures denote average annual traffic growth, between 1999 and 2025, for separate road sections,

Source BTRE estimates.

TABLE 3.20 CANBERRA CONNECTORS: BASE YEAR AND PROJECTED TRAFFIC LEVELS, 1999 AND 2025

		Average traffic levels (vehicles per day)						Average annual traffic growth (per cent per annum)		
	Length	Light vehicles		Heavy vehicles		All vehicles		Light vehicles	Heavy vehicles	All vehicles
Section	(km)	1999	2025	1999	2025	1999	2025			
Federal Hwy	73.5	11077	20940	865	1968	11942	22908	2.48	3.21	2.54
Barton Hwy	48.9	8033	10164	882	1718	8915	11882	0.91	2.60	1.11
Total	122.4	9861	16635	872	1868	10733	18503	2.03	2.97	2.12

Sources BTRE estimates.

TABLE 3.21 SYDNEY–WOLLONGONG CORRIDOR: BASE YEAR AND PROJECTED TRAFFIC LEVELS, 1999 AND 2025

		Average traffic levels (vehicles per day)						Average annual traffic growth (per cent per annum)		
	Length	Light vehicles		Heavy vehicles		All vehicles		Light vehicles	Heavy vehicles	All vehicles
Section	(km)	1999	2025	1999	2025	1999	2025			
Sydney–Wollongong	93.2	21410	33232	8637	17315	30047	50546	1.71	2.71	2.02

Sources BTRE estimates.

TABLE 3.22 MELBOURNE–GEELONG CORRIDOR: BASE YEAR AND PROJECTED TRAFFIC LEVELS, 1999 AND 2025

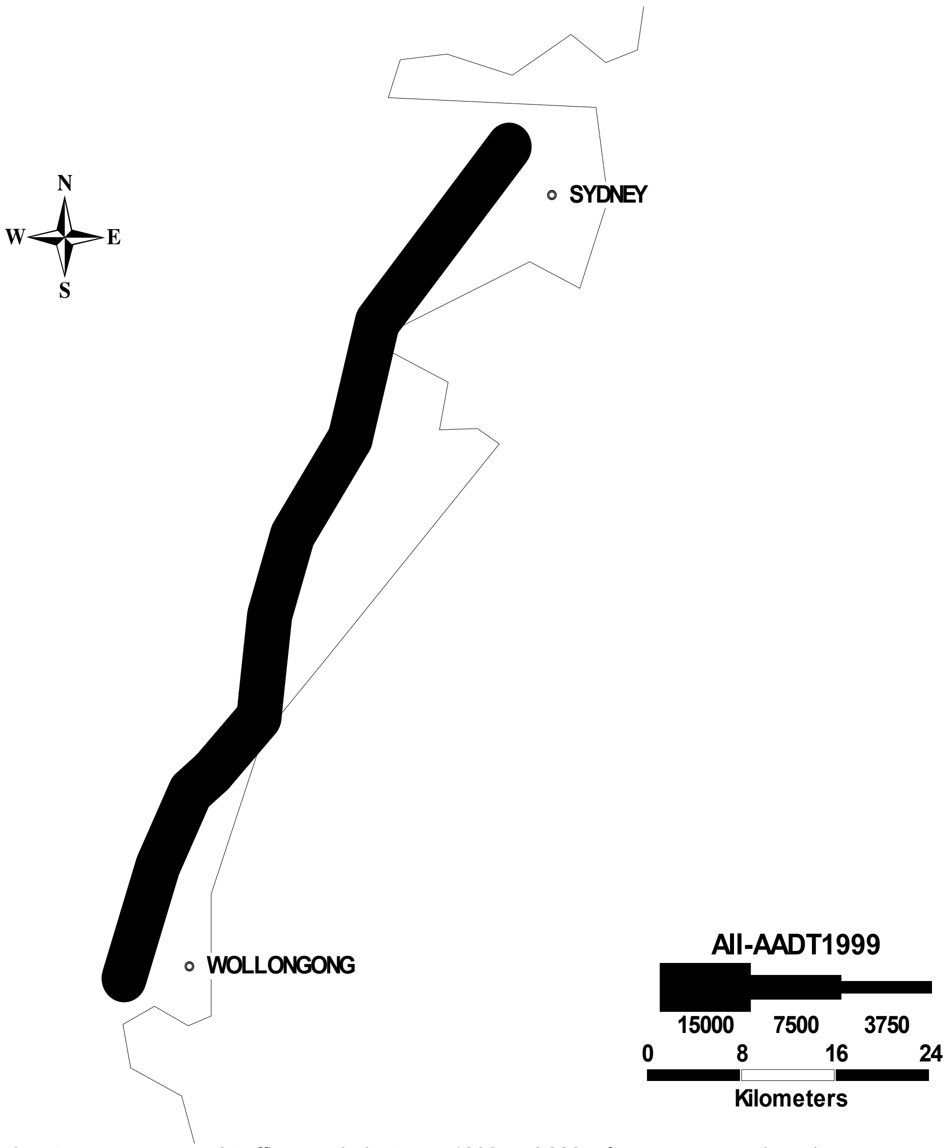
		Average traffic levels (vehicles per day)						Average annual traffic growth (per cent per annum)		
	Length	Light vehicles		Heavy vehicles		All vehicles		Light vehicles	Heavy vehicles	All vehicles
Section	(km)	1999	2025	1999	2025	1999	2025			
Melbourne to Outskirts	9.3	68554	115300	7719	14746	76273	130046	2.02	2.52	2.07
Outskirts to Geelong	62.3	36551	66140	4199	8182	40750	74322	2.31	2.60	2.34
Total	71.6	40708	72525	4656	9035	45364	81560	2.25	2.58	2.28

Sources BTRE estimates.

19. Sydney–Wollongong corridor

Table 3.21 lists the base year and projected traffic levels in 2025 and figure 3.26 illustrates base year traffic and projected traffic growth on the Sydney–Wollongong corridor. The Sydney–Wollongong corridor is a mix of freeway and highway conditions. Total traffic is projected to grow by 2.0 per cent per annum between 1999 and 2025, with heavy vehicle traffic projected to grow by 2.7 per cent per annum and light vehicle traffic by 1.7 per cent per annum over that period.

FIGURE 3.26 SYDNEY–WOLLONGONG CORRIDOR: BASE YEAR TRAFFIC LEVELS AND PROJECTED TRAFFIC GROWTH 1999–2025



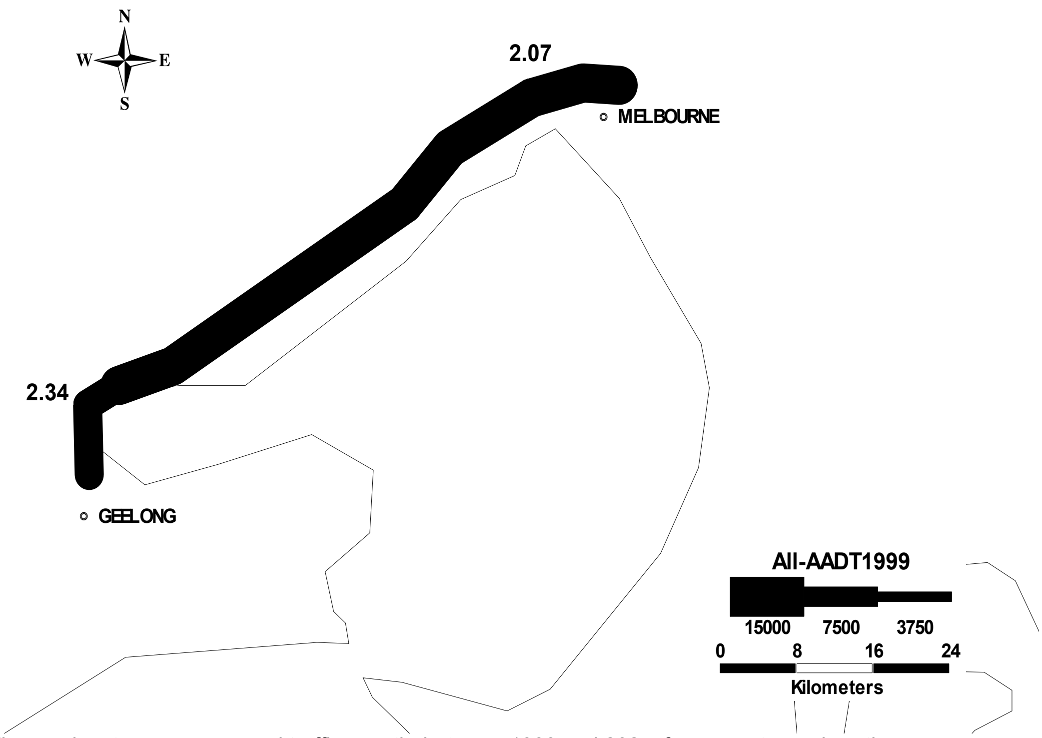
Note Figures denote average annual traffic growth, between 1999 and 2025, for separate road sections,

Source BTRE estimates.

20. Melbourne–Geelong corridor

Table 3.22 lists the base year and projected traffic levels in 2025 and figure 3.27 illustrates base year traffic and projected traffic growth on the Melbourne–Geelong corridor—Princes Freeway. Traffic along the Princes Freeway is projected to grow by 2.28 per cent per annum between 1999 and 2025. Heavy vehicle traffic is projected to grow slightly faster, 2.6 per cent per annum, than light vehicle traffic, 2.25 per cent per annum.

FIGURE 3.27 MELBOURNE–GEELONG CORRIDOR: BASE YEAR TRAFFIC LEVELS AND PROJECTED TRAFFIC GROWTH 1999–2025



Note Figures denote average annual traffic growth, between 1999 and 2025, for separate road sections,
Source BTRE estimates.

The results presented here are just a summary of the results available from the OZPASS and FreightSim models. As already mentioned, appendix IX provides some further illustrations of the projected growth in traffic, for the 10 interstate corridors and the Brisbane–Cairns corridor, between the base year and 2015. Because the OZPASS and FreightSim models provide estimates of all movements by OD pair, when combined with the State and Territory road traffic data, it is possible to make inferences about the proportion of total trips on along any corridor by place of origin and place of destination. Producing a catalogue of such results was beyond the scope of this paper.

AUGMENTING THE TRAFFIC GROWTH PROJECTIONS

OZPASS and FreightSim models are designed to provide projections of non-urban traffic levels Australia-wide, using a consistent methodology. The strength of the models is in projecting growth in long-distance inter-regional freight movements between major population centres. However, because OZPASS and FreightSim are so broad in scope they will necessarily abstract from some of the small-area, local-level influences that may affect growth in local traffic along parts of the AusLink National Network, such as, for example, the development of a new mine site with the associated increase in local freight movements.

It is perfectly reasonable to augment the OZPASS and FreightSim projections with more detailed local-level information where that is available. In particular, traffic growth on the AusLink networks around provincial urban centres will be predominantly affected by local traffic arrangements. For example, where there is a town bypass, traffic levels on the corridor will be much less than where the corridor runs through the town centre. Changes in local traffic arrangements, or construction of town bypasses, will influence future traffic levels across parts of the corridor. Local planning information, to the extent that it is available, may be used to improve on these AusLink traffic projections around provincial urban centres.

COMPARISON WITH OTHER TRAFFIC PROJECTIONS

This paper is intended to demonstrate the BTRE OZPASS and FreightSim passenger and freight movement projections models and their applicability to providing long-term projections of traffic growth across the non-urban links of the AusLink National Network. This paper also provides a base case set projections of traffic growth across the AusLink National Network, based on assumptions about future population growth, economic growth and transport costs. The last step in the projection process would be to check the reasonableness of the projected traffic growth against other projections and historical trends. At this stage, the BTRE has not undertaken any comprehensive comparisons with other projections or past traffic growth, mainly because the data has not yet been available.

SUMMARY

- OZPASS and FreightSim models provide projections of total inter-regional origin–destination passenger travel, in terms of passenger numbers, and freight movements, in terms of tonnages. In order to evaluate infrastructure it is often necessary to convert passenger and freight movements to measures of total vehicle traffic.
- The BTRE assumes an average vehicle occupancy factor of 1.8 persons per vehicle for rural passenger travel to convert inter-regional passenger movements into equivalent vehicle movements. For freight movements, the BTRE has used FDF Pty Ltd's *FreightTrucks*™ model to convert inter-regional freight tonnages into equivalent freight vehicle movements.
- The BTRE's traffic projection method splits traffic into four components—inter-regional and local traffic for each of passenger and freight vehicle traffic—and projects growth separately for each components. To derive local passenger and freight vehicle traffic the BTRE first assigns the inter-regional traffic to the road network and then subtracts the assigned traffic from road authority estimates of total traffic. In this way, the base year traffic matches observed total on-road traffic.
- The traffic projections presented in this chapter imply growth in total traffic across the non-urban sections of the AusLink National Network of 2.14 per cent per annum between 1999 and 2025. Growth in light vehicle traffic—2.1 per cent per annum—is projected to be slightly slower than growth in heavy vehicle traffic—2.5 per cent per annum—across the network.
- The network wide average annual traffic growth estimates encompass significant variation in traffic growth on individual corridors. Some of the notable results from these projections are:
  - Overall traffic growth is projected to be strongest on the east coast corridors, particularly Sydney–Brisbane (coastal) and Brisbane–Cairns, due to strong projected population growth along the east coast. The Perth–Bunbury corridor is also projected to experience strong traffic growth due to population growth.
  - The Adelaide–Darwin and Perth–Darwin corridors are projected to experience strong light vehicle traffic growth, albeit from a very low base, as a result of strong population and foreign tourist growth.
- The breadth of OZPASS and FreightSim models mean that they necessarily abstract from small-area, local-level detail. Local level planning information, where it is available, may be used to augment the OZPASS and FreightSim projections to derive better estimates of future traffic growth across the AusLink National Network.

CHAPTER 4 CONCLUDING REMARKS

This paper has outlined the BTRE's OZPASS and FreightSim models and provided projections, to 2025, of total inter-regional passenger travel, freight movements and traffic growth across the non-urban corridors of the AusLink National Network. This chapter provides some final remarks about the models, proposing areas for potential improvement, and outlines the tasks involved in updating the projections using more current data.

OZPASS AND FREIGHTSIM—A RECAP

OZPASS and FreightSim are designed to project long-term trends in inter-regional passenger travel and freight movements, for all major transport modes, across Australia, and, by extension, the implications for non-urban light and heavy road vehicle traffic growth. The models were designed for deriving projections of future passenger and freight movements across non-urban links of the AusLink National Network.

The strength of OZPASS and FreightSim is that they provide a single consistent national approach to projecting inter-regional passenger travel and freight movements across the whole of Australia, using the best available data on origin–destination passenger and freight flows to do so. The corollary of this approach, however, is that OZPASS and FreightSim necessarily abstract from much of the small-area, local-level detail that may have a strong influence on traffic growth along small sections of an AusLink corridor. In chapter 3 it was recommended that specific local area information about future traffic growth, where it is available, may be used to augment the OZPASS and FreightSim based traffic projections.

Another feature of the OZPASS and FreightSim models is that they allow analysts to alter assumptions about future population growth or GDP growth and analyse the impact of these changes on projected passenger and freight transport growth relatively easily and transparently.

MODELLING AND DATA ISSUES

This paper represents the first attempt by the BTRE to use both OZPASS and FreightSim to project traffic across the AusLink National Network. Not surprisingly, then, this research has revealed some modelling and data issues associated with both models that warrant further attention. Most of the issues identified in the study are associated with the FreightSim and *FreightTrucks*™ models, although some are common also to OZPASS. Some of these issues are being addressed in current BTRE or BTRE commissioned work and others are in the nature of desirable model improvements that are presently not resourced.

Under-enumeration of inter-regional freight movements—*FreightInfo™* 1999

As outlined in chapter 2, the *FreightInfo™* 1999 freight flows, which are used as input into FreightSim, appear to under-estimate total inter-capital road freight movements, particularly for non-bulk freight moving between capital cities. (Appendix VII describes the methods used to validate the *FreightInfo™* data.) For the projections presented in chapters 2 and 3 in this paper, the BTRE substituted the inter-urban non-bulk road freight movements data, between selected urban centres, from the ABS (2002a) Freight Movements Survey (FMS), appropriately scaled for the 10–15 per cent under-enumeration apparent in that survey, for the corresponding *FreightInfo™* 1999 data. This approach appears to provide more reliable estimates of base inter-capital road freight movements.

The BTRE has commissioned FDF Pty Ltd to update the *FreightInfo™* database to 2003–04. As part of that work, the BTRE has asked FDF Pty Ltd to pay attention to the issue of under-enumeration of non-bulk road freight.

Under-estimation of average truck loads and growth in truck size—FreightTrucks™

The data validation exercise also suggests that the *FreightTrucks*™ model default assumption understates the average load of commercial vehicles across the non-urban links of the AusLink National Network, and therefore will overstate the total number of inter-regional truck movements. This appears to be a particular issue for movement to and/or from non-capital city regions. For the projections presented in this paper, the BTRE has adjusted the average load assumptions and truck type mix assumptions in *FreightTrucks*™ to derive estimates of on-road heavy vehicle traffic.

Additionally, the present version of *FreightTrucks*™ does not explicitly allow for changes in vehicle type mix and average vehicle loads over time. Previous BTRE freight task projections, such as in BTRE (2002), have assumed an increase in the proportion of B-doubles, relative to six-axle articulated trucks, and a slight increase in heavy vehicle average payloads. The projected heavy vehicle traffic levels presented in chapter 3, however, are based on the adjusted *FreightTrucks*™ vehicle type mix and average vehicle loads and assume no change in vehicle mix and average loads over the projection horizon. To the extent that heavy vehicles become larger and average loads increase, the projections will be in the nature of upper end estimates of heavy vehicle traffic growth. Allowing for explicit changes in the heavy vehicle type mix and average vehicle loads in *FreightTrucks*™ is a desirable feature.

Exogenous mode share assumptions

Common to both OZPASS and FreightSim is that future mode shares are determined exogenously by the assumed mode share competitiveness indexes. The mode share competitiveness index values are based on historically estimated trends in mode share. There is no facility in the current version of OZPASS and FreightSim for mode share choice to be determined endogenously through projected changes in prices, service quality, consumer preference, etc.—the usual factors thought to directly influence mode choice. The BTRE acknowledges this is a limitation in the current design of OZPASS and FreightSim, however, the information required to endogenise mode choice in the models is not yet available. The BTRE would see endogenising mode choice as a desirable feature to have in the OZPASS and FreightSim models, but has no firm plans to redesign this aspect of the models.

Linking FreightSim to CGE model projections of regional goods movements

In the longer term, further development of FreightSim might involve linking the FreightSim base year freight flows data to a regional Computerised General Equilibrium (CGE), such as the Centre of Policy Studies' Monash and TERM models—see Adams et al. (2000) and Horridge et al. (2003) for a description of Monash and TERM. The principal advantage of using a CGE based approach to projecting inter-regional freight flows is that the CGE model includes the effect of prices on commodity supply and demand outcomes, a feature which the current version of FreightSim lacks. Currently production projections for bulk commodities must be set exogenously. A CGE model would allow bulk commodity production to be determined endogenously within the model, rather than being set exogenously.

Travel propensity of an aging population

Presently, OZPASS does not make an explicit allowance for differing travel propensities by persons of different age. With significant ageing of the Australian population projected over the next 20–30 years, further development of OZPASS may be warranted to explicitly account for the different travel propensities and average trip distances by age and also regional location.

UPDATING THE PROJECTIONS

The inter-regional travel projections presented in chapters 2 and 3 are based on 1999 base year inter-regional passenger travel and freight movement estimates, combined with population projections from 1999–2025 and Australian Treasury (2002) long-term GDP growth projections. To determine total road traffic growth across the non-urban AusLink National Network the passenger travel and freight projections are combined with base year road traffic volumes collected by State and Territory road authorities. These data sets represent the most current single year data set available to the BTRE for undertaking such projections.

The BTRE intends to update the projections, using 2003–04 base year data, when all the data becomes available. Most of the necessary data is currently available to the BTRE, but updated base freight movements data and current road traffic volume data are still required. The key data needs for such an exercise are:

- Population projections by small geographic areas. The BTRE has already obtained the latest SLA-level population projections covering the period 2002–22, which are based on the 2001 Census.
- Projections of future economic activity. The Inter-generational Report (Australian Treasury 2002) provides projections of economic output to 2040.
- Passenger travel data. Tourism Research Australia's National Visitor Survey (NVS) and International Visitor Survey (IVS) continue to provide estimates of inter-regional origin–destination passenger travel adequate for projecting future use of non-urban transport infrastructure. NVS and IVS data are presently available up to June 2004.
- Freight movements data. The BTRE has engaged FDF Pty Ltd to update the *FreightInfo*™ data to 2003–04. This dataset should be available mid-2006.
- Road traffic data. Critical to the traffic projections are detailed traffic count data for the AusLink National Network from the State and Territory road authorities. The traffic count data is required to separately enumerate light and heavy commercial vehicles. To update the projetions, traffic count data from around 2003–04 is required.

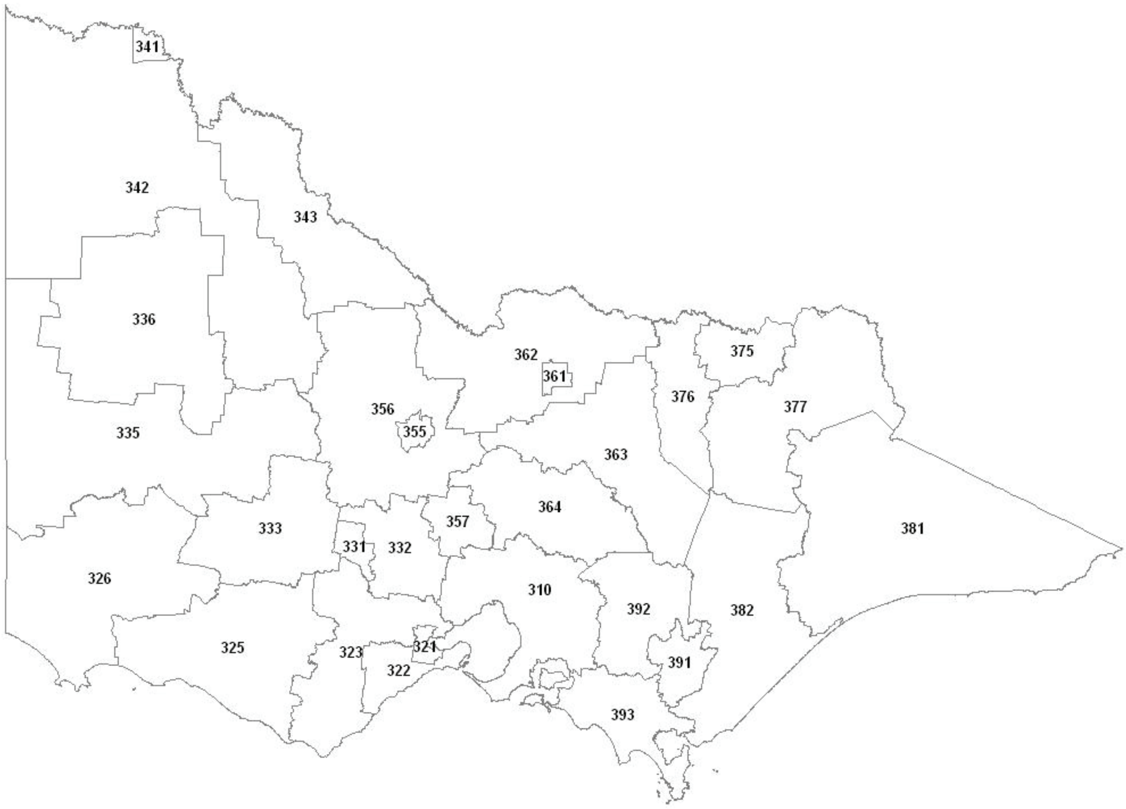
APPENDIX I FREIGHTINFO™1999 REGIONAL CLASSIFICATION

FDF Pty Ltd's *FreightInfo*™ 1999 database provides estimate of inter-regional freight movements between 132 separate regions—8 capital city Statistical Divisions, 123 Statistical Sub-Divisions and 1 overseas region—for 6 transport modes—road, rail, air, sea, pipeline and conveyer. Figures I.1 to I.7 illustrate the *FreightInfo*™ regional classification, and the region names are listed in table I.1.

FIGURE I.1 FREIGHTINFO™1999 REGIONS, NEW SOUTH WALES

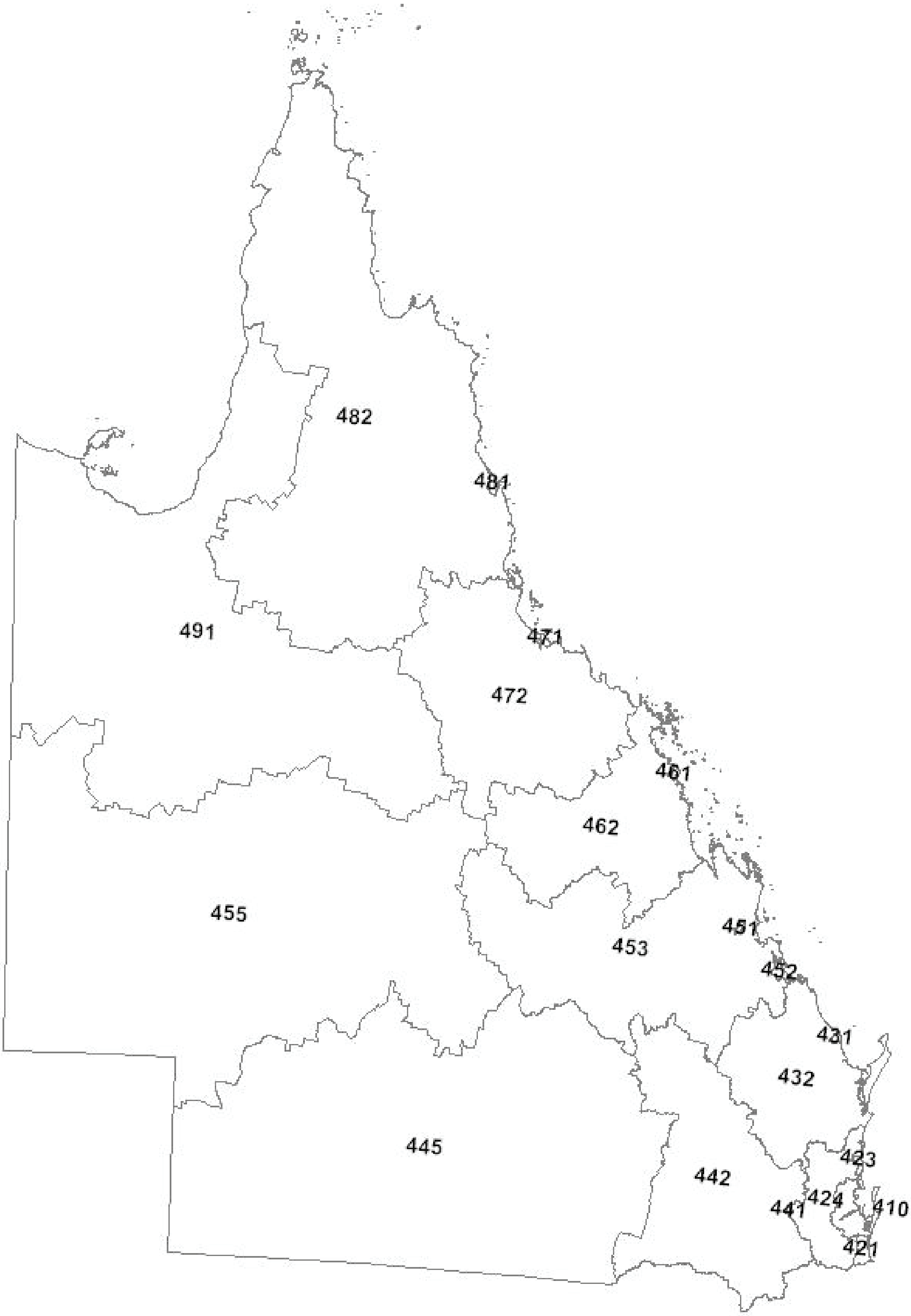
Source FDF (2001).

FIGURE I.2 FREIGHTINFO™ 1999 REGIONS, VICTORIA



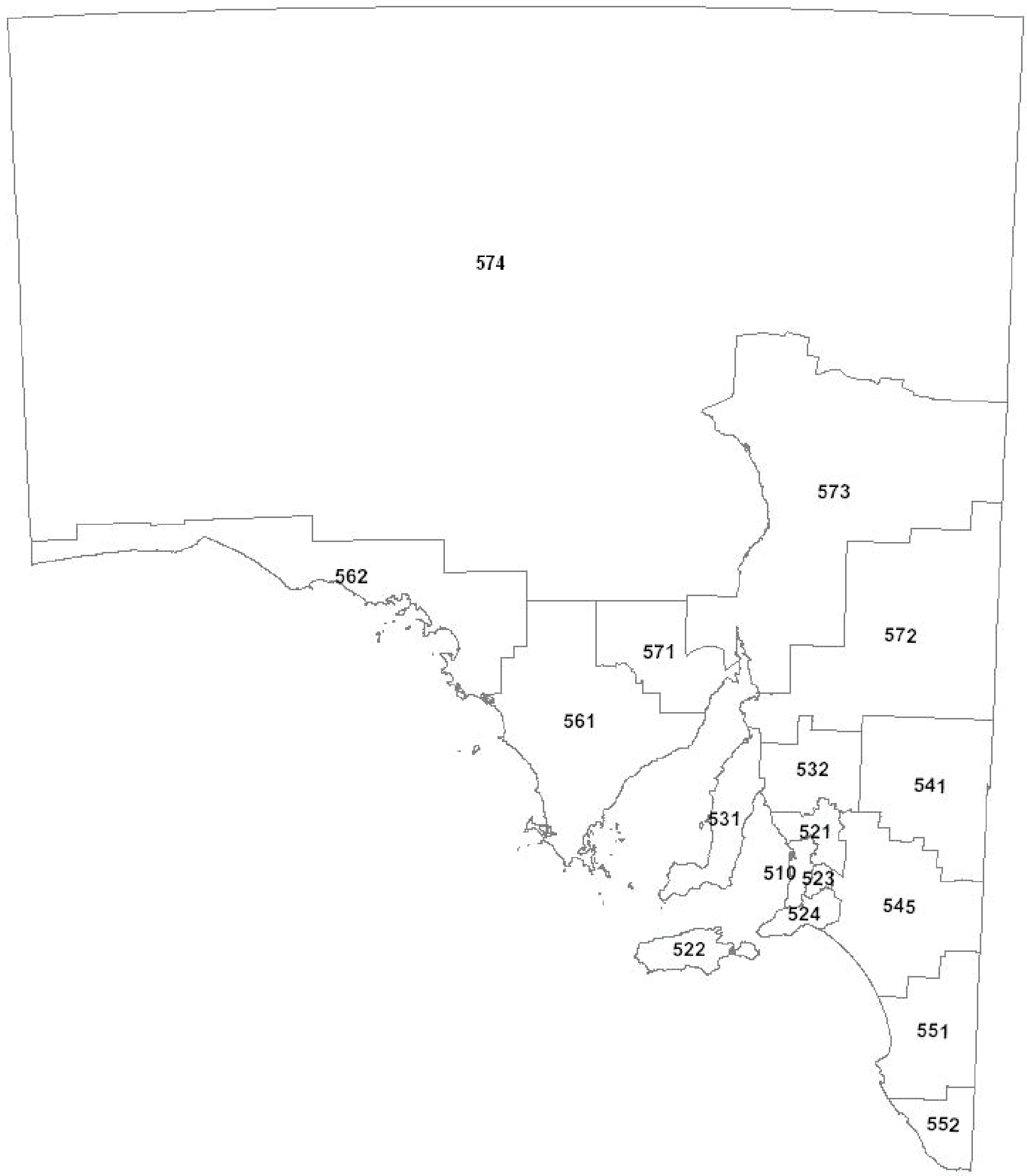
Source FDF (2001).

FIGURE I.3 FREIGHTINFO™ 1999 REGIONS, QUEENSLAND



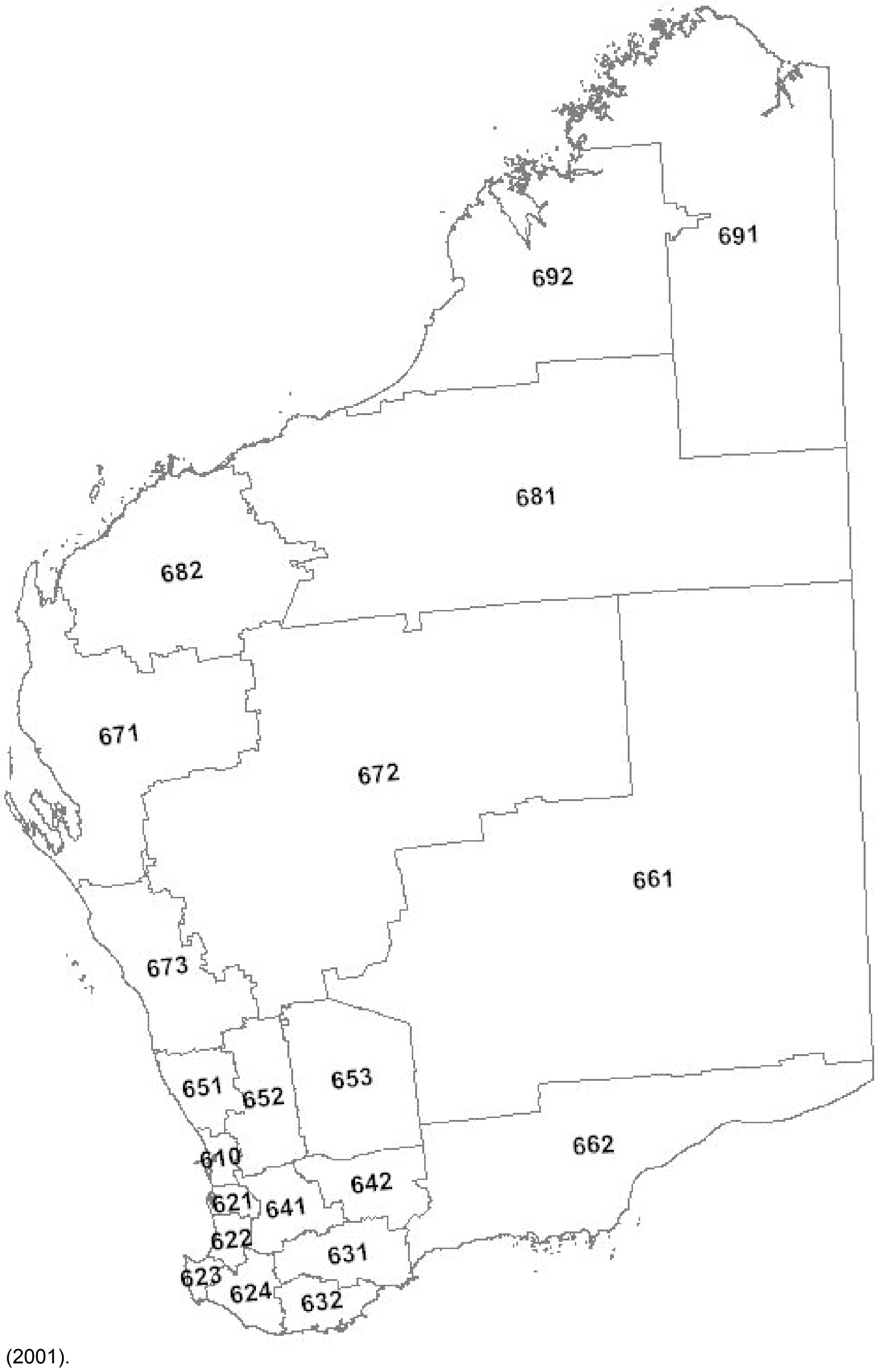
Source FDF (2001).

FIGURE I.4 FREIGHTINFO™1999 REGIONS, SOUTH AUSTRALIA



Source FDF (2001).

FIGURE I.5 FREIGHTINFO™1999 REGIONS, WESTERN AUSTRALIA

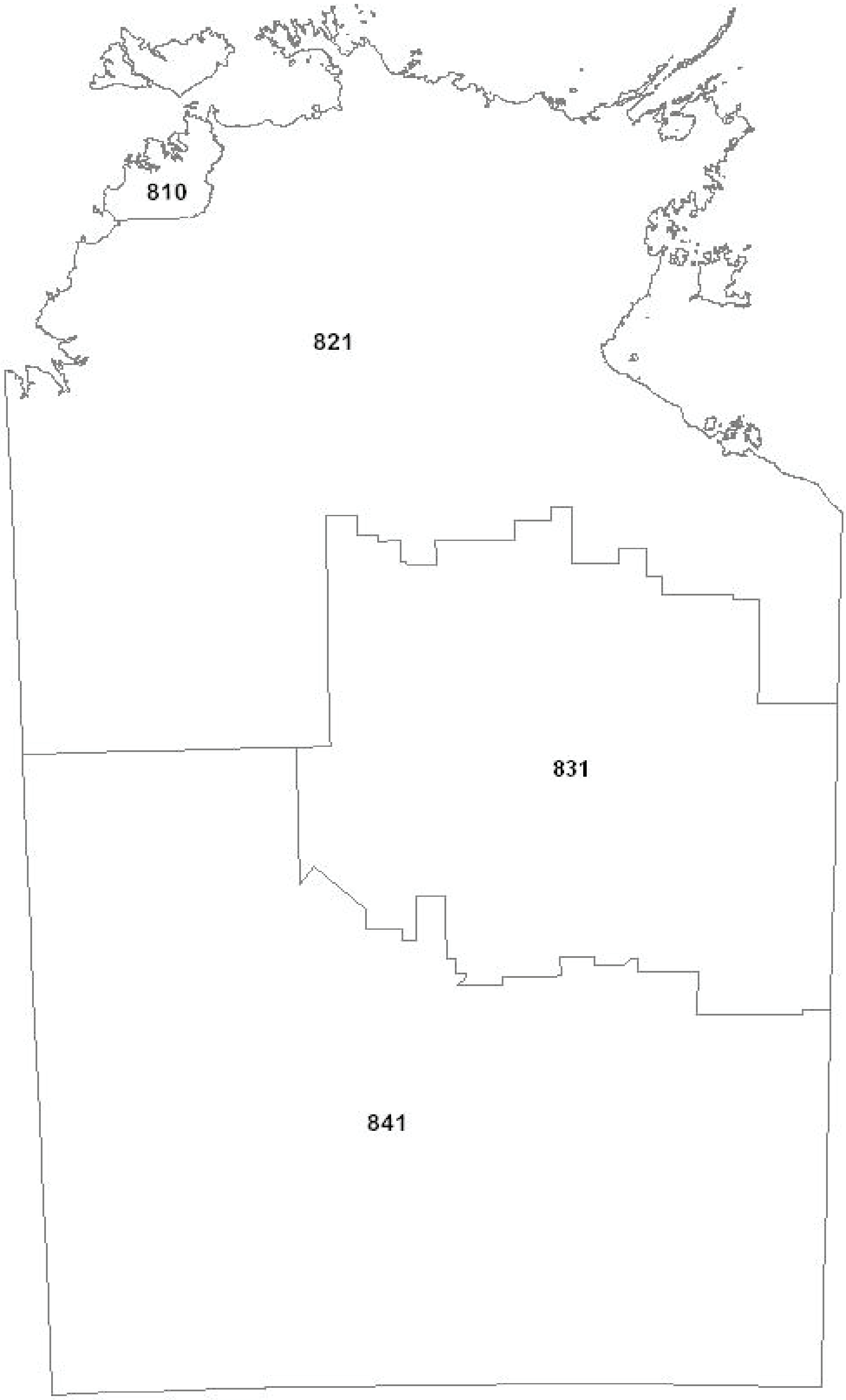


Source FDF (2001).

FIGURE I.6 FREIGHTINFO™1999 REGIONS, TASMANIA

Source FDF (2001).

FIGURE I.7 FREIGHTINFO™1999 REGIONS, NORTHERN TERRITORY



Source FDF (2001).

TABLE I.1 FREIGHTINFO™1999 GEOGRAPHIC REGIONS

Region code	*Region*
110	ACT
210	Sydney
215	Gosford-Wyong
221	Newcastle
225	Hunter (Balance)
231	Wollongong
235	Illawarra (Balance)
241	Tweed Heads
243	Richmond-Tweed (Balance)
245	Clarence
248	Hastings
251	Northern Slopes
252	Northern Tablelands
253	North Central Plain
255	Central Macquarie
256	Macquarie-Barwon
257	Upper Darling
261	Bathurst-Orange
262	Central Tablelands
263	Lachlan
265	Queanbeyan
266	Southern Tablelands
267	Lower South Coast
268	Snowy
271	Central Murrumbidgee
272	Lower Murrumbidgee
275	Albury
276	Upper Murray
277	Central Murray
278	Murray-Darling
281	Far West
295	Lord Howe Island
310	Melbourne
321	Geelong
322	East Barwon
323	West Barwon
325	Hopkins
326	Glenelg
331	Ballarat
332	East Central Highlands
333	West Central Highlands
335	South Wimmera
336	North Wimmera
341	Mildura
342	West Mallee
343	East Mallee

TABLE I.1 FREIGHTINFO™1999 GEOGRAPHIC REGIONS (CONTINUED)

Region code	*Region*
355	Bendigo
356	Northern Loddon-Campaspe
357	South Loddon-Campaspe
361	Shepparton-Mooroopna
362	North Goulburn
363	South Goulburn
364	South West Goulburn
375	Wodonga
376	North Ovens-Murray
377	East Ovens-Murray
381	East Gippsland Shire
382	Wellington-Snowy
391	Latrobe Valley
392	West Gippsland
393	South Gippsland
410	Brisbane
421	Gold Coast City and Albert Shire Part B
423	Sunshine Coast
424	Moreton (Balance)
431	Bundaberg
432	Wide Bay-Burnett (Balance)
441	Darling Downs
442	Darling Downs (Balance)
445	South West
451	Rockhampton
452	Gladstone
453	Fitzroy (Balance)
455	Central West
461	Mackay
462	Mackay (Balance)
471	Townsville City and Thuringowa City Part A
472	Northern (Balance)
481	Cairns
482	Far North (Balance)
491	North West
510	Adelaide
521	Barossa
522	Kangaroo Island
523	Onkaparinga
524	Fleurieu
531	Yorke
532	Lower North
541	Riverland
545	Murray Mallee
551	Upper South East
552	Lower South East

TABLE I.1 FREIGHTINFO™1999 GEOGRAPHIC REGIONS (CONTINUED)

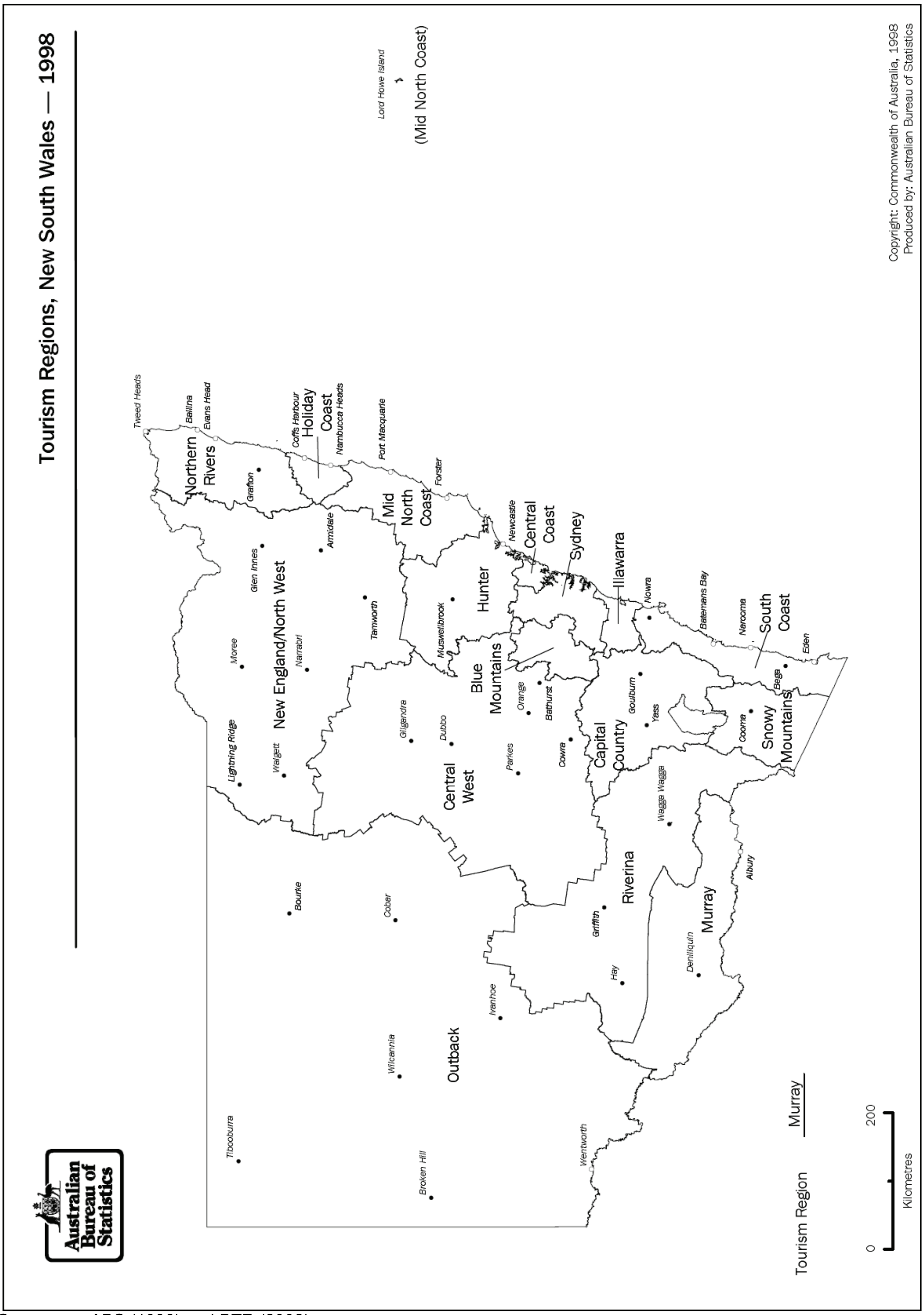
Region code	*Region*
561	Lincoln
562	West Coast
571	Whyalla
572	Pirie
573	Flinders Ranges
574	Far North
610	Perth
621	Dale
622	Preston
623	Vasse
624	Blackwood
631	Pallinup
632	King
641	Hotham
642	Lakes
651	Moore
652	Avon
653	Campion
661	Lefroy
662	Johnston
671	Gascoyne
672	Carnegie
673	Greenough River
681	De Grey
682	Fortescue
691	Ord
692	Fitzroy
710	Hobart
721	Southern
731	Greater Launceston
732	Central North
733	North Eastern
741	Burnie-Devonport
742	North Western Rural
743	Lyell
810	Darwin
821	Northern Territory Balance (Balance)
831	Barkly
841	Central NT
999	Overseas

Source FDF (2001).

APPENDIX II NVS AND IVS REGIONAL CLASSIFICATION

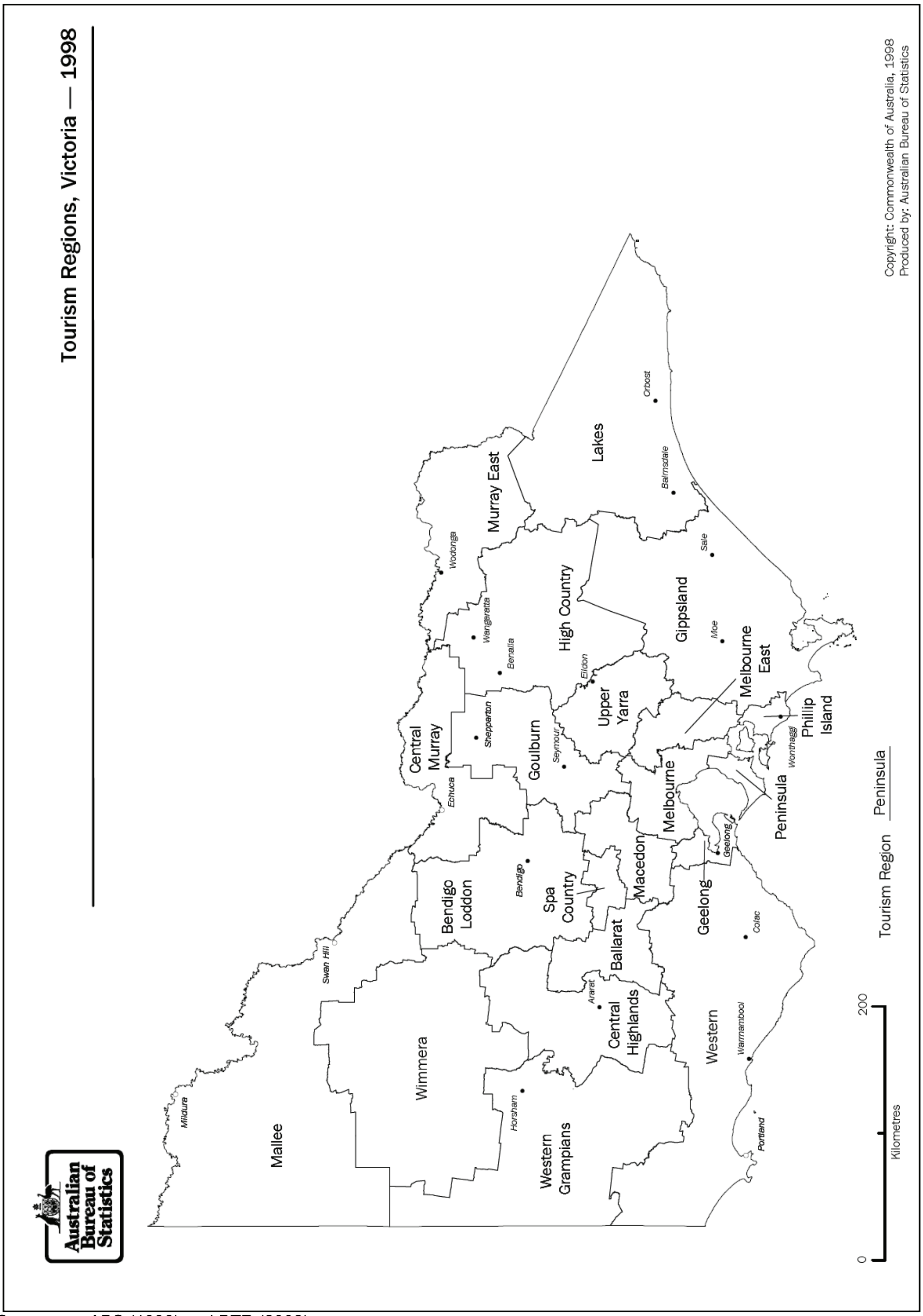
The passenger travel projections, derived using OZPASS, rely on Tourism Research Australia's (TRA)—formerly the Bureau of Tourism Research (BTR)—National Visitor Survey (NVS) and International Visitor Survey (IVS) data for the base year travel patterns. The NVS and IVS measure travel within and between 91 separate geographic areas covering almost all of Australia. The geographic areas not covered are Other Territories and some Off-Shore and Migratory Areas. The TRA tourism region structure is the default geographic classification for projecting future travel patterns, although OZPASS includes functions that enable users to expand or aggregate the set of regions. Figures II.1 to II.7 illustrate the geographic areas covered by the TRA tourism regions used in the 1998, 1999 and 2000 NVS and IVS.

FIGURE II.1 TOURISM REGIONS, NEW SOUTH WALES, 1998–2000



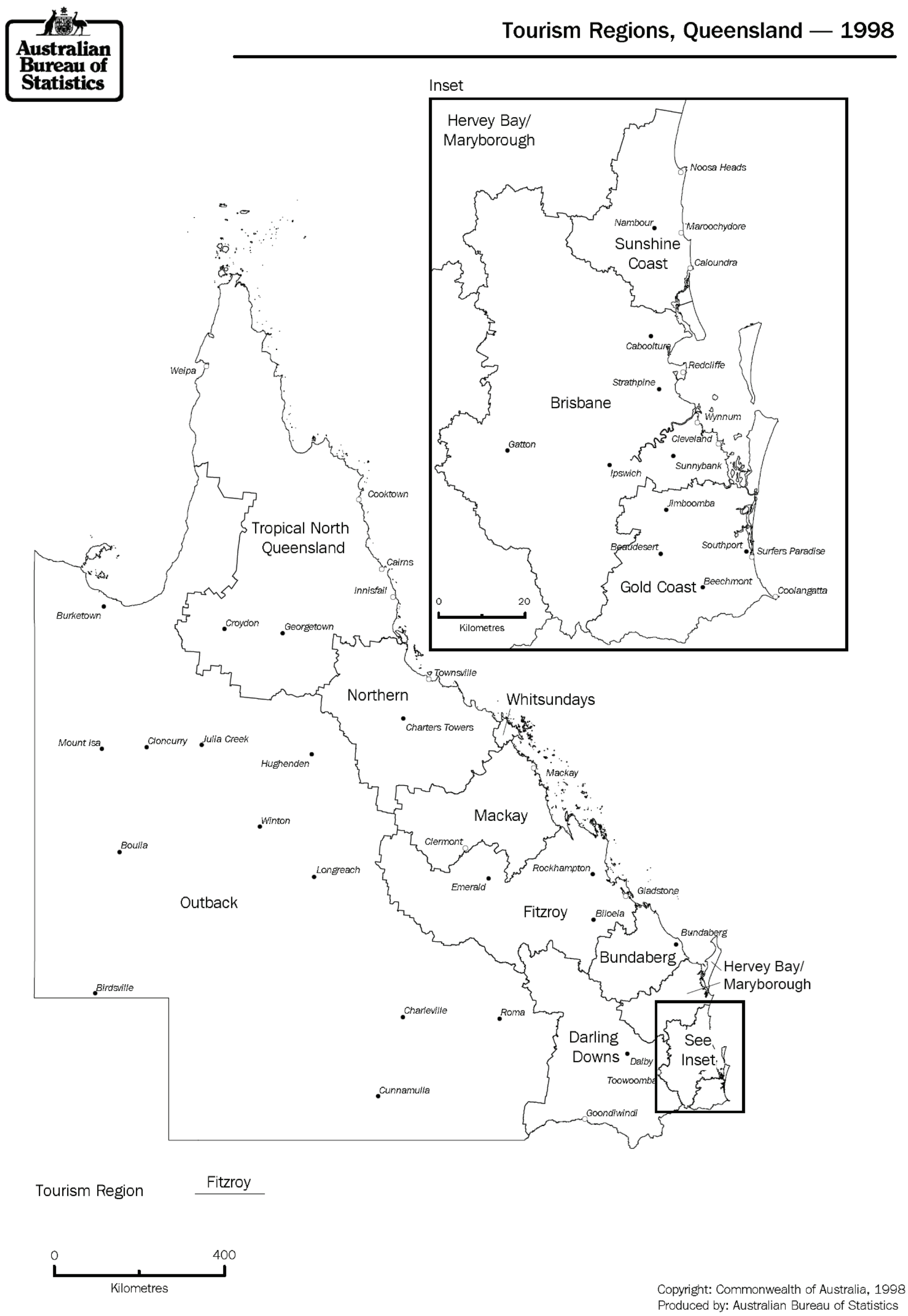
Sources: ABS (1996) and BTR (2002).

FIGURE II.2 TOURISM REGIONS, VICTORIA, 1998–2000



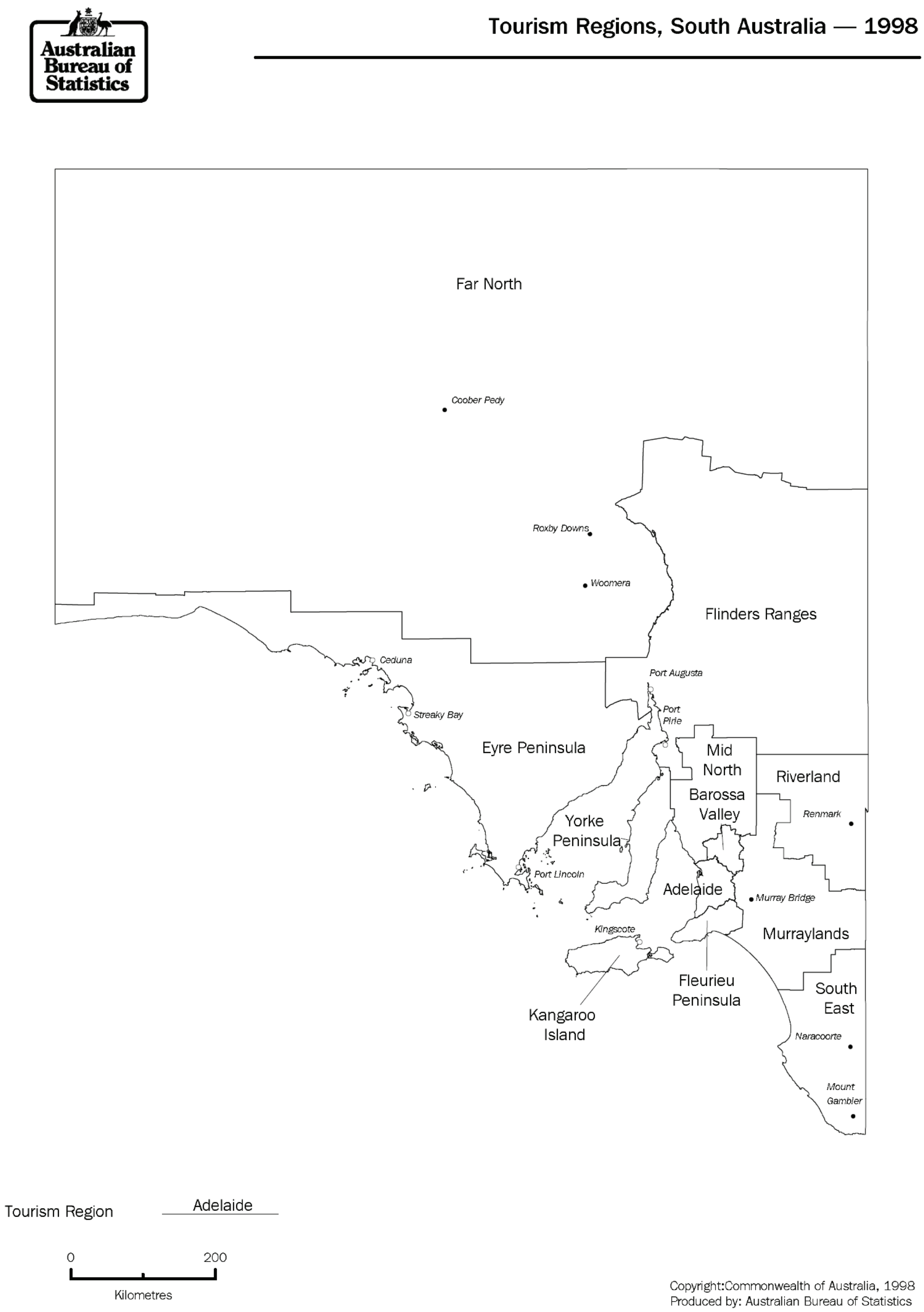
Sources: ABS (1996) and BTR (2002).

FIGURE II.3 TOURISM REGIONS, QUEENSLAND, 1998–2000



Sources: ABS (1996) and BTR (2002).

FIGURE II.4 TOURISM REGIONS, SOUTH AUSTRALIA, 1998–2000



Sources: ABS (1996) and BTR (2002).

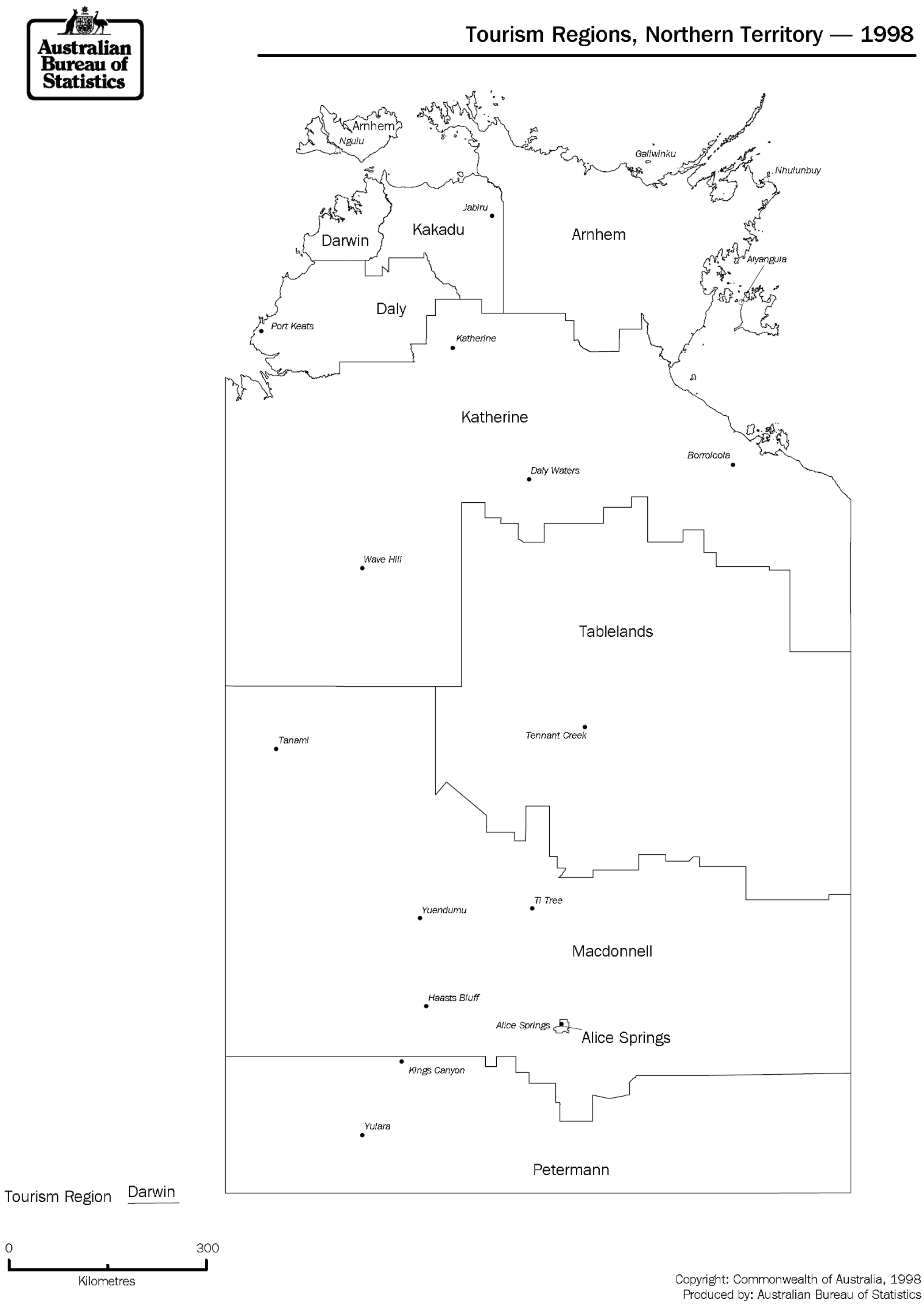
FIGURE II.5 TOURISM REGIONS, WESTERN AUSTRALIA, 1998–2000

Sources: ABS (1996) and BTR (2002).

FIGURE II.6 TOURISM REGIONS, TASMANIA, 1998–2000

Sources: ABS (2002a) and BTR (2002).

FIGURE II.7 TOURISM REGIONS, NORTHERN TERRITORY, 1998–2000



Sources: ABS (1996) and BTR (2002).

TABLE II.1 TOURISM REGIONS, 1998–2000

BTR code	*BTR region*
101	South Coast
102	Illawarra
104	Sydney
105	Snowy Mountains
106	Capital Country
107	Murray
108	Riverina
109	Central West
110	Hunter
111	Mid North Coast
112	Holiday Coast
113	Northern Rivers
114	New England/North West
115	Outback
117	Canberra
118	Central Coast
119	Blue Mountains
120	Lord Howe Island
201	Melbourne
202	Wimmera
203	Mallee
204	Western
205	Western Grampians
206	Bendigo Loddon
207	Peninsula
208	Central Murray
209	Goulburn
210	High Country
211	Lakes
212	Gippsland
213	Melbourne East
214	Geelong
215	Macedon
216	Spa Country

TABLE II.1 TOURISM REGIONS, 1998–2000 (CONTINUED)

BTR code	*BTR region*
217	Ballarat
218	Central Highlands
219	Upper Yarra
220	Murray East
221	Phillip Island
301	Gold Coast
302	Brisbane
303	Sunshine Coast
304	Hervey Bay / Maryborough
306	Darling Downs
307	Bundaberg
308	Fitzroy
309	Mackay
310	Whitsundays
311	Northern
312	Tropical North Queensland
313	Great Barrier Reef
314	Outback
401	South East
402	Murraylands
403	Fleurieu Peninsula
404	Adelaide
405	Barossa Valley
406	Riverland
407	Mid North
409	Flinders Ranges
410	Far North
411	Eyre Peninsula
412	Yorke Peninsula
413	Kangaroo Island
501	South East
502	Goldfields
503	Midwest
504	Gascoyne
505	Pilbara
506	Kimberley
507	Perth
508	Peel
509	South West
510	Great Southern
511	Wheatbelt

TABLE II.1 TOURISM REGIONS 1998–2000 (CONTINUED)

BTR code	*BTR region*
601	Greater Hobart
602	Southern
603	East Coast
604	Northern
605	Greater Launceston
606	North West
607	West Coast
801	Darwin
802	Kakadu
803	Arnhem
804	Katherine
805	Tablelands
806	Petermann
807	Alice Springs
808	Macdonnell
809	Daly

Sources BTR (2002).

APPENDIX III AGGREGATE ASSUMPTIONS

Table III.1 lists the projected growth in GDP and the Australian population from 1999–2000 to 2024–25. Projected GDP growth is from the Australian Treasury's projections, published as part of the *Intergenerational Report 2002–03* (Australian Treasury 2002). The projections have GDP growth declining from around 4 per cent per annum in 1999–2000 to 2024–25. Population projections are based on the ABS SLA-based population projections for the period 1999 to 2019 (ABS 2001a). The BTRE extended the projections to 2025 using a second order polynomial trend fitted to the projections for 1999 to 2019, for each SLA.

TABLE III.1 PROJECTED GDP AND POPULATION GROWTH, 2000 TO 2025

(per cent per annum)

Year	*GDP growth*	*Population growth*
1999–00	4.00	1.27
2000–01	1.75	1.14
2001–02	3.93	1.03
2002–03	3.82	1.01
2003–04	3.45	0.98
2004–05	3.45	0.96
2005–06	3.45	0.93
2006–07	3.05	0.91
2007–08	2.73	0.88
2008–09	2.70	0.86
2009–10	2.66	0.84
2010–11	2.61	0.82
2011–12	2.53	0.81
2012–13	2.49	0.79
2013–14	2.41	0.78
2014–15	2.36	0.77
2015–16	2.30	0.75
2016–17	2.24	0.74
2017–18	2.19	0.72
2018–19	2.16	0.71
2019–20	2.14	0.73
2020–21	2.10	0.71
2021–22	2.08	0.70
2022–23	2.08	0.70
2023–24	2.01	0.69
2024–25	2.00	0.69

Sources Australian Treasury (2002).

APPENDIX IV STATE AND TERRITORY ROAD DATA

The road data set used for this analysis contains data for the National Highways and selected roads of national significance supplied by the State and Territory road agencies for BTE Working Paper 35: *Roads 2020* (BTE 1997). The data set is described in detail in SMEC (1998). Table IV.1 provides a summary of the data by jurisdiction.

The data set contains road condition and traffic count data for the period 1996 for just over 90 000 separate road sections. The road condition data includes surface type, lane width, shoulder width, terrain (flat, undulating, mountainous) and road roughness. The road traffic count data includes average annual daily traffic count data, and estimates of the percentage of commercial vehicles for most road sections.

The typical section length supplied by each of the States and Territories varies from just under 100 metres in Victoria to approximately 7.6 kilometres in New South Wales.

TABLE IV.1 ROAD DATA SUMMARY

State Code	*No. sections*	*Total length (km)*	*Average section length (km)*
NSW	844	6 442	7.63
VIC	43 942	3 483	0.08
QLD	8 393	5 581	0.66
SA	3 889	3 757	0.97
WA	32 497	12 046	0.37
TAS	525	636	1.21
NT	1 162	3 159	2.72
ACT	68	62	0.91
Total	91 320	35 166	0.38

Sources SMEC (1998).

TABLE IV.2 AUSLINK NETWORK NON-URBAN ROAD LINKS

<table>
<tr><th>CorridorID</th><th>LinkID</th><th>SectionID</th><th>Region</th><th>Corridor</th><th>Notes</th></tr>
<tr><td>3200</td><td></td><td></td><td>Interstate</td><td>Melbourne to Sydney</td><td></td></tr>
<tr><td>1200</td><td></td><td></td><td>Interstate</td><td>Canberra connectors</td><td></td></tr>
<tr><td>3500</td><td></td><td></td><td>Interstate</td><td>Melbourne to Adelaide</td><td></td></tr>
<tr><td>2500</td><td></td><td></td><td>Interstate</td><td>Sydney to Adelaide</td><td>Excludes Hume Highway sections from Sydney–Sturt Highway, which are included in Melbourne–Sydney corridor.</td></tr>
<tr><td>3400</td><td></td><td></td><td>Interstate</td><td>Melbourne to Brisbane</td><td>Excludes Hume Highway sections from Melbourne–Seymour (included in the Melbourne–Sydney corridor) and Warrego Highway between Toowoomba–Brisbane (included with Brisbane–Darwin).</td></tr>
<tr><td>5600</td><td></td><td></td><td>Interstate</td><td>Adelaide to Perth</td><td></td></tr>
<tr><td>5800</td><td></td><td></td><td>Interstate</td><td>Adelaide to Darwin</td><td>Excludes the Princes Highway sections between Adelaide and Port Augusta, which are included in the Adelaide–Perth corridor.</td></tr>
<tr><td>6800</td><td></td><td></td><td>Interstate</td><td>Perth to Darwin</td><td>Excludes Stuart Highway sections between Katherine and Darwin, which are included in the Adelaide–Darwin corridor.</td></tr>
<tr><td>4800</td><td></td><td></td><td>Interstate</td><td>Brisbane to Darwin</td><td>Excludes Stuart Highway sections between Barkly Highway and Darwin, which are included in the Adelaide–Darwin corridor.</td></tr>
<tr><td>7700</td><td></td><td></td><td>Interstate</td><td>Hobart to Smithtown</td><td></td></tr>
<tr><td>2400</td><td></td><td></td><td>Interstate</td><td>Sydney to Brisbane (inland route)</td><td></td></tr>
<tr><td>2410</td><td></td><td></td><td>Interstate</td><td>Sydney to Brisbane (Pacific Highway)</td><td>Excludes the F3 Freeway between Sydney and Newcastle, which are included in the Sydney–Brisbane (inland route) corridor.</td></tr>
<tr><td>4400</td><td></td><td></td><td>Intrastate</td><td>Brisbane to Cairns</td><td></td></tr>
<tr><td>6628</td><td></td><td></td><td>Intrastate</td><td>Bunbury to Perth</td><td></td></tr>
<tr><td>3210</td><td>24</td><td></td><td>Intrastate</td><td>Sydney–Wollongong</td><td></td></tr>
<tr><td>2212</td><td></td><td></td><td rowspan="2">Intrastate</td><td rowspan="2">Sydney–Dubbo</td><td rowspan="2"></td></tr>
<tr><td>2411</td><td>21 | 22</td><td>0 | 1–3</td></tr>
<tr><td>3210</td><td>31, 32</td><td></td><td>Intrastate</td><td>Melbourne–Sale (Bairnsdale)</td><td></td></tr>
<tr><td>3311</td><td></td><td></td><td>Intrastate</td><td>Melbourne–Mildura</td><td></td></tr>
<tr><td>3510</td><td>31</td><td></td><td>Intrastate</td><td>Melbourne–Geelong</td><td></td></tr>
<tr><td>4410</td><td></td><td></td><td>Intrastate</td><td>Townsville–Mt Isa (Cloncurry)</td><td>Excludes the sections of the Flinders Highway between Cloncurry and Mt Isa, which are included in the Brisbane–Darwin corridor.</td></tr>
</table>

Sources DOTARS (2004, table 4, pp. 69-70) and SMEC (1998).

AUSLINK NON-URBAN NATIONAL ROAD NETWORK

The State and Territory road data set includes data for every road section in the AusLink non-urban national network. Table IV.2 shows the concordance between the AusLink non-urban corridors and the road sections contained in the State and Territory road data set.

DATA ISSUES

Commercial vehicles traffic counts

Inspection of the original road data reveals a significant number of sections where the proportion of commercial vehicles equalled one per cent, exactly. Table IV.3 shows estimates of the number of sections by the proportion of commercial vehicles. SMEC (1998) reports that the estimated proportion of commercial vehicles were taken from the raw data supplied by the States and Territories. For those sections where there were no estimates of the number of commercial vehicles, it would appear that the estimate has been set to unity. Most of the road sections for which there was no data on commercial vehicle numbers are in New South Wales, Victoria and Western Australia (see table IV.4).

TABLE IV.3 NUMBER OF SECTIONS BY PROPORTION OF COMMERCIAL VEHICLES

Proportion CVs (per cent)	*No. Sections*
1	6 255
> 1 and ≤ 5	861
> 5 and ≤ 10	14 796
> 10 and ≤ 15	21 766
> 15 and ≤ 20	15 666
> 20 and ≤ 25	16 548
> 25 and ≤ 30	6 138
> 30 and ≤ 35	5 474
> 35 and ≤ 40	2 538
> 40 and ≤ 45	610
> 45 and ≤ 50	533
> 50 and ≤ 55	114
> 55 and ≤ 60	7
> 60	14
Total	91 320

Sources SMEC (1998) and BTRE estimates.

Across all roads contained in the database, commercial vehicles constitute approximately 19 per cent of the traffic stream, on a length-weighted basis. Left unadjusted, the low commercial vehicle counts on those sections would likely lead to lower than optimal road expenditure, due to the higher impact on road maintenance expenditure from heavy vehicles.

For this analysis, road sections with a proportion of vehicles equal to one per cent were adjusted to equal the average proportion of commercial vehicles on surrounding road sections or nearby roads. Where no information was available on the proportion of vehicles on nearby roads, the proportion of commercial vehicles was assumed to equal 15 per cent. The assumed commercial vehicle proportions for these road sections are listed in table IV.4.

TABLE IV.4 ROAD SECTIONS WITH ONE PER CENT COMMERCIAL VEHICLES

State	*Corridor*	*Road*	*No. sections*	*Length*	*Assumed commercial vehicle share)*
				(km)	*(per cent)*
NSW	Sydney to Bathurst	Great Western Highway	30	150	15[A]
NSW	Sydney to Brisbane	Pacific Highway	100	700	18[A]
NSW	Bathurst to Cunnamulla	Mitchell Highway	41	801	15[A]
NSW	Adelaide to Nyngan	Barrier Highway	18	631	15[N]
NSW	Melbourne to Sydney	Princes Hwy	50	373	10-15[A]
VIC	Melbourne to Sydney	Hume Hwy	2108	102	15[N]
VIC	Geelong to Benalla	Midland Hwy	2630	245	8[N]
WA	000H006 to Port Hedland	Port Hedland Road	47	10	16[N]
WA	000H007 to Karratha	Point Samson-Roebourne	60	18	16[N]
WA	00H007 to Dampier	Dampier Road	111	26	16[N]
WA	Pannawonica		128	46	16[N]
WA	Woodie Woodie Rd	Woodie Woodie Rd	11	223	15[A]
WA	Tom Price to Paraburdoo	Paraburdoo-Tom Price	315	151	30[A]
WA	Kambalda to Meekatharra	Goldfields Highway	300	116	15[A]
WA	Narrogin to Williams	Williams-Narrogin Highway	105	31	15[A]
WA	Pinjarra to Mandurah	Pinjarra Rd	114	17	15[A]
TAS	Hobart to Smithtown	Brooker Hwy	23	11	10.5-12[N]
TAS	Hobart to Smithtown	Illawarra Rd	2	2	20[N]
TAS	Launceston to Georgetown	East Tamar Hwy	12	20	10-26[N]
TAS	Triabunna to Hobart	Tasman Hwy	14	12	8-25[N]
TAS	Cygnet to Hobart	Huon Hwy	23	30	11-15[N]
TAS	Cygnet to Hobart	Southern Outlet Hwy	13	10	12[N]

A Denotes BTRE assumption.

N Denotes assumption based on commercial vehicle proportion on nearby sections or roads.

Source SMEC (1998) and BTRE estimates.

APPENDIX V EXTENDING THE PRODUCTION PROJECTIONS

Extension of the production projections, to 2025, was undertaken by fitting a second order polynomial to the existing projections and using the parameter estimates to predict production to 2025. Listing V.1 provides the source code that was used to extend the production projections. The code is implemented in R—the open-source language and environment for statistical computing and graphics.[6] For each commodity and region, the code takes the base case projections and fits a second order polynomial function with respect to time, and then projects beyond the base case projection horizon to 2025.

LISTING V.1R CODE FOR EXTENDING THE PRODUCTION PROJECTIONS

```
## ==============================================================
## Filename:        production_forecasts_1999-2025.R
##
## Author:          Bureau of Transport & Regional Economics
##
##
## Version 0.01:    09 September 2003
##
## Description:     R script for extending the production forecasts in
##                  the FreightSim model.
##                  The script reads in the base production projections,
##                  fits a 2nd order polynomial approximation to the
##                  existing production projections (to 2021) and then
##                  extends production projections to 2025.
##
## References:      See also ~/projects/R/SLAPopulation.tar.gz for
##                  similar process used to extend the SLA-based
##                  population projections.
## ==============================================================

## --------------------------------------------------------------
## Section 0 - Load relevant libraries
## --------------------------------------------------------------
library(tseries);

## Set default variables:
home.dir <- "~/projects/freight/freightsim/";
```

6 R is available as Free Software under the terms of the Free Software Foundation's GNU General Public License in source code form. R binaries may also be obtained from R-project website at http://www.r-project.org/.

```
## -------------------------------------------------------------
## 1. Read data and manipulate data into a desired form
## -------------------------------------------------------------
production <-
  read.table(paste(home.dir, "1production-corrected.txt", sep=""),
             header=T, dec = ".", sep="\t", skip=0);

region <- as.numeric(levels(factor(production$Region)));
commodity <- as.numeric(levels(factor(production$Commodity.Code)));

## --------------------------------------------------------------
## 2. Estimate the model.
## --------------------------------------------------------------
write.table(paste("Region", "Commodity code", "Year", "Quantity", sep="\t"),
            file=paste(home.dir, "1production-corrected-2025.txt", sep=""),
            eol = "\r\n", dec = ".", sep="\t", quote = F, append = F,
            row.names=F, col.names=F );

## Select the data for each commodity and each region and estimate the model:
for (i in 1:length(commodity)) {
  for (j in 1:length(region)) {
    p.cr <- subset(production,
                   Region == region[j] & Commodity.Code == commodity[i],
                   select = c(Year, Quantity));
    if ( dim(p.cr)[1] > 0 ) {
      ## Set the variables:
      x <- p.cr$Year;
      x.out <- p.cr$Year[length(p.cr$Year)] + 1:3;
      if ( commodity[i] == 15 ) {
        ## The original data had one less projection year for commodity 15.
        ## This adds an extra year to the projections for that commodity.
        x.out <- p.cr$Year[length(p.cr$Year)] + 1:4;
      }
      y <- p.cr$Quantity;
      ## Estimate the model, save coefficients and calculate projections:
      ##  For 2nd order polynomial:
      lm.2o <- lm(y ~ x + I(x^2));
      b.2 <- coef(lm.2o);    # Rename coefficients vector.
      p.cr.out <- cbind(Year = x.out,
                        Quantity = round(b.2[1] + b.2[2]*x.out +
                          b.2[3]*(x.out^2), digits=2));
      ##  For 3rd order polynomial:
    #     lm.3o <- lm(y ~ x + I(x^2) + I(x^3));
    #     b.3 <- coef(lm.3o);
    #     p.cr.out <- round(b.3[1] + b.3[2]*x.out + b.3[3]*(x.out^2) +
    #                       b.3[4]*(x.out^3), digits=1);
      ## 4. Write results out to a file.
      prod.out <- cbind(Region = region[j], Commodity = commodity[i],
                        rbind(p.cr, p.cr.out));
      write.table(prod.out, file=paste(home.dir,
                             "1production-corrected-2025.txt", sep=""),
                  eol = "\r\n", dec = ".", sep="\t", append = T, quote = F,
                  col.names=F, row.names=F);
    cat(paste("Region: ", region[j], "\t", "Commodity: ", commodity[i], "\t",
              "Year: ", x.out[length(x.out)], "\n", sep=""));
    }
    else {
      cat(paste("Region: ", region[j], "\t", "Commodity: ", commodity[i],
"\t",
                "No production", "\n", sep=""));
    }
  }
}
## ======================== EOF ================================
```

APPENDIX VI TRANSCAD TRAFFIC ASSIGNMENT

The output from FreightSim and *FreightTrucks*™ provides freight flow estimates in specified in terms of origin-destination (OD) pairs. For transport infrastructure assessment, it is necessary to convert the OD estimates into traffic along each road section. The BTRE uses the traffic assignment algorithms included in the *TransCAD* Transportation GIS Software package together with the road and rail layers included in the AUSLIG (1993) TOPO-10M vector topographic data set.

Some adjustment of the topographic data is necessary before it is possible to assign the traffic. This appendix describes the adjustments undertaken by the BTRE and the assignment procedures.

PRE-ASSIGNMENT DATA ADJUSTMENTS

Traffic assignment in *TransCAD* requires some information about the capacity of each road section and the travel cost over the road section. The TOPO-10M road layer data does include this information, and so it is necessary to manually add these data items.

Capacity

Capacity may be handled by adding a new field to the road layer data set and leaving the value of the variable unspecified. If the value of the variable is unspecified, *TransCAD* treats the road as free from capacity constraints.

Travel cost

For travel costs, the BTRE uses the road section length weighted according to the road standard. For the simulations presented in this report, the following assumptions were used to compute the adjusted road length:

- For principal roads (Class = 2) the adjusted length is set equal to the nominal length.
- For secondary roads (Class = 3) the adjusted length is set 25 per cent higher than the nominal length.

- For minor roads/tracks (Class = 4) the adjusted length is set 50 per cent higher than the nominal length.
- For extra links added by BTRE (see below) set adjusted length equal to the nominal length.

The *TransCAD* condition is:

```
IF Class = 2 THEN Length * 1.0 ELSE IF Class = 3 THEN Length * 1.25
ELSE IF class = 4 THEN Length * 1.5 ELSE Length * 1.0
```

Network settings

Additional links

For the purposes of assigning the traffic to the road network, the BTRE has inserted additional road layer connectors between Melbourne and Devonport and Cape Jervis and Penneshaw (Kangaroo Island) to cater for vehicular traffic that moves by ferry between the mainland and Tasmania and Kangaroo Island.

The AUSLIG (1993) TOPO-10M data set also did not include links for the Gore Highway between the Leichhardt Highway (north of Goondiwindi) and Toowoomba. The BTRE added these links to the network for this analysis, link numbers:

Modifications to the SMEC (1998) database

SMEC Australia Pty Ltd, was engaged by the then BTE to integrate road network data supplied by each of the State and Territory road transport authorities. The resulting data set, described in SMEC (1998), included information on road type, road condition and traffic levels. SMEC linked the road authority data to the AUSLIG (1993) data set. In the course of this analysis, some residual errors were discovered in the data set. In particular, the assignment between the road authority and AUSLIG (1993) data appears to be in error along the Princes Highway between Sydney and Eden (NSW). Figure VI.1 shows a section of the Princes Highway between, roughly Batemans Bay and Eden. This section is marked in the SMEC (1998) data set as lying between Sydney and Wollongong. For the analysis presented in this paper, the BTRE amended the ThrDLinkID field in the SMEC (1998) data set, which corresponds to the link in the AUSLIG (1993) data, as shown in table VI.1.

TABLE VI.1 ADJUSTMENTS TO BASE ROAD DATA SET

							Original data		BTRE alterations	
CorridorID	*LinkID*	*SectionID*	*Name code*	*Length (km)*	*AADT*	*State code*	*ThrDLinkID*	*Town Names*	*New ThrDLinkID*	*New Town Names*
3210	24	1	NSW1	0.64272	20000	NSW	1037	WOLLONGONG	706	Nowra
3210	24	2	NSW1	0.38728	20000	NSW	432	WOLLONGONG	706	
3210	24	3	NSW1	3.00875	20101	NSW	263	WOLLONGONG	706	
3210	24	4	NSW1	1.14125	20101	NSW	755	WOLLONGONG	706	
3210	24	5	NSW1	2.01	40464	NSW	755	BULLI	706	
3210	24	6	NSW1	1.87112	8941	NSW	755		706	
3210	24	7	NSW1	10.43888	8941	NSW	755		706	
3210	24	8	NSW1	1.95	8500	NSW	755		706	
3210	24	9	NSW1	5.13	8500	NSW	755		706	
3210	24	10	NSW1	10.29	8484	NSW	755		198	
3210	24	11	NSW1	0.34	16722	NSW	755	SYDNEY	774	
3210	24	12	NSW1	2.09842	16722	NSW	481	SYDNEY	774	
3210	24	13	NSW1	2.29158	16722	NSW	1136	SYDNEY	774	
3210	24	14	NSW1	3.96	20000	NSW	1136	SYDNEY	774	
3210	24	15	NSW1	4.32308	20000	NSW	1136	SYDNEY	774	Wollongong
3210	24	16	NSW1	0.75692	20000	NSW	1136	SYDNEY	774	
3210	24	17	NSW1	1.92	25728	NSW	1136	SYDNEY	1402	
3210	24	18	NSW1	5.08002	20125	NSW	1136	SYDNEY	1402	
3210	24	19	NSW1	0.28998	20125	NSW	1136	SYDNEY	1402	
3210	24	20	NSW1	1.25	36984	NSW	1136	SYDNEY	1402	
3210	24	21	NSW1	0.29886	34109	NSW	1136	SYDNEY	1402	
3210	24	22	NSW1	2.63114	34109	NSW	1136	SYDNEY	1402	
3210	24	23	NSW1	1.15	40000	NSW	1136	SYDNEY	1402	
3210	24	24	NSW6006	6.34128	48144	NSW	1136	SYDNEY	1402	
3210	24	25	NSW6006	5.66872	48144	NSW	1136	SYDNEY	1401	

TABLE VI.1 ADJUSTMENTS TO BASE ROAD DATA SET (CONTINUED)

							Original data		*BTRE alterations*	
CorridorID	*LinkID*	*SectionID*	*Name code*	*Length*	*AADT*	*State code*	*ThrDLinkID*	*Town Names*	*New ThrDLinkID*	*New Town Names*
3210	24	26	NSW6006	1.69764	47230	NSW	1136	SYDNEY	1401	
3210	24	27	NSW6006	1.59236	47230	NSW	1136	SYDNEY	1400	
3210	24	28	NSW6006	1.01882	53038	NSW	1136	SYDNEY	1400	
3210	24	29	NSW6006	1.40118	53038	NSW	1136	SYDNEY	1400	
3210	24	30	NSW6006	0.50568	40000	NSW	1136	SYDNEY	1400	
3210	24	31	NSW6006	1.21432	40000	NSW	1136	SYDNEY	1400	
3210	24	32	NSW95	5.63729	32909	NSW	347	SYDNEY	1400	
3210	24	33	NSW95	0.13271	32909	NSW	347	SYDNEY	1400	Waterfall
3210	24	34	NSW513	8.73	30000	NSW	347	SYDNEY	1400	
3210	24	35	NSW6006	0.61984	21366	NSW	347	SYDNEY	1400	
3210	24	36	NSW6006	18.75016	21366	NSW	347	SYDNEY	1064	
3210	24	37	NSW1	5.36	36296	NSW	347	SYDNEY	1064	
3210	24	38	NSW1	2.33	1	NSW	347	SYDNEY	1064	
3210	24	39	NSW1	1.82	1	NSW	347	SYDNEY	1064	Sydney
3210	24	40	NSW1	3.2	1	NSW	347	SYDNEY	1064	Sydney
3210	24	41	NSW1	0.79	1	NSW	347	SYDNEY	1064	Sydney
3210	25	1	NSW1	34.04	2200	NSW	347		894	
3210	25	2	NSW1	12.97	3109	NSW	347		894	
3210	25	3	NSW1	3.44	7350	NSW	347	EDEN	894	
3210	25	4	NSW1	14.1	4392	NSW	347		1037	
3210	25	5	NSW1	2.05	6159	NSW	1050	MERIMBULA	432	
3210	25	6	NSW1	0.61	6500	NSW	1050	MERIMBULA	432	
3210	25	7	NSW1	6.41	7287	NSW	1050	MERIMBULA	432	
3210	25	8	NSW1	26.08	3845	NSW	1050		263	
3210	25	9	NSW1	3.18	5425	NSW	1050	BEGA	263	
3210	25	10	NSW1	9.71	4415	NSW	1050		263	
3210	25	11	NSW1	8.86	2675	NSW	1050		755	

TABLE VI.1 ADJUSTMENTS TO BASE ROAD DATA SET (CONTINUED)

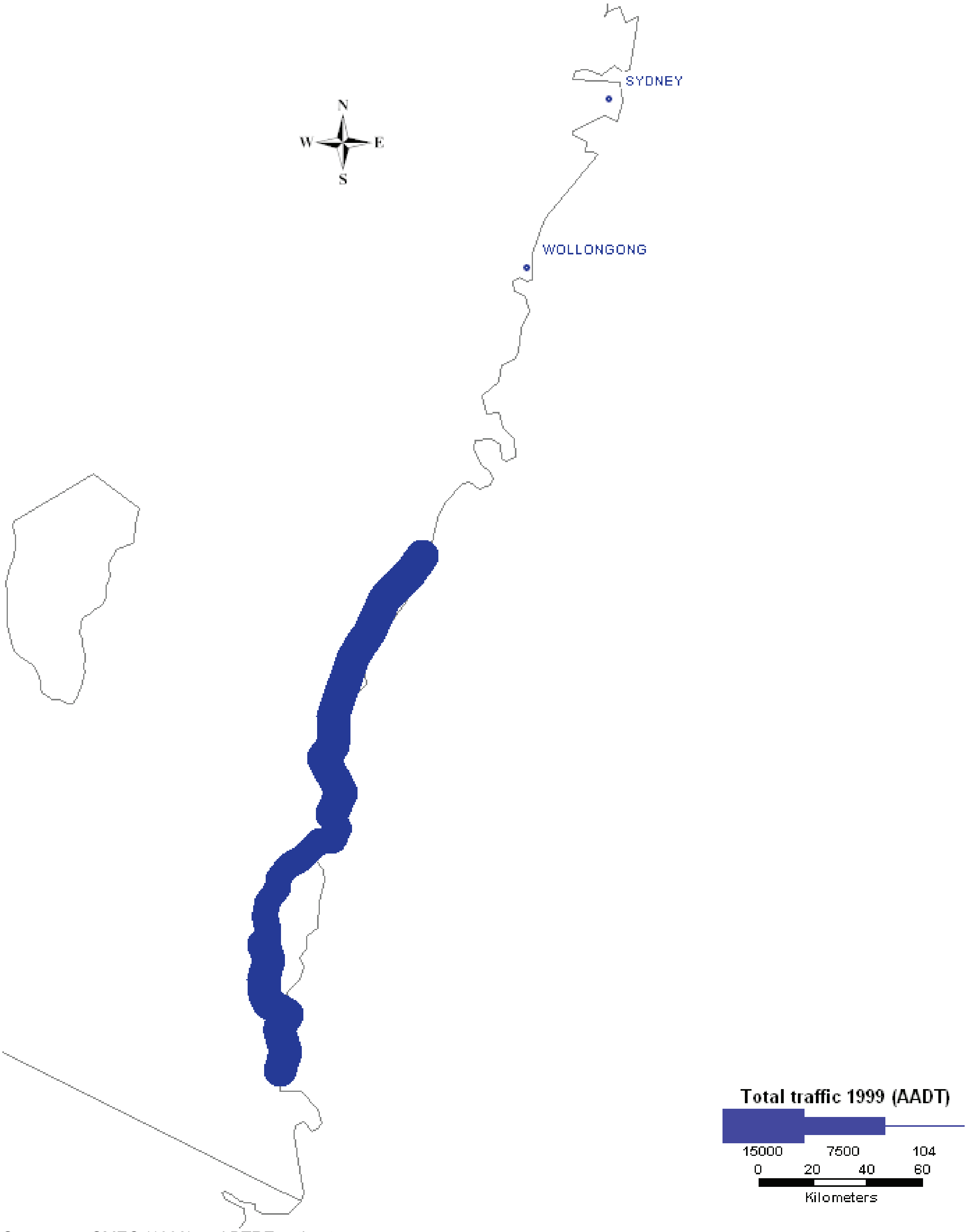
							Original data		BTRE alterations	
CorridorID	*LinkID*	*SectionID*	*Name code*	*Length*	*AADT*	*State code*	*ThrDLinkID*	*Town Names*	*New ThrDLinkID*	*New Town Names*
3210	25	12	NSW1	20.87	2000	NSW	1050		755	
3210	25	13	NSW1	0.85	2000	NSW	1050		755	
3210	25	14	NSW1	9.62	1559	NSW	1148		755	
3210	25	15	NSW1	24.12	2749	NSW	1148		755	
3210	25	16	NSW1	4.53	7470	NSW	1148	NAROOMA	481	
3210	26	1	NSW1	15.91	7470	NSW	1402	NAROOMA	481	
3210	26	2	NSW1	1.7	3460	NSW	1402		481	
3210	26	3	NSW1	9.1	4000	NSW	1402		481	
3210	26	4	NSW1	12.65	4610	NSW	1402		481	
3210	26	5	NSW1	1.78	8458	NSW	1401	BATEMANS BAY	481	Moruya
3210	26	6	NSW1	5.27	4859	NSW	1401		481	
3210	26	7	NSW1	2.04	4613	NSW	1401		481	
3210	26	8	NSW1	0.52	4613	NSW	1401		481	
3210	26	9	NSW1	8.2	8670	NSW	1401		481	
3210	26	10	NSW1	2.10375	11636	NSW	1401	ULLADULLA	1136	Batemans Bay
3210	26	11	NSW1	0.64625	11636	NSW	1401		1136	Batemans Bay
3210	26	12	NSW1	10.66	5774	NSW	1401		347	
3210	26	13	NSW1	19.99	3392	NSW	1401		347	
3210	26	14	NSW1	15.04	5320	NSW	1401		347	
3210	26	16	NSW1	3.29	7000	NSW	1401		347	Ulladulla
3210	26	17	NSW1	4.09	10000	NSW	1401	NOWRA	1050	Ulladulla
3210	26	18	NSW1	3.14	14978	NSW	1401	NOWRA	1050	Ulladulla
3210	26	19	NSW1	1.66	8847	NSW	1401		1050	
3210	26	20	NSW1	5.11	5925	NSW	1401		1050	
3210	26	21	NSW1	8.76	5925	NSW	1401		1050	
3210	26	22	NSW1	11.39	6861	NSW	1401		1050	
3210	26	23	NSW1	8.54	6992	NSW	1401		1050	

TABLE VI.1 ADJUSTMENTS TO ROAD TRAFFIC DATA SET (CONTINUED)

							Original data		*BTRE alterations*	
CorridorID	*LinkID*	*SectionID*	*Name code*	*Length*	*AADT*	*State code*	*ThrDLinkID*	*Town Names*	*New ThrDLinkID*	*New Town Names*
3210	26	24	NSW1	6.50022	9442	NSW	1401		1148	
3210	26	25	NSW1	1.35978	9442	NSW	1401		1148	
3210	26	26	NSW1	3.5	9283	NSW	1401		1148	
3210	26	27	NSW1	6.68	15461	NSW	1401		1148	
3210	26	28	NSW6006	4.89652	40000	NSW	1400	WOLLONGONG	1148	Nowra
3210	26	29	NSW6006	2.61348	40000	NSW	1400	WOLLONGONG	1148	Nowra

Sources SMEC (1998) and BTRE estimates.

FIGURE VI.1 PRINCES HIGHWAY DATA

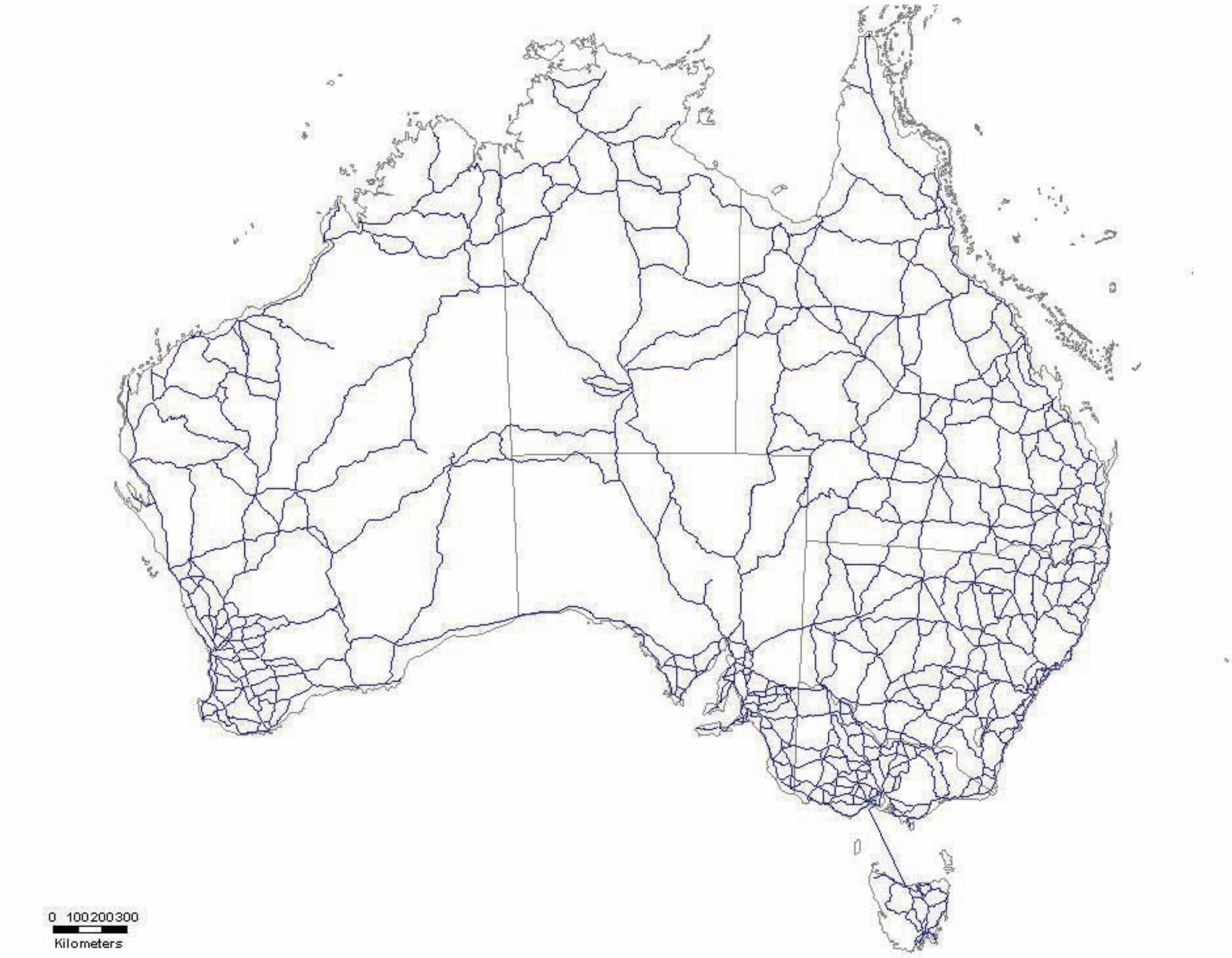


Sources SMEC (1998) and BTRE estimates.

Network specification

Traffic assignment in *TransCAD* requires specification of a road network. For the traffic assignments presented in this report, the whole of the TOPO-10M road layer, including the added link between Melbourne and Devonport, was included. The full road network is illustrated in figure VI.2.

FIGURE VI.2 ROAD NETWORK USED IN TRAFFIC ASSIGNMENTS



Source AUSLIG (1993).

TRAFFIC ASSIGNMENT

Traffic assignment in *TransCAD* requires specification of a number of assumptions about the setting. For the road freight and passenger vehicle simulations we used the traffic assignment settings listed in table VI.2.

TABLE VI.2 *TransCAD* TRAFFIC ASSIGNMENT SETTINGS

Assignment method	*Stochastic User Equilibrium*
Time	AdjLength
Capacity	Capacity
Max. iterations	20
Convergence criteria	0.01
Function	Gumbel
α	0.15
β	4.0
ε	10.0

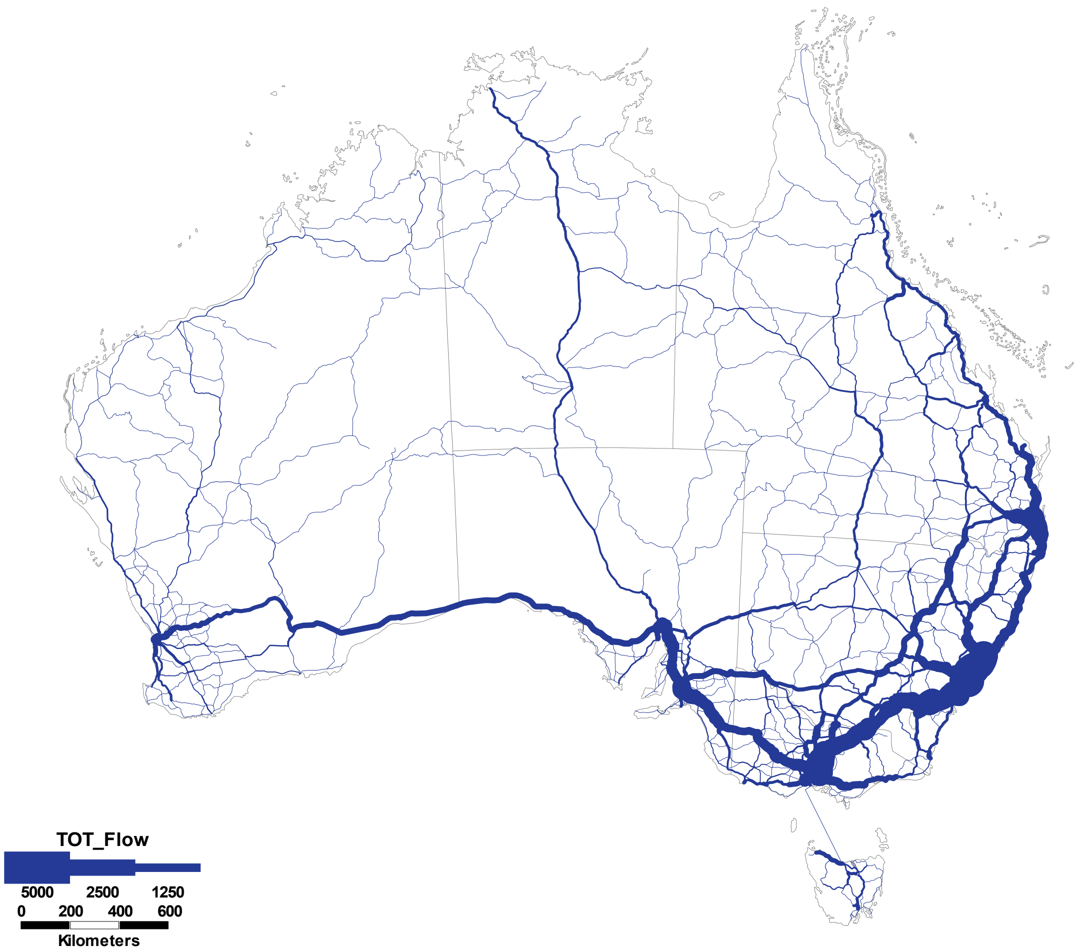
Road freight assignment results

1999

```
INPUT FILES
===========
Network                  : Z:\Road\AusLink Strategic
Projections\TransCAD Files\AusLinkSP\Geodata\Network\RoadFreight.net
Demand Table             : Z:\Road\AusLink Strategic
Projections\TransCAD
Files\AusLinkSP\TruckAssignment\Inputs\AllTrucks.mtx

OUTPUT FILES
============
Flow Table               : Z:\Road\AusLink Strategic
Projections\TransCAD
Files\AusLinkSP\TruckAssignment\Results\ASN_LinkFlow_1999.bin

LINK FIELDS
===========
Cost                     : AdjustedLength
Capacity                 : Capacity
Probability Function     : Gumbel

OD DEMAND
=========
OD Pairs                 :                16900
Non zero OD Pairs        :                 2666
Demand                   :            284527.00
Intranodal Demand        :            229632.00

PARAMETERS
==========
Method                   : Stochastic User Equilibrium
Maximum Iterations       :                   20
Iterations               :                    3
Conv. Criteria           :                 0.01

Running Results
===============
Relative Gap             :                 0.00
RMSE                     :                74.25
```

```
% RMSE                      :                  39.57
Max Flow Change              :                 920.50
Equilibrium reached          : Yes
Total V-Time-T               :            22556290.27
Total V-Dist-T               :            22167417.63


Total Running Time 00:00:00.453.
```

FIGURE VI.3 ROAD FREIGHT TASK ASSIGNMENT, 1999

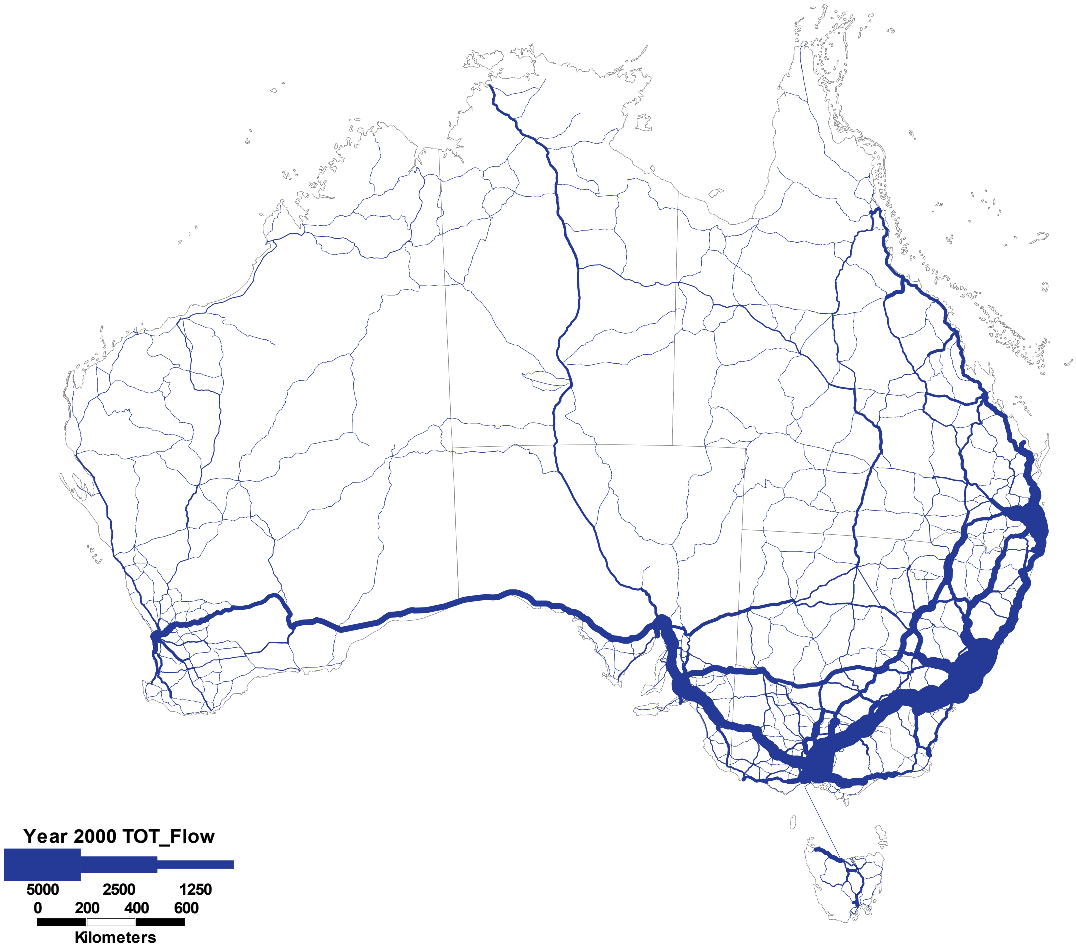


2000

```
INPUT FILES
===========
Network                      : Z:\Road\AusLink Strategic
Projections\TransCAD Files\AusLinkSP\Geodata\Network\RoadFreight.net
Demand Table                 : Z:\Road\AusLink Strategic
Projections\TransCAD
Files\AusLinkSP\TruckAssignment\Inputs\AllTrucks.mtx

OUTPUT FILES
============
```

```
Flow Table                : Z:\Road\AusLink Strategic
Projections\TransCAD
Files\AusLinkSP\TruckAssignment\Results\ASN_LinkFlow_2000.bin

LINK FIELDS
===========
Cost                      : AdjustedLength
Capacity                  : Capacity
Probability Function      : Gumbel

OD DEMAND
=========
OD Pairs                  :                 16900
Non zero OD Pairs         :                  2641
Demand                    :             296317.00
Intranodal Demand         :             239443.00

PARAMETERS
==========
Method                    : Stochastic User Equilibrium
Maximum Iterations        :                    20
Iterations                :                     3
Conv. Criteria            :                  0.01

Running Results
===============
Relative Gap              :                  0.00
RMSE                      :                 77.14
% RMSE                   :                 39.97
Max Flow Change           :                964.00
Equilibrium reached       : Yes
Total V-Time-T            :           23045734.13
Total V-Dist-T            :           22653544.63


Total Running Time 00:00:00.516.
```

FIGURE VI.4 ROAD FREIGHT TASK ASSIGNMENT, 2000

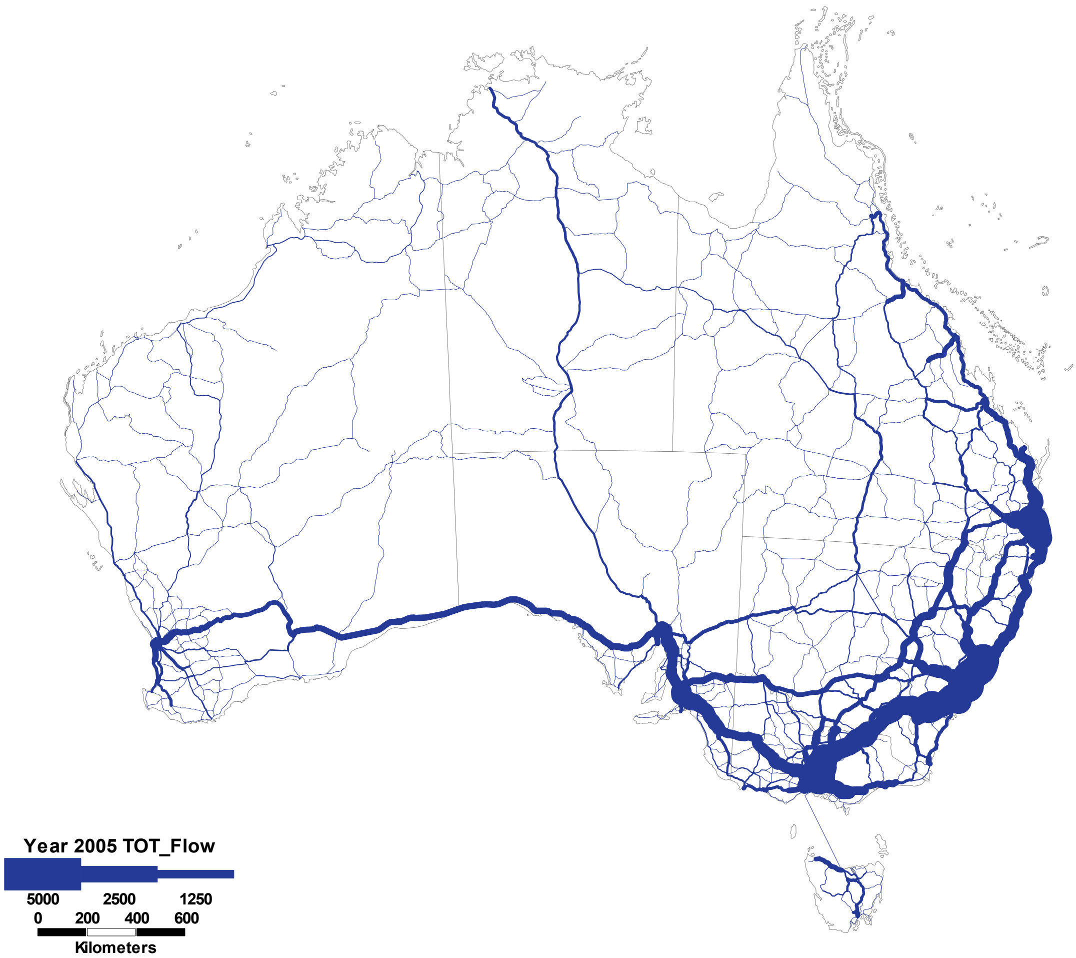


2005

```
INPUT FILES
===========
Network                    : Z:\Road\AusLink Strategic
Projections\TransCAD Files\AusLinkSP\Geodata\Network\RoadFreight.net
Demand Table               : Z:\Road\AusLink Strategic
Projections\TransCAD
Files\AusLinkSP\TruckAssignment\Inputs\AllTrucks.mtx

OUTPUT FILES
============
Flow Table                 : Z:\Road\AusLink Strategic
Projections\TransCAD
Files\AusLinkSP\TruckAssignment\Results\ASN_LinkFlow_2005.bin

LINK FIELDS
===========
Cost                       : AdjustedLength
Capacity                   : Capacity
Probability Function       : Gumbel

OD DEMAND
```

```
=========
OD Pairs                    :              16900
Non zero OD Pairs           :               2626
Demand                      :          352683.00
Intranodal Demand           :          285539.00

PARAMETERS
==========
Method                      : Stochastic User Equilibrium
Maximum Iterations          :                 20
Iterations                  :                  3
Conv. Criteria              :               0.01

Running Results
===============
Relative Gap                :               0.00
RMSE                        :              90.22
% RMSE                     :              40.97
Max Flow Change             :            1159.50
Equilibrium reached         : Yes
Total V-Time-T              :        25594428.03
Total V-Dist-T              :        25186081.70


Total Running Time 00:00:00.436.
```

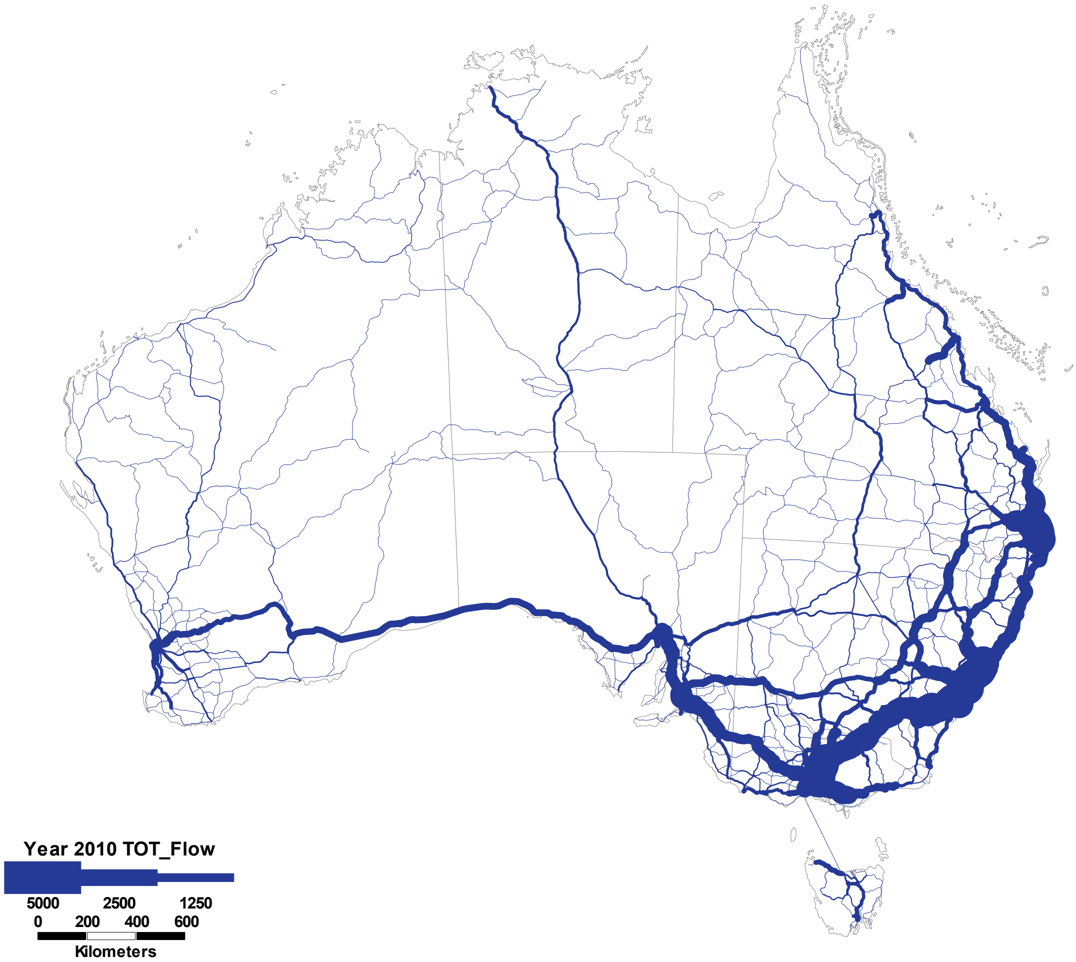
FIGURE VI.5 ROAD FREIGHT TASK ASSIGNMENT, 2005



2010

```
INPUT FILES
===========
Network                  : Z:\Road\AusLink Strategic
Projections\TransCAD Files\AusLinkSP\Geodata\Network\RoadFreight.net
Demand Table             : Z:\Road\AusLink Strategic
Projections\TransCAD
Files\AusLinkSP\TruckAssignment\Inputs\AllTrucks.mtx

OUTPUT FILES
============
Flow Table               : Z:\Road\AusLink Strategic
Projections\TransCAD
Files\AusLinkSP\TruckAssignment\Results\ASN_LinkFlow_2010.bin

LINK FIELDS
===========
Cost                     : AdjustedLength
Capacity                 : Capacity
Probability Function     : Gumbel

OD DEMAND
=========
OD Pairs                 :                16900
Non zero OD Pairs        :                 2623
Demand                   :            411044.00
Intranodal Demand        :            333255.00

PARAMETERS
==========
Method                   : Stochastic User Equilibrium
Maximum Iterations       :                   20
Iterations               :                    3
Conv. Criteria           :                 0.01

Running Results
===============
Relative Gap             :                 0.00
RMSE                     :               105.20
% RMSE                 :                 42.16
Max Flow Change          :              1363.00
Equilibrium reached      : Yes
Total V-Time-T           :          28375634.46
Total V-Dist-T           :          27946623.09


Total Running Time 00:00:00.421.
```

FIGURE VI.6 ROAD FREIGHT TASK ASSIGNMENT, 2010

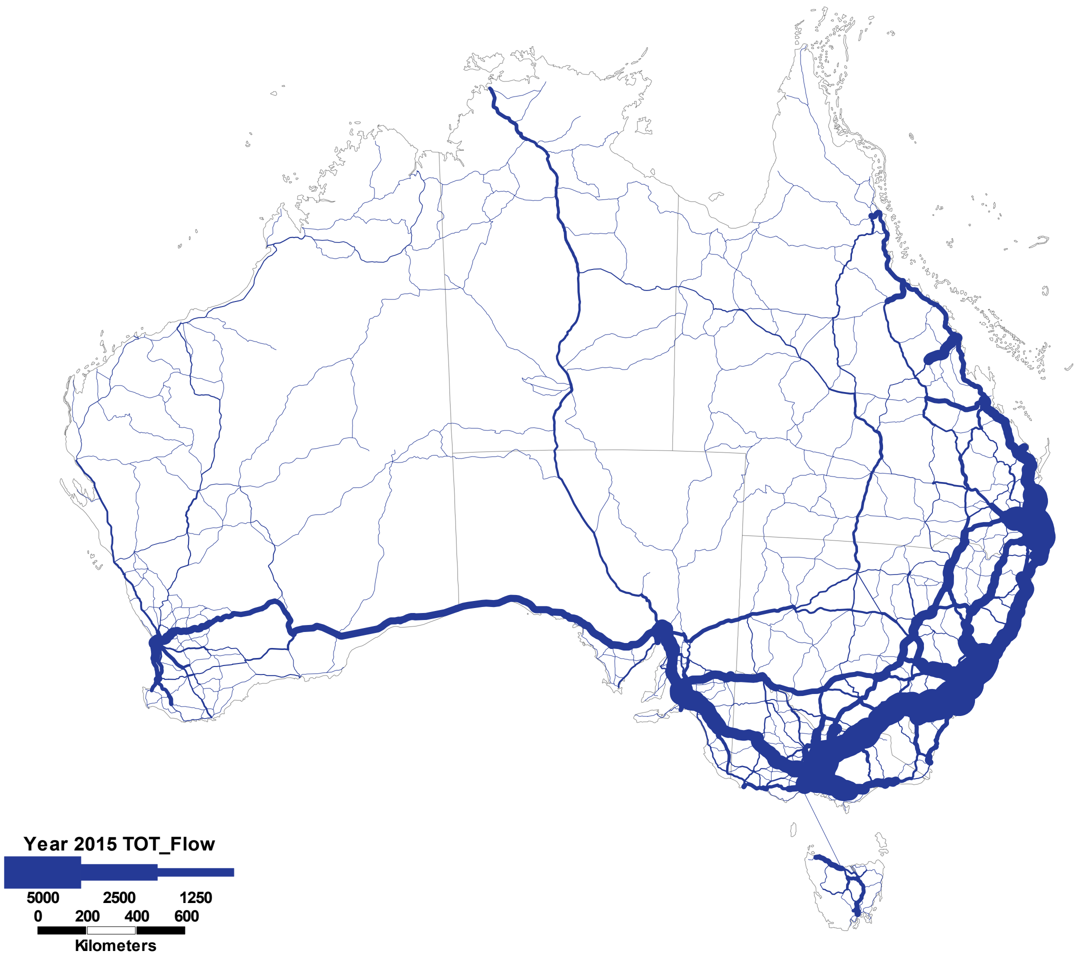


2015

```
INPUT FILES
===========
Network                    : Z:\Road\AusLink Strategic
Projections\TransCAD Files\AusLinkSP\Geodata\Network\RoadFreight.net
Demand Table               : Z:\Road\AusLink Strategic
Projections\TransCAD
Files\AusLinkSP\TruckAssignment\Inputs\AllTrucks.mtx

OUTPUT FILES
============
Flow Table                 : Z:\Road\AusLink Strategic
Projections\TransCAD
Files\AusLinkSP\TruckAssignment\Results\ASN_LinkFlow_2015.bin

LINK FIELDS
===========
Cost                       : AdjustedLength
Capacity                   : Capacity
Probability Function       : Gumbel

OD DEMAND
```

```
=========
OD Pairs                    :               16900
Non zero OD Pairs           :                2619
Demand                      :           468317.00
Intranodal Demand           :           380503.00

PARAMETERS
==========
Method                      : Stochastic User Equilibrium
Maximum Iterations          :                  20
Iterations                  :                   3
Conv. Criteria              :                0.01

Running Results
===============
Relative Gap                :                0.00
RMSE                        :              121.13
% RMSE                    :              43.54
Max Flow Change             :             1560.50
Equilibrium reached         : Yes
Total V-Time-T              :         31099637.81
Total V-Dist-T              :         30647433.99


Total Running Time 00:00:00.422.
```

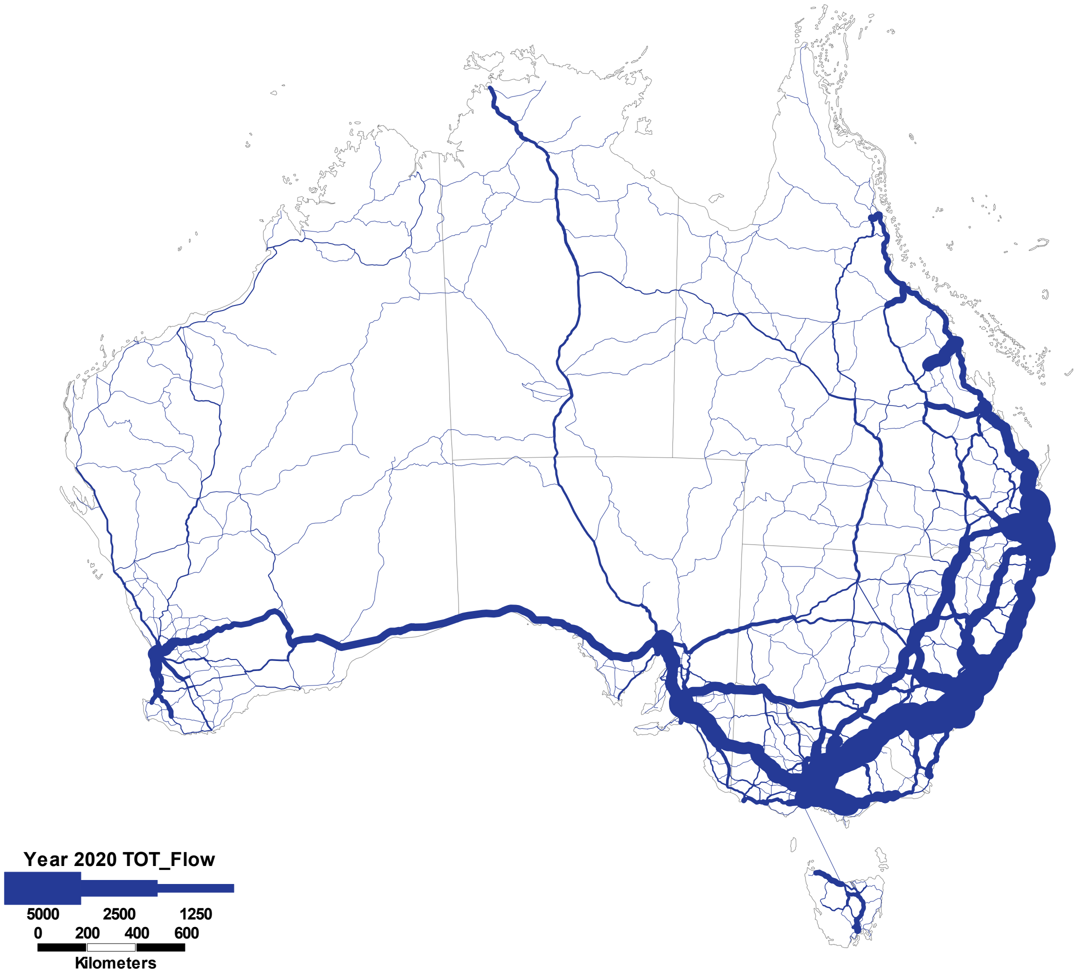
FIGURE VI.7 ROAD FREIGHT TASK ASSIGNMENT, 2015



2020

```
INPUT FILES
===========
Network                  : Z:\Road\AusLink Strategic
Projections\TransCAD Files\AusLinkSP\Geodata\Network\RoadFreight.net
Demand Table             : Z:\Road\AusLink Strategic
Projections\TransCAD
Files\AusLinkSP\TruckAssignment\Inputs\AllTrucks.mtx

OUTPUT FILES
============
Flow Table               : Z:\Road\AusLink Strategic
Projections\TransCAD
Files\AusLinkSP\TruckAssignment\Results\ASN_LinkFlow_2020.bin

LINK FIELDS
===========
Cost                     : AdjustedLength
Capacity                 : Capacity
Probability Function     : Gumbel

OD DEMAND
=========
OD Pairs                 :                16900
Non zero OD Pairs        :                 2632
Demand                   :            526309.00
Intranodal Demand        :            428277.00

PARAMETERS
==========
Method                   : Stochastic User Equilibrium
Maximum Iterations       :                   20
Iterations               :                    3
Conv. Criteria           :                 0.01

Running Results
===============
Relative Gap             :                 0.00
RMSE                     :               141.38
% RMSE                  :                45.36
Max Flow Change          :              1837.50
Equilibrium reached      : Yes
Total V-Time-T           :          34545980.82
Total V-Dist-T           :          34073710.09


Total Running Time 00:00:00.453.
```

FIGURE VI.8   ROAD FREIGHT TASK ASSIGNMENT, 2020

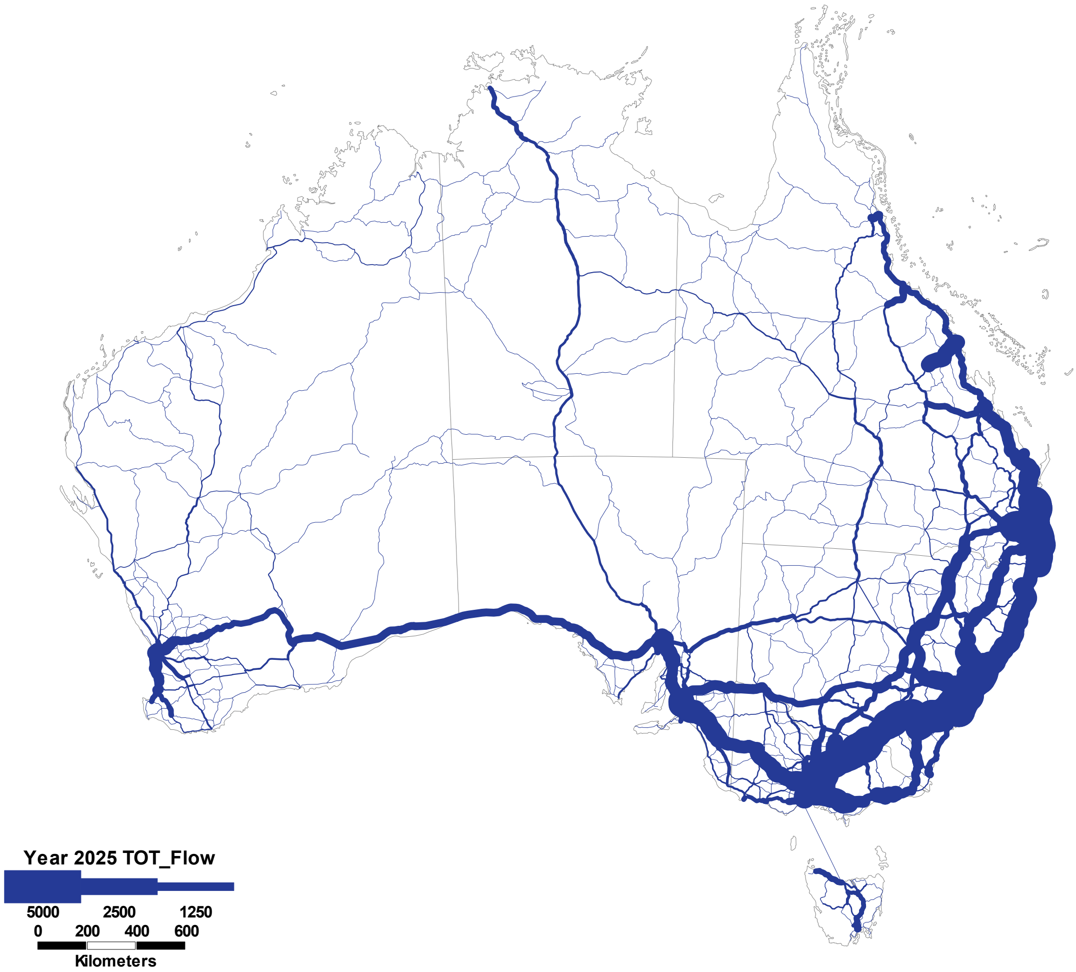


2025

```
INPUT FILES
===========
Network                    : Z:\Road\AusLink Strategic
Projections\TransCAD Files\AusLinkSP\Geodata\Network\RoadFreight.net
Demand Table               : Z:\Road\AusLink Strategic
Projections\TransCAD
Files\AusLinkSP\TruckAssignment\Inputs\AllTrucks.mtx

OUTPUT FILES
============
Flow Table                 : Z:\Road\AusLink Strategic
Projections\TransCAD
Files\AusLinkSP\TruckAssignment\Results\ASN_LinkFlow_2025.bin

LINK FIELDS
===========
Cost                       : AdjustedLength
Capacity                   : Capacity
Probability Function       : Gumbel
```

```
OD DEMAND
=========
OD Pairs                  :              16900
Non zero OD Pairs         :               2611
Demand                    :          585593.00
Intranodal Demand         :          478068.00

PARAMETERS
==========
Method                    : Stochastic User Equilibrium
Maximum Iterations        :                 20
Iterations                :                  3
Conv. Criteria            :               0.01

Running Results
===============
Relative Gap              :               0.00
RMSE                      :             175.55
% RMSE                   :              50.72
Max Flow Change           :            2409.50
Equilibrium reached       : Yes
Total V-Time-T            :        37814922.37
Total V-Dist-T            :        37325607.27


Total Running Time 00:00:00.468.
```

FIGURE VI.9 ROAD FREIGHT TASK ASSIGNMENT, 2025



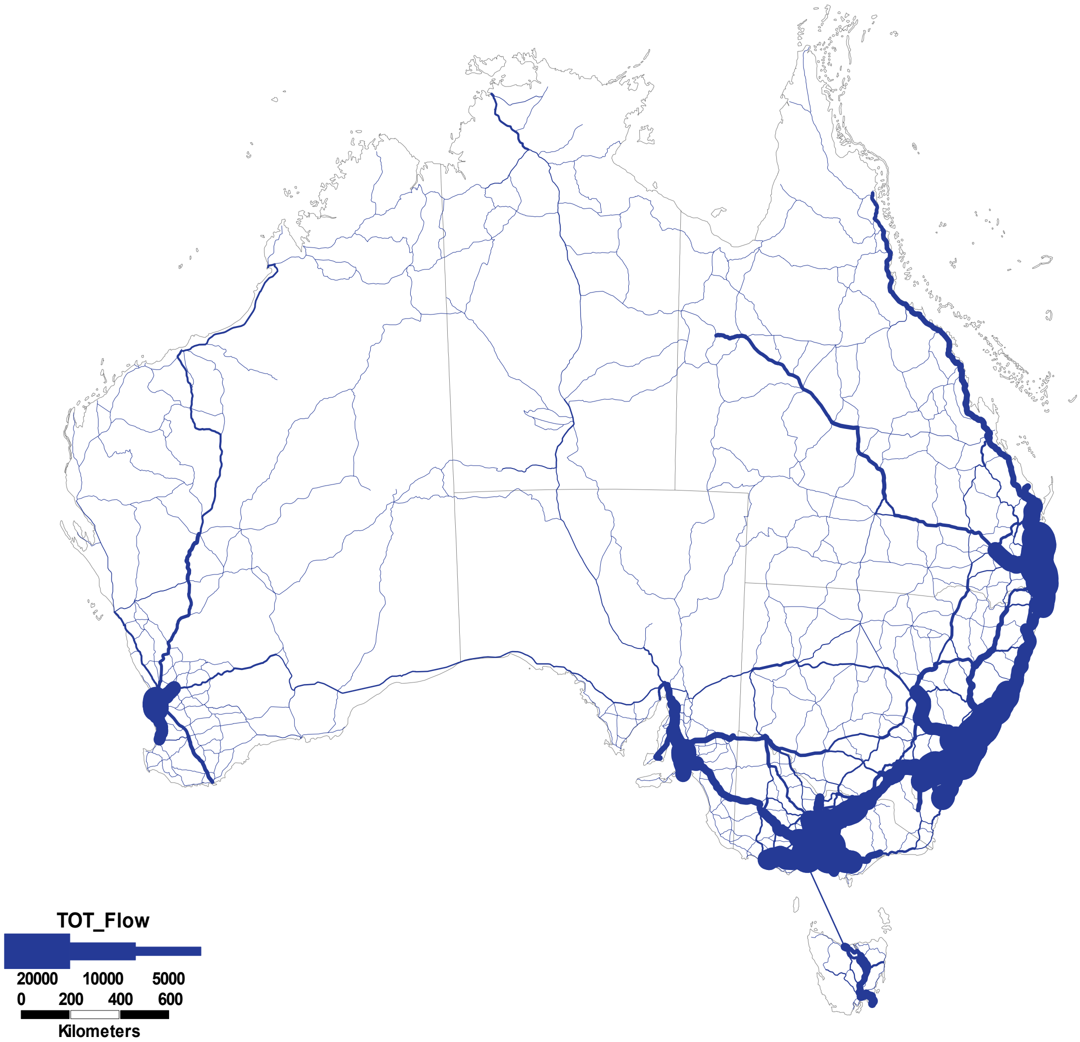
Road passenger vehicle assignment results

1999

```
INPUT FILES
===========
Network                   : Z:\Road\AusLink Strategic
Projections\TransCAD Files\AusLinkSP\Geodata\Network\RoadFreight.net
Demand Table              : Z:\Road\AusLink Strategic
Projections\TransCAD
Files\AusLinkSP\PassengerAssignment\Inputs\OZPASS--Results.mtx

OUTPUT FILES
============
Flow Table                : Z:\Road\AusLink Strategic
Projections\TransCAD
Files\AusLinkSP\PassengerAssignment\Results\ASN_LinkFlow1999.bin

LINK FIELDS
===========
Cost                      : AdjustedLength
```

```
Capacity                    : Capacity
Probability Function        : Gumbel

OD DEMAND
=========
OD Pairs                    :              8836
Non zero OD Pairs           :              3539
Demand                      :         642265.87
Intranodal Demand           :         202158.64

PARAMETERS
==========
Method                      : Stochastic User Equilibrium
Maximum Iterations          :                20
Iterations                  :                 3
Conv. Criteria              :              0.01

Running Results
===============
Relative Gap                :              0.00
RMSE                        :            283.48
% RMSE                     :             25.72
Max Flow Change             :           3344.45
Equilibrium reached         : Yes
Total V-Time-T              :      101599880.00
Total V-Dist-T              :      100612627.51


Total Running Time 00:00:00.421.
```

FIGURE VI.10 ROAD PASSENGER VEHICLE ASSIGNMENT, 1999

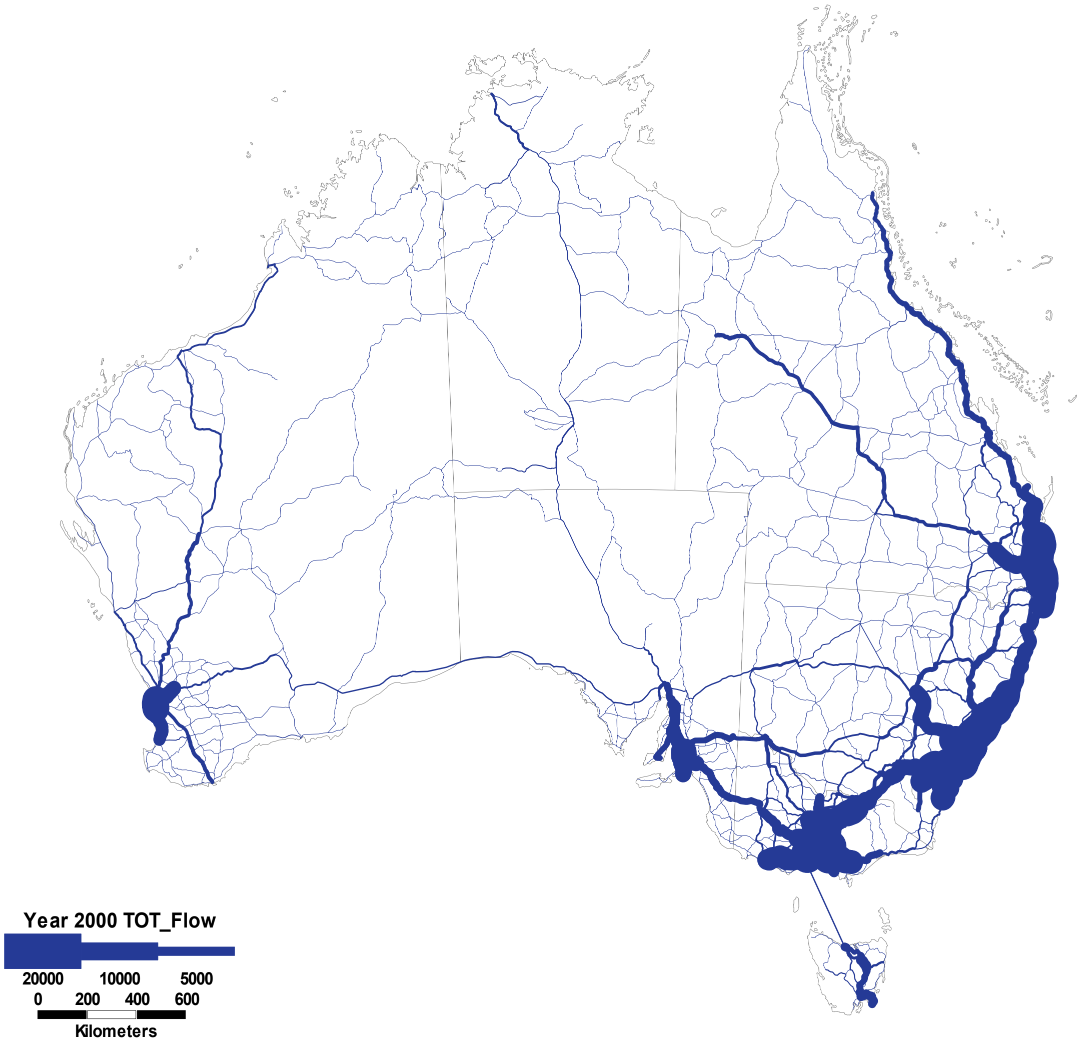


2000

```
INPUT FILES
===========
Network                       : Z:\Road\AusLink Strategic
Projections\TransCAD Files\AusLinkSP\Geodata\Network\RoadFreight.net
Demand Table                  : Z:\Road\AusLink Strategic
Projections\TransCAD
Files\AusLinkSP\PassengerAssignment\Inputs\OZPASS--Results.mtx

OUTPUT FILES
============
Flow Table                    : Z:\Road\AusLink Strategic
Projections\TransCAD
Files\AusLinkSP\PassengerAssignment\Results\ASN_LinkFlow2000.bin

LINK FIELDS
===========
Cost                          : AdjustedLength
Capacity                      : Capacity
```

```
Probability Function     : Gumbel

OD DEMAND
=========
OD Pairs                 :              8836
Non zero OD Pairs        :              3543
Demand                   :         667469.49
Intranodal Demand        :         209819.26

PARAMETERS
==========
Method                   : Stochastic User Equilibrium
Maximum Iterations       :                20
Iterations               :                 3
Conv. Criteria           :              0.01

Running Results
===============
Relative Gap             :              0.00
RMSE                     :            293.14
% RMSE                  :             25.64
Max Flow Change          :           3454.97
Equilibrium reached      : Yes
Total V-Time-T           :      105157870.17
Total V-Dist-T           :      104138085.81


Total Running Time 00:00:00.380.
```

FIGURE VI.11 ROAD PASSENGER VEHICLE ASSIGNMENT, 2000

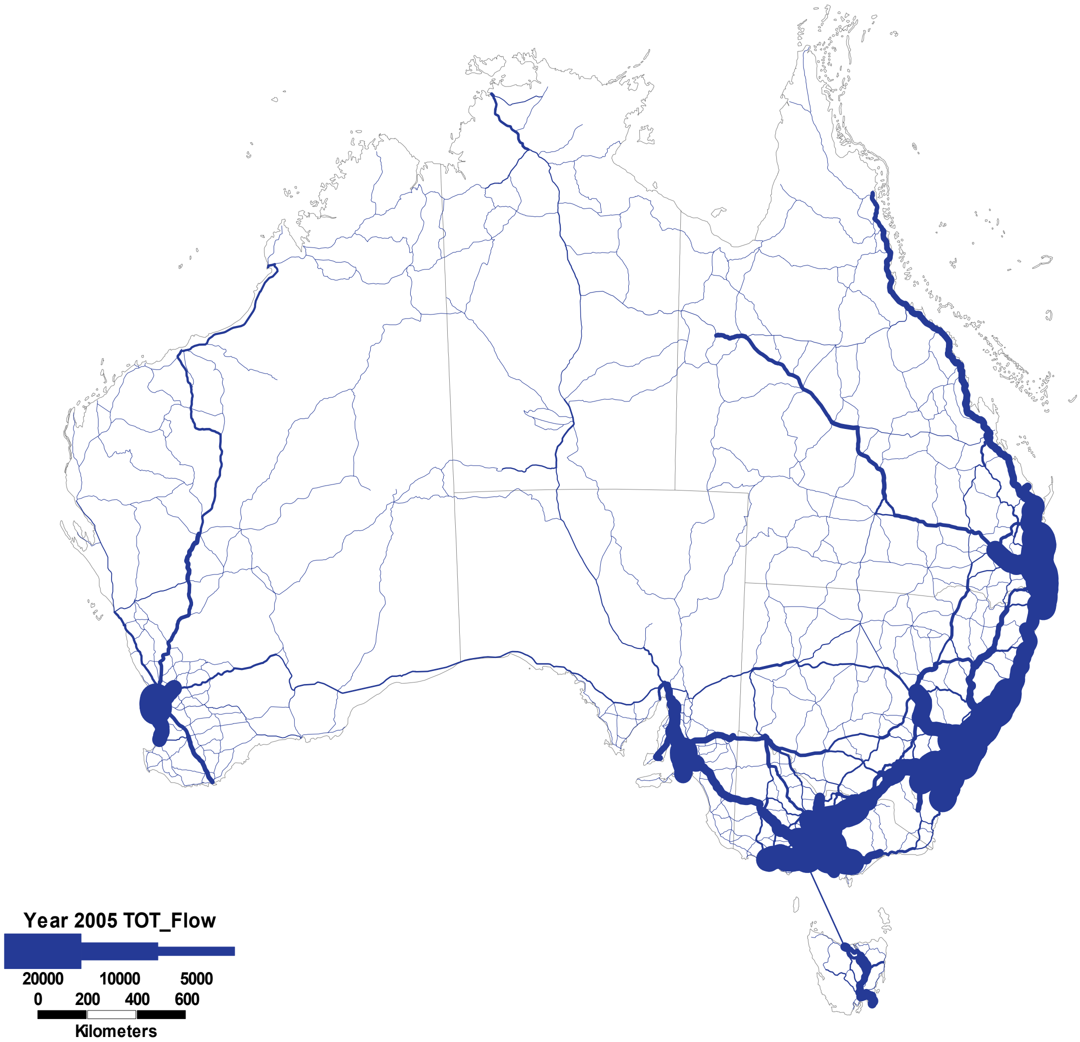


2005

```
INPUT FILES
===========
Network                    : Z:\Road\AusLink Strategic
Projections\TransCAD Files\AusLinkSP\Geodata\Network\RoadFreight.net
Demand Table               : Z:\Road\AusLink Strategic
Projections\TransCAD
Files\AusLinkSP\PassengerAssignment\Inputs\OZPASS--Results.mtx

OUTPUT FILES
============
Flow Table                 : Z:\Road\AusLink Strategic
Projections\TransCAD
Files\AusLinkSP\PassengerAssignment\Results\ASN_LinkFlow2005.bin

LINK FIELDS
===========
Cost                       : AdjustedLength
Capacity                   : Capacity
```

```
Probability Function     : Gumbel

OD DEMAND
=========
OD Pairs                 :              8836
Non zero OD Pairs        :              3552
Demand                   :         752266.99
Intranodal Demand        :         235948.72

PARAMETERS
==========
Method                   : Stochastic User Equilibrium
Maximum Iterations       :                20
Iterations               :                 3
Conv. Criteria           :              0.01

Running Results
===============
Relative Gap             :              0.00
RMSE                     :            320.91
% RMSE                  :             25.15
Max Flow Change          :           3760.89
Equilibrium reached      : Yes
Total V-Time-T           :      116134880.80
Total V-Dist-T           :      115016939.65


Total Running Time 00:00:00.376.
```

FIGURE VI.12 ROAD PASSENGER VEHICLE ASSIGNMENT, 2005

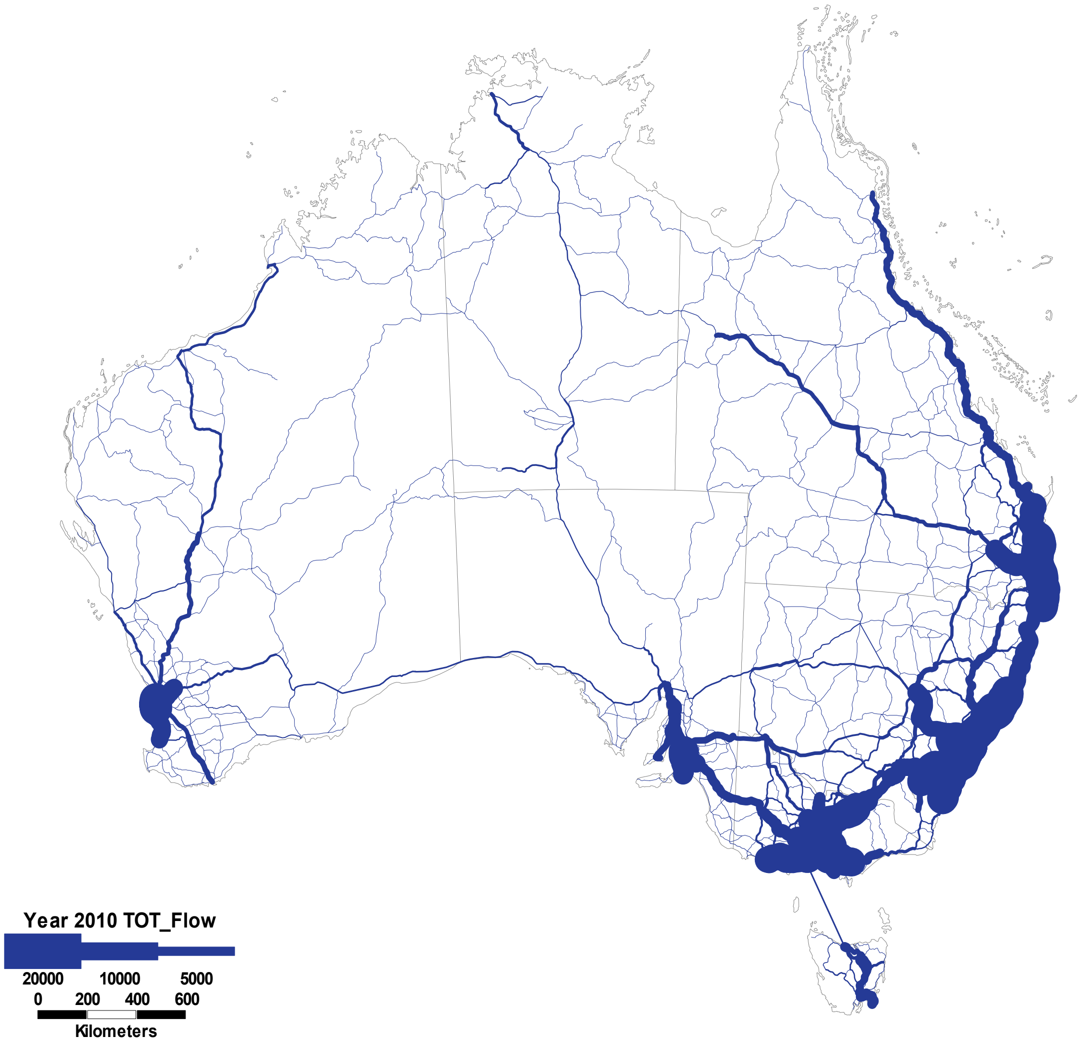


2010

```
INPUT FILES
===========
Network                    : Z:\Road\AusLink Strategic
Projections\TransCAD Files\AusLinkSP\Geodata\Network\RoadFreight.net
Demand Table               : Z:\Road\AusLink Strategic
Projections\TransCAD
Files\AusLinkSP\PassengerAssignment\Inputs\OZPASS--Results.mtx

OUTPUT FILES
============
Flow Table                 : Z:\Road\AusLink Strategic
Projections\TransCAD
Files\AusLinkSP\PassengerAssignment\Results\ASN_LinkFlow2010.bin

LINK FIELDS
===========
Cost                       : AdjustedLength
Capacity                   : Capacity
```

```
Probability Function      : Gumbel

OD DEMAND
=========
OD Pairs                  :                8836
Non zero OD Pairs         :                3578
Demand                    :           860095.09
Intranodal Demand         :           268983.98

PARAMETERS
==========
Method                    : Stochastic User Equilibrium
Maximum Iterations        :                  20
Iterations                :                   3
Conv. Criteria            :                0.01

Running Results
===============
Relative Gap              :                0.00
RMSE                      :              357.24
% RMSE                   :              24.70
Max Flow Change           :             4153.11
Equilibrium reached       : Yes
Total V-Time-T            :        130623799.97
Total V-Dist-T            :        129367424.83


Total Running Time 00:00:00.377.
```

FIGURE VI.13 ROAD PASSENGER VEHICLE ASSIGNMENT, 2010



2015

```
INPUT FILES
===========
Network                    : Z:\Road\AusLink Strategic
Projections\TransCAD Files\AusLinkSP\Geodata\Network\RoadFreight.net
Demand Table               : Z:\Road\AusLink Strategic
Projections\TransCAD
Files\AusLinkSP\PassengerAssignment\Inputs\OZPASS--Results.mtx

OUTPUT FILES
============
Flow Table                 : Z:\Road\AusLink Strategic
Projections\TransCAD
Files\AusLinkSP\PassengerAssignment\Results\ASN_LinkFlow2015.bin

LINK FIELDS
===========
Cost                       : AdjustedLength
Capacity                   : Capacity
```

```
Probability Function     : Gumbel

OD DEMAND
=========
OD Pairs                 :                8836
Non zero OD Pairs        :                3610
Demand                   :           978562.40
Intranodal Demand        :           305387.68

PARAMETERS
==========
Method                   : Stochastic User Equilibrium
Maximum Iterations       :                  20
Iterations               :                   3
Conv. Criteria           :                0.01

Running Results
===============
Relative Gap             :                0.00
RMSE                     :              396.44
% RMSE                 :                24.30
Max Flow Change          :             4630.91
Equilibrium reached      : Yes
Total V-Time-T           :        146248068.87
Total V-Dist-T           :        144838137.67


Total Running Time 00:00:00.391.
```

FIGURE VI.14 ROAD PASSENGER VEHICLE ASSIGNMENT, 2015

2020

```
INPUT FILES
===========
Network                    : Z:\Road\AusLink Strategic
Projections\TransCAD Files\AusLinkSP\Geodata\Network\RoadFreight.net
Demand Table               : Z:\Road\AusLink Strategic
Projections\TransCAD
Files\AusLinkSP\PassengerAssignment\Inputs\OZPASS--Results.mtx

OUTPUT FILES
============
Flow Table                 : Z:\Road\AusLink Strategic
Projections\TransCAD
Files\AusLinkSP\PassengerAssignment\Results\ASN_LinkFlow2020.bin

LINK FIELDS
===========
Cost                       : AdjustedLength
Capacity                   : Capacity
```

```
Probability Function      : Gumbel

OD DEMAND
=========
OD Pairs                  :                 8836
Non zero OD Pairs         :                 3618
Demand                    :           1108926.28
Intranodal Demand         :            345558.55

PARAMETERS
==========
Method                    : Stochastic User Equilibrium
Maximum Iterations        :                   20
Iterations                :                    3
Conv. Criteria            :                 0.01

Running Results
===============
Relative Gap              :                 0.00
RMSE                      :               439.13
% RMSE                   :                23.96
Max Flow Change           :              5162.36
Equilibrium reached       : Yes
Total V-Time-T            :         163072398.10
Total V-Dist-T            :         161498088.72


Total Running Time 00:00:00.375.
```

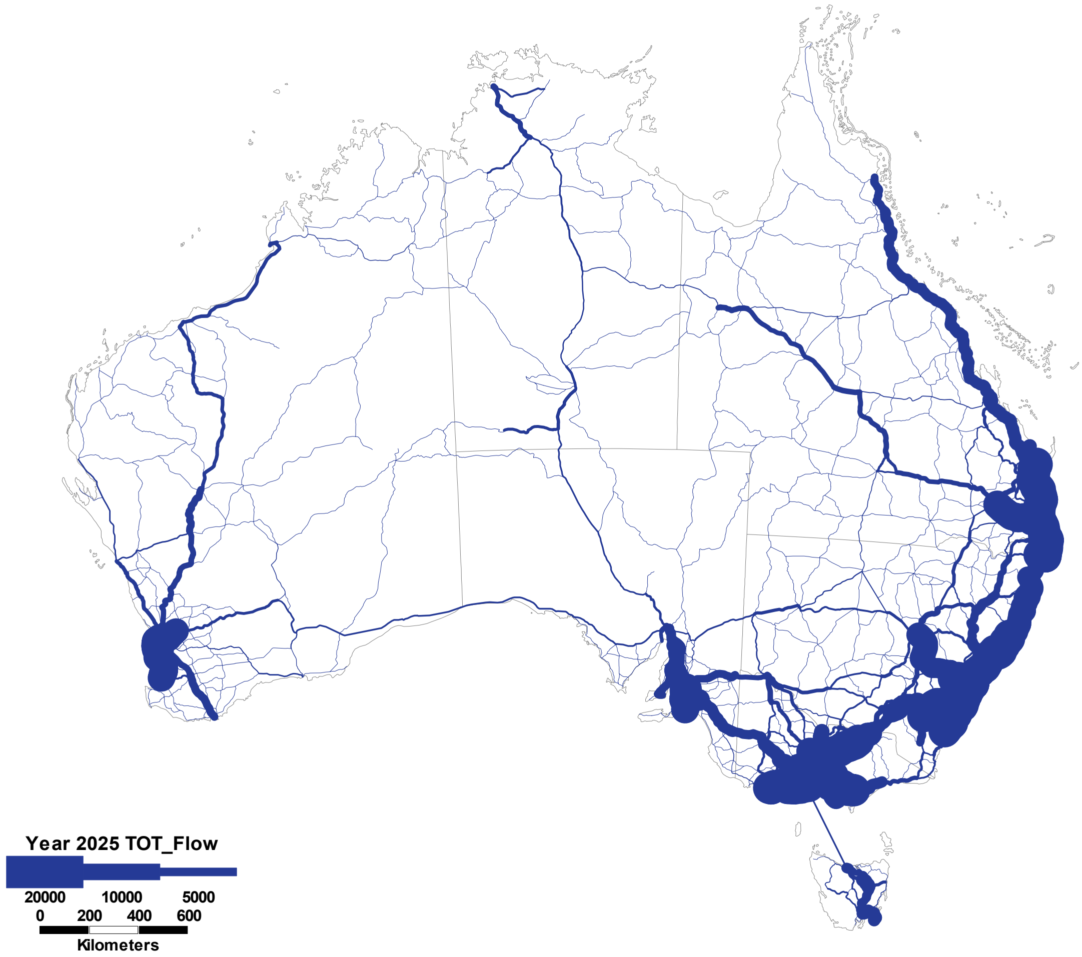
FIGURE VI.15 ROAD PASSENGER VEHICLE ASSIGNMENT, 2020

2025

```
INPUT FILES
===========
Network                  : Z:\Road\AusLink Strategic
Projections\TransCAD Files\AusLinkSP\Geodata\Network\RoadFreight.net
Demand Table             : Z:\Road\AusLink Strategic
Projections\TransCAD
Files\AusLinkSP\PassengerAssignment\Inputs\OZPASS--Results.mtx

OUTPUT FILES
============
Flow Table               : Z:\Road\AusLink Strategic
Projections\TransCAD
Files\AusLinkSP\PassengerAssignment\Results\ASN_LinkFlow2025.bin

LINK FIELDS
===========
Cost                     : AdjustedLength
Capacity                 : Capacity
```

```
Probability Function      : Gumbel

OD DEMAND
=========
OD Pairs                  :                  8836
Non zero OD Pairs         :                  3624
Demand                    :            1252701.19
Intranodal Demand         :             390211.96

PARAMETERS
==========
Method                    : Stochastic User Equilibrium
Maximum Iterations        :                    20
Iterations                :                     3
Conv. Criteria            :                  0.01

Running Results
===============
Relative Gap              :                  0.00
RMSE                      :                486.47
% RMSE                   :                23.71
Max Flow Change           :               5755.64
Equilibrium reached       : Yes
Total V-Time-T            :          180827789.31
Total V-Dist-T            :          179086644.20


Total Running Time 00:00:00.370.
```

FIGURE VI.16 ROAD PASSENGER VEHICLE ASSIGNMENT, 2025



TRANSCAD SELECTION SETS

The following selection sets are used to select the towns and road layers for the figures produced in chapter 2.

1. *Sydney-Brisbane (Inland)*

Towns:

```
NAME='SYDNEY' OR NAME = 'NEWCASTLE' OR NAME = 'MAITLAND' OR NAME =
'SINGLETON' OR NAME = 'MUSWELLBROOK' OR NAME = 'TAMWORTH' OR NAME =
'ARMIDALE' OR NAME = 'GLEN INNES' OR NAME = 'TENTERFIELD' OR NAME =
'WARWICK' OR NAME = 'IPSWICH' OR NAME = 'BRISBANE'
```

Roads:

```
AusLinkCorridorCode = 1
```

2. *Sydney-Brisbane (Coastal)*

Towns:

```
NAME = 'SYDNEY' OR NAME = 'NEWCASTLE' OR NAME = 'TAREE' OR NAME =
'PORT MACQUARIE' OR NAME = 'KEMPSEY' OR NAME = 'COFFS HARBOUR' OR NAME
= 'GRAFTON' OR NAME = 'BALLINA' OR NAME = 'MURWILLUMBAH' OR NAME =
'BRISBANE'
```

Roads:

```
AusLinkCorridorCode = 2
```

3. *Sydney–Melbourne*

Towns:

```
NAME = 'SYDNEY' OR NAME = 'MITTAGONG' OR NAME = 'GOULBURN' OR NAME =
'YASS' OR NAME = 'CANBERRA' OR NAME = 'JUGIONG' OR NAME = 'GUNDAGAI'
OR NAME = 'TARCUTTA' OR NAME = 'HOLBROOK' OR NAME = 'ALBURY' OR NAME =
'WODONGA' OR NAME = 'WANGARATTA' OR NAME = 'BENALLA' OR NAME = '
EUROA' OR NAME = 'SEYMOUR' OR NAME = 'MELBOURNE'
```

Roads:

```
AusLinkCorridorCode = 3
```

4. *Melbourne–Adelaide*

Towns:

```
NAME = 'MELBOURNE' OR NAME = 'BALLARAT' OR NAME = 'ARARAT' OR NAME =
'HORSHAM' OR NAME = 'BORDERTOWN' OR NAME = 'TAILEM BEND' OR NAME =
'ADELAIDE'
```

Roads:

```
AusLinkCorridorCode = 4
```

5. *Melbourne–Brisbane*

Towns:

```
NAME = 'SEYMOUR' OR NAME = 'SHEPPARTON' OR NAME = 'TOCUMWAL' OR NAME =
'NARRANDERA' OR NAME = 'WEST WYALONG' OR NAME = 'FORBES' OR NAME = 'PARKES'
OR NAME = 'DUBBO' OR NAME = 'COONABARABRAN' OR NAME = 'NARRABRI' OR NAME =
'MOREE' OR NAME = 'GOONDIWINDI' OR NAME = 'TOOWOOMBA' OR NAME = 'SYDNEY' OR
NAME = 'BRISBANE' OR NAME = 'MELBOURNE'
```

Roads:

```
AusLinkCorridorCode = 5
```

6. *Sydney–Adelaide*

Towns:

```
NAME = 'SYDNEY' OR NAME = 'CANBERRA' OR NAME = 'YASS' OR NAME = 'WAGGA
WAGGA' OR NAME = 'NARRANDERA' OR NAME = 'HAY' OR NAME = 'MILDURA' OR
NAME = 'RENMARK' OR NAME = 'ADELAIDE'
```

Roads:

```
AusLinkCorridorCode = 6
```

7. *Adelaide–Perth*

Towns:

```
NAME = 'ADELAIDE' OR NAME = 'PORT AUGUSTA' OR NAME = 'CEDUNA' OR NAME
= 'EUCLA' OR NAME = 'NORSEMAN' OR NAME = 'COOLGARDIE' OR NAME =
'SOUTHERN CROSS' OR NAME = 'NORTHAM' OR NAME = 'PERTH'
```

Roads:

```
AusLinkCorridorCode = 7
```

8. *Adelaide–Darwin*

Towns:

```
NAME = 'ADELAIDE' OR NAME = 'PORT AUGUSTA' OR NAME = 'COOBER PEDY' OR
NAME = 'ALICE SPRINGS' OR NAME = 'TENNANT CREEK' OR NAME = 'KATHERINE'
OR NAME = 'DARWIN'
```

Roads:

```
AusLinkCorridorCode = 8
```

9. *Perth–Darwin*

Towns:

```
NAME = 'PERTH' OR NAME = 'GERALDTON' OR NAME = 'CARNARVON' OR NAME =
'EXMOUTH' OR NAME = 'PORT HEDLAND' OR NAME = 'BROOME' OR NAME =
'KUNUNURRA' OR NAME = 'KATHERINE' OR NAME = 'DARWIN' OR NAME = 'MOUNT
MAGNET' OR NAME = 'MEEKATHARRA' OR NAME = 'NEWMAN'
```

Roads:

```
AusLinkCorridorCode = 9
```

10. *Brisbane–Darwin*

Towns:

```
NAME = 'BRISBANE' OR NAME = 'TOOWOOMBA' OR NAME = ' MILES' OR NAME =
'ROMA' OR NAME =' BLACKALL' OR NAME = 'LONGREACH' OR NAME = ' WINTON'
OR NAME = ' CLONCURRY' OR NAME = 'MT ISA' OR NAME = 'CAMOOWEAL' OR
NAME = 'THREE WAYS' OR NAME = 'KATHERINE' OR NAME = 'DARWIN'
```

Roads:

```
AusLinkCorridorCode = 10
```

11. Brisbane–Cairns

Towns:

```
NAME = 'BRISBANE' OR NAME = 'GYMPIE' OR NAME = 'BUNDABERG' OR NAME =
'GLADSTONE' OR NAME = 'ROCKHAMPTON' OR NAME = 'MACKAY' OR NAME =
'BOWEN' OR NAME = 'TOWNSVILLE' OR NAME = 'TULLY' OR NAME = 'CAIRNS'
```

Roads:

```
AusLinkCorridorCode = 11
```

12. Melbourne–Sale

Towns:

```
NAME = 'MELBOURNE' OR NAME = 'TRARALGON' OR NAME = 'SALE'
```

Roads:

```
AusLinkCorridorCode = 12
```

13. Perth–Bunbury

Towns:

```
NAME = 'PERTH' OR NAME = 'MANDURAH' OR NAME = 'BUNBURY'
```

Roads:

```
AusLinkCorridorCode = 13
```

14. Hobart–Smithton

Towns:

```
NAME = 'HOBART' OR NAME = 'OATLANDS' OR NAME = 'ROSS' OR NAME =
'LAUNCESTON' OR NAME = 'DELORAINE' OR NAME = 'DEVONPORT' OR NAME =
'BURNIE' OR NAME = 'SMITHTON'
```

Roads:

```
AusLinkCorridorCode = 14
```

15. Melbourne–Mildura

Towns:

```
NAME = 'MELBOURNE' OR NAME = 'KYNETON' OR NAME = 'BENDIGO' OR NAME =
'OUYEN' OR NAME = 'MILDURA'
```

Roads:

```
AusLinkCorridorCode = 15
```

16. Sydney–Dubbo

Towns:

```
NAME = 'SYDNEY' OR NAME = 'KATOOMBA' OR NAME = 'BATHURST' OR NAME =
'ORANGE' OR NAME = 'WELLINGTON' OR NAME = 'DUBBO'
```

Roads:

```
AusLinkCorridorCode = 16
```

17. Townsville–Mt Isa

Towns:

```
NAME = 'TOWNSVILLE' OR NAME = 'CHARTERS TOWERS' OR NAME = 'HUGHENDEN'
OR NAME = 'JULIA CREEK' OR NAME = 'CLONCURRY' OR NAME = 'MT ISA'
```

Roads:

```
AusLinkCorridorCode = 17
```

18. Canberra connectors

Towns:

```
NAME = 'CANBERRA' OR NAME = 'GOULBURN' OR NAME = 'YASS'
```

Roads:

```
AusLinkCorridorCode = 18
```

19. Sydney–Wollongong

Towns:

```
NAME = 'SYDNEY' OR NAME = 'WOLLONGONG'
```

Roads:

```
AusLinkCorridorCode = 19
```

20. Melbourne–Geelong

Towns:

```
NAME = 'MELBOURNE' OR NAME = 'GEELONG'
```

Roads:

```
AusLinkCorridorCode = 20
```

APPENDIX VII VALIDATING THE FREIGHTSIM FREIGHT TASK PROJECTIONS

In projecting future inter-regional freight movements, the BTRE investigated the reliability of the base year freight movements in the *FreightInfo™* 1999 data set and the projected growth in inter-regional freight movements. The analysis suggested that the *FreightInfo™* 1999 data, supplied with the FreightSim model, underestimated the inter-capital non-bulk road freight task quite significantly, accounting for less than half the total non-bulk road freight movements between the six mainland capital cities, excepting Darwin. This has implications for the projected growth in heavy vehicle traffic across the non-urban links of the AusLink National Network.

In order to provide more reliable road freight projections, the BTRE substituted inter-city and within urban area non-bulk road freight movement estimates from the ABS (2002a) Freight Movements Survey (FMS), appropriately scaled to account for the apparent under-enumeration in the FMS, for the equivalent *FreightInfo™* estimates. The urban regions for which the FMS non-bulk freight movements were substituted for the corresponding *FreightInfo™*1999 data included the capital city regions: Sydney (FDF region 210), Melbourne (310), Brisbane (410), Adelaide (510) and Canberra (110); and other urban centres: Gosford (215), Newcastle (221), Wollongong (231), Tweed Heads (241), Geelong (321), Gold Coast (421), Sunshine Coast (423), Townsville (471) and Cairns (481). Perth, Darwin and Hobart were excluded, as the *FreightInfo™*1999 data appears to adequately measure non-bulk freight to and from these cities.

Further, when the FreightSim results are then input into FDF Pty Ltd's *FreightTrucks*™ model, the resulting truck movement estimates appear to overstate the number of trucks required to undertake the inter-regional freight task. When assigned to the road network, the average on-road vehicle loads implied by FreightSim and *FreightTrucks*™ significantly under-estimate average loads recorded at selected CULWAY/Weigh-in-Motion (WIM) sites. In the projections presented in chapters 2 and 3, the BTRE has also adjusted the truck type mix and average load assumptions in *FreightTrucks*™ to mitigate for this apparent under-estimation of average loads.

This appendix describes the analysis undertaken by the BTRE to validate the *FreightInfo™* 1999 freight movement estimates and the *FreightTrucks™* model. It was prepared in the earlier stages of this project and, as a consequence, does not provide any validation of the FMS-adjusted freight movement estimates used to derive the projections presented in chapters 2 and 3. All results are based on the version of FreightSim as at December 2004 and the version of *FreightTrucks*™ supplied to the BTRE in mid-2003.

The analysis presented in this appendix comprises two principal areas:

1. Base year FreightSim freight flow and *FreightTrucks*™ estimates are compared with other, independent data sources. In particular, the base year FreightSim freight task estimates are compared with data from the recent Survey of Motor Vehicle Use (ABS 2003a) and the 2001 Freight Movements Survey (ABS 2002a). The *FreightTrucks*™ heavy vehicle traffic results are compared with actual traffic count information supplied to the BTRE by the States and Territories (SMEC 1998) and with CULWAY/WIM site data (for Marulan heavy vehicle checking station only).
2. Freight task growth projections derived using FreightSim are compared with other, independent freight task projections. In particular, the FreightSim freight task projections are compared with previously published BTRE projections in BTRE (2002, 2003b) and the projections outlined in the AusLink White Paper (DOTARS 2004).

The structure of this appendix is as follows. The next section recaps the FreightSim and *FreightTrucks*™ models and provides an overview of the freight projections used for this validation exercise. The base year comparisons, of course, are independent of the projection input assumptions. The freight traffic growth rates, however, will be dependent on these assumptions. The third section outlines the comparison between the FreightSim base case estimates and other estimates. Section four compares the projected growth in the freight task, by transport mode with other published projections. In section five, the base year *FreightTrucks*™ heavy vehicle traffic estimates are compared with the available traffic count data. Some concluding remarks are made at the end of the appendix.

FREIGHTSIM AND FREIGHTRUCKS™—A RECAP

FreightSim is designed to project future inter-regional freight movements in Australia. The model projects total regional production and consumption for each of 16 separate commodities—15 bulk commodities and manufactures (non-bulk)—and then estimates total inter-regional commodity movements by distributing commodities from regions of excess supply to regions of excess demand. FreightSim is designed to allow users to simulate alternative projection scenarios. Because it is designed as a simulation tool, some validation of the FreightSim results is recommended to ensure that the model results are consistent with the input assumptions, observed freight movements and comparable with other freight task projections.

FDF Pty Ltd's *FreightTrucks*™ model provides a set of rules for translating estimates of the inter-regional road freight movements, produced by FreightSim, into numbers of heavy road vehicle movements. Estimating heavy vehicle movements are a critical element of any economic assessment of road infrastructure spending needs as heavy vehicles impose greater loads on pavements, increasing road wear and accelerating maintenance and rehabilitation expenditures. Where roads are congested, the acceleration/deceleration characteristics of heavy vehicles can greatly reduce effective road capacity.

Together, FreightSim and *FreightTrucks*™ provide a means of projecting future heavy freight vehicle traffic across all non-urban roads in Australia for use in evaluating future road maintenance and investment expenditure needs.

FREIGHTSIM FREIGHT TASK PROJECTIONS

For the analysis presented in this appendix, the BTRE has used a preliminary set of base case freight task projections produced early on in the project. They will differ from the projections presented in the body of the report. Table VII.1 shows the aggregate freight movements for 1999—the base year—and freight task projections for 2025 used in this analysis.

In these projections, non-metallic minerals, metallic minerals and coal and coke are the three largest commodity group freight tasks in terms of total tonnes uplifted. Projected growth in the movement of all three commodity groups is quite strong—coal and coke by 3.0 per cent per annum, and non-metallic and metallic minerals by 2.5 and 2.3 per cent per annum, respectively. Total cement movements are projected to grow by around 3.7 per cent per annum, from around 12 million tonnes in 1999 to 31 million tonnes in 2025. Freight transport of manufactured products is also projected to grow strongly, by 2.8 per cent per annum. Live cattle and sheep transport are projected to grow least strongly, by 0.6 and 0.9 per cent per annum, respectively, between 1999 and 2025.

TABLE VII.1 ACTUAL AND PROJECTED AGGREGATE FREIGHT TASK—ROAD, RAIL, COASTAL SHIPPING AND DOMESTIC AVIATION—1999 AND 2025

Code	Commodity	1999	2025	Growth 1999–2025
		(million tonnes)		*(per cent pa)*
1	Manufactured products	87.7	179.2	2.8
2	Grains and oilseeds	69.3	97.0	1.3
3	Sheep live	2.5	3.2	0.9
4	Cattle live	5.0	5.9	0.6
5	Meat	9.4	12.0	1.0
6	Agricultural products	100.8	136.0	1.2
7	Coal and coke	210.7	508.1	3.4
8	Metallic minerals	220.8	393.8	2.3
9	Non-metallic minerals	758.3	1426.4	2.5
10	Oil and petroleum products	54.9	75.7	1.2
11	Gas	2.5	4.0	1.8
12	Steel and metals	63.9	99.9	1.7
13	Fertilisers	10.3	14.8	1.4
14	Cement	12.1	31.3	3.7
15	Timber and timber products	43.9	69.2	1.8
16	Other bulk	6.6	11.1	2.0
	Total	1658.7	3067.6	2.4

Sources FreightSim and BTRE estimates.

FREIGHT TASK VALIDATION

Validation of the FreightSim base year freight movements was undertaken primarily using the ABS Survey of Motor Vehicle Use (SMVU) and Freight Movements Survey (FMS) data. These two collections are described below.

SMVU freight task estimates

The SMVU is a sample-based survey of registered motor vehicles. The SMVU has been undertaken more or less triennially between 1971 and 1998 and annually since then. The SMVU collects information on kilometres travelled by all vehicles and tonnes carried by commercial vehicles. The SMVU is the major source of time-series data on Australian road freight movements. The BTRE uses the SMVU tonne kilometre task estimates to model and forecast road freight transport activity.

FMS freight task estimates

The FMS provides a full enumeration of total domestic freight movements by rail, air and coastal shipping and has been conducted on a quarterly basis since 1995. Inter-regional air and coastal shipping freight task estimates are available from other sources—BTRE (2000) and DOTARS (2000)—but inter-regional rail freight task estimates are not. In 2000–01, the ABS undertook a sample based survey of articulated truck freight movements and produced estimates of total inter-regional road freight movements by those vehicles for the twelve months to 31 March 2001. Rigid trucks and other commercial vehicles were not included in the FMS.

Base case validation

Table VII.2 shows the base case freight task estimates derived using FreightSim compared with estimates of the actual domestic freight task by transport mode. The estimates cover either calendar 1999 or financial year 1998–99. For road, the comparison indicates that FreightSim under-estimates total road freight tonnes uplifted by approximately 294 million tonnes, or 30 per cent, in comparison with the 1999 SMVU estimates (ABS 2002a). The difference between the FreightSim estimate of the road freight task and the actual road freight task estimate is of significant concern since road freight makes up almost three quarters of the total freight by mass. Of course, comparison on a total tonnes uplifted basis is not necessarily the best measure for comparing the total freight task, because the same consignment may be counted more than once. Tonne-kilometre measures of the freight task are preferable because in weighting by distance travelled they avoid this potential 'double-counting' problem.

For rail and coastal shipping, the FreightSim freight task estimates are much closer to the actual estimates. For rail, the FreightSim freight task estimates are within 3 per cent of the actual rail freight task in 1999 (ARA 2000). The FreightSim total coastal shipping freight task estimate is within 6 per cent of the actual coastal shipping freight task (BTRE 2000).

The FreightSim estimate of the domestic air freight task is 348 thousand tonnes, some 78 per cent above actual air freight carried by domestic and regional airlines reported in DOTARS Air Transport Statistics (ATS, DOTARS 2000). However, the FreightSim estimate probably makes some allowance for air freight carried on dedicated air freight services, which is not recorded in the ATS estimates. Air freight represents less than 1 per cent of the total freight tonnes uplifted, and therefore any discrepancy in the FreightSim air freight task estimate is not of significant concern.

TABLE VII.2 COMPARISON OF FREIGHTSIM WITH ACTUAL FREIGHT TASK, 1999

(million tonnes)

Mode	*Actual estimates*	FreightSim
Road[a]	1464	1170.4
Rail[b]	492	442.7
Coastal Shipping[c]	48.4	45.2
Air (domestic)[d]	0.196	0.348
Total	2004.6	1658.7

a. Actual road freight task estimates for the period 1 August 1998 to 31 July 1999, from the Survey of Motor Vehicle Use (ABS 2003a).

b. Actual rail freight task estimates include transport of sugar cane by rail (ABS 2002b).

c. Actual coastal shipping freight data for 1998–99 (BTRE 2000).

d. Actual domestic air freight equal to cargo-on-board services operated by domestic and regional airlines (DOTARS 2000). The figure does no include air freight on dedicated air freight services.

Sources ABS (2003a), ABS (2002b), BTRE (2000), DOTARS (2000).

Total land freight task validation

The FreightSim land freight task (i.e. road and rail freight) estimate was 1613 million tonnes for 1999, with road freight accounting for 1171 million tonnes and rail 442 million tonnes. Three-quarters of the total freight task was movement of goods wholly within a freight region[7]—intra-regional freight—whilst the remainder involved freight transported between freight regions—inter-regional freight. Table VII.3 summarises the FreightSim estimates of inter-regional and intra-regional freight movements by road and rail in 1999.

TABLE VII.3 BASE YEAR FREIGHTSIM FREIGHT FLOW ESTIMATES, 1999

(million tonnes)

Mode	*Intra-regional*	*Inter-regional*	*Total*
Road	964.6	205.8	1170.5
Rail	251.7	191.0	442.7
Total	1216.3	396.8	1613.2

Sources FreightSim (2003).

Comparing mass-distance measures of the total land freight task

Mass-distance measures of the FreightSim land freight task estimates may be derived by assigning the inter-regional freight movements to the road and rail networks and assuming an average freight haulage distance for intra-regional freight movements.

7 Freight regions are equivalent to Statistical Subdivision (ABS 1996), with the exception of the State/Territory capitals, where the freight regions are equivalent to the Statistical Division.

The FreightSim road and rail freight tasks were assigned to the AUSLIG (1993) TOPO 10M vector topographic road and rail data layers using the stochastic user equilibrium traffic assignment algorithm in *TransCAD* (Caliper 2004). A single node was selected for each region and all freight to and from the region was assigned to that node. The assigned road freight task estimates and the assigned rail freight task estimates were scaled up by 6.5 per cent and 10 per cent, respectively, to account for the degree of under-estimation of total distance in the road and rail layers of the AUSLIG (1993) data set.[8] When assigned to the network, the inter-regional road and rail freight tasks are approximately 72.4 and 73.8 billion tonne kilometres in 1999 (see table VII.4).

For the intra-regional freight task, it was assumed that the average travel distance was equal to three-quarters of the radius of a circle equal in area to the area of each geographic region.[9] While this is necessarily a rough approximation to the actual travel distances, measured in this way, the intra-regional road and rail freight tasks are approximately 44.6 and 40.0 billion tonne kilometres in 1999.

Using these methods, the FreightSim road freight task measures approximately 117.0 billion tonne kilometres in 1999, which is 10 per cent less than the SMVU estimate of 130 billion tonne kilometres for the 12 months to 31 July 1999. And the FreightSim rail freight task measures approximately 113 billion tonne kilometres, approximately 11 per cent less than the actual rail freight tonne-kilometre task in calendar 1999—127.4 billion tonne kilometres.

The same assignment methods may be used to assign the 2025 FreightSim freight projections to the road and rail networks and thereby compute the projected growth rate in the total road and rail tonne kilometre freight task. Table VII.4 shows that the base case projections imply growth in the total road freight task equal to 2.5 per cent per annum, between 1999 and 2025. This is below the rate of growth implied by the BTRE's aggregate road freight task projections—3.6 per cent per annum (DOTARS 2004)—which were also based on an average rate of economic growth of 2.6 per cent per annum between 1999 and 2025 (Australian Treasury 2002). Of course, the growth in road freight task

8 The distances reported in the road and rail layer of the AUSLIG (1993) TOPO–10M data set are not the actual road and rail link distances, but rather a GIS projection of the distance between geographic coordinates. Consequently, the distances in the AUSLIG (1993) data set will under-estimate the actual road and rail distances (Geoscience Australia, pers. comm., G. Lawford, October 2004). This does not appear to be documented in the AUSLIG (1993) data set.

9 The expected distance between two points randomly selected within the unit circle is approximately 0.9054 of the radius. For the case where the probability of selecting a point within the unit circle is distributed as a logistic probability density function centred at (0, 0) the expected distance between two points is approximately 0.6534 of the radius. Three-quarters of the radius is an approximation between these two cases.

is also a function of the assumed consumption and import elasticities and increasing the value of these elasticities will increase the projected growth in inter-regional road freight movements.

TABLE VII.4 FREIGHTSIM ASSIGNED LAND FREIGHT TASK, 1999 AND 2025

(billion tonne kilometres)

	1999		*2025*		*Growth rate (per cent pa)*	
	Road	*Rail*	*Road*	*Rail*	*Road*	*Rail*
Inter-regional	72.4	73.8	147.4	127.8	2.8	2.1
Intra-regional	44.6	40.0	77.4	78.1	2.1	2.6
Total	117.0	113.8	224.8	205.9	2.5	2.3

Note The inter-regional freight task estimates are based on assignment of the freight task to the road and rail freight networks using the traffic assignment algorithms in *TransCAD* (Caliper 2004).

The intra-regional freight task estimates are based on an assumed average travel distance equal to one-half the radius of a circle equal in area to the area of the geographic region within which the travel was undertaken.

Sources BTRE estimates.

Origin–destination freight task estimates

Another means of validating the FreightSim freight task estimates is to compare inter-capital freight traffic projections with other available estimates. BTRE (2003b) provides estimates of the total origin–destination (OD) freight task for seven Australian inter-capital corridors. The estimates, listed in table VII.5, imply total freight between the seven inter-capital corridors of 25.5 million tonnes and 31.2 billion tonne kilometres in 1998–99. The Sydney–Melbourne corridor is the largest corridor in both tonnes and tonne kilometres. The long-distance routes, such as Melbourne–Brisbane and Eastern Capitals–Perth are much more significant in tonne kilometres terms than tonnes uplifted.

TABLE VII.5 BTRE (2003a) ESTIMATED INTER-CAPITAL NON-BULK FREIGHT, 1998–99

	Mode			*Mode*		
	Road	*Rail*	*Total*	*Road*	*Rail*	*Total*
Corridor	*('000 tonnes)*			*(million tonne kilometres)*		
Sydney–Melbourne	7 014	873	7 887	6 116	839	6 955
Sydney–Brisbane	4 047	914	4 961	3 938	888	4 826
Melbourne–Brisbane	2 031	786	2 817	3 418	1 519	4 937
Sydney–Adelaide	1 271	318	1 589	1 798	545	2 343
Melbourne–Adelaide	2 982	726	3 708	2 162	560	2 722
Eastern Capitals–Perth	982	1 884	2 866	3 370	5 616	8 987
Sydney–Canberra	1 648	–	1 648	473	–	473
All seven corridors	19 975	5 501	25 476	21 275	9 967	31 243

Source BTRE (2003b).

Origin–destination data from FreightSim data may be aggregated to the same corridors, for comparison with the BTRE (2003b) data. These estimates are shown in table VII.6. Comparing the estimates in table VII.6 with those in table VII.5, however, shows a considerable difference between them. This may be partly attributable to the nature of the OD definitions—but this should explain only part of the difference as for both data sets the origin and destination regions cover the capital city Statistical Divisions. In some corridors the difference between the freight task estimates is very large—for example, between Sydney and Melbourne the FreightSim estimates capture 31 per cent of the freight task estimate in BTRE (2003b) and between Sydney and Brisbane the FreightSim data captures only 28 per cent of the freight task estimate in BTRE (2003b).

TABLE VII.6 FREIGHTSIM INTERCAPITAL NON-BULK AND TOTAL FREIGHT ESTIMATES, 1999

	Non-bulk freight			*All commodities*		
	Road	*Rail*	*Total*	*Road*	*Rail*	*Total*
Corridor	*('000 tonnes)*			*('000 tonnes)*		
Sydney–Melbourne	2 178	1 218	3 396	3 218	1 462	4 680
Sydney–Brisbane	1 124	848	1 972	1 554	860	2 414
Melbourne–Brisbane	1 311	422	1 733	1 637	629	2 267
Sydney–Adelaide	623	229	852	1 047	251	1 298
Melbourne–Adelaide	868	2 048	2 916	1 329	2 570	3 899
Eastern Capitals–Perth	1 258	1 992	3 250	1 798	2 532	4 330
Sydney–Canberra	552	8	560	1 312	168	1 480
All seven corridors	7 915	6 765	14 681	11 895	8 472	20 367

Source FreightSim estimates.

It is also possible to compare the data with the 2001 FMS OD road freight task estimates (ABS 2002a). The OD FMS estimates are listed in table VII.7. The raw FMS results have been scaled up by 10 per cent in table VII.7 to account for the apparent under-reporting of trips in the survey—see ABS (2002a) and Sutcliffe (2002) for a discussion of sampling issues associated with the FMS—and rigid trucks—the FMS only surveyed articulated trucks. However, this should not have a significant impact on the inter-capital road freight task estimates as articulated trucks perform the majority of the inter-capital freight task.[10] This data also appears to imply that the FreightSim data significantly under-estimates the total inter-capital road freight in all corridors except between the Eastern State capitals and Perth.

10 For example, data from the Marulan truck station suggests that articulated trucks carry 91 per cent of the total road freight past Marulan. Marulan would include a mix of inter-capital and other freight.

TABLE VII.7 FREIGHT MOVEMENTS SURVEY INTERCAPITAL ROAD FREIGHT ESTIMATES, 12 MONTHS TO 31 MARCH 2001

Corridor	*Tonne task (‘000 tonnes)*	*TKM task (million tkm)*
Sydney–Melbourne	7 156	6 289
Sydney–Brisbane	4 487	4 399
Melbourne–Brisbane	1 855	3 196
Sydney–Adelaide	1 255	1 821
Melbourne–Adelaide	3 336	2 503
Eastern Capitals–Perth	830	2 839
Sydney–Canberra	1 614	463
All seven corridors	20 533	21 509

a. Note The FMS road freight task estimates have been scaled up by 10 per cent to account for the apparent under-reporting of road freight trips in the FMS.

Sources ABS (2002a) and BTRE estimates.

Urban freight task

Table VII.8 shows the base year FreightSim estimates of within capital and inter-capital road and rail fright movements.

TABLE VII.8 BASE YEAR FREIGHTSIM CAPITAL CITY FREIGHT FLOW ESTIMATES, 1999
(million tonnes)

Mode	*Intra-regional*	*Inter-capital*	*Total*
Road	549.5	12.3	561.8
Rail	8.2	8.5	16.7
Total	557.7	20.8	578.5

Sources FreightSim estimates.

Unfortunately, other estimates of the urban road freight transport task are not sufficiently comparable with the FreightSim measures to provide conclusive results. Of the other two major sources of road freight data—the SMVU and FMS—the SMVU reports only the total freight tonne-kilometres undertaken within urban areas—essentially capital city statistical divisions—and the FMS provides estimates of the OD freight task undertaken by articulated trucks (in tonnages and tonne-kilometres). Table VII.9 shows the estimates of the urban road freight task from these two data sources and the FreightSim estimates.

The SMVU reports total road freight task undertaken within capital cities. The capital city task estimates are based on respondents’ estimates of the total distance travelled within capital cities. The SMVU estimate, therefore, will include the urban component of freight trips that extend beyond the urban boundaries.

In contrast, the FMS and FreightSim estimates provided in table VII.8 measure only the OD freight movements entirely within capital cities; the FMS for articulated trucks only and FreightSim for all trucks. The SMVU reports a total of 15.4 billion tonne-kilometres are carried by articulated trucks in capital cities. The FMS, by contrast, implies that articulated trucks carry a total of 5 billion tonne-kilometres of freight entirely within the boundaries of the capital cities. This is well below the estimate of 15.4 billion kilometres implied by the SMVU, and it is difficult to reconcile these two figures.

The FMS estimate of the articulated truck capital city road freight task implies a total of 190 million tonnes in 2001. The FreightSim estimate shows a total of 500.7 million tonnes of freight was carried in capital cities in 1999.

While appearing to suggest discrepancies between these three data sources, it is not possible to fully reconcile these different source estimates.

TABLE VII.9 URBAN ROAD FREIGHT TASK ESTIMATES[a]

	SMVU		*FMS*[b]		*FreightSim*[b]
Vehicle type	*Capital cities*	*Other urban areas*	*Capital cities*		*Capital cities*
	(million tkm)		*(million tkm)*	*(million tonnes)*	*(million tonnes)*
LCVs	2 604	8 34			
Rigid trucks	11 531	3 306			
Articulated trucks	15 384	4 915	5 054	188.5	
Total	29 518	9 055			549.5

a. Capital cities areas are based on the capital city Statistical Divisions defined in the Australian Standard Statistical Geography (1996) (ABS 1996).

b. The FMS and *FreightInfo* based estimates measure the total freight carried wholly within a single capital city SD.

Sources ABS (2002a and 2003a) and *FreightInfo99*.

PROJECTED GROWTH IN ROAD AND RAIL FREIGHT

BTRE (2003b) provided projections of future inter-capital road and rail freight traffic. Notwithstanding the differences in the levels, between the FreightSim and BTRE (2003b) estimates implied in tables VII.5 and VII.6, it is useful to compare the growth rates in inter-capital freight movements, implied by the FreightSim projections, with those in BTRE (2003b). Table VII.10 shows such a comparison. Readers should note that the FreightSim projections cover the period from 1999 to 2025, whereas the BTRE (2003b) projections cover the shorter period between 1999 and 2020.

The results in table VII.10 show that for road freight the projected growth rates are relatively similar, albeit that FreightSim generally produces higher growth rates. Only for Melbourne–Adelaide does the FreightSim projection greatly vary from the BTRE (2003b) projections. For rail, however, the FreightSim projections, while generally of the same sign as the BTRE (2003b) projections are greatly at variance with the growth rates implied by the BTRE (2003b) projections. These results suggest that the mode competitiveness indexes are assigning more of the freight task to road, away from rail, relative to the assumptions in BTRE (2003b).

TABLE VII.10 COMPARISON INTER-CAPITAL ROAD AND RAIL FREIGHT TASK GROWTH

('000 tonnes)

	FreightSim			*BTRE (2003b)*		
Corridor	*1999*	*2025*	*Growth (per cent pa)*	*1999*	*2020*	*Growth (per cent pa)*
			Road			
Mel–Syd	3 218	8 656	4.8	7 014	15 348	3.8
Syd–Bne	1 554	4 915	5.6	4 047	11 386	5.0
Mel–Bne	1 637	3 712	4.0	2 031	3 926	3.2
Syd–Adl	1 047	2 117	3.4	1 271	2 928	4.1
Mel–Adl	1 329	5 492	7.0	2 982	7 355	4.4
ES–Per	1 798	4 392	4.3	982	1 707	2.7
Syd–Cbr	1 312	2 308	2.7	1 648	3 821	4.1
Total	11 895	31 591	4.8	19 975	46 472	4.1
			Rail			
Mel–Syd	1 462	624	–4.0	873	752	–0.7
Syd–Bne	860	260	–5.5	914	292	–5.3
Mel–Bne	629	925	1.9	786	2 000	4.5
Syd–Adl	251	191	–1.3	318	171	–2.9
Mel–Adl	2 570	1 563	–2.3	726	103	–8.9
ES–Per	2 532	4 391	2.7	1 884	4 139	3.8
Syd–Cbr	168	223	1.4	–	1	NA
Total	8 472	8 177	–0.2	5 501	7 458	1.5
			Road and rail			
Mel–Syd	4 680	9 279	3.3	7 887	16 100	3.5
Syd–Bne	2 414	5 174	3.7	4 961	11 679	4.2
Mel–Bne	2 267	4 637	3.5	2 817	5 927	3.6
Syd–Adl	1 298	2 309	2.8	1 589	3 099	3.2
Mel–Adl	3 899	7 055	2.9	3 708	7 458	3.4
ES–Per	4 330	8 783	3.4	2 866	5 846	3.5
Syd–Cbr	1 480	2 531	2.6	1 648	3 822	4.1
Total	20 367	39 768	3.2	25 476	53 930	3.6

Sources BTRE (2003b), FreightSim, *FreightInfo99* and BTRE estimates.

TRAFFIC ASSIGNMENT VALIDATION METHODS

Traffic count and CULWAY/WIM site measurements are another independent data source which may be used to validate the FreightSim/*FreightTrucks*™ output. For this study, the BTRE only had CULWAY/WIM data for the Marulan truck station. The BTRE is aware, however, that the data set collected as part of NRTC (2001) provides a set of CULWAY/WIM site data covering almost all the non-urban links in the AusLink National Network. That data was not available to the BTRE for inclusion in this version of the paper, but would be useful for comparing the FreightSim/*FreightTrucks*™ more widely.

CULWAY/WIM site data

The NSW RTA provided the BTRE with heavy vehicle count and gross vehicle mass data for the Marulan heavy vehicle checking station in 1999, by Austroads vehicle class (NSW RTA, pers. comm. May 2003). The Marulan checking station data recorded approximately 924 000 heavy vehicle movements—that is, vehicles with a gross mass of 8 tonnes or more, including both trucks and buses—and a total gross mass of 28.8 million tonnes. Allowing for the tare weight of the vehicles, the total road freight passing Marulan would be approximately 15–16 million tonnes.[11] Understanding that freight traffic past Marulan would include both bulk and non-bulk traffic OD traffic for the Melbourne–Sydney, Sydney–Adelaide and Sydney–Canberra city pairs, reported in table VII.8, as well as bulk and non-bulk freight for a range of other OD region pairs, freight traffic between these three inter-capital pairs totalled approximately 10 million tonnes in 1999, about two-thirds of the total traffic measured at Marulan. By comparison the *FreightInfo*™ 1999 data implies total freight of 5.6 million tonnes for these three inter-capital OD pairs, one-third the level of road freight moving over the Marulan truck count site.

Freight Movements Survey data

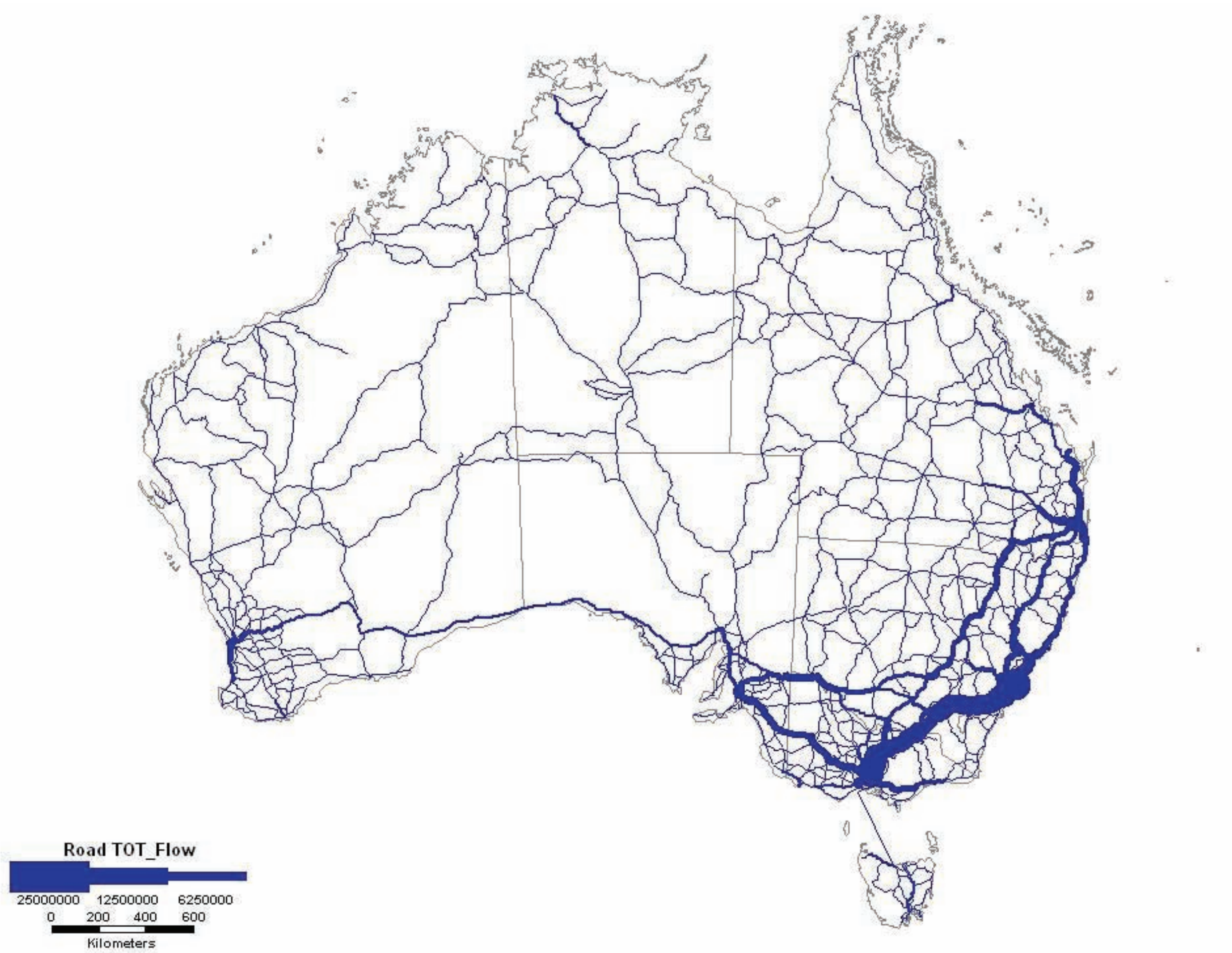
Because the FMS provides road freight task estimates to the Statistical Division and Statistical Subdivision level, it is possible to assign the FMS inter-regional road freight data to the road network and compare that with the FreightSim traffic estimates also assigned to the same road network. The BTRE assigned the FMS Statistical Subdivision level data to the AUSLIG (1993) road layer using the Stochastic User Equilibrium assignment algorithm in *TransCAD*. The traffic assignment settings used are the same as those listed in appendix VI, table VI.2. Figure VII.1 shows the traffic assignment results. The assignment procedure assigned 16.6 million tonnes of freight traffic, in 2001, to the section of the

11 This assumes that the Marulan truck count station was operational for the full year. Over recent years, the Marulan count station has been closed for parts of the years resulting in an under-estimation of the total freight task at Marulan.

Hume Highway that covers Marulan. Allowing for the apparent under-reporting of freight trips in the FMS[12] would increase this estimate by approximately 10 per cent—to 18.3 million tonnes. Remembering that the 1999 Marulan checking station data implied total freight traffic of between 15 and 16 million tonnes, and allowing for some growth in freight vehicle traffic between 1999 and 2001 would imply an estimate of around 16–17 million tonnes in 2001. These results suggest that, the FMS estimates provide road freight task estimates of a similar magnitude to the levels recorded at Marulan.

In contrast, assignment of the *FreightInfo™* 1999 data to the road network, produced an estimate of 11.2 million tonnes of road freight on the road section covering Marulan—3.9 million tonnes is non-bulk traffic and 7.3 million tonnes is bulk commodity traffic—much less than the Marulan checking station estimate or the assigned FMS estimate.

FIGURE VII.1 FMS TRAFFIC ASSIGNMENT RESULTS



Sources ABS (2002b) and BTRE estimates.

12 In comparison with the SMVU data, the FMS appears to under-report total road freight by approximately 10 per cent.

FreightTrucks™ — Converting freight movements to vehicle movements

The data in table VII.6, and the comparison with evidence from the Marulan truck count station, suggest that the FreightSim base year data under-estimates the total road freight task, at least on inter-capital routes. Inspection of the number of trucks assigned to the AusLink highways derived using the *FreightTrucks™* model, however, reveals that on most routes 70 to 80 per cent of the estimated trucks are inter-regional movements. These results are listed in table VII.11. The main exceptions are mainly shorter-distance capital city to hinterland routes, such as Sydney–Wollongong, Melbourne–Geelong and Melbourne–Sale, and Hobart–Smithtown where there is likely to be a larger amount of intra-regional freight. The other major exception is the Sydney–Brisbane (inland) route where the share of inter-regional trucks is around 40 per cent of total truck traffic. It is possible that the traffic assignment process is assigning more of the freight via the Pacific Highway (the coastal route) rather than the New England Highway (the inland route) and that hence the shares are the reverse of what might be expected.

These results imply that even though *FreightInfo™* appears to significantly understate the inter-regional road freight task, inter-regional trucks make up most of the truck movements are inter-regional. Correcting for the apparent under-estimation of the inter-regional road freight in *FreightInfo™* 1999, when input into FDF Pty Ltd's *FreightTrucks*™ model, would likely result in an over-estimate of the number of heavy vehicle movements. This prompted the BTRE to investigate the average heavy vehicle loads implied by the FreightSim and *FreightTrucks*™ models.

Table VII.12 shows the average load of trucks on the AusLink National Network non-urban road corridors using the FreightSim/*FreightTrucks*™ models and those implied by the 2001 FMS. It should be noted that the FMS surveyed articulated trucks only and the average load estimates cover only trips undertaken when laden. While the proportion of unladen heavy vehicle travel and the articulated trucks share in the traffic stream will vary by route, the Sydney–Melbourne data may serve as a rough guide. Data for the Marulan truck count site for 1999 indicates that articulated trucks constitute approximately 81 per cent of heavy vehicles above 8 tonnes GVM. The average load for articulated trucks, including unladen vehicles was approximately 19.25 tonnes. Including other heavy vehicles, the average load for heavy vehicles at Marulan is approximately 17.0 tonnes. By way of comparison, the FMS implies an average load when laden for articulated of 22.3 tonnes for Sydney–Melbourne OD movements. Even allowing for the fact that the FMS average load estimates are only for laden articulated trucks, across all AusLink non-urban corridors the average load implied by the FreightSim/*FreightTrucks*™ models is one-half or less of the actual average load for OD freight track on those routes. This evidence suggests that the average loads resulting from the

FreightTrucks™ model significantly under-estimate actual on-road average loads.

TABLE VII.11 PROPORTION OF INTER-REGIONAL TRUCKS ON AUSLINK NATIONAL NETWORK NON-URBAN CORRIDORS, 1996

(per cent)

AusLink Corridor	*Share 1996*
Sydney–Brisbane (Inland)	40.8
Sydney–Brisbane (Coastal)	80.3
Melbourne–Sydney	72.5
Melbourne–Adelaide	89.8
Melbourne–Brisbane	80.3
Sydney–Adelaide	89.4
Adelaide–Perth	91.8
Adelaide–Darwin	100
Perth–Darwin	84.4
Brisbane–Darwin	87.8
Brisbane–Cairns	92.7
Melbourne–Sale	58.0
Perth–Bunbury	76.2
Hobart–Smithtown	42.2
Melbourne–Mildura	66.5
Sydney–Dubbo	76.5
Townsville–Mt Isa	95.1
Canberra connectors	76.0
Sydney–Wollongong	27.9
Melbourne–Geelong	56.5

Sources BTRE estimates and FreightSim/*FreightTrucks*™ models.

The reason for the low average load results from *FreightTrucks™* is not immediately apparent and is probably caused by a number of factors. Firstly, the under-estimation of inter-capital non-bulk freight, which tends to have larger truck configurations and higher average loads, is probably partly responsible for the low average load estimates. While the individual average load assumptions appear reasonable (e.g. 20 tonnes for semi-trailers and 30 tonnes for B-doubles on inter-capital routes) the combination of freight, trucks, trip types is quite complex—*FreightTrucks™* consists of 16 commodity types, 9 truck types and five trip types, each with its own average load assumption. By way of reference, the raw results taken directly from the *FreightTrucks™* model imply an average load, across all OD pairs, of around 10.9 tonnes—close to the 8–9 tonnes on the non-urban AusLink roads. Surprisingly the implied average load of intra-regional trips, including within capital city trips, is about 12 tonnes, and is higher than the average load of inter-regional trips, approximately 7.7 tonnes.

For the projections presented in this report, the BTRE adjusted the vehicle mix and increased the assumed vehicle average loads for selected commodities for road freight to and from non-capital city regions. These amendments will have mitigated the apparent over-estimation of the number of truck movements implied by the *FreightTrucks™* model.

TABLE VII.12 AVERAGE LOAD OF INTER-REGIONAL FREIGHT TRUCKS ON AUSLINK NATIONAL NETWORK NON-URBAN CORRIDORS, FREIGHTSIM 1999 AND FMS 2001

(tonnes)

AusLink corridor	FreightSim *1999*	*FMS 2001*
Sydney–Brisbane (Inland)	8.9	22.1
Sydney–Brisbane (Coastal)	8.4	20.6
Melbourne–Sydney	9.4	22.3
Melbourne–Adelaide	6.6	21.8
Melbourne–Brisbane	8.1	23.6
Sydney–Adelaide	7.9	23.1
Adelaide–Perth	6.5	29.7
Adelaide–Darwin	2.3	46.5
Perth–Darwin	2.6	41.8
Brisbane–Darwin	4.1	28.8
Brisbane–Cairns	6.0	21.9
Melbourne–Sale	8.0	20.1
Perth–Bunbury	8.4	29.5
Hobart–Smithtown	9.0	22.6
Melbourne–Mildura	6.5	21.3
Sydney–Dubbo	8.0	21.2
Townsville–Mt Isa	4.6	21.9
Canberra connectors	10.3	19.7
Sydney–Wollongong	10.5	26.8
Melbourne–Geelong	7.5	21.7

Sources ABS (2002a), FreightSim/*FreightTrucks™* models and BTRE estimates.

CONCLUDING REMARKS

This appendix has presented some results of BTRE attempts to validate the FreightSim/*FreightTrucks™* base data and model projections. The BTRE analysis suggests some deficiencies in the base year freight flows data provided with FreightSim and also some anomalous results from the *FreightTrucks™* models. In particular:

- The *FreightInfo™* 1999 road freight tonnages are approximately 30 per cent less than the equivalent measures reported from the Survey of Motor Vehicle Use (ABS 2003a) and the Freight Movements Survey (ABS 2002a). The *FreightInfo™* 1999 rail and coastal shipping estimates appear reasonable, within 10 per cent of the actual aggregate rail and coastal shipping freight task estimates.

- The *FreightInfo*™ 1999 inter-capital road freight measures are significantly less than other measures of the inter-capital OD road freight. For example, across seven inter-capital corridors the *FreightInfo*™ 1999 estimate is 40 per cent less than the BTRE (2003b) estimate. Assignment of the *FreightInfo*™ and FMS (ABS 2002a) data to the road network shows a similar difference—the *FreightInfo*™ based estimates at Marulan are around 40 per cent less than the FMS-based estimates and CULWAY/WIM site data from the Marulan heavy vehicle checking station.
- It would appear that the method used to produce the *FreightInfo*™ estimates performs better for bulk commodity flows of significant sizes, where regional production, consumption and transport movement data are more easily obtained. *FreightInfo*™, however, appears to miss a large proportion of the non-bulk road freight task.
- The *FreightTrucks*™ model implies average loads that are 50 to 60 per cent of measured inter-capital OD on-road loads carried by articulated trucks. This is probably partly due to the under-estimation of inter-capital non-bulk freight, which tends to have larger truck configurations and higher average loads. While the individual average load assumptions appear reasonable (e.g. 20 tonnes for semi-trailers and 30 tonnes for B-doubles on inter-capital routes) the combination of freight, trucks, trip types is quite complex—*FreightTrucks*™ consists of 16 commodity types, 9 truck types and 5 trip types, each with its own average load assumption. When summed over freight by commodity, by vehicle type, the model produces low average loads.

Further research—FreightSim and *FreightTrucks*™

As already mentioned in the report, the BTRE has commissioned FDF Pty Ltd to update the *FreightInfo™* database to 2003–04 and as part of that work to pay attention to the issue of under-enumeration of non-bulk road freight. In this regard, information from other independent sources, such as the CULWAY/WIM site estimates of the total freight carried past each site would provide a useful check on the *FreightInfo™* estimates. The *FreightTrucks*™ model also warrants further attention, particularly to ensure that the model conversion factors produced sensible heavy vehicle traffic estimates but also, as mentioned in chapter 4, to allow for changes in vehicle mix and average loads over time.

APPENDIX VIII OZPASS AND FREIGHTSIM SETTINGS

Projecting future light (passenger) and heavy (freight) vehicle traffic using OZPASS and FreightSim is a three stage process that is presently both labour intensive and requires structured management of large data sets. The first stage of the projection process involves running both OZPASS and FreightSim and saving the results for further processing. The second stage involves assigning the passenger and heavy vehicle traffic to the road network. The BTRE does this using the traffic assignment algorithms in *TransCAD: Transportation GIS Software*. The third stage involves matching the assigned (inter-regional) traffic, from stage two, with actual AADT traffic count information. Between each stage of the process some further processing is required in order to transform the results into a form for use in the next stage. These transformations are a critical part of the simulation procedures. Most of these data transformations are undertaken using SQL queries in Microsoft Access databases.

This appendix provides a list of the data locations and the key processes involved in producing the projections.

PASSENGER TASK PROJECTIONS

Table VIII.1 lists the files used in for deriving the passenger travel projections using OZPASS. Table VIII.2 lists the query set in the PassengerTrafficProjections.mdb database used to construct the light vehicle traffic projections.

TABLE VIII.1 OZPASS SIMULATION FILE LOCATIONS

Directory	*File name*	*Description*
OZPASS1.0	Corporate_1.1.mdb	OZPASS Corporate database (Access '97 format)
	Personal_1.1.mdb	OZPASS Personal database (Access '97 format) Results from the simulation stored in tables: • Results_ON_PassTravel – Overnight trips • Results_DT_PassTravel – Day trips • Results_IV_PassTravel – Int'l visitor trips.
	OZPASS_Results.mdb	OZPASS results set (Access 2002-2003 format database): • ON_1999-2025_20Jul05 – Overnight trips • DT_1999-2025_20Jul05 – Day trips • IV_1999-2025_20Jul05 – Int'l visitor trips • RL_1999-2025_20Jul05 – Rural local VKT.
Simulation_Jul05	PassengerTrafficProjections.mdb	MS Access 2003 format database, which links to the OZPASS results saved in the OZPASS_Results.mdb database, with a series of queries for: • Combining the raw OZPASS passenger travel results • Converting those results into AADTs for assignment in TransCAD. • Combining the TransCAD traffic assignment results with State and Territory traffic count data.

TABLE VIII.2 KEY QUERIES IN PASSENGERTRAFFICPROJECTIONS.MDB DATABASE

Query name	*Description*
01_CONCATENATE PASSENGER TRAVEL	Concatenate the OZPASS inter-regional car and bus passenger travel projections into single temporary table.
02_ATTACH AUSLIG REGION CODES	Attach AUSLIG region codes from table 'Road:Road<->BTR_1998'to Query: 01_CONCATENATE PASSENGER TRAVEL results.
-->Export to file: \PassengerAssignment\Inputs\Input--TransCAD.xls	
--> Import into TransCAD and assign traffic to the road network	
-->Import TransCAD results into table: AssignedPassengerVehicleTraffic.	
03a_ASSIGNED THRU PASSENGER TRAFFIC_w1996	Calculate assigned inter-regional traffic derived from TransCAD traffic assignment. This query creates 1996 ‘Thru’ traffic estimates, to match to the 1996 State/Territory traffic data, by back-casting using the annual growth in traffic between 1999 and 2005.
03b_CALCULATE BASE YEAR PASSENGER TRAFFIC	Query to calculate the base year 'Thru' and 'Local' light (passenger) vehicle traffic from TransCAD assigned traffic and State & Territory AADT traffic count data. (Note: The query includes adjustments to the PceCom for some road sections.)
04_LOCAL PASSENGER TRAFFIC PROJECTIONS	Compute local passenger vehicle VKT projections for 1999–2025, by SLA.
05_CALCULATE FUTURE PASSENGER TRAFFIC	Calculate future 'thru' and local light vehicle traffic projections from base year estimates and estimated passenger travel growth derived from OZPASS.
06_AGGREGATE FUTURE PASSENGER TRAFFIC	Combine ‘thru’ and local traffic projections.
07a_SUMMARY_TOTALVKT	Summary of total VKT for non-urban corridors.
07b_GROWTH RATES FOR TransCAD	Summary of growth in total VKT—for export to TransCAD to produce figures in Chapter 3.

TRANSCAD ASSIGNMENT FILE LOCATIONS

All *TransCAD* assignments were undertaken with *TransCAD* v3.5d. All files used in the *TransCAD* traffic assignment procedures are stored in a WinZip archive file: AusLinkSP-TransCAD_Sep2004.zip in the *TransCAD* Files subdirectory.

OZPASS settings

This section shows the settings used in the OZPASS passenger simulations for projecting inter-regional overnight and day trips by domestic residents, inter-regional trips by international visitors and rural local travel. The settings are all shown in screenshots from the OZPASS.

Inter-regional overnight trips

Figures VIII.1 to VIII.4 show the settings used to generate the inter-regional overnight trip passenger travel projections. The key settings are the choice of travel mode share indices table and the assumed population and income growth rates. The mode share indices used to generate the inter-regional passenger travel are shown in table 2.1. The population and income growth settings used for the projections are captured in the 'Population_Income' and 'TravelCost_IRPTProject_ZeroAWE' tables, selected on the scenario table (figure VIII.3). The 'Population_Income' table is an income weighted index of future population growth. Reflecting observed historical trends in growth in household incomes (see BTRE 2003a), household incomes in capital cities are assumed to grow by 1.4 per cent per annum and incomes in non-capital city regions are assumed to growth by 0.5 per cent per annum. The 'Include day trippers' selection box on the model options tab is unchecked because day trips are projected separately. These settings imply growth in total population and household income of a similar amount to assuming growth in household incomes of 1.25 per cent per annum across Australia, which is similar to the growth in AWE experienced over the last twenty years (BTRE 2003a). These settings, however, will produce faster growth in trips from and between capital cities and slower growth in trips between non-capital city areas.

FIGURE VIII.1 INTER-REGIONAL OVERNIGHT TRAVEL SETTINGS—DATA SOURCES

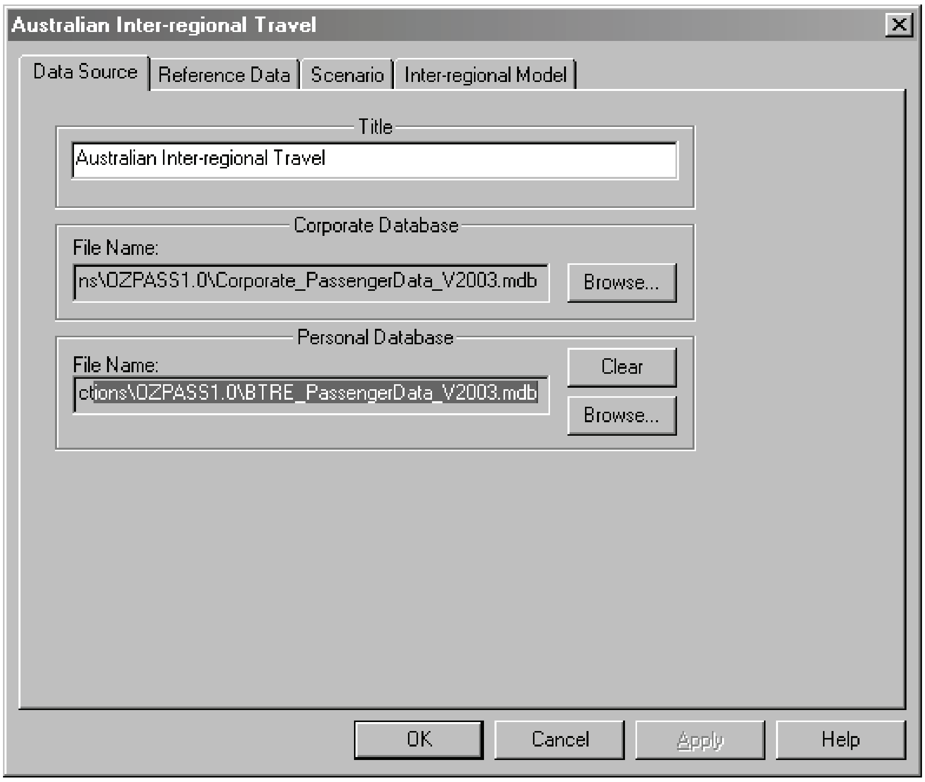


FIGURE VIII.2 INTER-REGIONAL OVERNIGHT TRAVEL SETTINGS—REFERENCE DATA

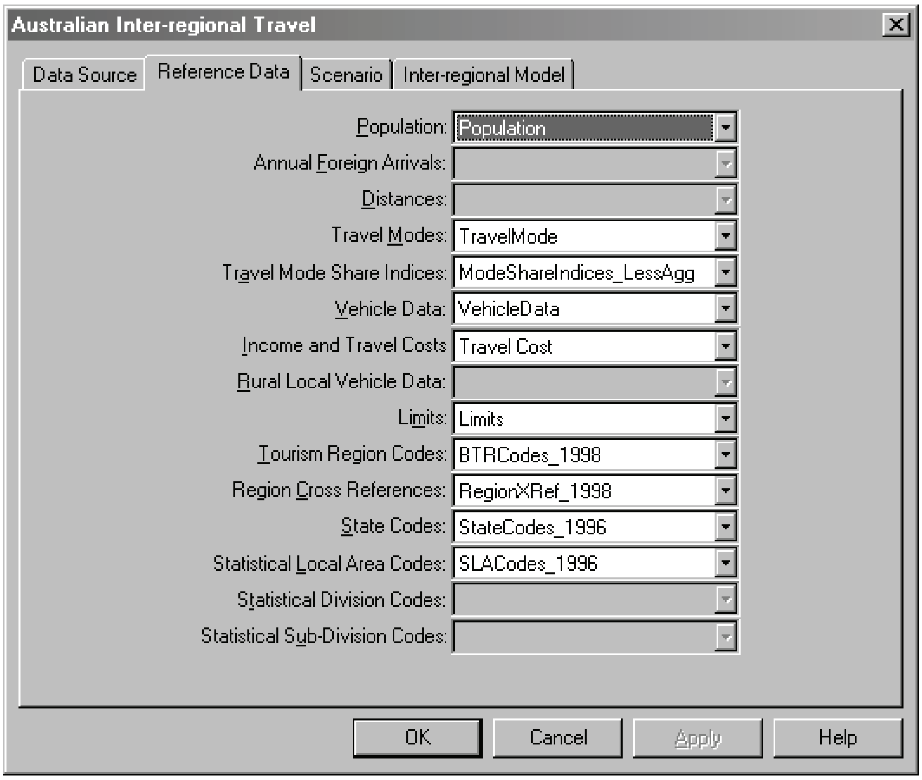


FIGURE VIII.3 INTER-REGIONAL OVERNIGHT TRAVEL SETTINGS—SCENARIO OPTIONS

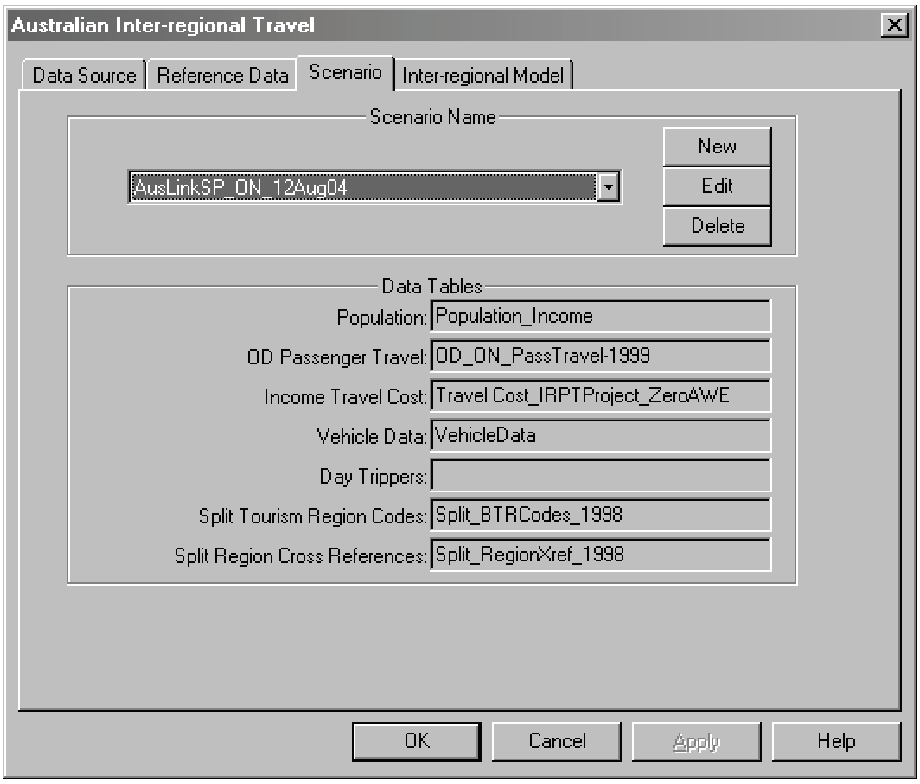
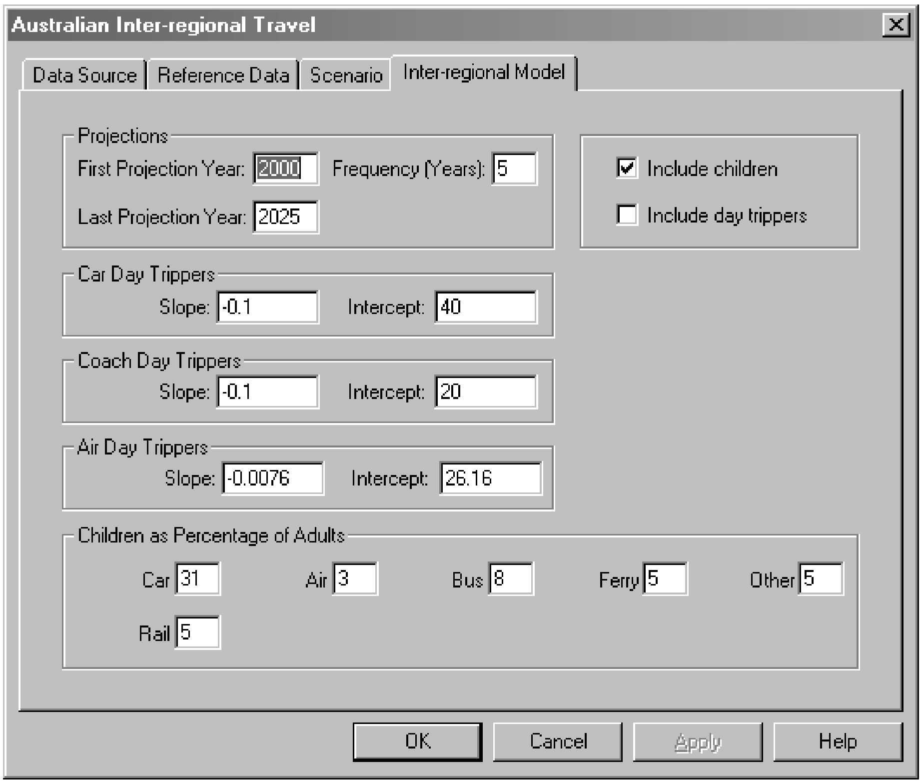


FIGURE VIII.4 INTER-REGIONAL OVERNIGHT TRAVEL SETTINGS—MODEL OPTIONS



Inter-regional day trips

Figures VIII.5 to VIII.6 show the scenario and model option used to generate the inter-regional day trip passenger travel projections. The data source and reference data are identical to those shown in figures VIII.1 and VIII.2.

FIGURE VIII.5 INTER-REGIONAL DAY TRIP TRAVEL SETTINGS—SCENARIO OPTIONS

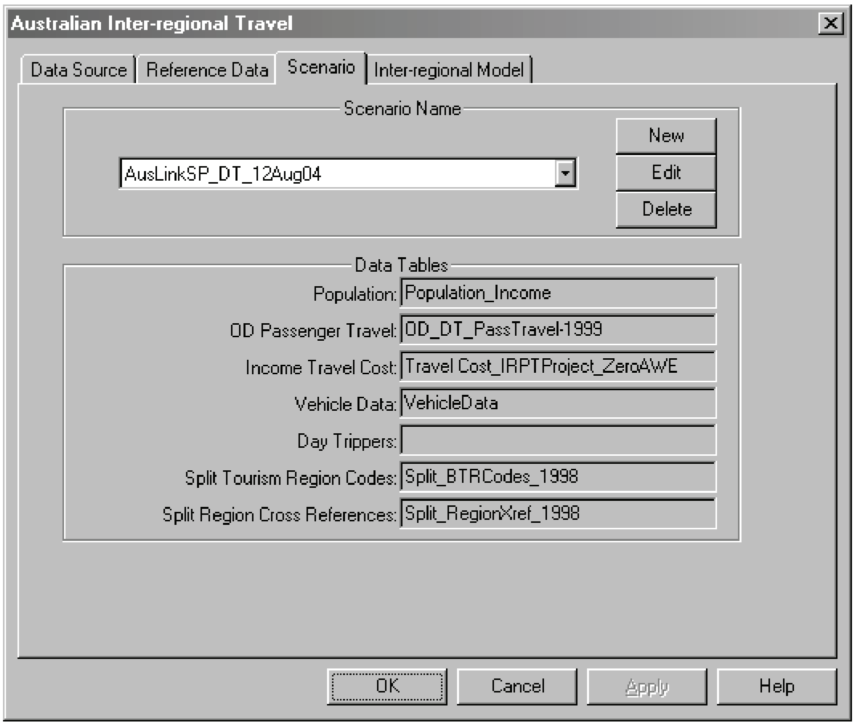
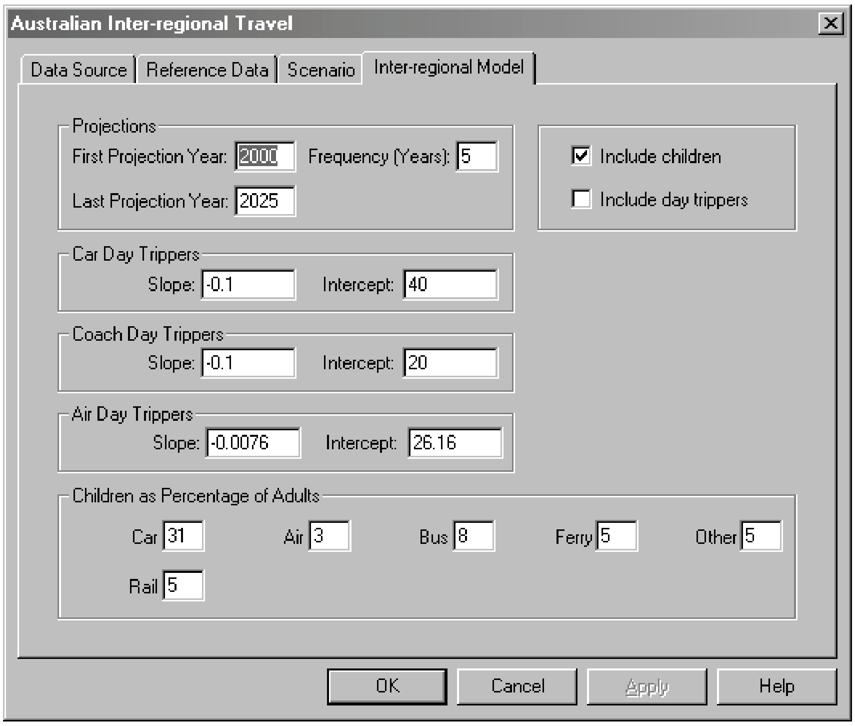


FIGURE VIII.6 INTER-REGIONAL DAY TRIP TRAVEL SETTINGS—PROJECTION OPTIONS



Inter-regional international visitor trips

Figures VIII.7 to VIII.10 show the settings used to generate the inter-regional international visitor passenger travel projections presented in this paper.

FIGURE VIII.7 INTER-REGIONAL INTERNATIONAL VISITOR TRAVEL SETTINGS—DATA SOURCES

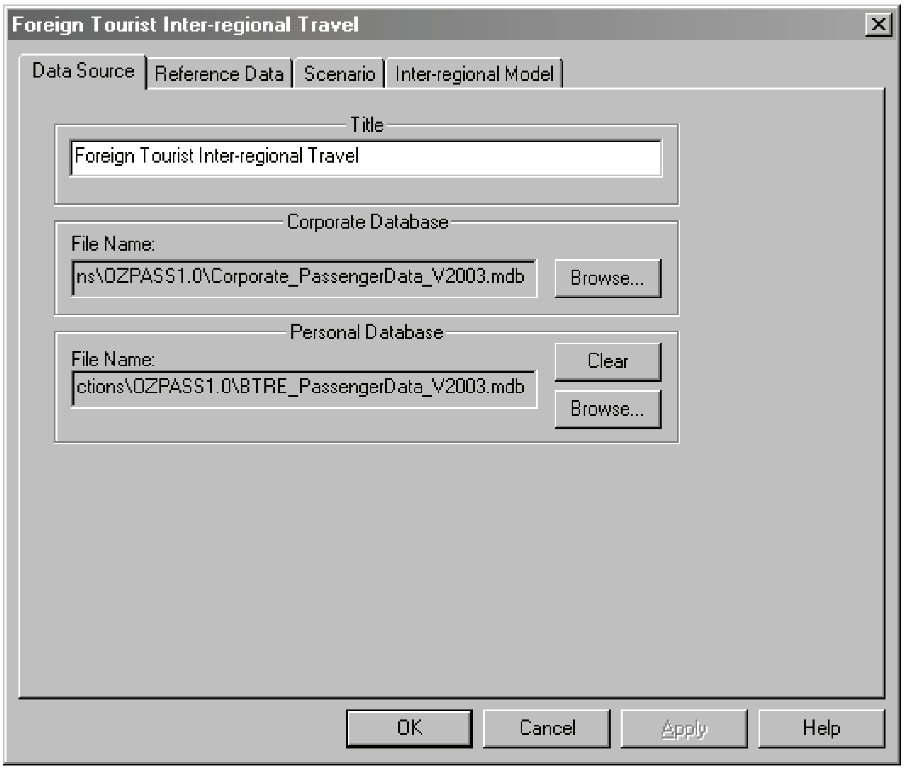


FIGURE VIII.8 INTER-REGIONAL INTERNATIONAL VISITOR TRAVEL SETTINGS—REFERENCE DATA

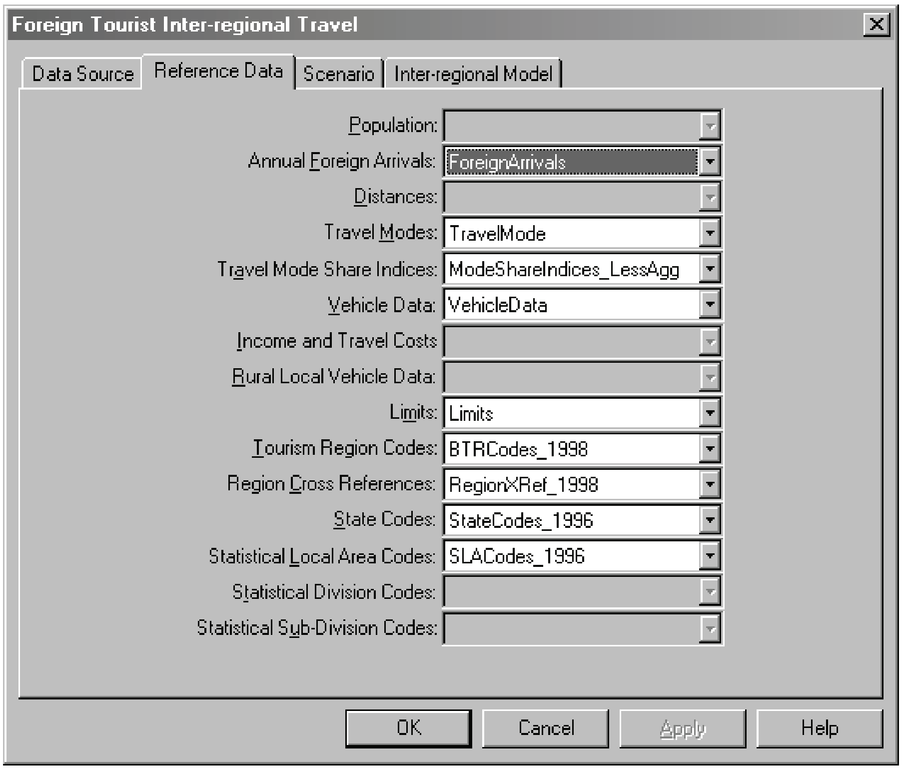


FIGURE VIII.9 INTER-REGIONAL INTERNATIONAL VISITOR TRAVEL SETTINGS—SCENARIO OPTIONS

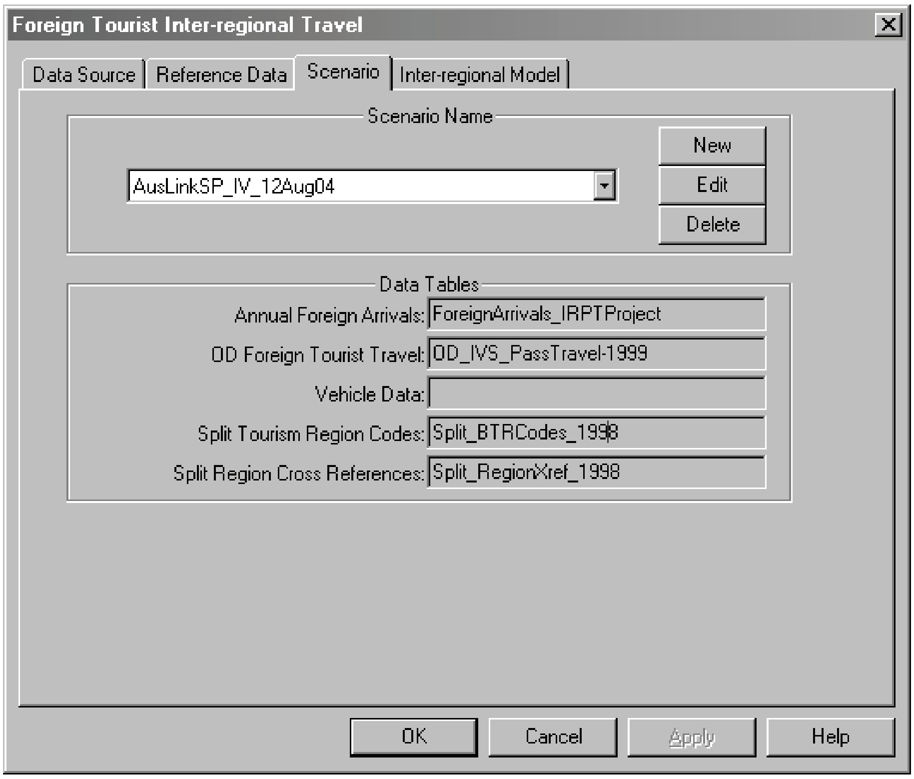
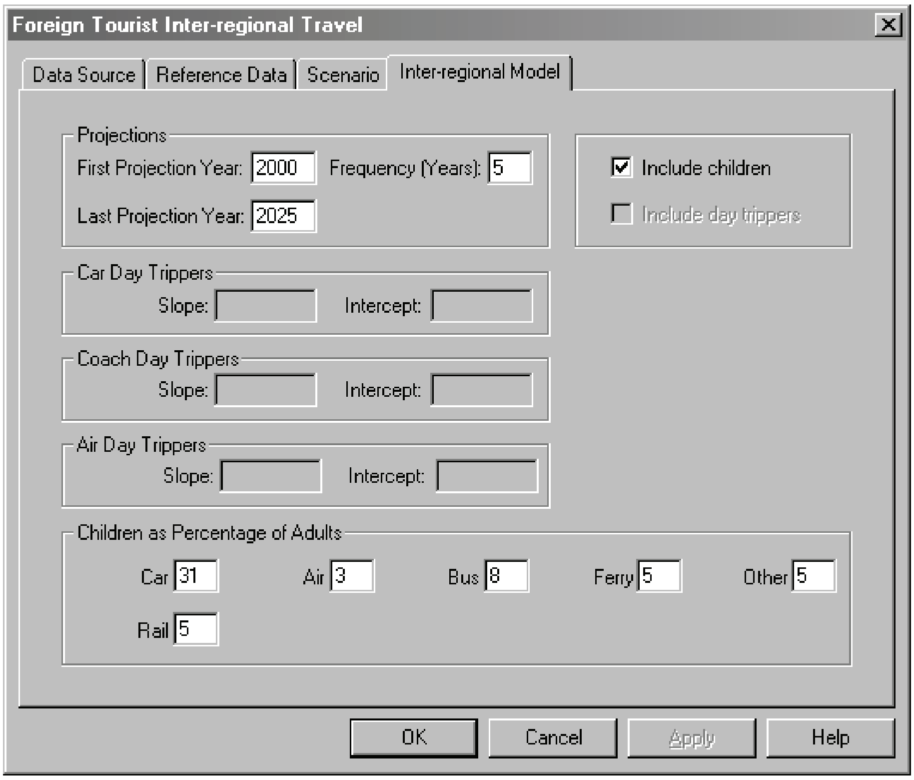


FIGURE VIII.10 INTER-REGIONAL INTERNATIONAL VISITOR TRAVEL SETTINGS—MODEL OPTIONS



Rural local travel

Figures VIII.11 to VIII.14 show the settings used to generate the rural local travel projections presented in this paper.

FIGURE VIII.11 RURAL LOCAL TRAVEL SETTINGS—DATA SOURCES

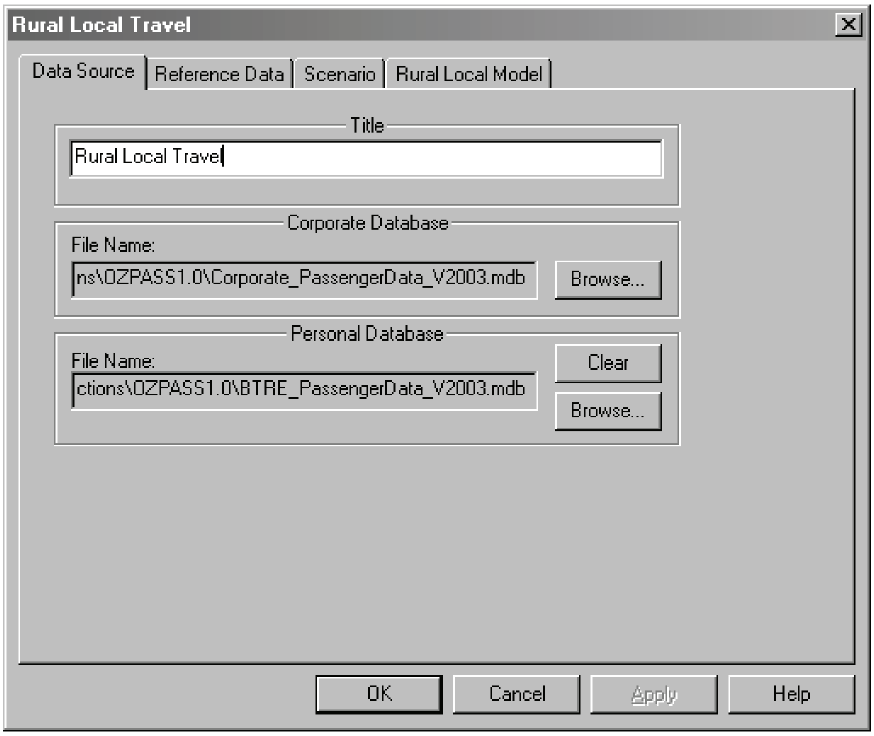


FIGURE VIII.12 RURAL LOCAL TRAVEL SETTINGS—REFERENCE DATA

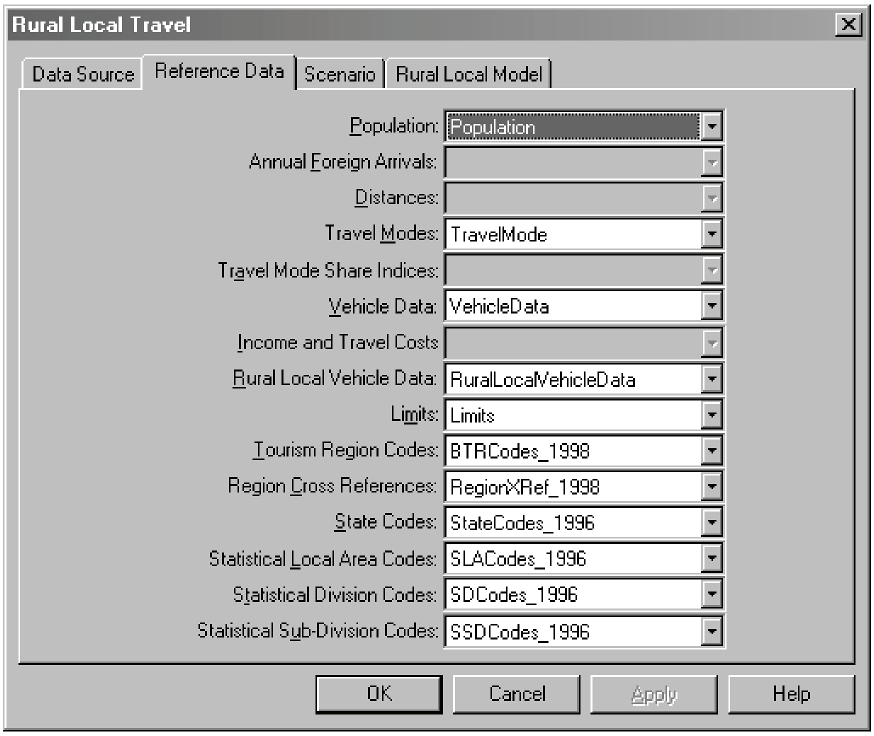


FIGURE VIII.13 RURAL LOCAL TRAVEL SETTINGS—SCENARIO OPTIONS

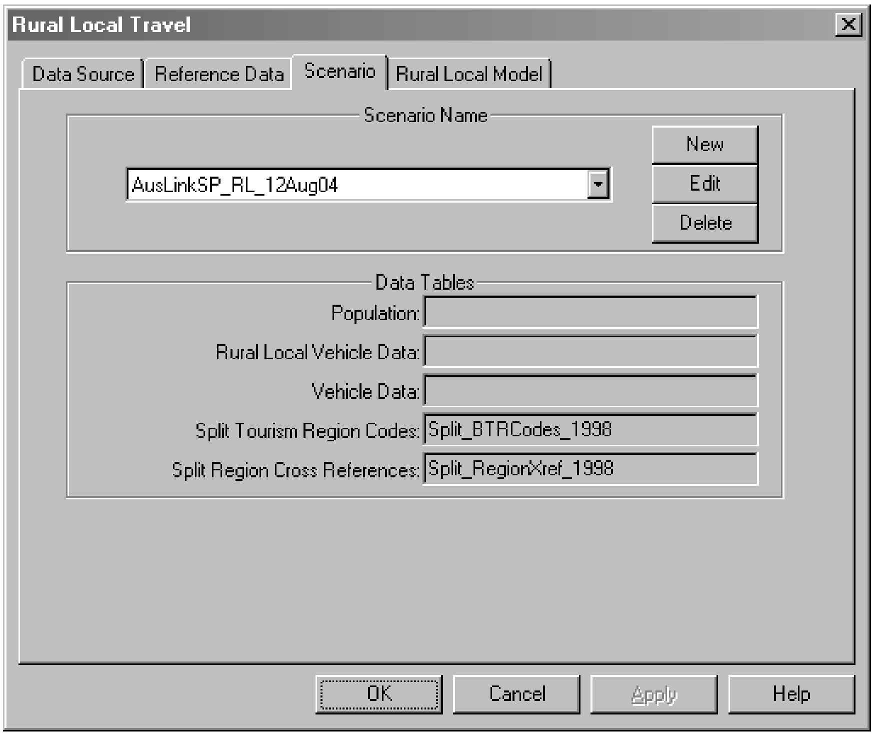
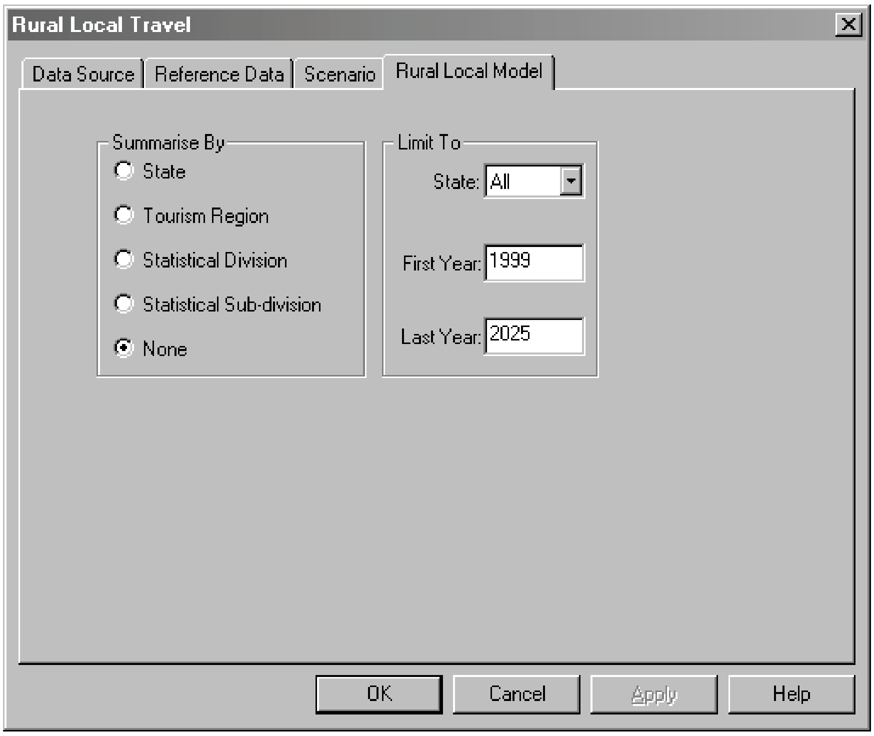


FIGURE VIII.14 RURAL LOCALTRAVEL SETTINGS—MODEL OPTIONS



FREIGHTSIM FREIGHT TASK PROJECTIONS

Table VIII.3 lists the key files for the FreightSim freight task projections. Table VIII.4 lists the query set in the FreightTrafficProjections.mdb database used to construct the heavy vehicle traffic projections.

TABLE VIII.3 FREIGHTSIM SIMULATION FILE LOCATIONS

Directory	*File name*	*Description*
FreightSim_Batch	Corporate1.1.mdb	FreightSim Corporate database
	Personal1.1.mdb	FreightSim Personal database
	Personel1.1_Prod.mdb	FreightSim raw results set
Simulation_Jul05	FreightSim_Results.mdb	Access 2002–03 format database with a series of queries for: • Checking the raw FreightSim results.
	FreightTrafficProjections.mdb	Access 2002–03 format database with a series of queries for: • Converting those results into a form for input into TransCAD. • Converting the TransCAD traffic assignment into vehicular traffic growth.
	Input--FreightTrucks.xls	Results from Query:01 in FreightTrafficProjections.mdb for input into FreightTrucks.
	FreightTrucks(Version 2).xls	Freight Trucks model spreadsheet for converting freight flows into average annual daily truck movements. (The output from freight trucks must be imported back into the FreightTrafficProjections.mdb database → Table name: FreightTruckResults.)
	Input--TransCAD.xls	Data exported from FreightTrafficProjections.mdb database for traffic assignment in TransCAD.

TABLE VIII.4 KEY QUERIES IN FREIGHTTRAFFICPROJECTIONS.MDB DATABASE

Query name	*Description*
01_CONCATENATE ROAD FREIGHT PROJECTIONS	Concatenate the FreightSim inter-regional commodity freight task projections into single temporary table.
--> Export the query results to *FreightTrucks* model spreadsheet(s).	
--> Calculate number of truck movements using *FreightTrucks*	
--> Import *FreightTrucks* results into FreightTrafficProjections.mdb database as table: FreightTrucksResults_1999-2010 and FreightTrucksResults_2015-2025	
02_00Combine_FreightTrucksResults	Query to combine the FreightTrucksResults_1999-2010 and FreightTrucksResults_2015-2025 tables.
02_0PRE-ADJUST_FreightTrucksResults	Query to remove anomalous road transport of gas between Fortescue (region 682), Greenough River (673) and Gascoyne (671).
02_ATTACH AUSLINK REGION CODES	Attached AUSLIG region codes from table "XRef_FDFRegion<->Auslig_ASGC" to Query:01.
-->Export to file: \TruckAssignment\Inputs\Input--TransCAD.xls	
--> Import into TransCAD and assign traffic to the road network	
-->Import TransCAD results into table: AssignedThruTruckTraffic.	
03a_ASSIGNED THRU TRUCK TRAFFIC_w1996	Calculate assigned inter-regional traffic derived from TransCAD traffic assignment.
03b_CALCULATE BASE YEAR TRUCK TRAFFIC	Query to calculate the base year 'Thru' and 'Local' truck traffic from TransCAD assigned AADT truck traffic and Road Authority AADT and PceCom information. Note: this query includes adjustments to the PceCom for some road sections.
04_LOCAL TRUCK TRAFFIC PROJECTIONS	Calculate local truck traffic projections, by FDF Region Code and ASGC SSD code, using FreightTrucks results.
05_CALCULATE FUTURE TRUCK TRAFFIC	Calculates future ‘thru’ and ‘local’ truck traffic from base year ‘thru’ and ‘local’ truck traffic (Query: 03) using the TransCAD assigned thru trucks by year (Query: 04) and projected growth in intra-regional truck trips (Query: 01).
06_AGGREGATE FUTURE TRUCK TRAFFIC	Aggregates future 'Thru' and 'Local' truck traffic, by road link id, into total trucks, by road link ID.
07a_SUMMARY_TOTAL LENGTH	Query for calculating growth in number of trucks along TransCAD links - Part 1.
07b_GROWTH RATES FOR TRANSCAD	Query for calculating growth in number of trucks along TransCAD links - Part 2.

FreightSim model settings

The FreightSim model settings may be set either interactively by the user, in a manner similar to approach used for specifying the settings for OZPASS shown in figures VIII.1 to VIII.14 above, or specified using a batch file. For the simulations presented in this report, FreightSim was run in batch mode. Listing VIII.1 lists the batch file used in generating the freight projections.

LISTING VIII.1 FREIGHTSIM BATCH FILE SETTINGS

```
<!------------------------------------------------------------------->
<!-- BaseCase.fb                                                   -->
<!-- FreightSim default settings -- September 2004 simulation     -->
<!-- Author:       D Mitchell                                      -->
<!-- Institution:  Bureau of Transport and Regional Economics     -->
<!-- Date:         21.12.2004                                      -->
<!-- Last updated: 17.02.2005                                      -->
<!--                                                               -->
<!-- Batch mode operation:                                         -->
<!-- ---------------------                                         -->
<!-- To run FreightSim in batch mode issue the following instruction -->
<!-- at the command prompt:                                        -->
<!--  Freight_2005.02.17.exe /b BaseCase.fb                        -->
<!--                                                               -->
<!------------------------------------------------------------------->

<!-- Sets the LogFile path -->
<!-- NOTE: Must be the first parameter specified in the Batch file -->
<LogFile Path = "G:\P&R Group\BTRE\Road\AusLink Strategic
Projections\Freight\FreightSim_Batch\BaseCase.log"/>
<!-- Sets the defaults-->
<Defaults>
  <ReferenceData>
    Population = Population,
    GDP = [GDP Treasury],
    Commodity Codes = CommodityCodes,
    Distances = [OD FDF Distances],
    Freight Modes = FreightModes,
    FreightCosts = FreightCostUpdate,
    NonBulkModeShareIndices = ModeShareIndicesNonBulk_Mod+Extra,
    BulkModeShareIndices = ModeShareIndicesBulk,
    PortRegions = PortRegionCodes,
    PortRegionXRef = PortXRefs,
    Freight Region Codes = FDFRegionCodes,
    FreightRegionXRef = RegionXRef_New,
    StateCodes = StateCodes_1996,
    SLACodes = SLACodes_1996,
    SDCodes = SDCodes_1996,
    SSDCodes = SSDCodes_1996
  </ReferenceData>
  <RunParameters>
    CorporateDB = G:\P&R Group\BTRE\Road\AusLink Strategic
Projections\Freight\FreightSim_Batch\Corporate1.1.mdb,
    PersonalDB = G:\P&R Group\BTRE\Road\AusLink Strategic
Projections\Freight\FreightSim_Batch\Personal1.1.mdb,
    ResultsDB = G:\P&R Group\BTRE\Road\AusLink Strategic
Projections\Freight\FreightSim_Batch\Results.mdb,
    DataYear = 1999,
    FirstYear = 2000,
    LastYear = 2025,
    Frequency = 5,
    InitialValues = [CombinedCityFMS-FDFData],
    Elasticity = 1.00,
    Movements Pattern = BulkMovements,
    Consumption = Consumption,
    Production = 00production-corrected-2025,
    Imports = Imports,
    MinDistancesDefault = Yes,
    State = national default,
    Commodity = default
  </RunParameters>
</Defaults>
<!--  ALTERNATIVE RunParameters:    -->
<!--    CorporateDB = G:\P&R Group\BTRE\Road\AusLink Strategic
Projections\Freight\FreightSim_Batch\Corporate1.1.mdb, -->
<!--    PersonalDB = G:\P&R Group\BTRE\Road\AusLink Strategic
Projections\Freight\FreightSim_Batch\Personal1.1.mdb, -->
<!--    ResultsDB = G:\P&R Group\BTRE\Road\AusLink Strategic
Projections\Freight\FreightSim_Batch\Results.mdb, -->
<!--   InitialValues = [AdjLatestFDFData+Cons&Prod],  -->
<!-- Commodity specific settings -->
```

```
<!-- 1. Manufactured products -->
<Consumption Commodity = "Manufactured products" Elasticity = "1.25">
    BaseCase_Consumption</Consumption>
<Imports Commodity = "Manufactured products" Elasticity = "1.25">
    BaseCase_Imports</Imports>
<Production Commodity = "Manufactured products" Elasticity = "1.30">
    BaseCase_Production</Production>
<NonBulkMovementsPattern Commodity = "Manufactured products">
    BaseCase_BaseYearMovements</NonBulkMovementsPattern>
<NonBulkFreight Commodity = "Manufactured products"
    ResultsTable="BaseCase_NonBulk_Results"/>

<!-- 2. Grains and oilseeds -->
<Consumption Commodity = "Grains and oilseeds" Elasticity = "0.5">
    BaseCase_Consumption</Consumption>
<Imports Commodity = "Grains and oilseeds" Elasticity = "0.5">
    BaseCase_Imports</Imports>
<Production Commodity = "Grains and oilseeds">
    BaseCase_Production</Production>
<BulkMovementsPattern Commodity = "Grains and oilseeds">
    BaseCase_BaseYearMovements</BulkMovementsPattern>
<BulkFreight Commodity = "Grains and oilseeds"
    ResultsTable="BaseCase_Bulk_Results"/>

<!-- 3. Sheep live -->
<Consumption Commodity = "Sheep live" Elasticity = "0.5">
    BaseCase_Consumption</Consumption>
<Imports Commodity = "Sheep live" Elasticity = "0.5">
    BaseCase_Imports</Imports>
<Production Commodity = "Sheep live">
    BaseCase_Production</Production>
<BulkMovementsPattern Commodity = "Sheep live">
    BaseCase_BaseYearMovements</BulkMovementsPattern>
<BulkFreight Commodity = "Sheep live"
    ResultsTable="BaseCase_Bulk_Results"/>

<!-- 4. Cattle live -->
<Consumption Commodity = "Cattle live" Elasticity = "0.25">
    BaseCase_Consumption</Consumption>
<Imports Commodity = "Cattle live" Elasticity = "0.25">
    BaseCase_Imports</Imports>
<Production Commodity = "Cattle live">
    BaseCase_Production</Production>
<BulkMovementsPattern Commodity = "Cattle live">
    BaseCase_BaseYearMovements</BulkMovementsPattern>
<BulkFreight Commodity = "Cattle live"
    ResultsTable="BaseCase_Bulk_Results"/>

<!-- 5. Meat -->
<Consumption Commodity = "Meat" Elasticity = "0.5">
    BaseCase_Consumption</Consumption>
<Imports Commodity = "Meat" Elasticity = "0.5">
    BaseCase_Imports</Imports>
<Production Commodity = "Meat">
    BaseCase_Production</Production>
<BulkMovementsPattern Commodity = "Meat">
    BaseCase_BaseYearMovements</BulkMovementsPattern>
<BulkFreight Commodity = "Meat"
    ResultsTable="BaseCase_Bulk_Results"/>

<!-- 6. Agricultural products -->
<Consumption Commodity = "Agricultural products" Elasticity = "0.5">
    BaseCase_Consumption</Consumption>
<Imports Commodity = "Agricultural products" Elasticity = "0.5">
    BaseCase_Imports</Imports>
<Production Commodity = "Agricultural products">
    BaseCase_Production</Production>
<BulkMovementsPattern Commodity = "Agricultural products">
    BaseCase_BaseYearMovements</BulkMovementsPattern>
<BulkFreight Commodity = "Agricultural products"
    ResultsTable="BaseCase_Bulk_Results"/>

<!-- 7. Coal and coke -->
<Consumption Commodity = "Coal and coke" Elasticity = "0.3">
```

```
    BaseCase_Consumption</Consumption>
<Imports Commodity = "Coal and coke" Elasticity = "0.3">
    BaseCase_Imports</Imports>
<Production Commodity = "Coal and coke">
    BaseCase_Production</Production>
<BulkMovementsPattern Commodity = "Coal and coke">
    BaseCase_BaseYearMovements</BulkMovementsPattern>
<BulkFreight Commodity = "Coal and coke"
    ResultsTable="BaseCase_Bulk_Results"/>

<!-- 8. Metallic minerals -->
<Consumption Commodity = "Metallic minerals" Elasticity = "0.5">
    BaseCase_Consumption</Consumption>
<Imports Commodity = "Metallic minerals" Elasticity = "0.5">
    BaseCase_Imports</Imports>
<Production Commodity = "Metallic minerals">
    BaseCase_Production</Production>
<BulkMovementsPattern Commodity = "Metallic minerals">
    BaseCase_BaseYearMovements</BulkMovementsPattern>
<BulkFreight Commodity = "Metallic minerals"
    ResultsTable="BaseCase_Bulk_Results"/>

<!-- 9. Non-metallic minerals -->
<Consumption Commodity = "Non-metallic minerals" Elasticity = "0.5">
    BaseCase_Consumption</Consumption>
<Imports Commodity = "Non-metallic minerals" Elasticity = "0.5">
    BaseCase_Imports</Imports>
<Production Commodity = "Non-metallic minerals">
    BaseCase_Production</Production>
<BulkMovementsPattern Commodity = "Non-metallic minerals">
    BaseCase_BaseYearMovements</BulkMovementsPattern>
<BulkFreight Commodity = "Non-metallic minerals"
    ResultsTable="BaseCase_Bulk_Results"/>

<!-- 10. Oil and petroleum products -->
<Consumption Commodity = "Oil and petroleum products" Elasticity = "0.5">
    BaseCase_Consumption</Consumption>
<Imports Commodity = "Oil and petroleum products" Elasticity = "0.5">
    BaseCase_Imports</Imports>
<Production Commodity = "Oil and petroleum products">
    BaseCase_Production</Production>
<BulkMovementsPattern Commodity = "Oil and petroleum products">
    BaseCase_BaseYearMovements</BulkMovementsPattern>
<BulkFreight Commodity = "Oil and petroleum products"
    ResultsTable="BaseCase_Bulk_Results"/>

<!-- 11. Gas -->
<Consumption Commodity = "Gas" Elasticity = "0.5">
    BaseCase_Consumption</Consumption>
<Imports Commodity = "Gas" Elasticity = "0.5">
    BaseCase_Imports</Imports>
<Production Commodity = "Gas">
    BaseCase_Production</Production>
<BulkMovementsPattern Commodity = "Gas">
    BaseCase_BaseYearMovements</BulkMovementsPattern>
<BulkFreight Commodity = "Gas"
    ResultsTable="BaseCase_Bulk_Results"/>

<!-- 12. Steel and metals -->
<Consumption Commodity = "Steel and metals" Elasticity = "0.5">
    BaseCase_Consumption</Consumption>
<Imports Commodity = "Steel and metals" Elasticity = "0.5">
    BaseCase_Imports</Imports>
<Production Commodity = "Steel and metals">
    BaseCase_Production</Production>
<BulkMovementsPattern Commodity = "Steel and metals">
    BaseCase_BaseYearMovements</BulkMovementsPattern>
<BulkFreight Commodity = "Steel and metals"
    ResultsTable="BaseCase_Bulk_Results"/>

<!-- 13. Fertilisers -->
<Consumption Commodity = "Fertilisers" Elasticity = "0.5">
    BaseCase_Consumption</Consumption>
<Imports Commodity = "Fertilisers" Elasticity = "0.5">
```

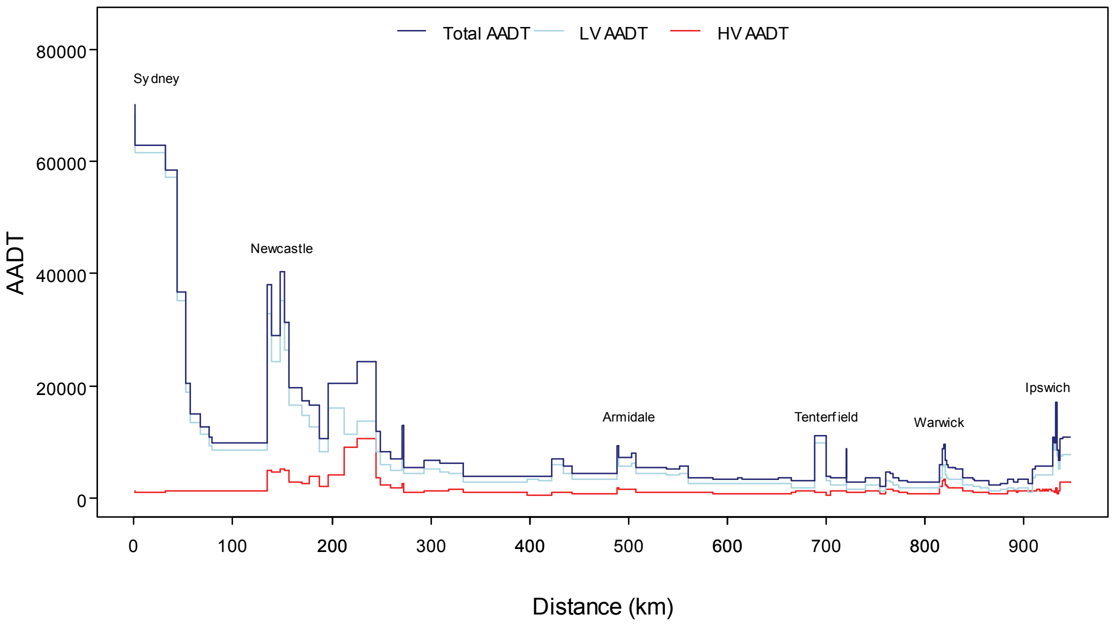
```
      BaseCase_Imports</Imports>
  <Production Commodity = "Fertilisers">
      BaseCase_Production</Production>
  <BulkMovementsPattern Commodity = "Fertilisers">
      BaseCase_BaseYearMovements</BulkMovementsPattern>
  <BulkFreight Commodity = "Fertilisers"
      ResultsTable="BaseCase_Bulk_Results"/>

  <!-- 14. Cement -->
  <Consumption Commodity = "Cement" Elasticity = "0.5">
      BaseCase_Consumption</Consumption>
  <Imports Commodity = "Cement" Elasticity = "0.5">
      BaseCase_Imports</Imports>
  <Production Commodity = "Cement">
      BaseCase_Production</Production>
  <BulkMovementsPattern Commodity = "Cement">
      BaseCase_BaseYearMovements</BulkMovementsPattern>
  <BulkFreight Commodity = "Cement"
      ResultsTable="BaseCase_Bulk_Results"/>

  <!-- 15. Timber and timber products -->
  <Consumption Commodity = "Timber and timber products" Elasticity = "0.5">
      BaseCase_Consumption</Consumption>
  <Imports Commodity = "Timber and timber products" Elasticity = "0.5">
      BaseCase_Imports</Imports>
  <Production Commodity = "Timber and timber products">
      BaseCase_Production</Production>
  <BulkMovementsPattern Commodity = "Timber and timber products">
      BaseCase_BaseYearMovements</BulkMovementsPattern>
  <BulkFreight Commodity = "Timber and timber products"
      ResultsTable="BaseCase_Bulk_Results"/>

  <!-- 16. Other bulk -->
  <Consumption Commodity = "Other bulk" Elasticity = "0.5">
      BaseCase_Consumption</Consumption>
  <Imports Commodity = "Other bulk" Elasticity = "0.5">
      BaseCase_Imports</Imports>
  <Production Commodity = "Other bulk">
      BaseCase_Production</Production>
  <BulkMovementsPattern Commodity = "Other bulk">
      BaseCase_BaseYearMovements</BulkMovementsPattern>
  <BulkFreight Commodity = "Other bulk"
      ResultsTable="BaseCase_Bulk_Results"/>

<!--  ------------------------ EOF ------------------------------  -->
```

APPENDIX IX CORRIDOR TRAFFIC PROJECTION RESULTS

This appendix provides an alternative presentation of the corridor traffic projection results discussed in chapter 3. The results presented here show a series of four AADT charts for each of the 10 interstate corridors and the Brisbane–Cairns corridor. No charts are provided for the shorter intrastate corridors. The series of four charts show:

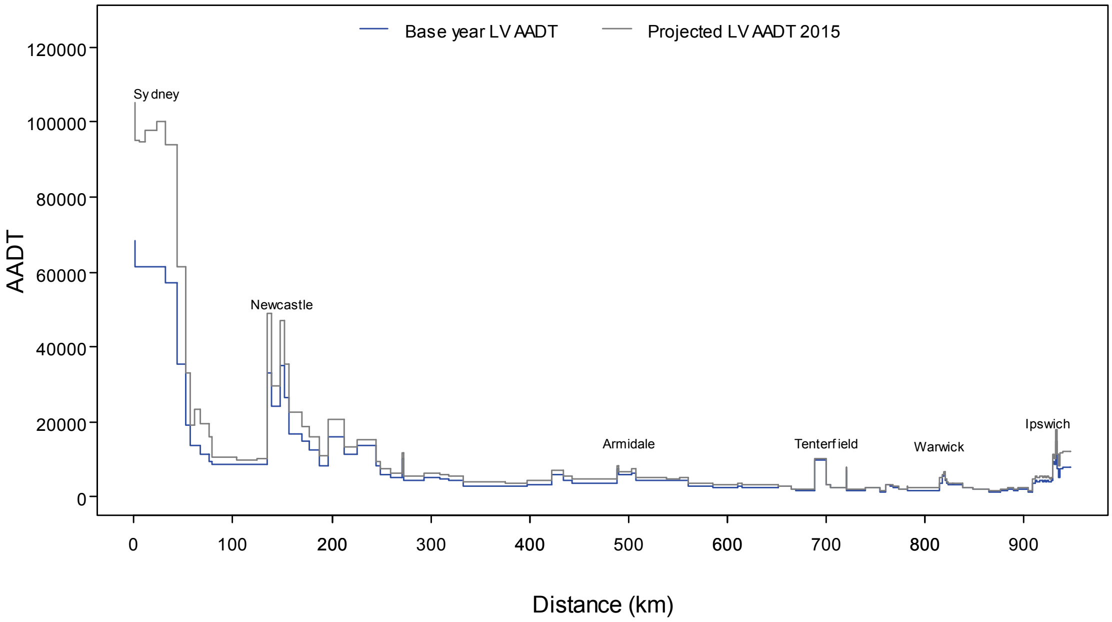
- Light vehicle, heavy vehicle and total AADT in the base year
- Base year actual and 2015 projected light vehicle AADT
- Base year actual and 2015 projected heavy vehicle AADT
- Base year actual and 2015 projected total AADT.

FIGURE IX.1 SYDNEY–BRISBANE (INLAND) CORRIDOR: BASE YEAR TRAFFIC LEVELS



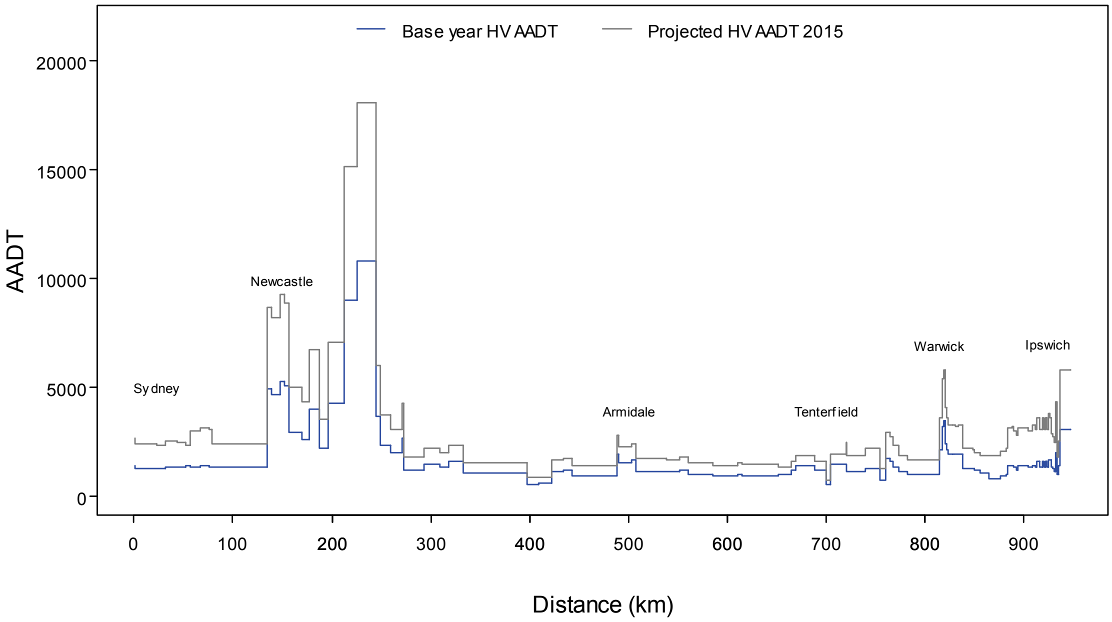
Sources BTRE estimates.

FIGURE IX.2 SYDNEY–BRISBANE (INLAND) CORRIDOR: BASE YEAR ACTUAL AND PROJECTED 2015 LIGHT VEHICLE TRAFFIC LEVELS



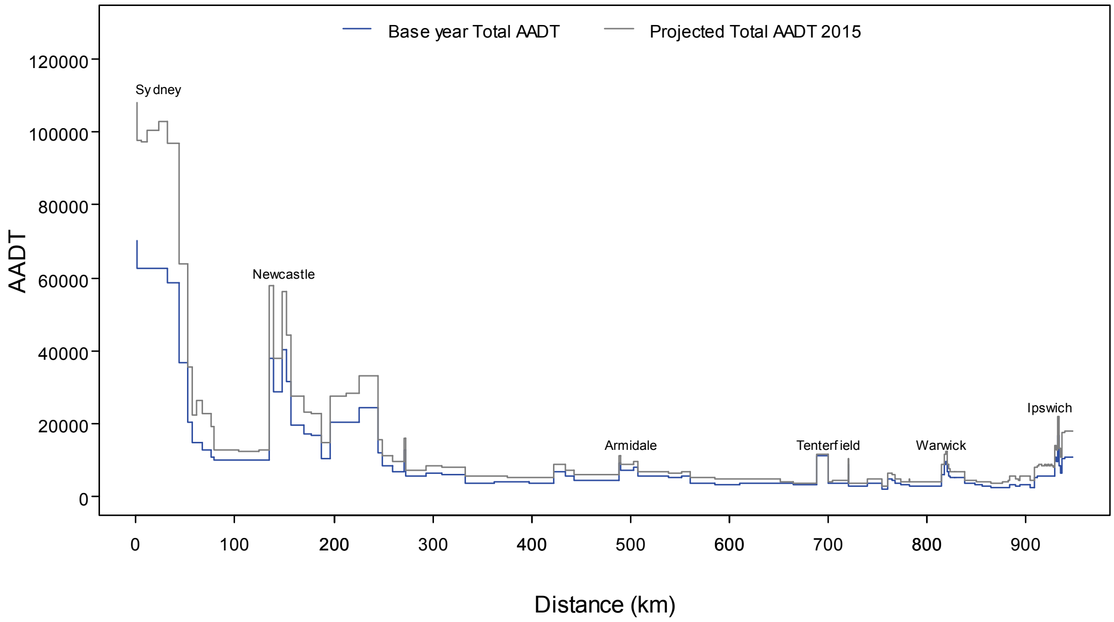
Sources BTRE estimates.

FIGURE IX.3 SYDNEY–BRISBANE (INLAND) CORRIDOR: BASE YEAR ACTUAL AND PROJECTED 2015 HEAVY VEHICLE TRAFFIC LEVELS



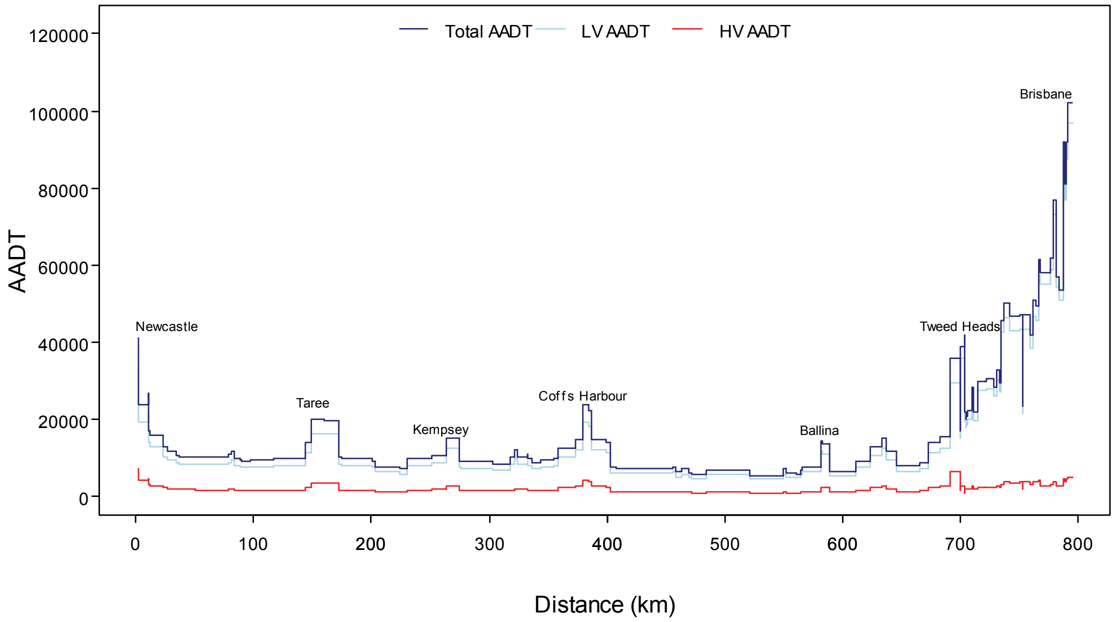
Sources BTRE estimates.

FIGURE IX.4 SYDNEY–BRISBANE (INLAND) CORRIDOR: BASE YEAR ACTUAL AND PROJECTED 2015 TOTAL TRAFFIC LEVELS



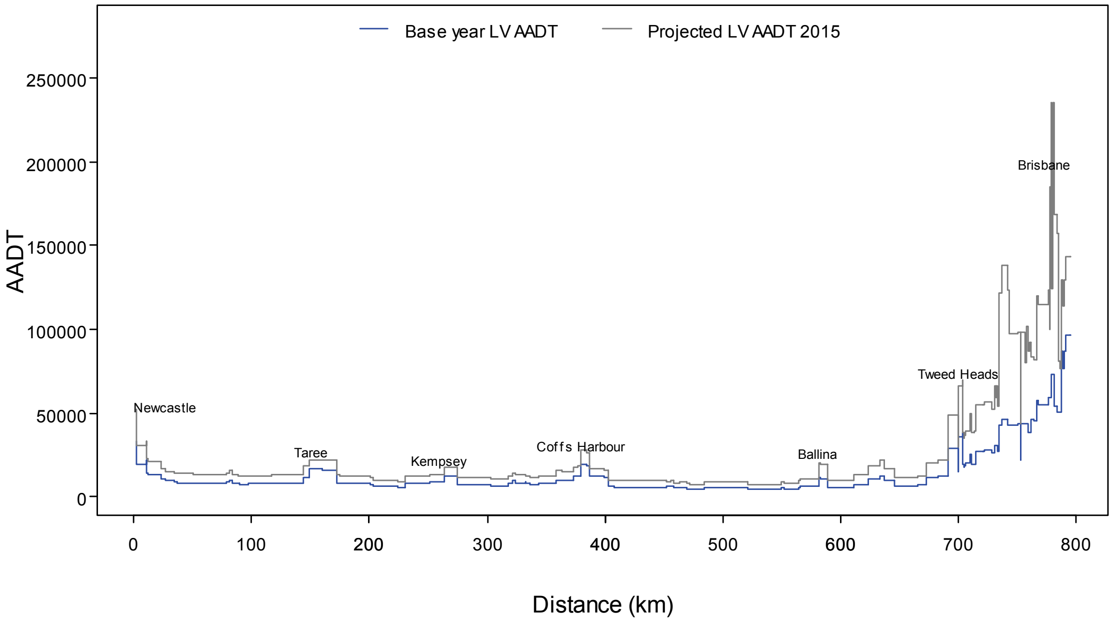
Sources BTRE estimates.

FIGURE IX.5 SYDNEY–BRISBANE (COASTAL) CORRIDOR: BASE YEAR TRAFFIC LEVELS



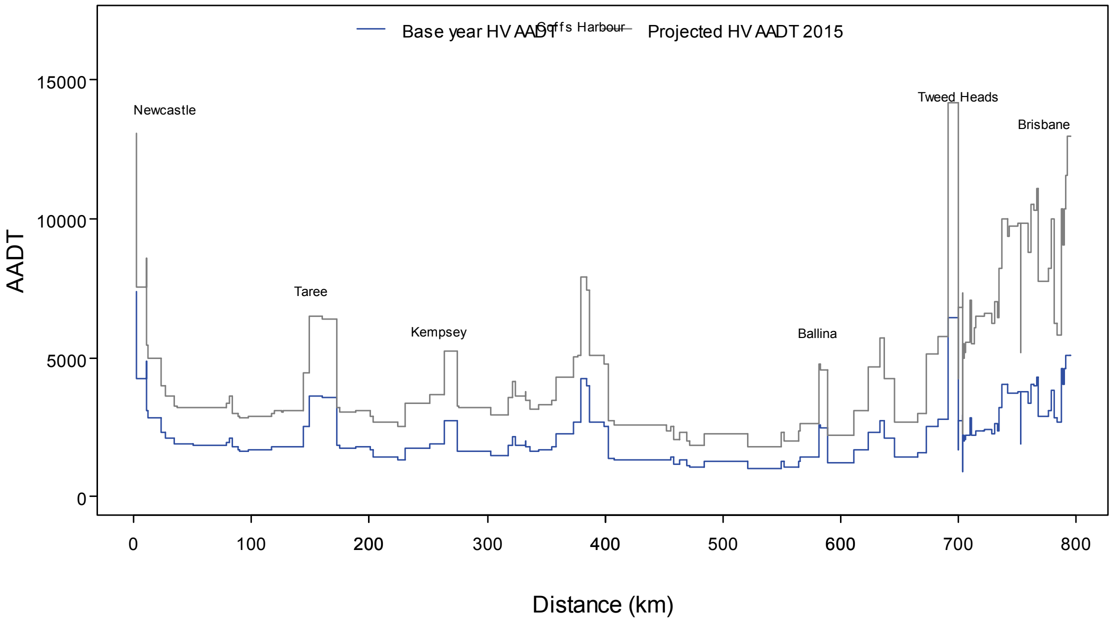
Sources BTRE estimates.

FIGURE IX.6 SYDNEY–BRISBANE (COASTAL) CORRIDOR: BASE YEAR ACTUAL AND PROJECTED 2015 LIGHT VEHICLE TRAFFIC LEVELS



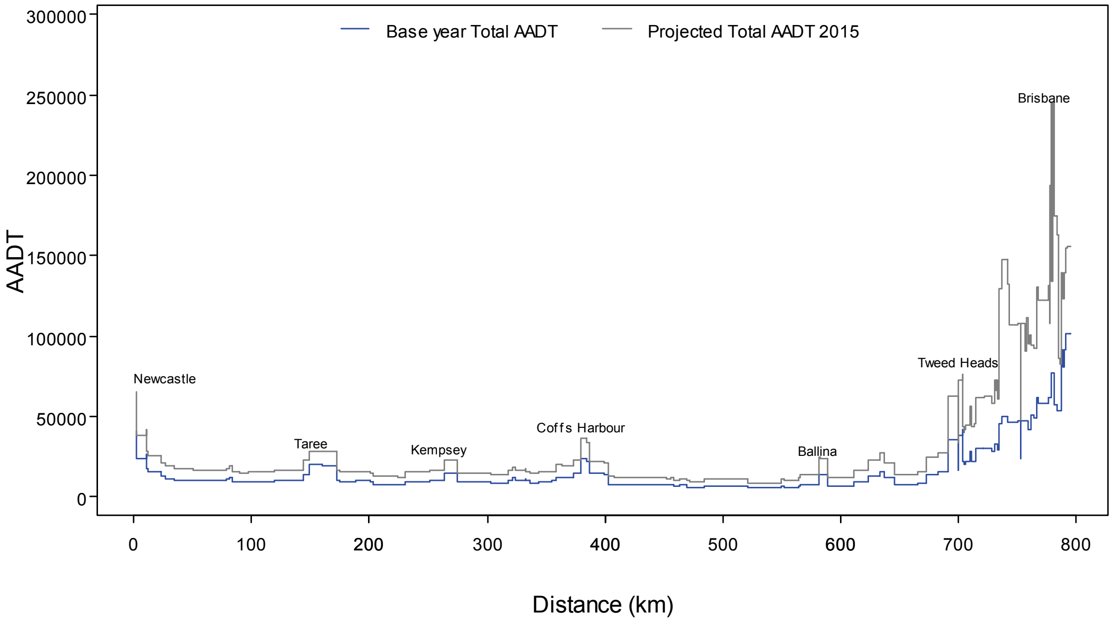
Sources BTRE estimates.

FIGURE IX.7 SYDNEY–BRISBANE (COASTAL) CORRIDOR: BASE YEAR ACTUAL AND PROJECTED 2015 HEAVY VEHICLE TRAFFIC LEVELS



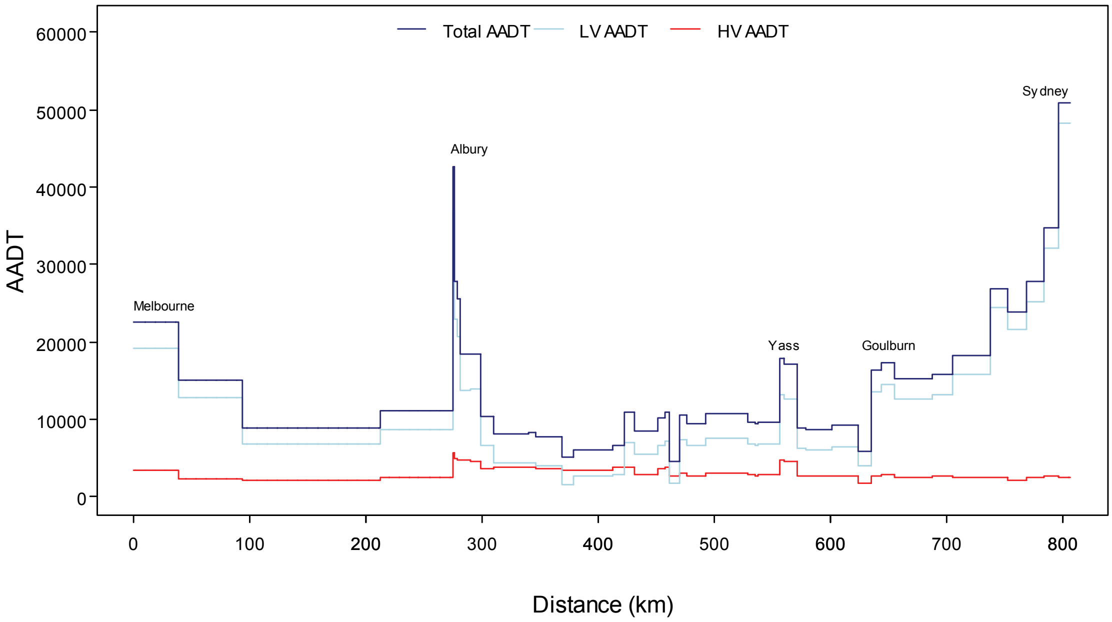
Sources BTRE estimates.

FIGURE IX.8 SYDNEY–BRISBANE (COASTAL) CORRIDOR: BASE YEAR ACTUAL AND PROJECTED 2015 TOTAL TRAFFIC LEVELS



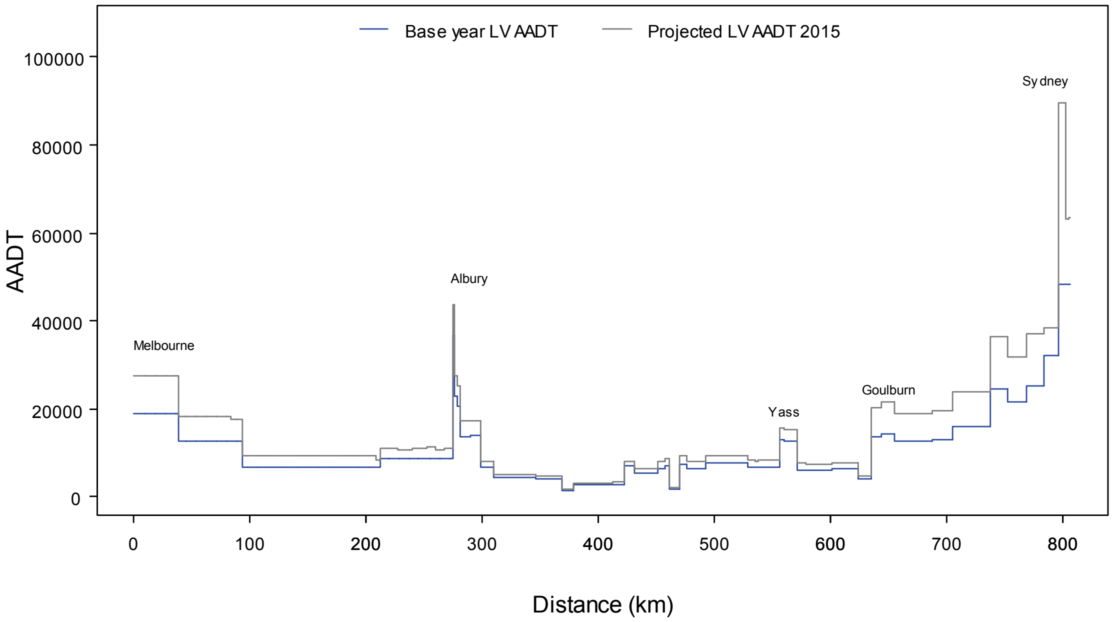
Sources BTRE estimates.

FIGURE IX.9 MELBOURNE–SYDNEY CORRIDOR: BASE YEAR TRAFFIC LEVELS



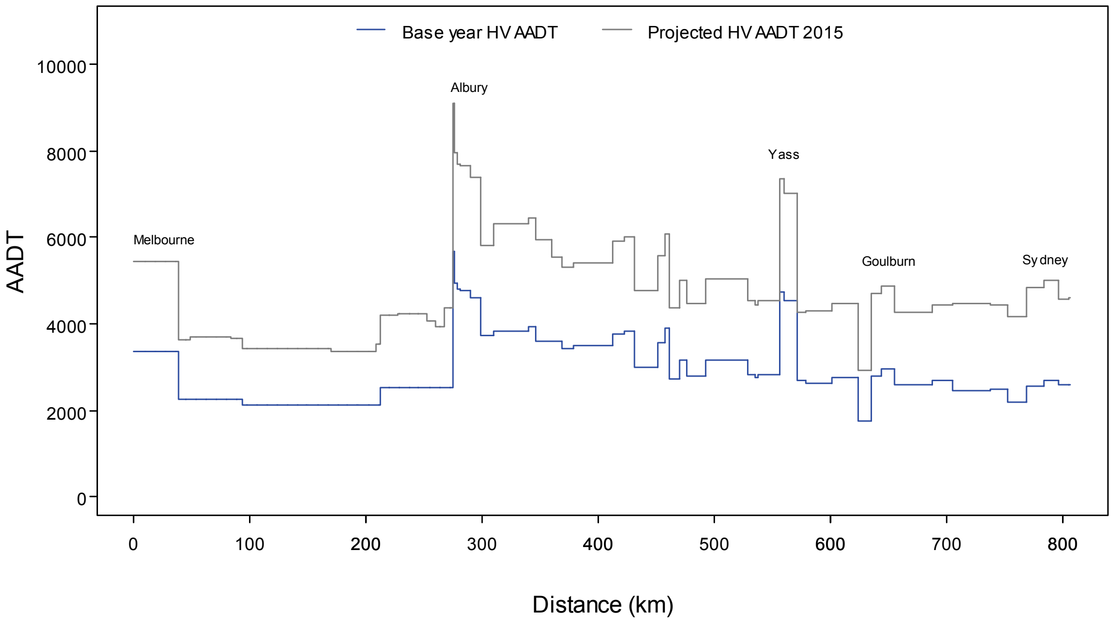
Sources BTRE estimates.

FIGURE IX.10 MELBOURNE–SYDNEY CORRIDOR: BASE YEAR ACTUAL AND PROJECTED 2015 LIGHT VEHICLE TRAFFIC LEVELS



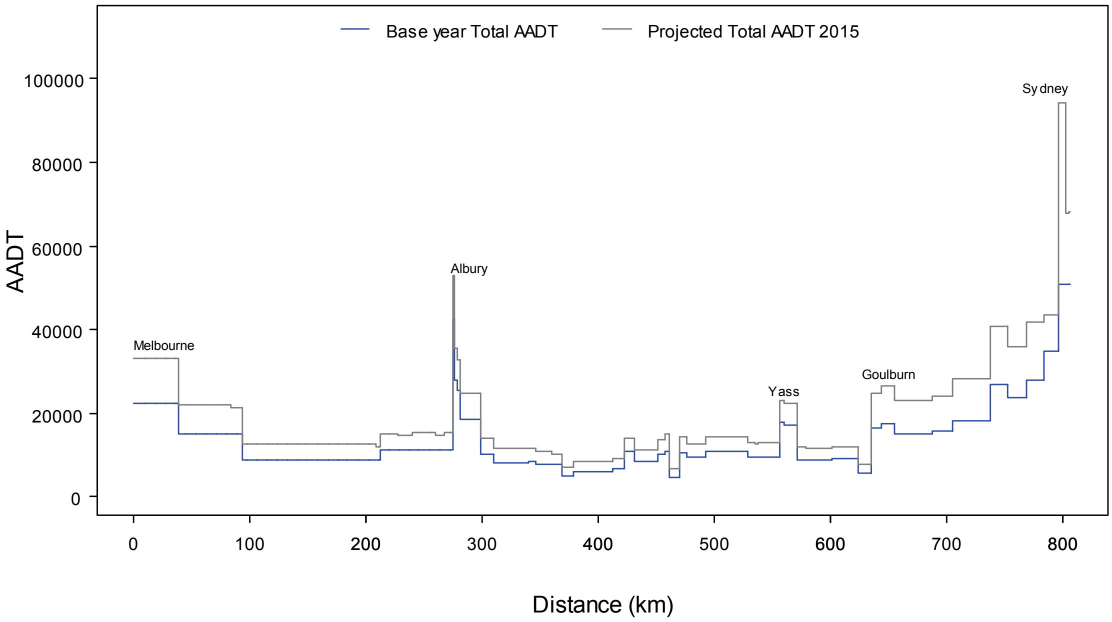
Sources BTRE estimates.

FIGURE IX.11 MELBOURNE–SYDNEY CORRIDOR: BASE YEAR ACTUAL AND PROJECTED 2015 HEAVY VEHICLE TRAFFIC LEVELS



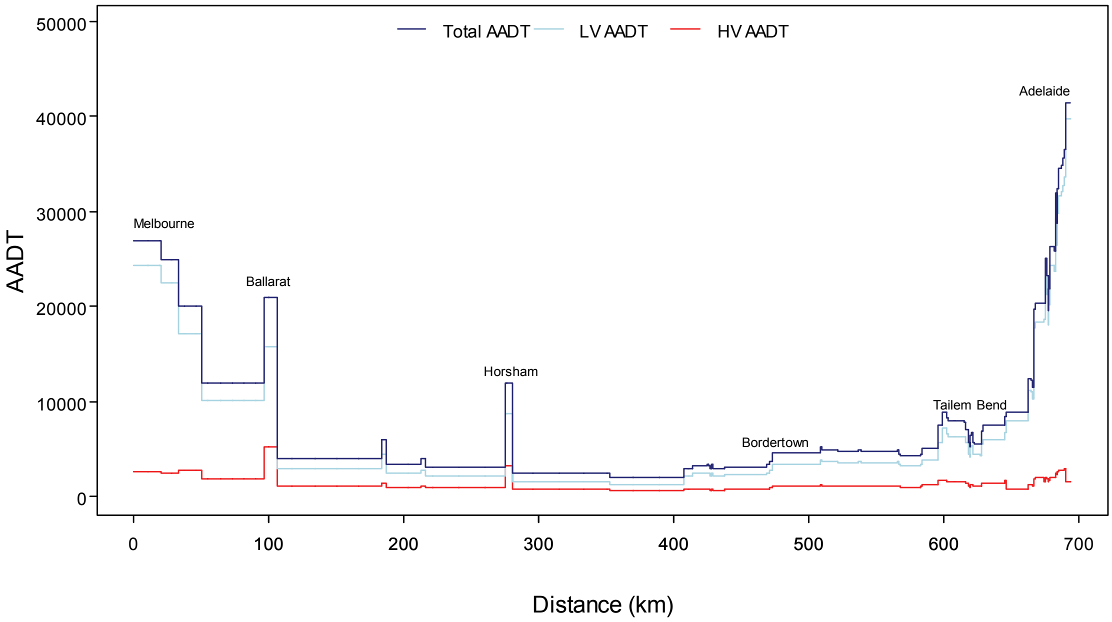
Sources BTRE estimates.

FIGURE IX.12 MELBOURNE–SYDNEY CORRIDOR: BASE YEAR ACTUAL AND PROJECTED 2015 TOTAL TRAFFIC LEVELS



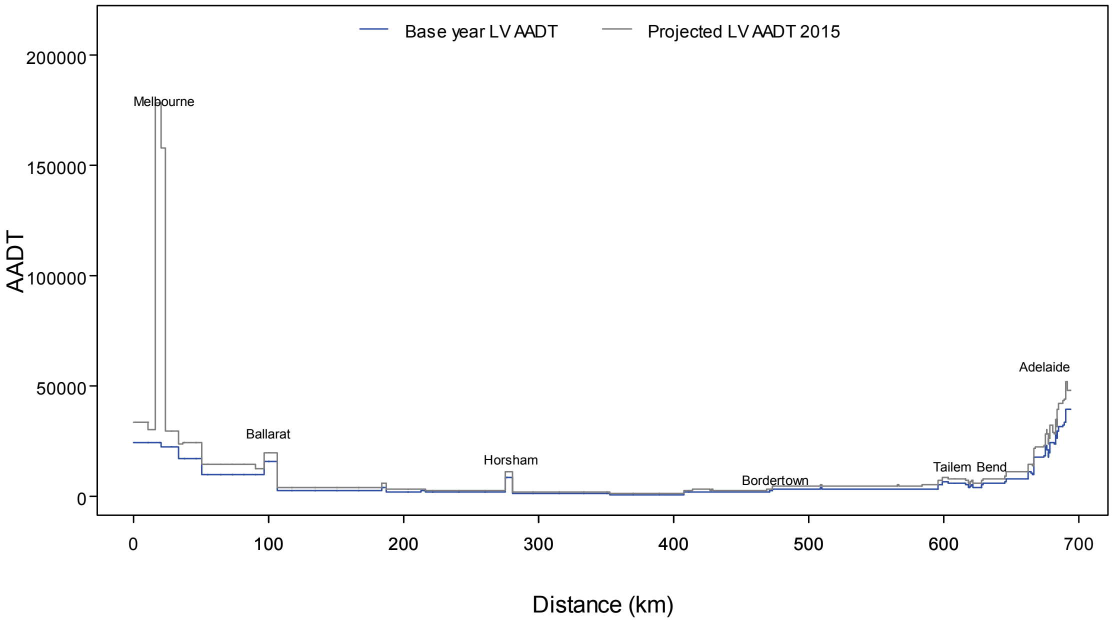
Sources BTRE estimates.

FIGURE IX.13 MELBOURNE–ADELAIDE CORRIDOR: BASE YEAR TRAFFIC LEVELS



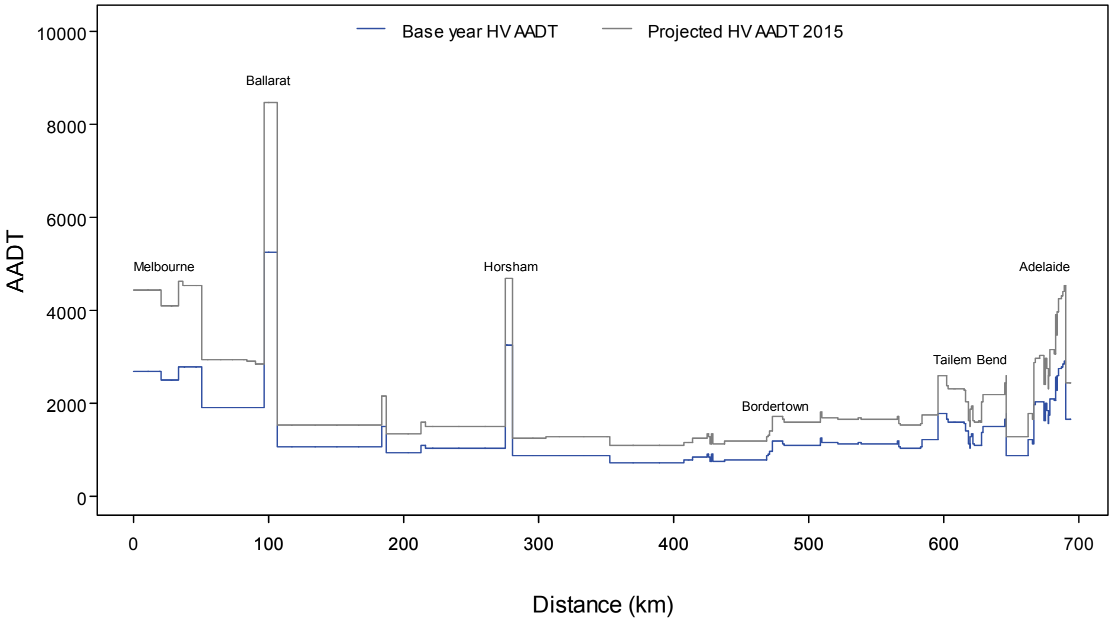
Sources BTRE estimates.

FIGURE IX.14 MELBOURNE–ADELAIDE CORRIDOR: BASE YEAR ACTUAL AND PROJECTED 2015 LIGHT VEHICLE TRAFFIC LEVELS



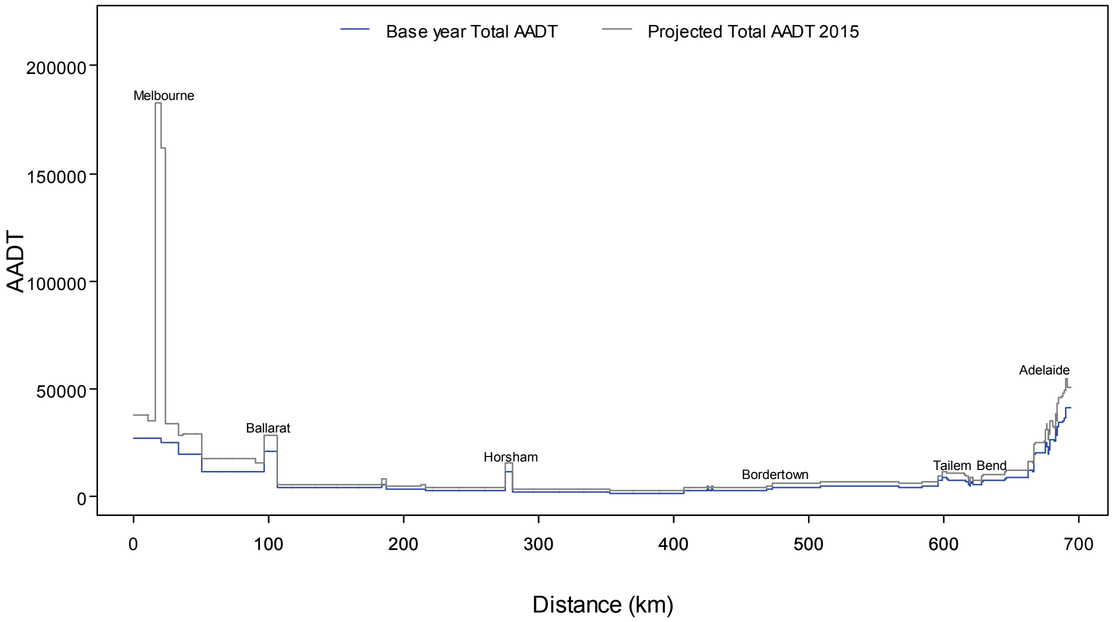
Sources BTRE estimates.

FIGURE IX.15 MELBOURNE–ADELAIDE CORRIDOR: BASE YEAR ACTUAL AND PROJECTED 2015 HEAVY VEHICLE TRAFFIC LEVELS



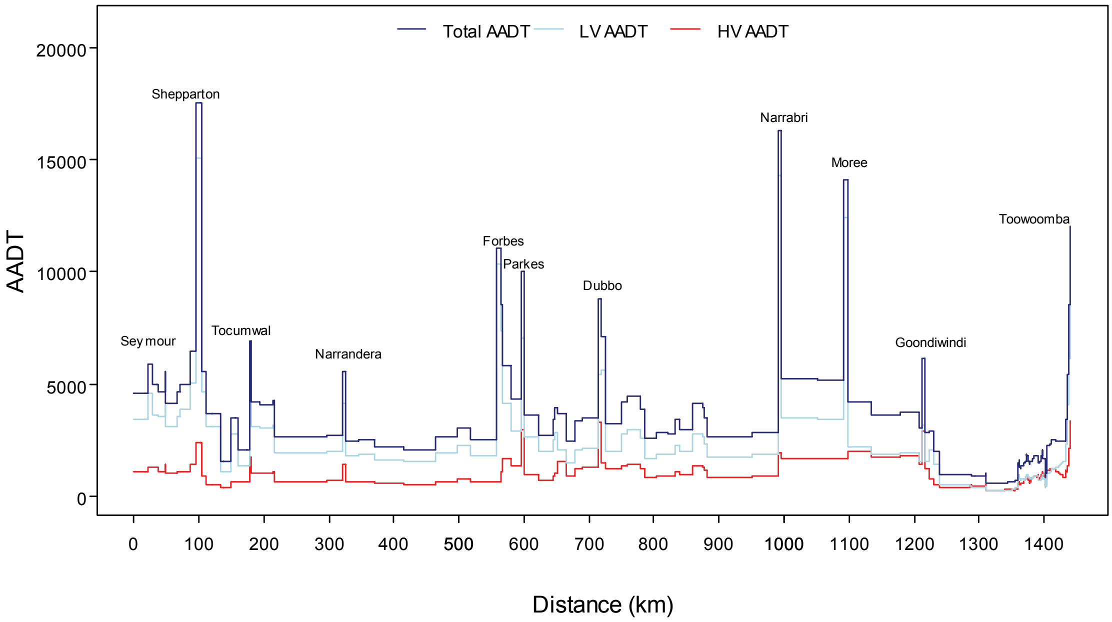
Sources BTRE estimates.

FIGURE IX.16 MELBOURNE–ADELAIDE CORRIDOR: BASE YEAR ACTUAL AND PROJECTED 2015 TOTAL TRAFFIC LEVELS



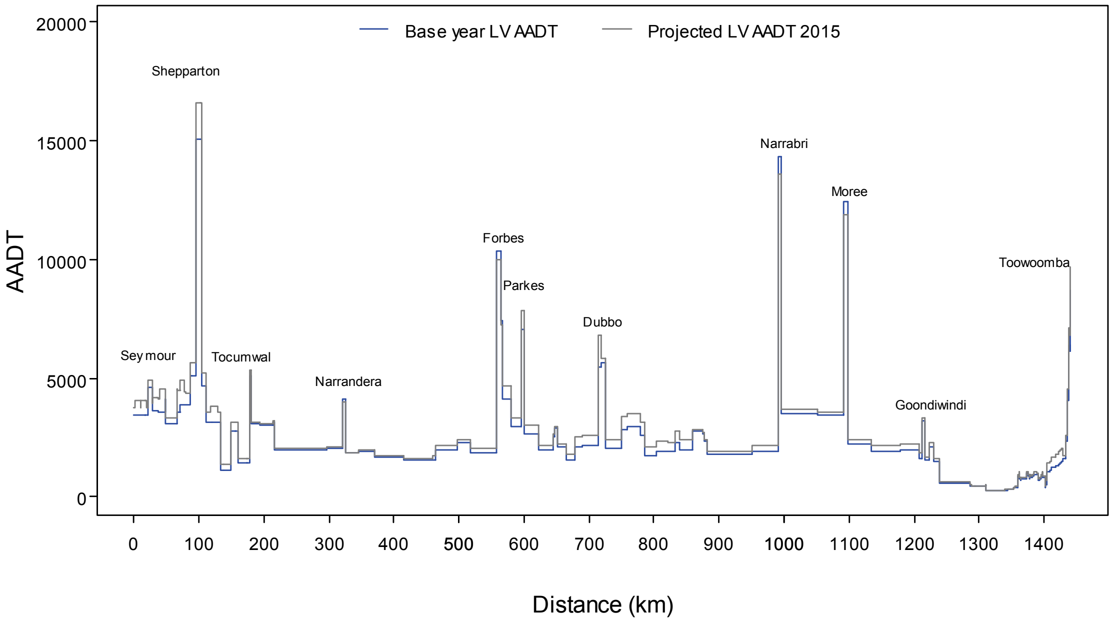
Sources BTRE estimates.

FIGURE IX.17 MELBOURNE–BRISBANE CORRIDOR: BASE YEAR TRAFFIC LEVELS



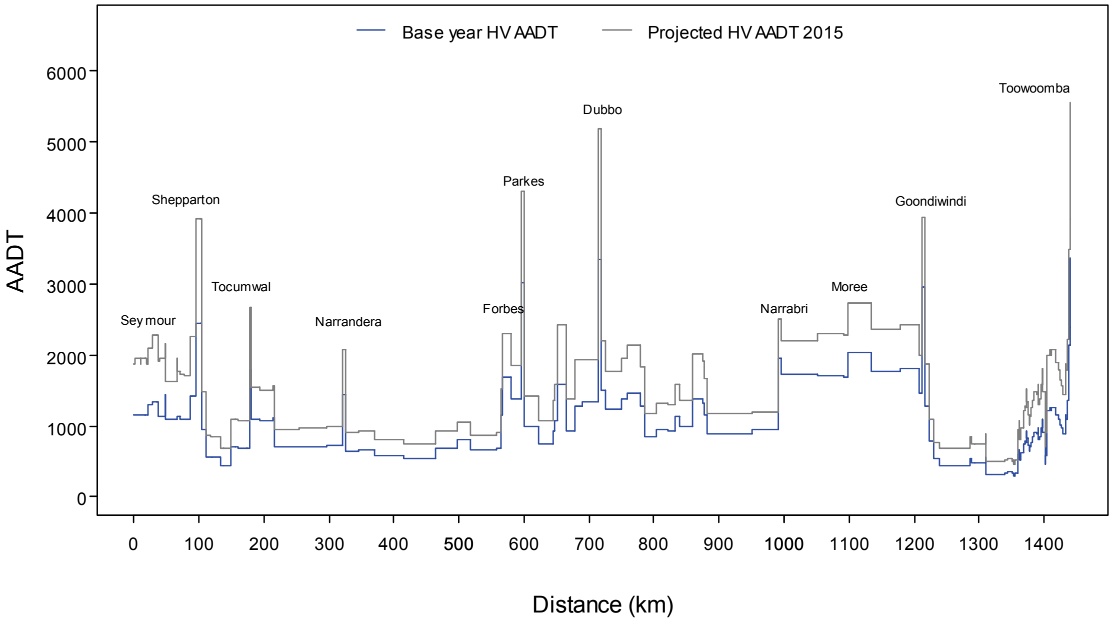
Sources BTRE estimates.

FIGURE IX.18 MELBOURNE–BRISBANE CORRIDOR: BASE YEAR ACTUAL AND PROJECTED 2015 LIGHT VEHICLE TRAFFIC LEVELS



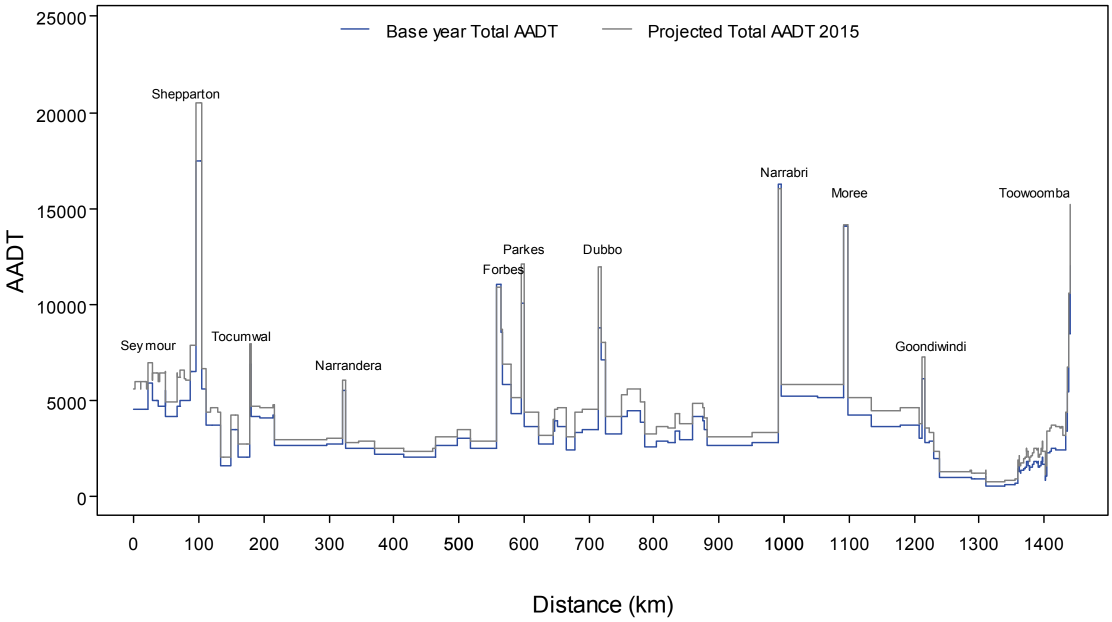
Sources BTRE estimates.

FIGURE IX.19 MELBOURNE–BRISBANE CORRIDOR: BASE YEAR ACTUAL AND PROJECTED 2015 HEAVY VEHICLE TRAFFIC LEVELS



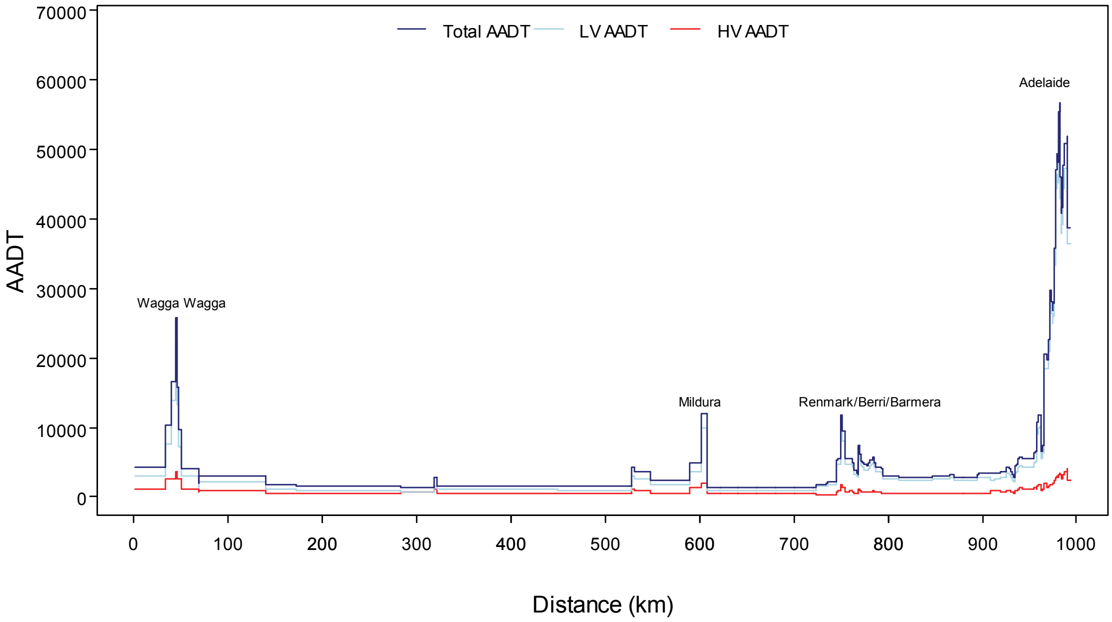
Sources BTRE estimates.

FIGURE IX.20 MELBOURNE–BRISBANE CORRIDOR: BASE YEAR ACTUAL AND PROJECTED 2015 TOTAL TRAFFIC LEVELS



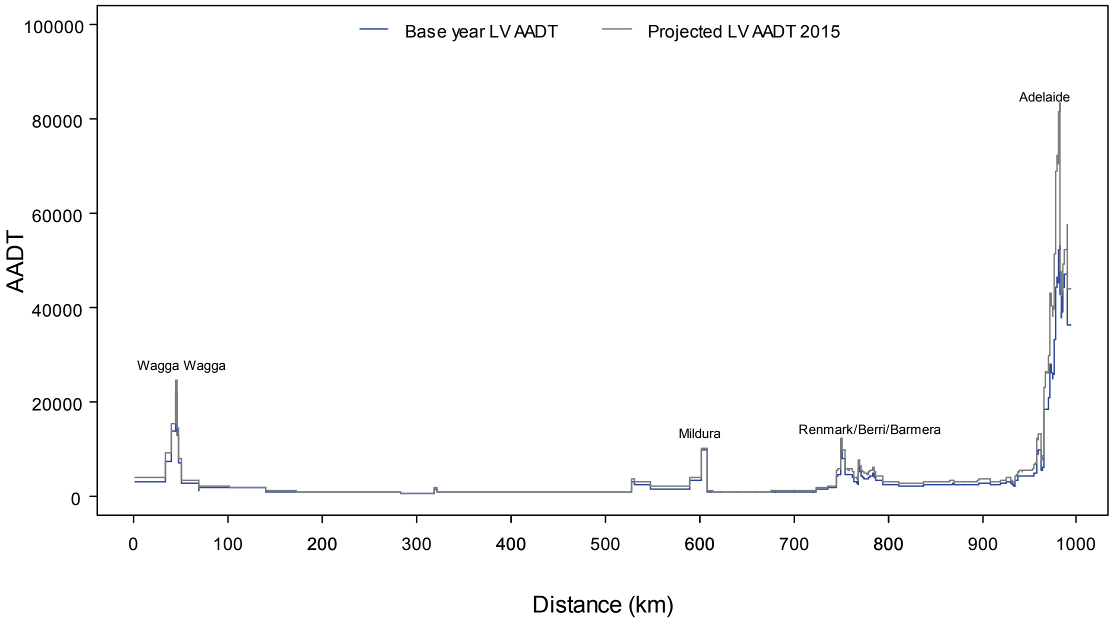
Sources BTRE estimates.

FIGURE IX.21 SYDNEY–ADELAIDE CORRIDOR: BASE YEAR TRAFFIC LEVELS



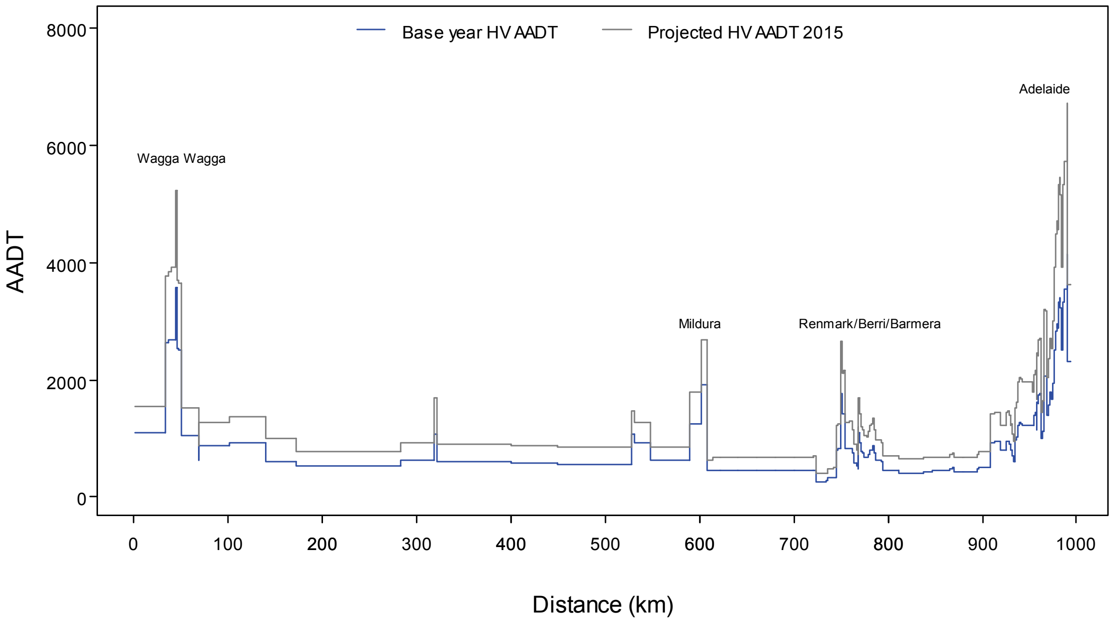
Sources BTRE estimates.

FIGURE IX.22 SYDNEY–ADELAIDE CORRIDOR: BASE YEAR ACTUAL AND PROJECTED 2015 LIGHT VEHICLE TRAFFIC LEVELS



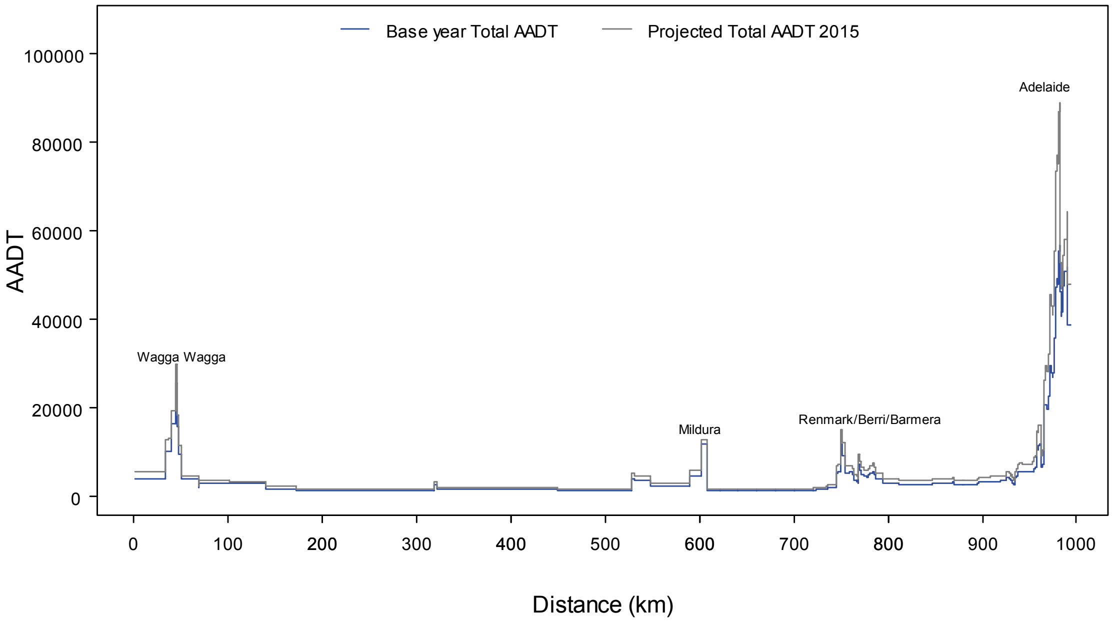
Sources BTRE estimates.

FIGURE IX.23 SYDNEY–ADELAIDE CORRIDOR: BASE YEAR ACTUAL AND PROJECTED 2015 HEAVY VEHICLE TRAFFIC LEVELS



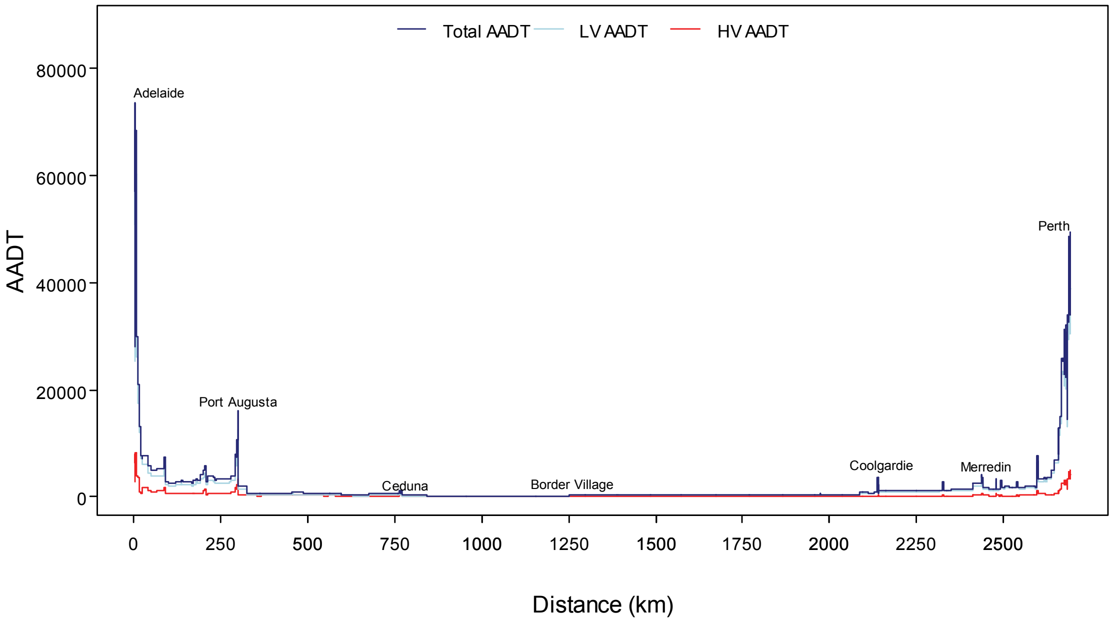
Sources BTRE estimates.

FIGURE IX.24 SYDNEY–ADELAIDE CORRIDOR: BASE YEAR ACTUAL AND PROJECTED 2015 TOTAL TRAFFIC LEVELS



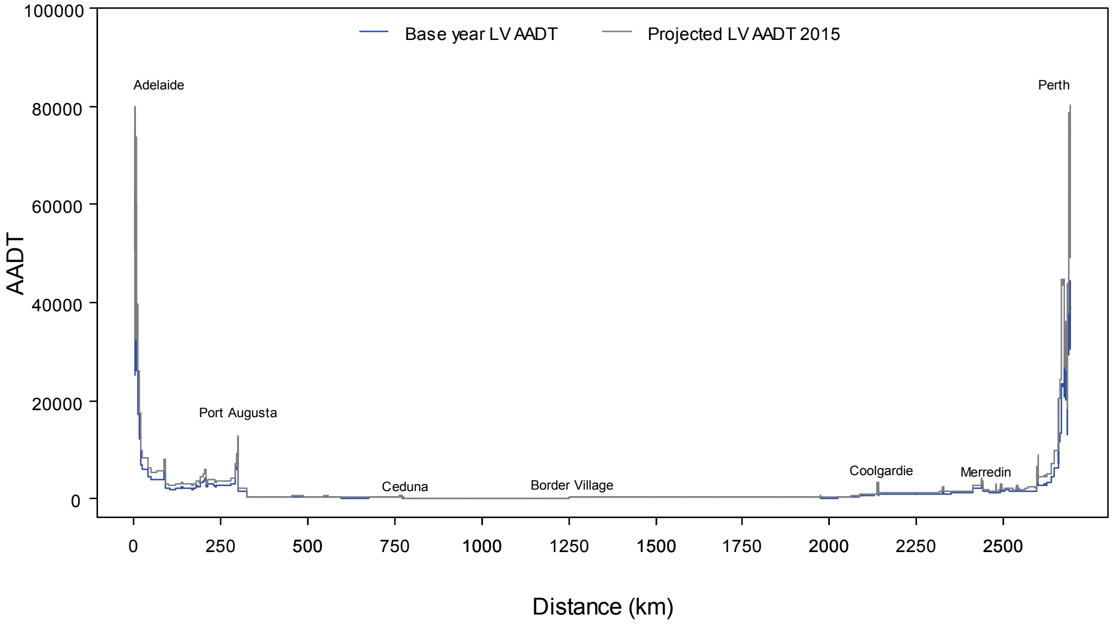
Sources BTRE estimates.

FIGURE IX.25 ADELAIDE–PERTH CORRIDOR: BASE YEAR TRAFFIC LEVELS



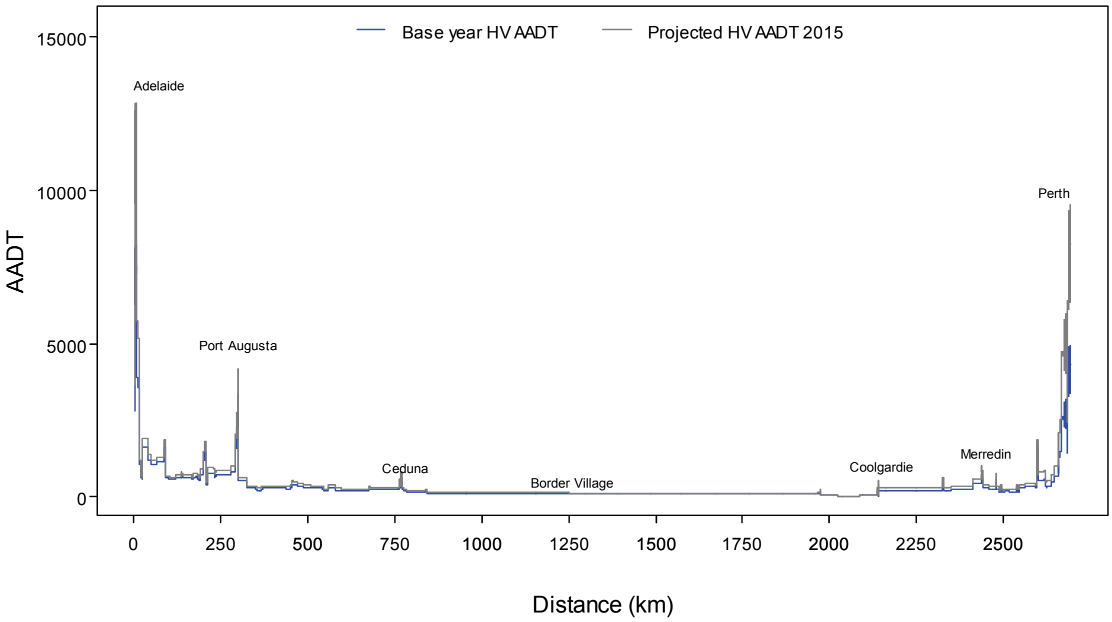
Sources BTRE estimates.

FIGURE IX.26 ADELAIDE–PERTH CORRIDOR: BASE YEAR ACTUAL AND PROJECTED 2015 LIGHT VEHICLE TRAFFIC LEVELS



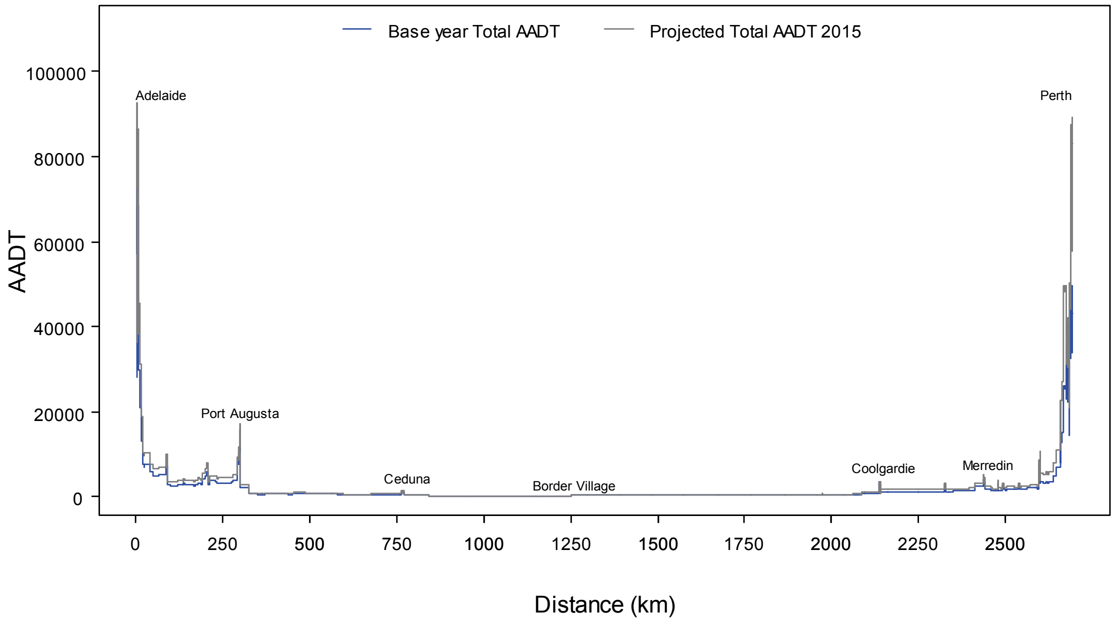
Sources BTRE estimates.

FIGURE IX.27 ADELAIDE–PERTH CORRIDOR: BASE YEAR ACTUAL AND PROJECTED 2015 HEAVY VEHICLE TRAFFIC LEVELS



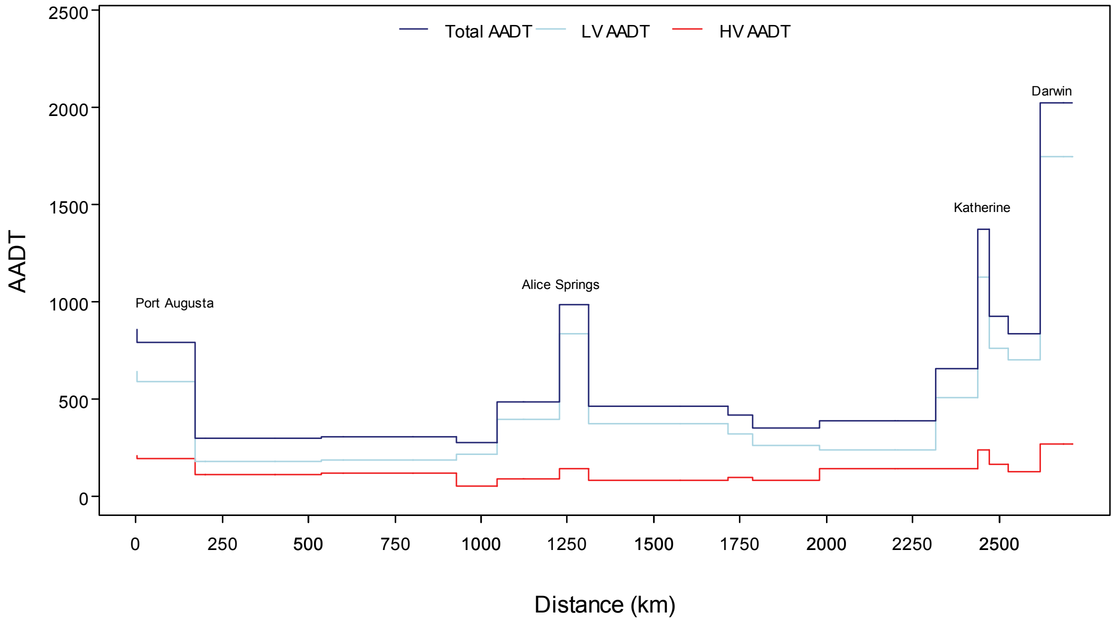
Sources BTRE estimates.

FIGURE IX.28 ADELAIDE–PERTH CORRIDOR: BASE YEAR ACTUAL AND PROJECTED 2015 TOTAL TRAFFIC LEVELS



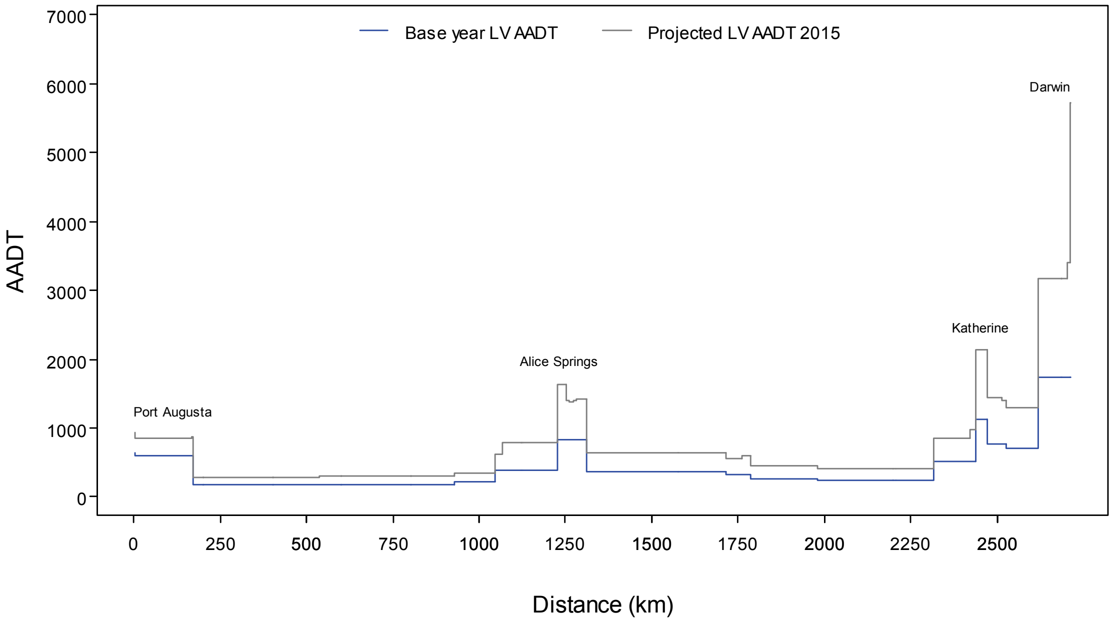
Sources BTRE estimates.

FIGURE IX.29 ADELAIDE–DARWIN CORRIDOR: BASE YEAR TRAFFIC LEVELS



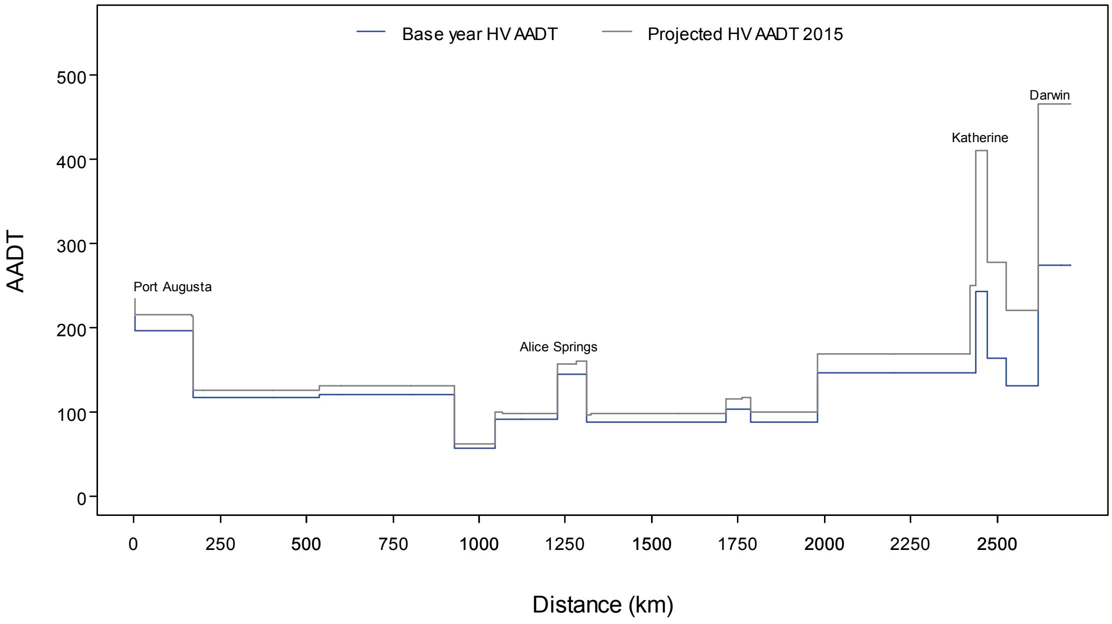
Sources BTRE estimates.

FIGURE IX.30 ADELAIDE–DARWIN CORRIDOR: BASE YEAR ACTUAL AND PROJECTED 2015 LIGHT VEHICLE TRAFFIC LEVELS



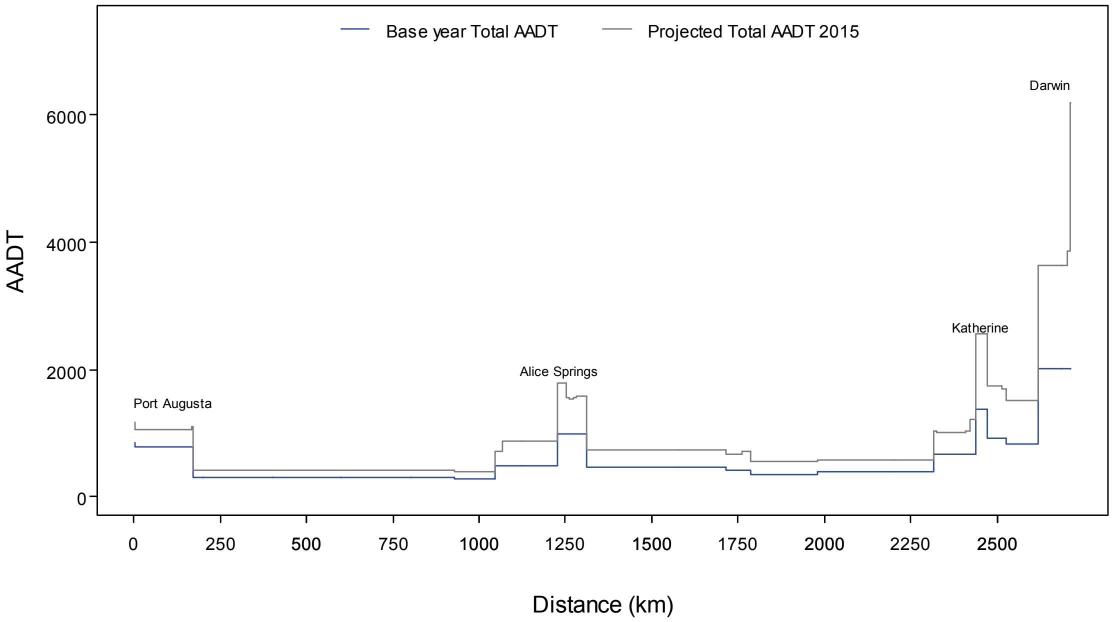
Sources BTRE estimates.

FIGURE IX.31 ADELAIDE–DARWIN CORRIDOR: BASE YEAR ACTUAL AND PROJECTED 2015 HEAVY VEHICLE TRAFFIC LEVELS



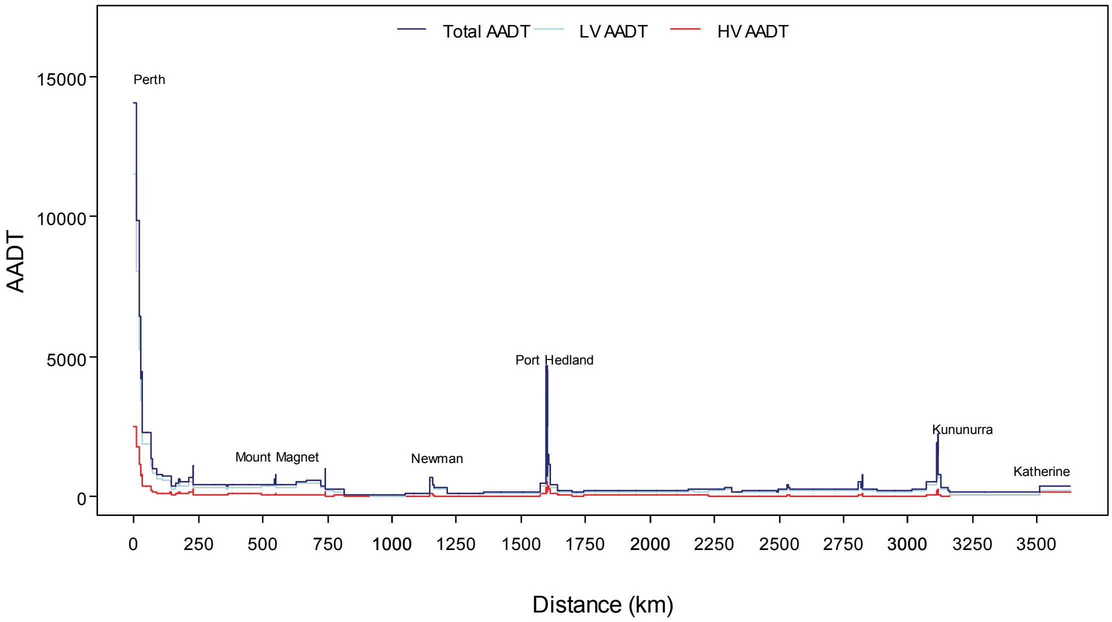
Sources BTRE estimates.

FIGURE IX.32 ADELAIDE–DARWIN CORRIDOR: BASE YEAR ACTUAL AND PROJECTED 2015 TOTAL TRAFFIC LEVELS



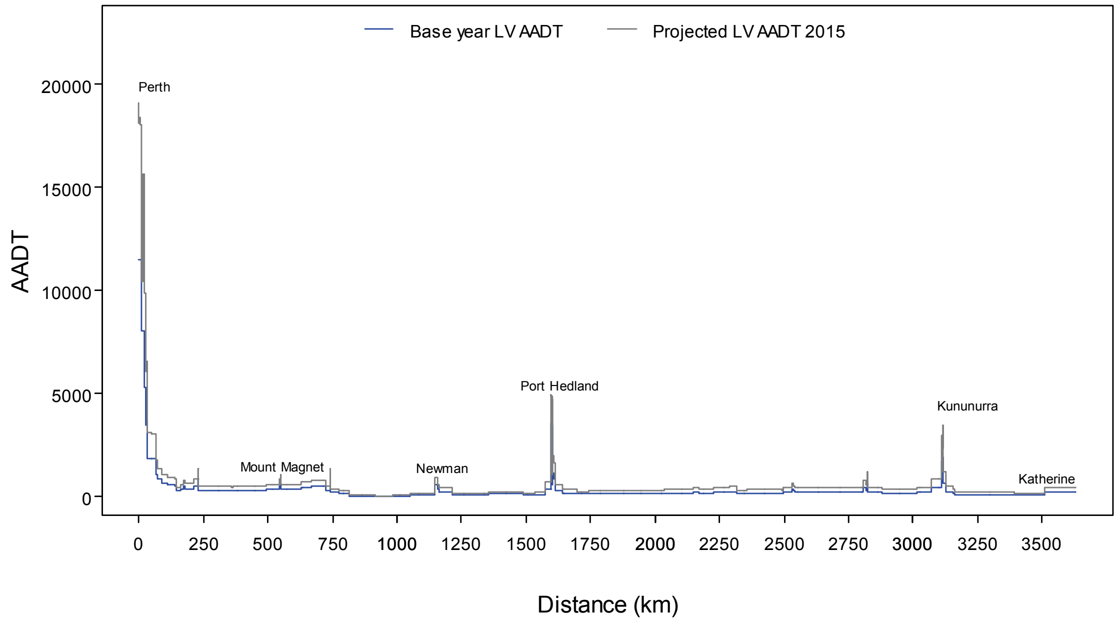
Sources BTRE estimates.

FIGURE IX.33 PERTH–DARWIN CORRIDOR: BASE YEAR TRAFFIC LEVELS



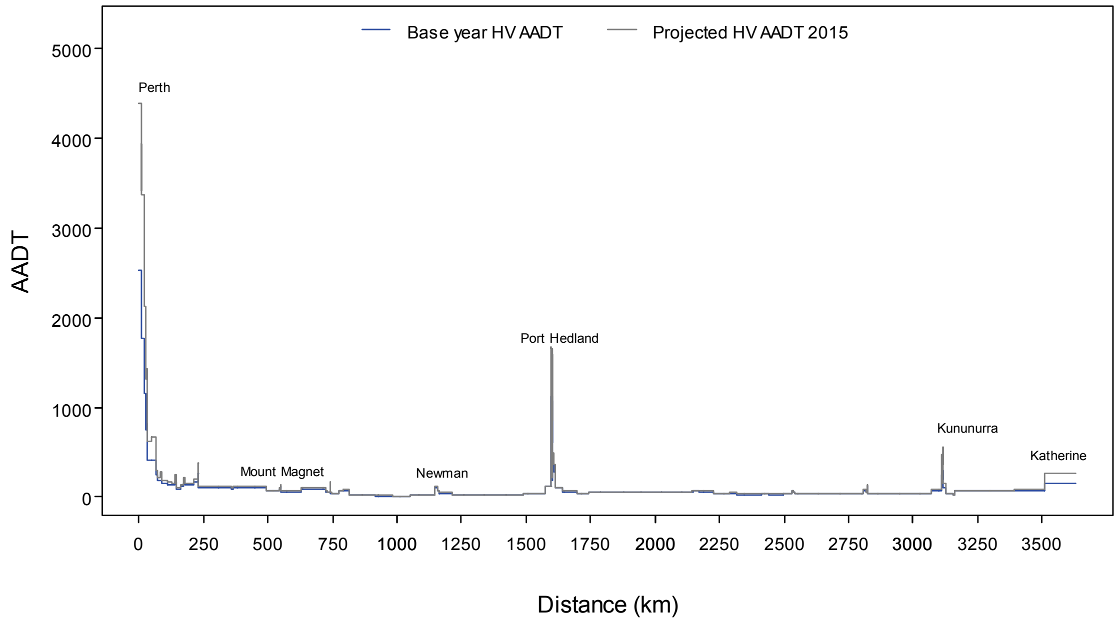
Sources BTRE estimates.

FIGURE IX.34 PERTH–DARWIN CORRIDOR: BASE YEAR ACTUAL AND PROJECTED 2015 LIGHT VEHICLE TRAFFIC LEVELS



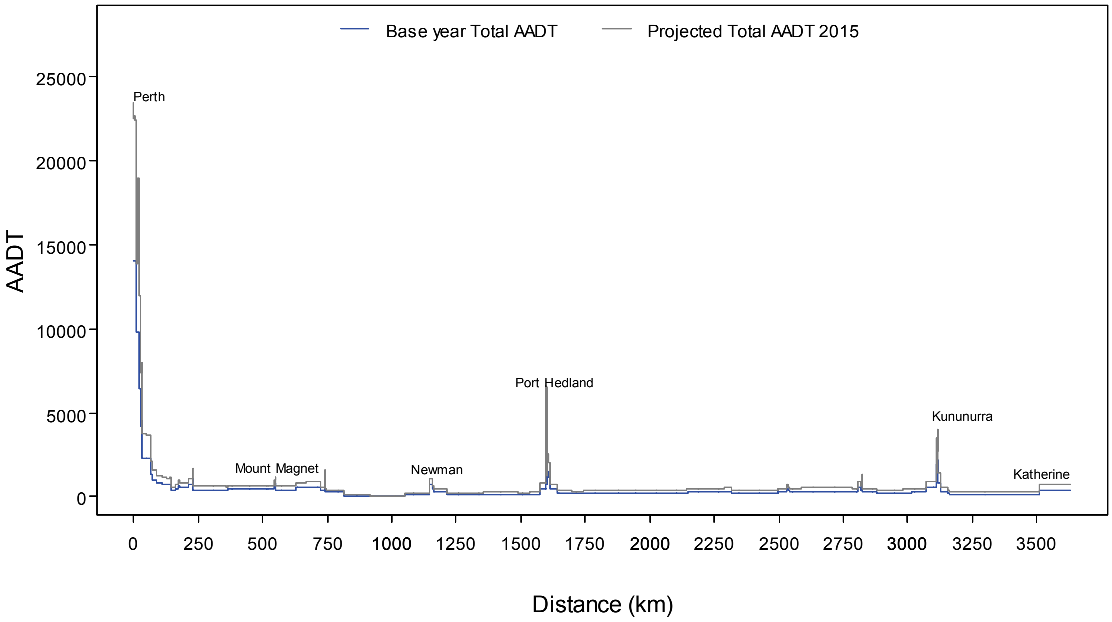
Sources BTRE estimates.

FIGURE IX.35 PERTH–DARWIN CORRIDOR: BASE YEAR ACTUAL AND PROJECTED 2015 HEAVY VEHICLE TRAFFIC LEVELS



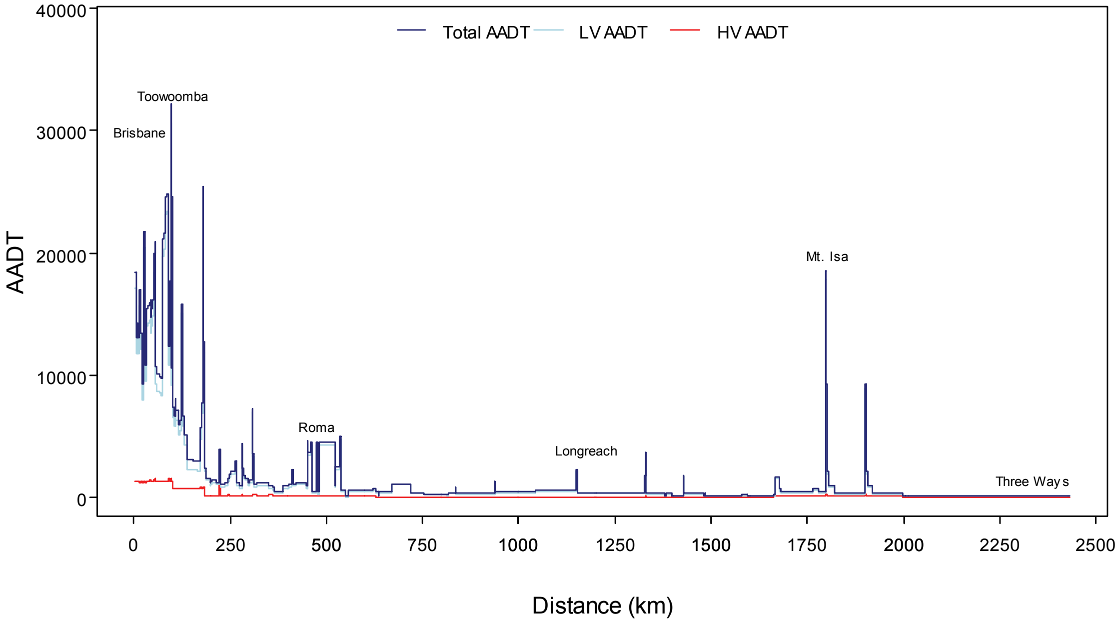
Sources BTRE estimates.

FIGURE IX.36 PERTH–DARWIN CORRIDOR: BASE YEAR ACTUAL AND PROJECTED 2015 TOTAL TRAFFIC LEVELS



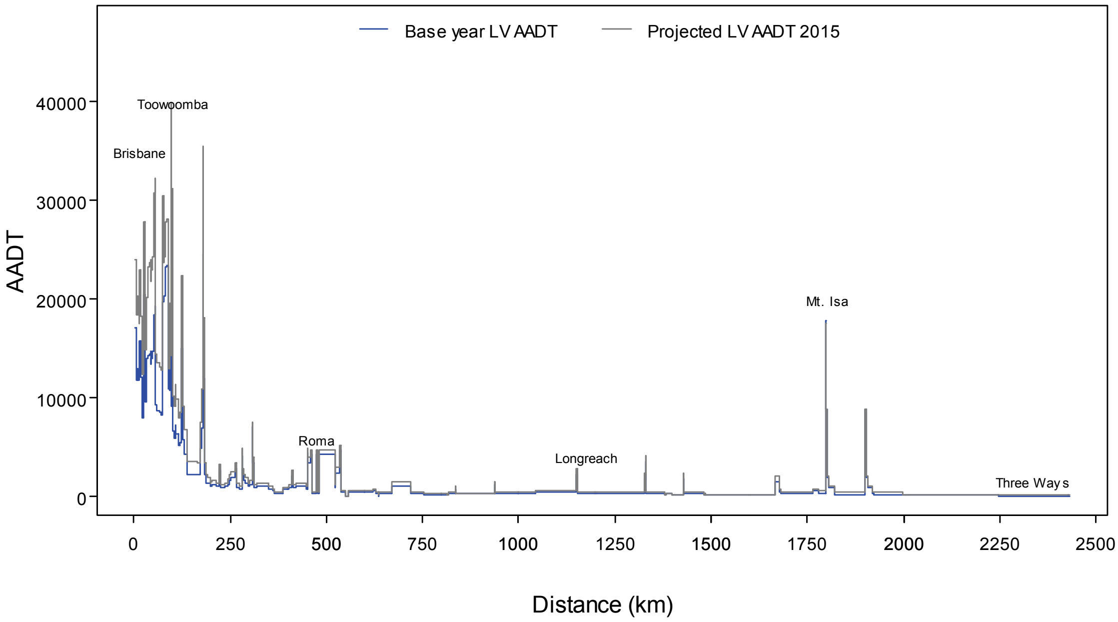
Sources BTRE estimates.

FIGURE IX.37 BRISBANE–DARWIN CORRIDOR: BASE YEAR TRAFFIC LEVELS



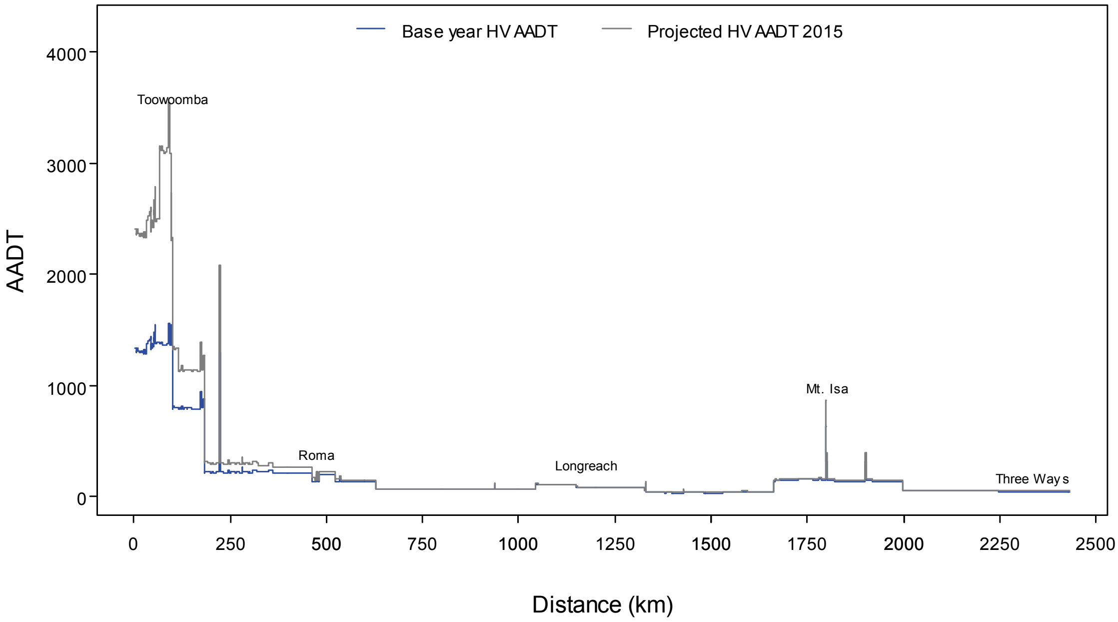
Sources BTRE estimates.

FIGURE IX.38 BRISBANE–DARWIN CORRIDOR: BASE YEAR ACTUAL AND PROJECTED 2015 LIGHT VEHICLE TRAFFIC LEVELS



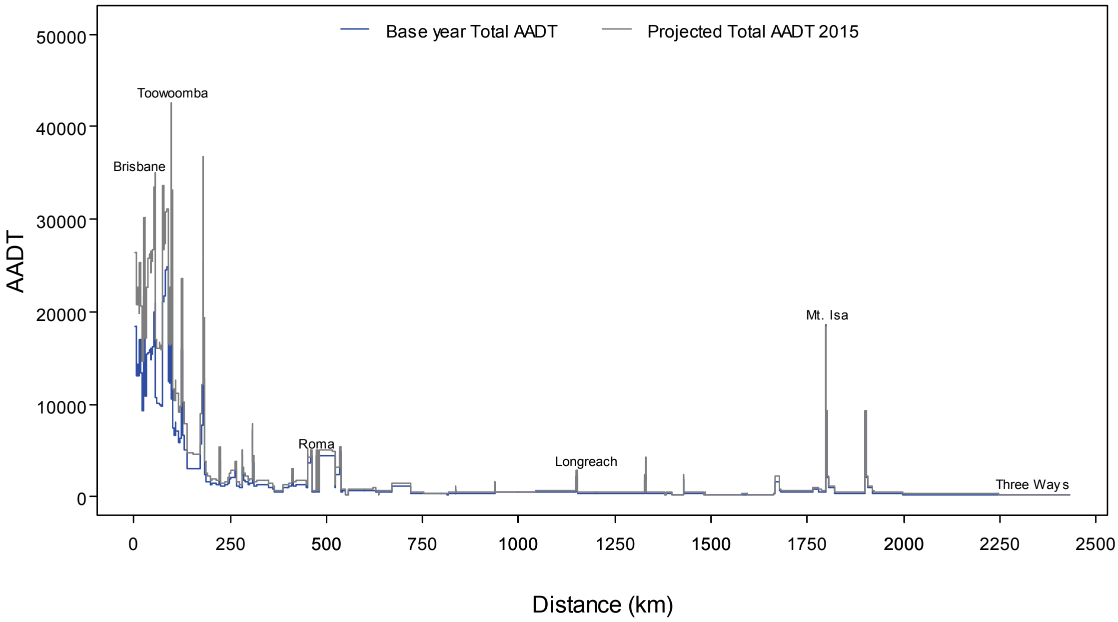
Sources BTRE estimates.

FIGURE IX.39 BRISBANE–DARWIN CORRIDOR: BASE YEAR ACTUAL AND PROJECTED 2015 HEAVY VEHICLE TRAFFIC LEVELS



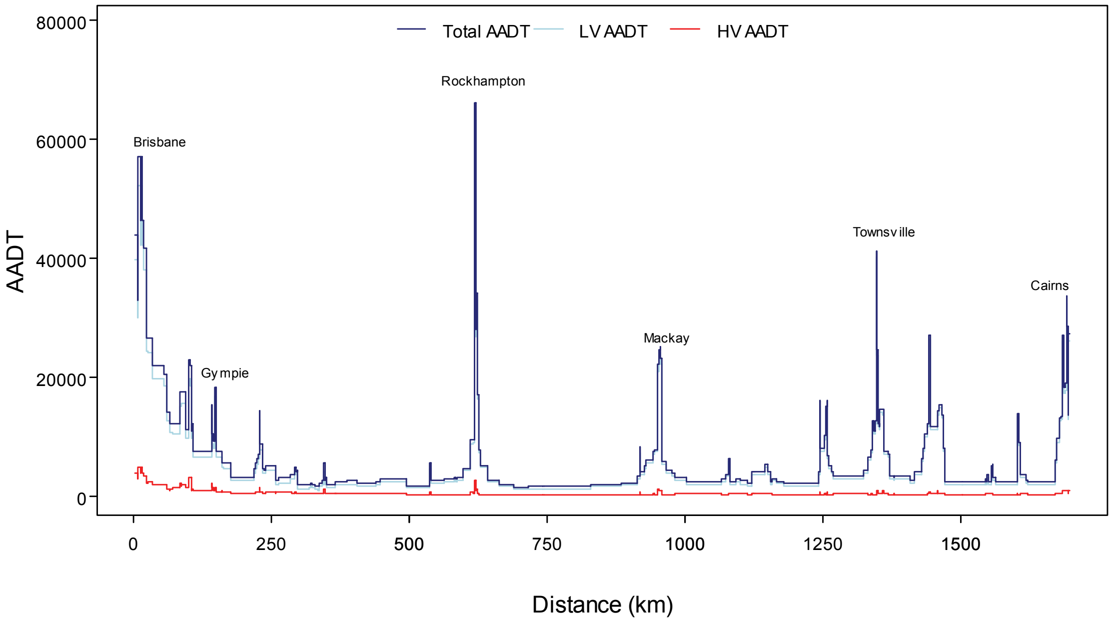
Sources BTRE estimates.

FIGURE IX.40 BRISBANE–DARWIN CORRIDOR: BASE YEAR ACTUAL AND PROJECTED 2015 TOTAL TRAFFIC LEVELS



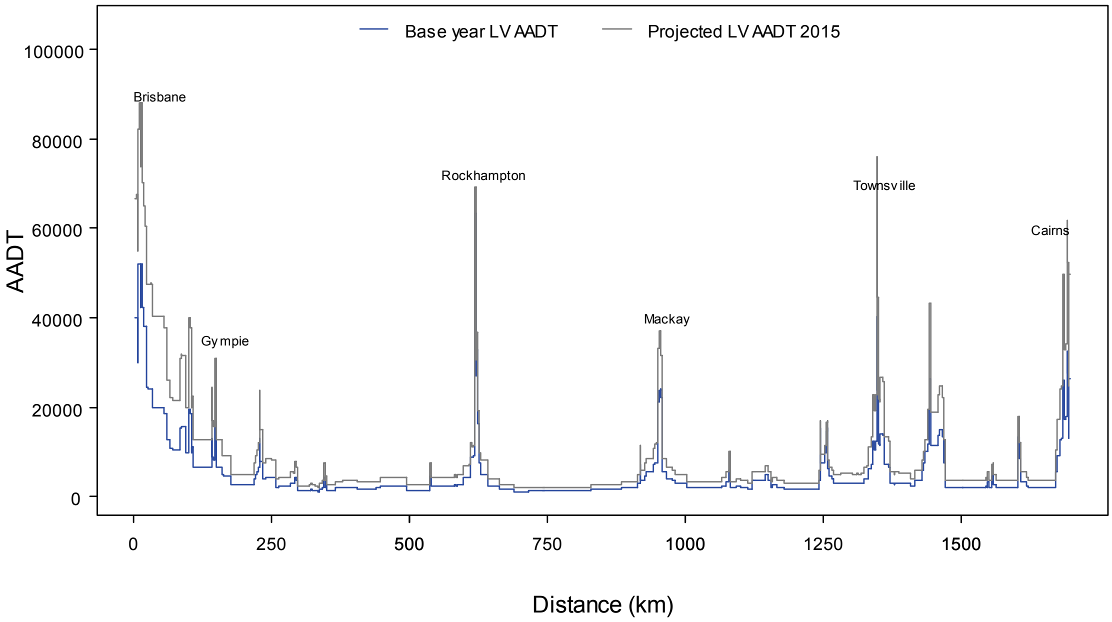
Sources BTRE estimates.

FIGURE IX.41 BRISBANE–CAIRNS CORRIDOR: BASE YEAR TRAFFIC LEVELS



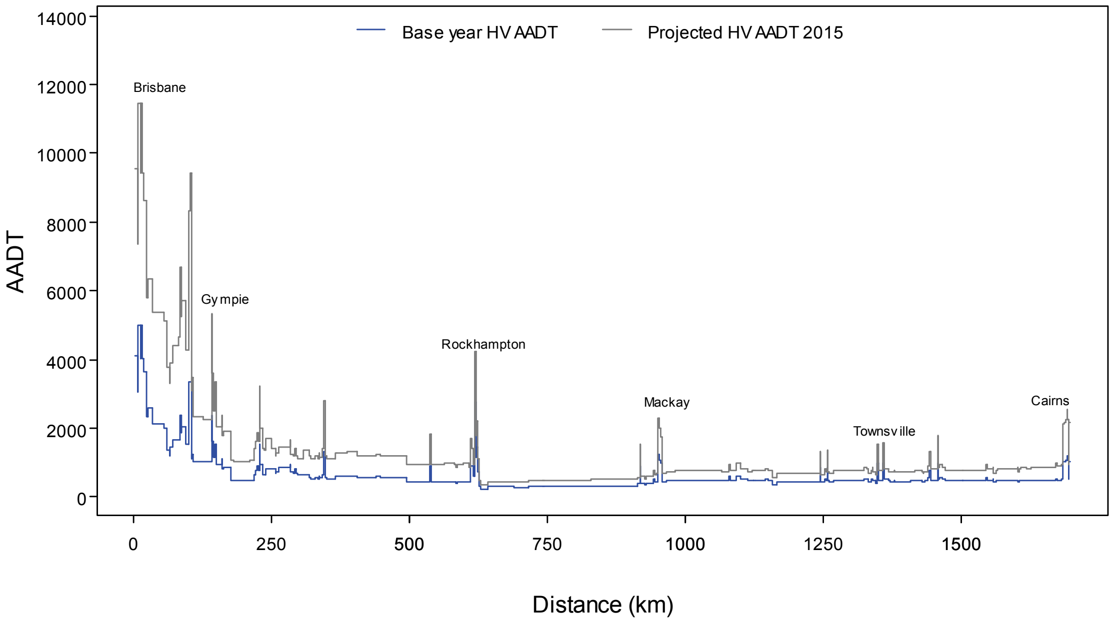
Sources BTRE estimates.

FIGURE IX.42 BRISBANE–CAIRNS CORRIDOR: BASE YEAR ACTUAL AND PROJECTED 2015 LIGHT VEHICLE TRAFFIC LEVELS



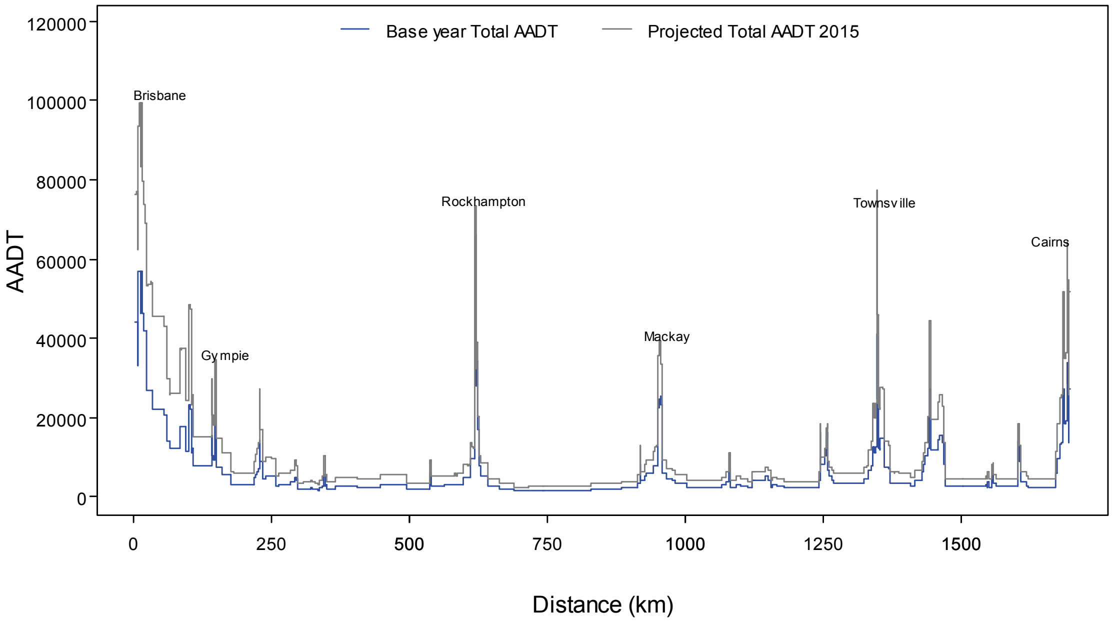
Sources BTRE estimates.

FIGURE IX.43 BRISBANE–CAIRNS CORRIDOR: BASE YEAR ACTUAL AND PROJECTED 2015 HEAVY VEHICLE TRAFFIC LEVELS



Sources BTRE estimates.

FIGURE IX.44 BRISBANE–CAIRNS CORRIDOR: BASE YEAR ACTUAL AND PROJECTED 2015 TOTAL TRAFFIC LEVELS



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NRTC—see National Road Transport Commission

NTPT—see National Transport Planning Taskforce

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ABBREVIATIONS

AADT	Average annual daily traffic
ABS	Australian Bureau of Statistics
ASGC	Australian Standard Geographical Classification
AWE	Average weekly earnings
BTCE	Bureau of Transport and Communications Economics (formerly BTE)
BTE	Bureau of Transport Economics (forerunner to BTRE)
BTRE	Bureau of Transport and Regional Economics (formerly BTE)
FMS	Freight Movements Survey
NHS	National Highway System
OD	Origin–destination
RIAM	Road Infrastructure Assessment Model
SD	Statistical Division
SLA	Statistical Local Area
SMVU	Survey of Motor Vehicle Use
TKM	tonne-kilometres
VKT	Vehicle kilometres travelled