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National road network intercity traffic projections to 2030

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Foreword

This report provides long-term passenger and freight vehicle traffic projections for intercity corridors of the National Land Transport Network (NLTN) between 2005 and 2030. The projections were derived using BITRE's long-term interregional passenger and freight transport projection models, OZPASS and FreightSim, drawing on the most recent available base year interregional passenger travel data, freight movement data and state and territory road traffic data. These projections update those presented in BTRE (2006*a*, Working Paper 66), *Demand Projections for AusLink Non-urban Corridors: Methodology and Projections*.

The key differences between these and the previous projections include:

- incorporation of updated base year road traffic volume data (c. 2005), provided by state and territory road authorities
- inclusion of an alternative projection scenario based on state-sourced regional population projections
- use of the latest Treasury long-term real GDP growth projections
- updated long-term regional commodity production projections for key commodities
- allowance for likely future increases in heavy vehicle productivity.

BITRE acknowledges the assistance of Tourism Research Australia in providing updated regional passenger travel data, and state and territory road authorities, who supplied the 2005 road traffic volume data, at small (one kilometre) section level and road freight volume information from selected Weigh-in-Motion sites. BITRE also thanks members of the Standing Committee on Transport's interjurisdictional Data Sharing Project steering committee, convened by BITRE, which oversaw the project. The analysis was undertaken between November 2006 and January 2008.

This report was prepared by David Mitchell, Afzal Hossain and Carlo Santangelo.

Phil Potterton
Executive Director
Bureau of Infrastructure, Transport and Regional Economics
February 2009

At a glance

- Inter-regional passenger travel between major intercity origin–destination pairs is projected to grow by 2.8 per cent a year between 2005 and 2030—a doubling over 25 years. Air and car, the largest modes, are projected to grow, on average, by 3.5 and 2.4 per cent a year.
- Inter-regional freight movements between major intercity origin–destination pairs are projected to also grow by 2.8 per cent a year, in tonnage terms—again a doubling over 25 years. Road is the dominant transport mode for intercity freight, projected to grow by 3.3 per cent a year while intercity rail freight is projected to grow by 1.9 per cent a year.
- Outside these corridors, rail freight movements of coal and iron ore, for export, are projected to grow by 2.1 and 4.8 per cent a year, respectively.
- Interstate origin–destination passenger travel growth is projected to vary between 2.5 and 3.5 per cent a year, across the different corridors, with the strongest growth on corridors linking Brisbane. Air travel is projected to increase as a share of all such trips. Growth in origin–destination passenger travel on intrastate national transport network corridors is projected to vary from 1.2 to 3.8 per cent a year across the different corridors.
- Interstate origin–destination freight traffic growth is projected to vary between 2.2 and 3.4 per cent a year, across most interstate national transport network corridors. Again, growth is projected to be strongest on corridors connecting Brisbane. Road is projected to increase its share of freight between centres less than 1500km apart, while rail and, to a lesser extent sea, are more significant for longer distance movements. Growth in origin–destination freight movements on intrastate corridors is projected to vary from 0.9 to 2.7 per cent a year across the different corridors.
- The passenger travel projections imply interstate national transport network corridor origin–destination car travel growth of between 0.8 and 2.3 per cent a year, and intrastate origin–destination car travel growth of between 0.6 and 2.7 per cent a year across the various corridors.
- Taking into account an expected 2 per cent annual improvement in heavy vehicle productivity, the freight movement projections imply interstate national transport network corridor origin–destination truck travel growth of up to 2.1 per cent a year, and intrastate origin–destination truck travel growth of up to 1.5 per cent a year across the various corridors.

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Executive Summary

This report provides updated long-term passenger and freight traffic projections for the National Land Transport Network (NLTN) non-urban corridors between 2005 and 2030. The projections have been derived using the Bureau of Infrastructure, Transport and Regional Economics' (BITRE) OZPASS and FreightSim models, which were specifically designed to project non-urban passenger travel and freight movements in Australia. While the projections presented here only cover the NLTN non-urban corridors, the modelling used to generate the projections covers all long-distance passenger and freight movements across Australia. The projections presented in this report update those presented in BTRE (2006*a*), *Demand Projections for AusLink Non-urban Corridors: Methodology and Projections* (Working Paper 66), using updated road traffic data supplied by state and territory road authorities, updated interregional passenger movement data from Tourism Research Australia's (TRA) National Visitor Survey (NVS) and International Visitor Survey (IVS), and the most recent Australian Bureau of Statistics (ABS) and state planning agency regional population projections.

OZPASS and FreightSim models: an overview

OZPASS

The OZPASS model is designed to project future long-distance OD passenger travel within Australia. The model uses travel data from TRA's NVS and IVS collections 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 IVS provides estimates of all journeys within Australia by international visitors. Together, the NVS and IVS provide a measure of all long-distance passenger trips in Australia, not part of a regular commute, by all major transport modes—private car, coach, rail, air and ferry—and all trip purposes. For these projections, BITRE used pooled average passenger trip data from the 2002, 2003 and 2004 NVS and IVS. For the purposes of projecting passenger vehicle traffic on NLTN roads, this data was treated as representative of passenger travel in 2004.

In OZPASS, future interregional passenger travel is projected using a gravity-model functional form that relates growth in interregional passenger travel to growth in regional populations, per capita GDP and average travel costs. In the general gravity model formulation, for any OD pair, projected travel growth is identical in each direction. In reality, growth in travel between any OD pair is likely to vary. In OZPASS, for each OD pair, growth in passenger travel is differentiated by direction according to the relative population growth in the two regions (refer to Appendix I for details).

OZPASS also includes a separate algorithm for projecting local light vehicle travel on local rural roads—that is, 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, projected trend growth in per capita light vehicle ownership and average vehicle utilisation.

FreightSim

FreightSim is a model for projecting interregional OD freight movements across six transport modes: road, rail, sea, air, pipeline and conveyer. The model was developed jointly by Bureau of Infrastructure, Transport and Regional Economics (BITRE) and FDF Pty Ltd under the auspices of Austroads. FreightSim comprises 132 separate regions—123 Statistical Subdivisions, eight capital city Statistical Divisions (ABS 1996) and one region covering the rest of the world—and 16 commodity classes—15 bulk commodity groups and one non-bulk group. Austroads (2003) provides a brief overview of FreightSim.

Projected future interregional transport flows are derived from projected growth in domestic regional production, regional consumption and international imports.

For the freight traffic projections presented in this report, BITRE had planned to use FDF Pty Ltd's FreightInfo 2003–04 national database of Australian interregional freight movements as the measure of base year freight flows. However, the 2003–04 FreightInfo data could not be satisfactorily reconciled with other transport data. In lieu of that data, the freight task projections in this report are based on FDF Pty Ltd's FreightInfo 1988–99 national database of Australian freight movements, augmented by data from the ABS 2000–01 Freight Movements Survey (ABS 2002) and BITRE's 1998–99 Australian Sea Freight statistics (BTE 2000). For the NLTN corridor freight vehicle traffic projections, the 1998–99 base year freight task was projected forward to 2005, and the 2005 projections used as the basis for matching to on-road heavy vehicle traffic data. BITRE also attempted to corroborate the projected 2005 data against other independent evidence on freight movements, especially road freight movements. In particular, BITRE compared the projected road freight data against state/territory supplied CULWAY/WIM site data (see Appendix F).

NLTN road traffic data

As part of the National Transport Data Framework (NTDF) data sharing project, initiated by the Australian Transport Council (ATC) and Standing Committee on Transport (SCOT), state and territory road transport agencies provided BITRE with 'small section' (generally one kilometre) road traffic data across the NLTN. The small section traffic data forms the base year traffic levels from which future road traffic flows are projected using OZPASS and FreightSim.

The combined small section road traffic data set contains 16 750 separate records for over 21 720 kilometres of the NLTN (including the urban corridors), as well as information for the Brand and North West Coastal Highways in Western Australia, which are not part of the NLTN. Divided roads comprise approximately 10 per cent, by length, of the combined data set. The data set includes separate traffic volume estimates for light vehicles and commercial vehicles for various years between 2003 and 2005. For the purposes of the projections, BITRE treated all traffic volume estimates as year 2005 data (see Appendix E for details of the base year road traffic data).

Geographic scope and market coverage

The geographic scope and coverage of the NVS, IVS and FreightInfo data sets limit the applicability of OZPASS and FreightSim to projecting long-distance passenger movements. In the case of FreightSim, the size of the FreightInfo regions (illustrated in Appendix A) preclude the use of the model for modelling urban or detailed local area freight movements. In the case of passenger travel, although the NVS data, and also the IVS data, includes quite detailed geographical trip information—to the Statistical Local Area (SLA) level—the NVS only records details of trips that are not part of a regular commute. Hence, commuter trips—to work, school, shopping trips, etc.—are not enumerated in OZPASS.

Accordingly, the models are not well-suited to providing projections of passenger travel and freight movements in urban areas and, consequently, this report does not include projections for the urban corridors included in the NLTN. For urban traffic growth, BITRE has separately projected aggregate growth in the urban passenger (BTRE 2003*b*,BTRE 2007*c*) and freight (BTRE 2006*a*) transport tasks for each state and territory capital city, which may be used to complement the non-urban corridor projections presented here.

Similarly, for those non-urban corridor sections that lie within or on the fringe of urban areas, the OZPASS and FreightSim-based long-distance travel projections may need to be augmented by local traffic modelling results to best predict future total traffic volumes.

On the other hand, the long-distance traffic growth projections presented in this report provide future estimates of traffic entering or exiting urban areas, an essential input into urban traffic models.

Travel projections

Chapters 2 and 3 of this report present the updated projections of future non-urban passenger travel and freight movements, and the corresponding levels of light and heavy vehicle traffic, to 2030, for the NLTN non-urban corridors. Among the key inputs influencing the travel projections are projected future population growth, future GDP growth, foreign visitor arrivals and future regional commodity production.

At the request of states and territories, this report presents two sets of long-term traffic projections for the NLTN non-urban corridors: one based on the latest ABS regional population projections (outlined in Chapter 3) and the other based on the latest available state planning agency regional population projections (see Appendix H). The differences between the two population projection sets and the resulting traffic projections are outlined below.

Key input assumptions

The key input assumptions underlying the passenger and freight projections produced by OZPASS and FreightSim are population growth, growth in per capita GDP and trends in passenger and freight transport costs. Growth in domestic travel by international visitors is influenced purely by projected total future short-term international visitor arrivals.

Projected population growth

The default population projections are based on the ABS (2006) Series B (Medium) state and territory population projections for the period 2004 to 2030, disaggregated to SLA-level using the ABS (2004*a*) SLA-level population projections, extended to 2030. The ABS (2006) Series B population projections imply average population growth of 0.94 per cent per annum between 2004 and 2030. 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.

New South Wales, Victorian, Queensland, South Australian and Western Australian planning authorities periodically publish regional population projections for their jurisdiction. The latest available state planning agency population projections were combined into a single set of 'state-sourced' population projections. Tasmania, the Northern Territory and the Australian Capital Territory do not produce separate state/territory population projections. For those jurisdictions, the ABS (2006) population projections were used in the state-sourced population projection set. In comparison to the ABS (2006) population projections, the state planning agency population projections imply slightly stronger population growth in New South Wales and Victoria and significantly stronger population growth in Queensland, South Australia and Western Australia. The combined state-based projections imply average population growth of 1.08 per cent per annum between 2004 and 2030.

Projected GDP growth

Projected future GDP growth is based on unpublished Australian Treasury nominal long-term GDP growth projections, supplied to Bureau of Transport and Regional Economics (BTRE) in 2005, and input into the *Intergenerational Report 2007* (Treasury 2007*a*). BITRE assumed, in accord with the assumption in Treasury (2007*a*) that consumer prices will increase by 2.5 per cent per annum on average, the mid-point of the Reserve Bank of Australia's target inflation band. The projections imply real GDP growth will decline from around 4 per cent per annum in 2003–04 to around 2.2 per cent per annum in 2029–30. Over the 10 years 2004–05 to 2014–15, projected real GDP growth will average 3.2 per cent per annum, and between 2014–15 and 2029–30 it will average 2.3 per cent per annum. The majority of projected GDP growth is attributable to increasing labour productivity. Aging of the population is projected to slow the rate of growth real GDP per person through its impact on the share of the population of working age and the rate of labour force participation (Treasury 2007*a*). Over the entire 25 year period, 2004–05 to 2029–30, real GDP growth is projected to average 2.67 per cent per annum.

Transport costs

Real passenger travel costs are projected to remain more or less 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

Short-term international visitor arrivals are assumed to grow in line with the Tourism Forecasting Committee projections from 2005 to 2015 (TRA 2006), which projects average annual growth of 5.1 per cent per annum. From 2015 onwards, BITRE has assumed short-term international visitor arrivals will grow, but at a declining rate, by 5 per cent per annum in 2015 falling to 4 per cent per annum in 2030. These assumptions imply an average rate of growth in short-term international visitor arrivals of approximately 4.9 per cent per annum between 2005 and 2030.

Commodity production projections

Considerable efforts were made to incorporate into these projections the latest available information on long-term projected future commodity production for most of the major bulk commodity groups. Among the major commodity groups for which BITRE revised and updated projected future production were:

- coal
- metallic minerals (e.g. iron ore, zinc, lead, copper, mineral sands, etc.)
- oil and gas
- cement
- timber.

For metallic minerals, BITRE has incorporated projected future regional production and planned production capacity investment for iron ore, zinc, lead, silver, copper, uranium, aluminium, manganese, tin, nickel and mineral sands. While the transport implications of increased minerals output will generally be concentrated on rail, there is likely to be an increase in associated road movements, of plant and equipment, during the capacity expansion phase and over the production phase.

The projections take into account major announced future mineral production capacity expansion projects, including:

- Iron ore production expansion plans of BHP Billiton, Rio Tinto, Fortescue Metals and Hancock Prospecting in the Pilbara. Smaller iron ore production operations in mid-west Western Australia and OneSteel's Iron Magnet magnetite mine operation in South Australia. Total Australian iron ore production is projected to increase almost fivefold over 1998–99 levels to 750 million tonnes in 2029–30.
- Near doubling in future copper, gold and uranium production capacity at Olympic Dam (South Australia).
- Possible medium-term commencement of uranium production at unmined uranium deposits such as Honeymoon (South Australia), Yeelirie (Western Australia), Jabiluka (Northern Territory) and Valhalla (Queensland).
- New and increased copper production capacity – Olympic Dam and Prominent Hill (South Australia) and various other projects in New South Wales, Queensland, Western Australian and the Northern Territory.
- New and increased zinc, lead and silver production capacity in New South Wales, Queensland, Western Australia and Northern Territory.
- New mineral sands mining projects in the Murray Basin (New South Wales and Victoria), Eucla basin (South Australia), various projects in Western Australia and at Goondicum, Queensland.

The timber production projections incorporate the expected future growth in plantation timber availability between 2005 and 2030, which is projected to grow by 2.6 per cent per annum over that period, with most of that growth made up of increased plantation hardwood availability. Plantation timber availability is expected to increase strongly in Western Australia, Tasmania and the

Green Triangle region—incorporating south east South Australia and south west Victoria—by 4.0, 4.6 and 3.9 per cent per annum, respectively.

The revised production projections imply much stronger growth in metallic minerals output—projected growth of over 5.3 per cent per annum between 1999 and 2025—in comparison to the assumptions underlying BTRE (2006*a*), which assumed growth of 2.0 per cent per annum over that period. Of the other commodities, coal output is now projected to grow by 2.2 per cent per annum, gas output by 4.4 per cent per annum and timber by 2.2 per cent per annum between 1999 and 2025. Of course, future production will vary across different regions and the commodity production assumptions take this into account. Projected future commodity production assumptions, for selected major commodities, are outlined in Appendix G.

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 kilometres, and significantly more attractive for travel over distances above 800 kilometres, while car is more attractive for trips of less than 400 kilometres. 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, relative to car and air, over 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 vary with distance. For OD pairs less than 1500 kilometres 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 further below.

Impact of future infrastructure investment on the projections

OZPASS and FreightSim currently do not explicitly incorporate the impact of future infrastructure changes on travel times, travel reliability, safety and the general amenity of transport, and the consequent impact on transport mode choice. Instead, this must be handled implicitly through choice of mode share competitiveness index value.

Over the last three decades, there has been substantial investment in and improvement to the interurban road network—through the former National Highway System program and continued under the AusLink initiative—but much less investment, in relative terms, in the interstate rail network. Over the near to medium term, however, budgeted rail expenditure is set to be significantly higher, with the Australian Rail Track Corporation (ARTC) spending up to $1.8 billion on track maintenance and renewal on the Defined Interstate Rail Network (DIRN) and in the Hunter Valley. This investment is expected to improve rail service levels and reduce rail operating costs, thereby improving rail's competitiveness in the intermodal freight transport task. At the same time, intercity road freight characteristics will also continue to improve, with the accelerated duplication of the Hume Highway and the Pacific Highway, as well as additional funding for several other NLTN highways.

Recognition of the relatively greater scope for improvement in intercity rail freight performance, as a result of actual and planned future infrastructure investment, has been factored into the mode share assumptions particularly on the longer (> 1500 kilometre) routes—Melbourne–Brisbane, Eastern States–Perth and Adelaide–Darwin. On these routes, the projections presented in this report assume that rail's share of long-distance intercity freight will increase relative to other modes, particularly road.

Passenger travel projections

Using the ABS (2006) population projections, these assumptions imply growth in total interregional passenger trips of 2.8 per cent per annum between 2005 and 2030. Air travel is projected to grow most strongly, by 3.6 per cent per annum. Long-distance car trips, not part of a regular commute to work, are projected to grow 2.8 per cent per annum between 2005 and 2030. Coach trips are projected to grow by 2.2 per cent per annum, boosted by foreign tourist visitors who tour Queensland and the Northern Territory by coach. Long-distance rail trips are projected to remain more or less at current total levels, with projected growth of 0.1 per cent per annum between 2005 and 2030.

Across the interstate non-urban NLTN corridors, end-to-end OD passenger trips are projected to grow by 2.9 per cent per annum, with end-to-end OD air trips projected to grow by 3.5 per cent across all non-urban NLTN corridors. Consistent with the input mode share assumptions, the projections imply declining passenger car travel between cities located more than 800 kilometres apart and reasonably strong growth in car travel between OD pairs within 400 kilometres.

Freight movement projections

The aggregate FreightSim interregional freight task projections, derived using the ABS (2006) population projections, imply growth in the total domestic freight task, measured in tonnes moved, of 2.6 per cent per annum between

2005 and 2030. Total road freight tonnages are projected to grow by 2.2 per cent per annum and total rail freight tonnages are projected to grow by 3.7 per cent per annum over this period. The coastal shipping freight task is projected to grow by approximately 1.8 per cent per annum between 2005 and 2030. Air freight is projected to grow by 3.8 per cent per annum, albeit from a very low base.

The FreightSim *total* road and rail freight task projections are slightly higher than the projections presented in BTRE (2006*a*) and BTRE (2006*b*) due, in part, to the higher assumed rate of population growth and, particularly for rail, the higher projected growth of coal and iron ore production to 2030. Across the NLTN corridors the projected road freight task growth is similar across most corridors to BTRE (2006*a*) corridor projections.

Across the interstate non-urban NLTN corridors, end-to-end OD freight is projected to grow by 2.4 per cent per annum between 2005 and 2030. The end-to-end OD road freight task, in total tonnage terms, is projected to grow by 2.8 per cent per annum between 2005 and 2030. End-to-end OD rail freight movements are projected to grow by 1.6 per cent per annum. Coastal shipping is projected to grow by 1.4 per cent per annum and air freight by 3.2 per cent per annum.

NLTN non-urban road traffic projections

Converting passenger and freight movements to vehicle movements

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 road traffic across each of the NLTN non-urban corridors.

For passenger vehicles, BITRE assumed an average vehicle occupancy of 2.7 persons per vehicle (including children) for all non-urban trips. This is based on trip and party composition information for overnight trips from the 2004 NVS. This differs from the passenger vehicle occupancy assumption used in BTRE (2006*a*), which assumed an average car passenger vehicle occupancy of 1.8 persons per vehicle for long-distance passenger trips.

For freight, BITRE used FDF Pty Ltd's FreightTrucks model, re-engineered into a relational database, to convert freight movements into equivalent freight vehicle movements. Importantly, FreightTrucks does not presently allow for improvements in heavy vehicle productivity over time, through increased average loads or substitution to larger vehicle combinations. However, previous BTRE research, for example BTRE (2002), has noted the significant trend increases in both the proportion of freight carried by larger trucks and average payloads, and assumed continuing future improvements in truck productivity.

For these projections, BITRE assumed heavy vehicle productivity improves by 2 per cent per annum, between 1999 and 2030, for interregional road freight and 1 per cent per annum for shorter-distance intra-regional road freight. These assumptions are in line with trends in road freight vehicle average loads observed over the last 10–15 years and also reflect the potential future uptake of larger heavy vehicle combinations—such as B-Triples and quad-axle vehicles—available under Performance Based Standards (PBS) vehicle regulations. These assumptions are imposed outside of the FreightTrucks model. The productivity improvement was assumed to apply equally to remote and non-remote areas. The heavy vehicle productivity improvement assumption is a major change from the earlier BITRE non-urban corridor heavy vehicle traffic projections (BTRE 2006*a*), which, for simplicity, assumed no change in heavy vehicle productivity over the projection horizon.

Passenger and freight OD vehicle movements were assigned to the GA (2004) GEODATA TOPO 2.5M road layer using the traffic assignment algorithms in TransCAD—transportation geographic information system (GIS) software—to derive projected future network traffic growth.

Projected non-urban corridor traffic growth

Under the ABS (2006) population projections, total light (passenger) vehicle traffic is projected to grow by 1.7 per cent per annum and heavy vehicle traffic by approximately 0.8 per cent per annum across the interstate non-urban NLTN corridors and by 1.9 and 0.5 per cent respectively across intrastate non-urban NLTN corridors. The heavy vehicle traffic growth projections include the effect of heavy vehicle productivity growth. In the absence of any growth in heavy vehicle productivity, total heavy vehicle traffic would grow by 2.3 per cent per annum across all interstate corridors and by 2.0 per cent per annum across all intrastate corridors. Using the state-sourced population projections, total light and heavy vehicle traffic is projected to grow by 1.9 and 0.8 per cent per annum, respectively, across the interstate non-urban NLTN corridors and 1.9 and 1.0 per cent per annum across the intrastate non-urban NLTN corridors.

Total traffic growth is projected to be strongest on those parts of the non-urban NLTN corridors in the Northern Territory and Queensland. 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 the Melbourne–Sale corridor.

Interstate corridors over which total road traffic is projected to grow most strongly include: Sydney–Brisbane via the Pacific Highway, Perth–Darwin, Adelaide–Darwin and Brisbane–Darwin. In part, the strong growth on some of these corridors reflects very strong passenger and freight traffic growth between the capital city and nearby regional urban centres. Overall traffic growth is also projected to be quite strong on some of the intrastate links, particularly the Brisbane–Cairns, Perth–Bunbury and Melbourne–Sale corridors. Heavy vehicle traffic growth is projected to strongest on these shorter intrastate corridors. On the major intercapital NLTN corridors, such as Sydney–Melbourne and Sydney–Brisbane (inland), road freight vehicle traffic is projected to grow at around 0.6 per cent per annum and 0.5 per cent per annum.

Comparison with previous projections

In these projections, heavy vehicle traffic is generally projected to grow less quickly than light vehicle traffic on most non-urban NLTN corridors. This is because of the assumed increase in average heavy vehicle size and average load, and is in contrast to BTRE (2006*a*) projections, in which heavy vehicle traffic was projected to grow more quickly than light vehicle traffic. In the absence of any change in heavy vehicle average loads, these projections would also imply heavy vehicle traffic generally growing faster than light vehicle traffic on most corridors.

The report also compares these updated projections with those independently-produced projections contained in the published NLTN Corridor Strategies. For most corridors, the updated passenger and road freight projections are similar the corridor strategy projections—in several cases, the corridor strategies used the previous BTRE (2006*a*) projections. Like BTRE (2006*a*), most corridor strategies assumed no change in heavy vehicle productivity, and hence the corridor strategy heavy vehicle traffic projections are higher than these projections.

In the case of Tasmania, for example, the Tasmanian Corridor Strategy (DOTARS and DIER 2007), which assumed some change in average back-loading tonnages but no change in heavy vehicle productivity, projected growth in heavy vehicle traffic of 2.0 per cent per annum on the Hobart–Burnie corridor, whereas this report, assuming an average 0.5 per cent increase in heavy vehicle productivity between 2000 and 2015, imply heavy vehicle traffic growth of 1.4 per cent per annum on that corridor. Similarly, the Tasmanian Corridor Strategy passenger travel projections are slightly higher than these projections due to differences in input population growth and the different treatment of traffic growth in urban areas.

Light and heavy vehicle traffic projections are presented separately for each NLTN non-urban corridor in Chapter 3—using the ABS (2006)-based population projections—and Appendix H—using the state-sourced population projections.

Further issues – Modelling and data

This report represents the second application of the existing OZPASS and FreightSim models to project future long-term traffic growth on the non-urban NLTN corridors. Despite the benefit of having undertaken this task previously, there remains significant modelling and data issues in undertaking this present task, most particularly in projecting interregional freight movements.

Model calibration and validation is one aspect of this projection methodology where further work is desirable. For these and the previous (BTRE 2006*a*) projections, BITRE has been unable to undertake extensive validation and calibration because it does not have access to sufficient road traffic volume data to validate and calibrate the models. Advice from state and territory road authorities suggests that measured road traffic volumes may include sampling error. BITRE is unable to evaluate the impact of sampling error on the projections due to insufficient data. BITRE has previously undertaken some limited validation of the projections, comparing the BTRE (2006*a*) traffic projections for the Bruce Highway with actual traffic growth, between 1996 and 2004. That comparison implies the models perform reasonably well for that corridor.

With regard to modelling interregional passenger travel, there are no significant data issues—the NVS and IVS are undertaken on a quarterly basis, so up-to-date long-distance passenger transport information is readily available. Greater use could be made of the information contained in the NVS and IVS unit record data to endogenise mode choice, destination choice and allow for differing travel propensities of different household types.

With regard to modelling interregional freight movements, however, data currency and sectoral coverage remain significant issues. The 2003–04 FreightInfo data was deemed not sufficiently reliable for use in deriving these projections. The 2001 Freight Movements Survey (FMS) data, which appears to provide reasonable estimates of interregional road freight flows in 2001, is now quite dated. WIM site data, where available, could potentially provide annual information about trends in long-distance heavy vehicle movements, but coverage is limited to those routes with WIM sites and the data does not provide any information about movements by commodity type. A new (road) freight movements survey, or similar regular freight survey collection, would greatly benefit any future updates of these projections.

Chapter 1 Introduction

1.1 National transport planning and investment

The National Land Transport Network (NLTN) is a single integrated network of land transport linkages of strategic national importance, funded by Federal, State and Territory Governments. The NLTN comprises road and rail corridors and intermodal connections linking state and territory capital cities, state capital cities and major centres of commercial activity, and corridors linking two or more major centres of commercial activity. The Australian Government funds national projects on the network that improve its performance, and thereby increase national and regional economic and social development.

Under the first five years of operation, to June 2009, the Australian Government will have contributed approximately $16 billion to road and rail projects across the NLTN, and to local roads across Australia, the latter through the Roads to Recovery program, Black Spot program and through grants to local councils (DITRDLG 2009). And over the next five years to 2013–14, the Australian Government plans to invest over $22 billion on Australia's land transport network through its Nation Building Program.

Strategic corridor analysis and projected network use

In determining NLTN project funding, consideration is given to the economic, environmental and social impacts of the project and the broader strategic transport needs. A key element in assessing the economic and environmental impacts of national projects are projections of future network usage.

Bureau of Infrastructure, Transport and Regional Economics (BITRE) has previously produced long-term traffic projections across the NLTN—BTRE (2006*a*) *Demand projections for AusLink non-urban corridors: methodology and projections* (Working Paper 66)—for use in evaluating the economic impact of potential NLTN projects. The NLTN Corridor Strategies, which outline the key land transport issues affecting a corridor of the NLTN, made extensive use of BTRE (2006*a*) passenger and freight traffic projections. Some corridor strategies supplemented BTRE (2006*a*) projections with current information from surveys of businesses along the corridor. (For example, the Sydney–Adelaide Corridor Strategy includes separate information on some of the major industries located along that corridor.) In turn, the inclusion of corridor-specific information in the individual corridor strategy documents led BITRE to undertake a more thorough update of long-term regional production projections for key commodities. (These projections are compared with the projections produced for each of the corridor strategies in the discussion in Chapter 3.)

This report provides updated traffic projections for the NLTN non-urban corridors for the period 2005 to 2030. The projections were derived using the latest available NLTN road traffic volume data, interregional passenger travel data and interregional freight movement data. The projections will help inform future iterations of the NLTN Corridor Strategies and are of direct use in network investment project appraisal.

The remainder of this chapter briefly summarises some of the key aspects of the report.

1.2 Geographic scope

National Land Transport Network corridors

The NLTN comprises 19 intercity corridors, illustrated in Figure 1.1, and specified urban corridors in Sydney, Melbourne, Brisbane, Adelaide and Perth. Two alternative routes link Sydney and Brisbane by road—the 'coastal route', via the Pacific Highway, and the 'inland route', via the New England and Cunningham Highways. These routes are both part of the Sydney–Brisbane corridor. Traffic projections are presented separately for each of these two routes. Table 1.1 lists the non-urban road and rail corridors that are part of the NLTN.

While the results presented in this paper are restricted to the intercity corridors on the NLTN, the OZPASS and FreightSim models 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. In fact, the modelling used to generate the NLTN non-urban corridor projections covered all long-distance passenger and freight movements across Australia.

OZPASS and FreightSim are not designed to provide projections for passenger travel and freight movements on the urban links of the NLTN and, consequently, this paper does not provide any urban traffic growth projections, with the exception of those parts of the interurban corridors that lie within urban areas. For urban traffic growth, BITRE has separately projected aggregate growth in the urban passenger (BTRE 2003*b*,BTRE 2007*c*) and freight (BTRE 2006*b*,BTRE 2007*c*) transport tasks for each State and Territory capital city, which may be used to inform the urban corridor strategies. Detailed analysis of future traffic growth on urban NLTN corridors is likely to require more detailed city-specific transport-network models. The OZPASS and FreightSim-based projections do, however, provide estimates of future traffic movements into and out of urban

Table 1.1 National Land Transport Network non-urban corridors

Corridor	*Road links*	*Rail link*
	Interstate corridors	
Sydney–Melbourne	Hume Highway	Sydney–Melbourne (SG)
Canberra connectors	Barton and Federal Highways	Goulburn–Canberra (SG)
Sydney–Brisbane (via inland)	F3, New England and Cunningham Highways	..
Sydney–Brisbane (via coast)	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 corridors	
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.
Source: DOTARS (2004, Figure 4, p. 69–70).

areas, a not insignificant element of urban road movements, which may be input into city-specific transport models.

Figure 1.1 National Land Transport Network

Source: DOTARS (2004, Figure 7, p. 18).

Corridor definitions

The traffic projection 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 as part of the Sydney–Adelaide corridor.

1.3 OZPASS and FreightSim models—a brief overview

BITRE's OZPASS and FreightSim models 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 A, B and I.

OZPASS

OZPASS is designed to project interregional origin–destination (OD) passenger travel in Australia. The model uses passenger trip data sourced from Tourism Research Australia's (TRA)—formerly the Bureau of Tourism Research (BTR) —National Visitor Survey (NVS) and International Visitor Survey (IVS) for the base year level and pattern of domestic passenger trips. The NVS includes overnight and day trips for business, leisure and personal purposes to a destination at least 25 kilometres from home. The IVS covers all travel undertaken by overseas visitors whilst in Australia. Together, the NVS and IVS provide a measure of all long-distance domestic passenger trips in Australia by all major transport modes—private car, coach, rail, air and ferry. The projections presented in this report are based on three-year average travel patterns obtained from the 2002, 2003 and 2004 NVS and IVS.

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

The FreightSim model is designed to project interregional OD freight movements within Australia, for six transport modes: road, rail, sea, air, pipeline and conveyer. The model was developed jointly by the then Bureau of Transport and Regional Economics (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 class covering all non-bulk freight.

Projected future interregional transport flows are derived from projected growth in domestic regional production, regional consumption and international imports.

The base year production, consumption and interregional transport flows presented in this report are based on FDF Pty Ltd's FreightInfo 1999 national database of Australian freight movements. The 1999 FreightInfo data set was the latest, most reliable interregional OD freight data set available for use in the updated projections.[1] 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 (2002) Freight Movements Survey (FMS) and BITRE's 1998–99 Australian Sea Freight (ASF) statistics (BTE 2000). The procedure used to augment the FreightInfo data using the FMS and ASF statistics data is described in Chapter 2.

The commodity production projections used in FreightSim are, as far as practicable, based on latest available information on long-term future regional commodity production for most major bulk commodity groups. Feedback provided on the projections presented in BTRE (2006*a*) suggested that the previous projections may have understated the impact of increasing commodity production, particularly mining output in Queensland, Western Australia and the Northern Territory, on domestic road freight growth. BITRE made considerable efforts to obtain and incorporate the latest available information on long-term future commodity production projections, for most of the major bulk commodity groups, in the projections.

1. BITRE originally intended to use the 2004 FreightInfo data for the base year OD freight movements, however, the accuracy and reliability of that dataset precluded its use in this report.

Other analytical tools

FreightTrucks

FreightSim provides estimates of interregional movements by freight tonnage. For application to transport networks it is necessary to convert freight 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 linked tables are used to convert freight movements into truck movements, which depend on the trip end locations and the type of commodity, for nine different truck types. Intercapital trips are generally assumed to have higher load factors than trips to and/or from non-capital city regions. For this report, BITRE first ported the FreightTrucks model tables into a database, and used that model to convert freight movements into truck movements.

TransCAD: Transportation GIS Software

Translating interregional passenger and freight vehicle movements into on-road vehicle movements requires assignment of OD passenger and freight vehicle movements to the transport network. There are many traffic assignment software packages available. For this report, BITRE used the traffic assignment algorithms embedded in *TransCAD*—the transportation geographic information system (GIS) software package. The traffic assignment results presented in this paper were derived using the road layer from the GA (2004) TOPO-2.5M vector topographic data set.

Base year NLTN corridor traffic volumes

For these projections, State and Territory road authorities kindly provided up-to-date (circa 2005) traffic volume information for all NLTN roads. Traffic volume information was provided separately for light and heavy vehicle traffic at small (one kilometre) section level across the entire network. Traffic volumes were specified separately for each direction of divided carriageways. Appendix E provides further details of the State and Territory road traffic volume data.

1.4 How does this report differ from BTRE (2006*a*)?

The updated projections presented in this report include a large range of updated input data and assumptions in comparison with the projections published in BTRE (2006*a*). Some of these differences have already been mentioned, in the discussion above, and are discussed in further detail within the report. The major differences between these and the previous (BTRE 2006*a*) projections are:

- Updated 2005 road traffic data, at small section level, for the NLTN. The updated traffic data appears to be more reliable, in terms of traffic volume accuracy and road segment location, than the 1996 road traffic volume data used in BTRE (2006*a*).
- The latest available three-year average passenger travel information from TRA's 2002, 2003 and 2004 NVS and IVS.
- The average passenger car occupancy factor for long-distance passenger car trips derived from the latest NVS overnight passenger unit record trip data.
- GA (2004) *GEODATA TOPO 2.5M* vector topographic road layer used for the road network passenger and freight vehicle traffic assignment.
- Updated production projections for major commodities, better reflecting likely future trends in domestic production of key commodities—especially coal, metallic minerals, timber, gas and oil.
- Comparison of assigned freight vehicle traffic to a wider set of on-road weigh-in-motion (WIM) site data.
- Long-term real gross domestic product (GDP) growth based on the latest Treasury Intergenerational Report projections (Treasury 2007*a*)
- Two sets of projections are provided:
  - The default projections are based on the latest ABS (2006) population projections
  - An alternative projections set based on State planning agency based long-term regional population projections.

Table 1.2 provides a summary of the key differences between the inputs and assumptions in BTRE (2006*a*) and those used in this report.

Table 1.3 provides a comparison of the commodity production projections used for the updated projections and the assumptions previously used in BTRE (2006*a*), for selected commodities. Notably, the revised production projections imply much stronger growth in metallic minerals output–growth of over 5.3 per cent per annum between 1999 and 2025, whereas BTRE (2006*a*) assumed growth of 2.0 per cent per annum. Of the other commodities, coal output is now projected to grow by 2.2 per cent per annum, gas output by 4.0 per cent per annum and timber by 2.2 per cent per annum between 1999 and 2025. Of course, commodity production growth will vary across different regional areas, and this report also takes this into account. Based on Geoscience Australia (GA) estimates, oil production is projected to decline in absolute terms between 2005 and 2030. The revised cement production projections, of 1.7 per cent per

Table 1.2 Differences between BTRE (2006*a*) projections and updated projections

Element	*BTRE (2006a) projections*	*Updated projections*
Road traffic data	c.1996 light & heavy vehicle traffic volumes at planning or pavement management section level	c. 2005 light & heavy vehicle traffic volumes at one kilometre section level
Passenger travel data	1998, 1999 & 2000 NVS and IVS average trip data	2002, 2003 & 2004 NVS and IVS average trip data
Long-distance interregional passenger vehicle occupancy	1.8 persons per vehicle	2.7 persons per vehicle
Australian road network	AUSLIG (1992) TOPO-10M road layer	GA (2004) TOPO-2.5M road layer
Commodity production projections	FreightSim projections	Updated commodity production projections using latest available information
GDP growth projections	Treasury (2002): Growth 2.60% p.a. between 2002–03 and 2024–25	Treasury (2007*a*): Growth 2.67% p.a. between 2004–05 and 2029–30
Population projections	ABS (2001*c*): Growth 0.85% p.a. between 1998–99 and 2024–25	ABS (2006): Growth 0.94% p.a. between 2003–04 and 2029–30 State-based: Growth 1.08% p.a. between 2003–04 and 2029–30

Table 1.3 Comparison: BTRE (2006*a*) commodity production projections and updated production projections

Commodity group	*Estimated output - 1999 (Mt)*	*BTRE (2006a) projected output 2025 (Mt)*	*Implied output growth (% pa)*	*Updated projected output 2025 (Mt)*	*Implied output growth (% pa)*
Coal	290.7	599.6	2.8	509.2	2.2
Metallic minerals	186.0	304.9	2.0	718.6	5.3
Oil	23.3	22.6	0	9.3	−3.5
Gas	26.6	75.3	4.2	73.5	4.0
Cement	7.3	21.3	4.2	11.2	1.7
Timber	17.9	33.1	2.3	31.4	2.2

Source: BITRE estimates.

annum, are based on a simple econometric model of cement production with respect to real GDP.

Appendix G describes the work undertaken to update the commodity production projections.

1.5 Structure of the report

The report describes the OZPASS and FreightSim models and provides updated long-term traffic projections for non-urban NLTN corridors derived using the model. The results are presented in this report in corridor summary form for each of the non-urban NLTN corridors. More detailed, small section projections will be provided to State and Territory authorities and made available through BITRE's website: http://www.bitre.gov.au/.

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 NLTN non-urban corridors.

Chapter 3 briefly outlines the steps involved in assigning the interregional passenger travel and freight movement projections to the NLTN, using the traffic assignment algorithms in *TransCAD*. The chapter provides summary level traffic projections, based on the Australian Bureau of Statistics (ABS) long-term regional population projections, for each of the 19 non-urban corridors identified as part of the NLTN. (Appendix H provides a summary of the traffic projections based on the State-sourced regional population projections.)

Chapter 4 provides some concluding remarks and outlines some areas for further development of the OZPASS and FreightSim models.

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

Chapter 2 Passenger travel and freight movement projections

BITRE has, over several years, developed separate models for projecting future light (i.e. passenger) vehicle and heavy (i.e. freight) vehicle traffic growth across the Australian non-urban road network—OZPASS and FreightSim. In the models, growth in future regional passenger travel and freight movements is derived using projected regional population growth, average per capita domestic product and future trends in transport costs.

This chapter provides an overview of the OZPASS and FreightSim models and outlines the key input assumptions, base year OD passenger travel and freight movements and projected growth in regional passenger travel and freight movements.

2.1 OZPASS and FreightSim: an overview

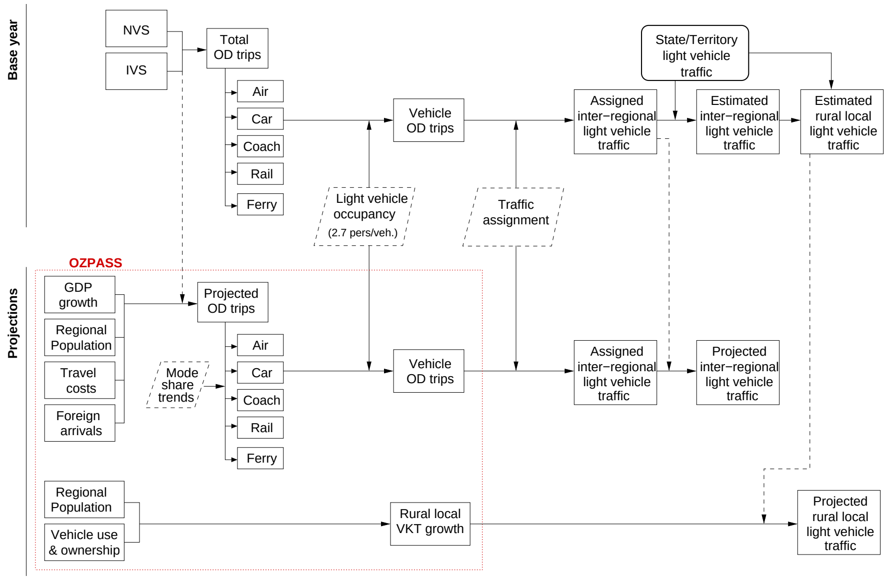
OZPASS projects growth in interregional passenger travel based on projected growth in regional populations, per capita GDP and trends in long-distance passenger travel costs.[2] This is a slight change from the version of OZPASS used in BTRE (2006*a*), which used projected growth in per capita household income instead of per capita GDP growth.

FreightSim uses projected growth in regional production, consumption and imports to project growth in interregional freight movements for 16 commodity types—15 bulk commodity types and a single category for non-bulk (i.e. manufactured goods) freight.

Recognising that light vehicle traffic on any road will comprise a mix of both short-distance ('local') and long-distance ('through') traffic, OZPASS includes

2. The regional (geographic) areas used in this report are broadly based on geographic areas available in the underlying base year data. For freight movements, the geographic regions are based on the FreightInfo 1999 region definitions. For passenger movements, the BTRE used a BTRE-defined region structure based on Urban Centres/Localities and Statistical Local Areas using the Statistical Local Area (SLA)-level information in the NVS and IVS. The regional area classifications used in the corridor projections are outlined in Appendices A and B.

Figure 2.1 BITRE non-urban light vehicle traffic projection methodology



separate algorithms to project long-distance and local passenger travel. For freight, long-distance freight traffic growth is based on growth in interregional freight movements. Local freight vehicle traffic growth is based on projected growth in total freight movements within each region.

The output from OZPASS—OD passenger movements—and FreightSim—OD freight movements—are then converted to equivalent vehicle movements and subsequently assigned to the road network. Growth in total traffic on each road section is equal to the share weighted average of growth in each of long-distance and local passenger vehicles and long-distance and local freight vehicles. Figures 2.1 and 2.2 provide a schematic outline of the processes involved in generating the light and heavy vehicle road traffic projections.

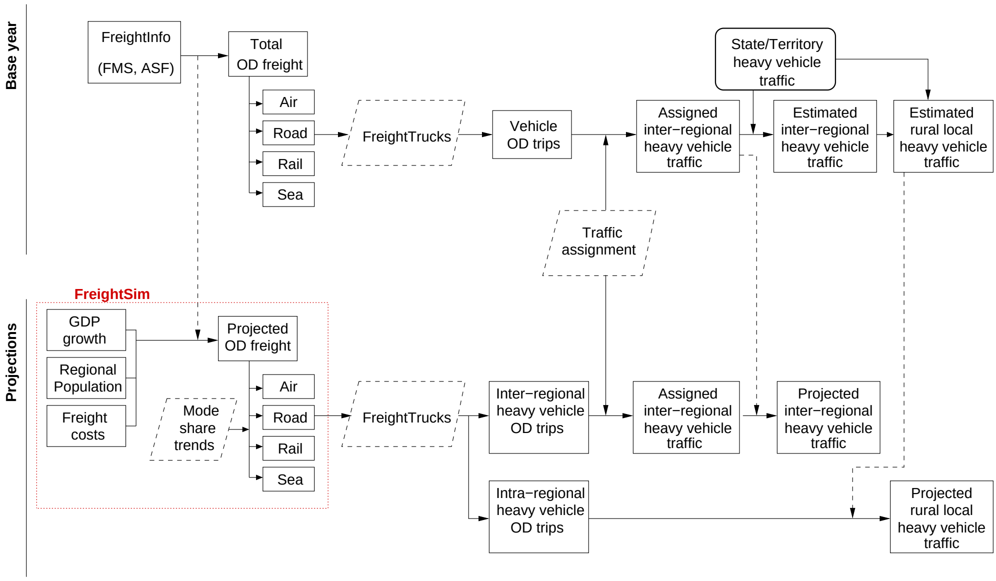
2.2 OZPASS: model structure, key assumptions and projections

OZPASS is designed to provide long-term trend projections of future long-distance non-urban passenger travel within Australia. The model covers the five principal motorised passenger transport modes: air, coach, rail, ferry and passenger cars.

Interregional domestic resident passenger travel

OZPASS uses a gravity model functional form to project growth in total domestic resident interregional passenger travel. In the gravity model, growth in

Figure 2.2 BITRE non-urban heavy vehicle traffic projection methodology



passenger travel between each OD pair is as a function of the relative attractive forces between the two regions—a function of population and income growth—and inversely proportional to the distance between the two regions.

Equation 2.1 outlines the gravity model formulation for total passenger travel between any two regions i and j.

$$T_{ijt} = \frac{A_{ij}\left(P_{it} \times P_{jt} \times \bar{Y}_t^2\right)^{\alpha}}{C_{ijt}^{\beta}} \tag{2.1}$$

where

T_{ijt} is the total trips between regions i and j at time t

P_{it}, P_{jt} denote the populations in region i and region j at time t

$\bar{Y}_t$ is per capita gross domestic product at time t

C_{ijt} is the real generalised travel cost between regions i and j at time t

A_{ij} is an OD specific constant

α,β are model parameters. The default parameter values are: α = 0.524 and β = 0.565.

The default gravity model parameter values were derived from a regression of OD passenger travel between 10 intercity pairs over a 35-year period (1970 to 2005).

In OZPASS, the base year OD travel is supplied exogenously and future traffic growth is projected using the projected growth in travel implied by the gravity model of equation (2.1). The projected growth in passenger travel between any two regions i and j, between period $t-1$ and period t, is given by equation (2.2).

$$\hat{T}_{ijt} = \alpha\left(\hat{P}_{it} + \hat{P}_{jt} + 2\hat{\hat{Y}}_t\right) - \beta\hat{C}_{ijt} \qquad (2.2)$$

where

$\hat{T}_{ijt}$ denotes the percentage growth in total trips between regions i and j and between periods $t-1$ and t

$\hat{P}_{it}, \hat{P}_{jt}$ denote proportionate population growth in regions i and j, between periods $t-1$ and t

$\hat{\hat{Y}}_t$ is the percentage growth in per capita gross domestic product between periods $t-1$ and t

$\hat{C}_{ijt}$ is the percentage growth in the real generalised travel cost between regions i and j and between periods $t-1$ and t

The gravity model provides projections of total passenger trips between each OD pair, but implies nothing about modal share. In OZPASS, changes in the mode share of passenger travel are determined by logistic substitution equations.[3] The logistic substitution equations are recursive formulae in which the annual change in mode share is a function of the prevailing mode share and the relative 'competitiveness' (or 'attractiveness') of each mode—equation (2.3). OZPASS contains simple distance-based 'rules of thumb', based on previous research (BTE 1998), for the relative 'competitiveness' of different transport modes.

$$S_{k,t+1} = \frac{c_k}{\sum_m c_m S_{m,t}} S_{k,t} \qquad (2.3)$$

where

c_k is the competitiveness index of mode k

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

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 kilometres, and significantly more attractive for travel over distances above 800 kilometres

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

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	1.00	1.00	1.00	1.00
Coach	0.98	0.98	0.98	0.98
Rail	0.98	0.97	0.98	0.98
Ferry	1.00	1.00	1.00	1.00
Other	0.98	0.98	0.98	0.99

Source: BITRE estimates.

- Car is more attractive over shorter distance routes, below 400 kilometres in length, where it gains market share at the expense of all other modes
- 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.

Interregional 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, OZPASS preserves the geographic pattern of domestic trips by international visitors over the projection period. 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. This simplifying assumption should not have a significant impact on the travel projections for most OD pairs, as international visitors represent less than 3 per cent of all passenger movements within Australia.

In terms of mode share trends for international visitor trips, BITRE 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, BITRE assumed a competitiveness index of one, equal to that of car travel, for trips of less than 400 kilometres. For coach trips greater than 400 kilometres 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 (>800 kilometres), where the mode share competitiveness index is assumed to be 0.98. The mode share competitiveness

Table 2.2 Mode share competitiveness indices for international visitor passenger trips

Mode	Distance (km) 0–200	200–400	400–800	>800
Air	0.98	0.97	1.02	1.03
Car	1.00	1.00	1.00	1.00
Coach	1.00	0.99	0.99	0.99
Rail	0.98	0.97	0.98	0.98
Ferry	1.00	1.00	1.00	1.00
Other	0.98	0.98	0.97	0.99

Source: BTRE estimates.

indexes for international visitor trips are shown in Table 2.2.

Rural local passenger travel

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

Base year rural local vehicle traffic is calculated as the residual of total traffic (measured in average annual daily traffic (AADT)) and the assigned base year interregional 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.

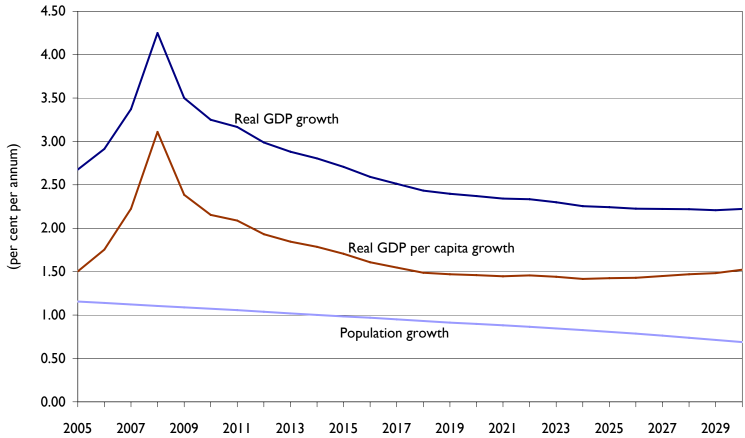
Base case assumptions

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 public financing arrangements. The base case assumptions required for OZPASS include growth in per capita real GDP, growth in the real weighted average generalised cost of travel across all modes, growth in international visitor arrivals and projected growth in estimated resident population, by geographic area.

Base year travel patterns

The base year travel data is drawn from TRA's NVS and IVS datasets. For the projections presented in this report, BITRE pooled travel data from the 2002, 2003 and 2004 NVS and IVS and used average annual travel level over this three year period as the base year interregional travel estimates. The base year travel data was assumed to be equivalent to total travel in 2004.

Figure 2.3 Projected real GDP and real per capita GDP growth



Sources: Treasury (2007*a*),Treasury (2007*b*), Treasury (pers. comm.) Sep. 2005 and BITRE estimates.

Projected per capita real GDP growth

Real GDP growth is assumed to follow the long-term annual GDP growth projections in the latest Intergenerational Report (IGR), Treasury (2007*a*). The IGR projected average real GDP growth of 2.4 per cent per annum over the next 40 years to 2040. The real GDP projections used in OZPASS (and FreightSim) are based on actual real annual GDP growth up to June 2007, the Mid Year Economic and Fiscal Outlook projections (Treasury 2007*b*) for 2007–08 and 2008–09 and annual nominal GDP estimates input to Treasury (2007*a*), less projected annual inflation of 2.50 per cent per annum. The projections imply average real GDP growth of 2.67 per cent per annum between 2005 and 2030. The majority of projected GDP growth is attributable to increasing labour productivity—the IGR assumes average labour productivity growth of 1.75 per cent per annum over the forward horizon, equal to the 30-year historical average rate of productivity growth. Aging of the population is projected to slow the rate of growth real GDP per person through its impact on the share of the population of working age and the rate of labour force participation (Treasury 2007*a*). The annual real GDP growth and per capita real GDP growth projections are shown in Figure 2.3. (Appendix D provides some further details on the real GDP growth projections and lists the assumed annual GDP growth rates.)

In comparison, Access Economics (2008) latest projections, which extend only to 2011–12, imply average annual growth of 3.7 per cent per annum between 2006–07 and 2011–12. Over the same period, the Mid-Year Economic and Fiscal Outlook (MYEFO) and IGR projections imply average annual GDP growth of 3.4 per cent.

Real average travel costs

In the base case, it is assumed that the real weighted average travel costs do not change over the projection period.

This assumption is based partly on long-term historical trends in the cost of travel between major city pairs and partly on assuming that most of the major reductions in travel costs are unlikely to be repeated in the future. In particular, between 1971 and 2004, the average real generalised cost of travel between city pairs, across all modes of transport (including private car), decreased by an average of 0.25 per cent per annum. This reflects both changes in the underlying cost of travel and changes in travel the mode shares. Much of this decrease is attributable to declines in the real cost of air travel through the 1980s, when air fares were regulated by the Independent Air Fares Committee (IAFC), and especially since 1990 following domestic aviation deregulation. Between 1970 and the early 1980s, the real generalised cost of travel increased slightly, principally as a result of fuel price increases and also partly due to substitution to air, a higher cost mode.

Of course, the historical trend information mentioned above relates only to major intercity routes. There is less evidence available on trends in travel costs between regional areas and from regional centres to major cities. The evidence presented in BTRE (2003*a*) 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 significantly between the mid-1980s and 2002. 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 appears the most reasonable assumption.

International visitors

Since 1983 short-term foreign visitor arrivals have grown by more than 9 per cent per annum. However, it is unlikely that such strong growth will be repeated in the future. In the updated projections presented in this report, growth in international inbound tourists is assumed to decline nearly linearly from 8.6 per cent per annum in 2004 to 4.0 per cent per annum by 2030. These projections are based on TRA (2006) projections of inbound foreign tourist numbers between 2006 and 2015, and BITRE projections thereafter. These assumptions imply growth in international visitor trips of approximately 4.9 per cent per annum between 2005 and 2030, with international visitor trips projected to increase as a proportion of all long-distance passenger travel within Australia.

It is worth noting that international visitor numbers have only a minor impact on road passenger traffic, as international visitors make up less than 3.0 per cent of total interregional passenger journeys in Australia. Of those interregional movements, less than 67 per cent are by car or coach. Where the international visitor travel growth projections are most likely to have any significant effect on total surface passenger travel is along Bruce Highway in Queensland and the Stuart and Lasseter Highways in the Northern Territory, where international visitors make up a relatively high proportion of surface (mainly coach) passenger travel movements.

Projected population growth

OZPASS uses SLA level population projections for projecting future interregional passenger travel. As outlined in Chapter 1, this report presents two sets of passenger travel projections, one based on ABS (2006) regional population projections and a second set of projections based on the latest available state-sourced regional population projections. This section provides a summary of these two sets of population projections. (Further details are provided in Appendix C.)

ABS (2006) projections

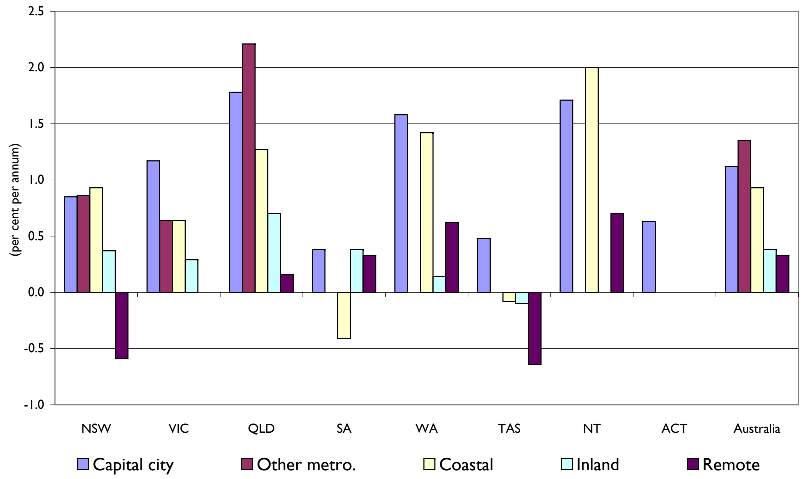
The ABS (2006, Series B) projections imply national population growth of approximately 0.9 per cent per annum between 2004 and 2030. Population growth is projected to be strongest in Queensland, Western Australia and Northern Territory, while South Australia is projected to have the lowest population growth of all mainland states. Tasmania's population is projected to grow by 0.15 per cent per annum over this period. Figure 2.4, and Table 2.3, shows the projected rates of population growth between 2004 and 2030, by state and territory and regional area.

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 New South Wales, South Australia and the Australian Capital Territory, and much lower population growth in Tasmania.
- Victoria's population is projected to grow at a rate similar to the national average.
- Generally, slower population growth in inland and remote areas across Australia. Population growth across coastal regions is projected to be mixed—with strong growth projected for coastal Queensland, Western Australia, Northern Territory and, to a similar extent, New South Wales, but slower growth in coastal regions in Victoria, and declining population levels in coastal regions in South Australia and Tasmania.

Panel (a), in Figure 2.5 (page 22), illustrates the ABS (2006, Series B) projected population growth by SLA. The population projections are divided into three classes:

Figure 2.4 Base case population growth projections, 2004 to 2030



Sources: ABS (2004*a*),ABS (2006) and BITRE estimates.

Table 2.3 ABS (2006)-based average annual projected population growth, by state/territory and region, 2004 to 2030

(per cent per annum)

	Region					
State / Territory	*Capital city*	*Other metro.*	*Coastal*	*Inland*	*Remote*	*All regions*
New South Wales	0.85	0.86	0.93	0.37	−0.59	0.79
Victoria	1.17	0.64	0.64	0.29	..	0.96
Queensland	1.78	2.21	1.27	0.7	0.16	1.57
South Australia	0.38	..	−0.41	0.38	0.33	0.3
Western Australia	1.58	..	1.42	0.14	0.62	1.42
Tasmania	0.48	..	−0.08	−0.1	−0.64	0.16
Northern Territory	1.71	..	2	..	0.7	1.3
Australian Capital Territory	0.63	..	..	..	..	0.63
Australia	1.12	1.35	0.93	0.38	0.33	0.94

.. Not applicable.
Sources: ABS (2004*a*),ABS (2006) and BITRE estimates.

- SLAs where the population is projected to grow faster than national average growth between 2004 and 2030 (dark shaded areas)
- SLAs where the population is projected to grow, but by less than national average growth between 2004 and 2030 (medium shaded areas)
- SLAs where the population is projected to decline between 2004 and 2030.

BITRE obtained state-sourced population projections (2004–30) for the five major states: New South Wales, Victoria, Queensland, South Australia and Western Australia. Tasmania, Northern Territory and the Australian Capital Territory

Table 2.4 State-sourced average annual projected population growth, by state/territory and region, 2004 to 2030

(per cent per annum)

	Region					
State / Territory	*Capital city*	*Other metro.*	*Coastal*	*Inland*	*Remote*	*All regions*
New South Wales	0.93	0.72	0.94	0.24	−0.65	0.81
Victoria	1.09	1.16	0.86	0.58	..	0.99
Queensland	1.70	2.27	1.85	0.77	0.72	1.72
South Australia	0.67	..	−0.16	0.08	−0.57	0.46
Western Australia	1.60	..	1.75	0.61	1.16	1.54
Tasmania	0.48	..	−0.08	−0.10	−0.64	0.16
Northern Territory	1.71	..	2.00	..	0.70	1.3
Australian Capital Territory	0.63	..	..	..	..	0.63
Australia	1.13	1.35	1.22	0.44	0.67	1.08

.. Not applicable.
Sources: ABS (2004*b*), DIPNR (NSW) (2004) DSE (Vic) (2004), DLGPSR (Qld) (2006), DOP (SA) (2007), WAPC (2005) and BITRE estimates.

do not produce separate, state-sourced population projections and the ABS (2006) projections were used for these jurisdictions.

New South Wales, Victoria and South Australia publish SLA-level projections. Queensland and Western Australia's regional population projections are published at the Local Government Area (LGA)-level. The LGA-level projections for these jurisdictions were translated to the SLA-level using the ABS (2003) SLA-level projections to apportion the LGA population for those LGAs that span two or more SLAs.

Table 2.4 shows the state-sourced average annual population growth by state and territory and by regional area. (The Tasmanian, Northern Territory and Australian Capital Territory growth rates are identical to those in Table 2.3.)

Panel (b) in Figure 2.5 (page 22) illustrates the projected population growth by SLA for the state-sourced projections. The population growth classification is identical to that used in panel (a).

Comparison of ABS (2006) and state-sourced projections

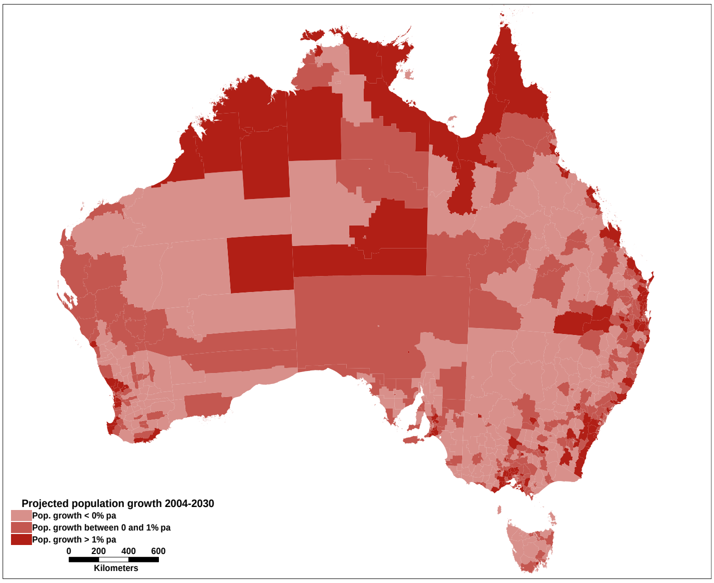
The separate state-sourced population projections are all slightly higher than the ABS (2006, Series B) population projections. For New South Wales, Victoria, Queensland and Western Australia, the state-sourced population projections are between 1 and 2 per cent higher than the ABS projections by 2030. For South Australia, the state-sourced population projections are 6 per cent higher than the ABS projections by 2030.

At the national level, the state-sourced population projections imply a population of 25.97 million persons by 2030, 1.4 per cent higher than the 2030 population implied by the ABS (2006, Series B) projections.

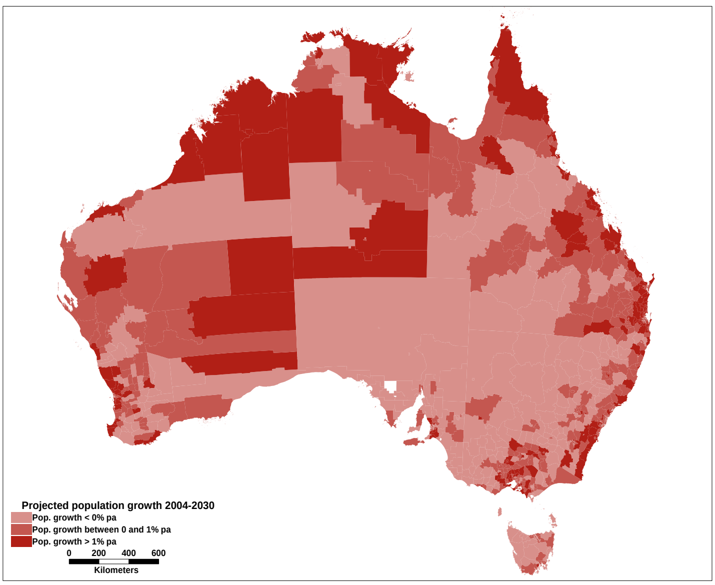
In terms of projected population growth, the state-sourced projections imply

Figure 2.5 Projected population growth by Statistical Local Area, 2004 to 2030

(a) ABS (2006) projections

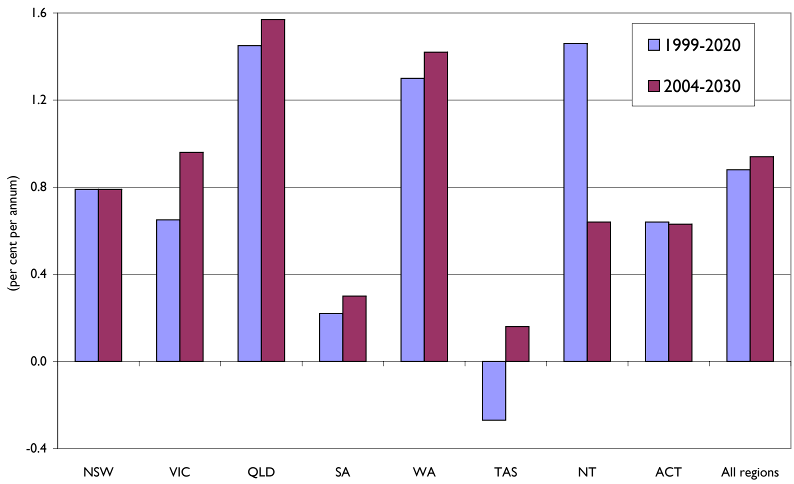


(b) State-sourced projections



Sources: ABS (2001b),ABS (2004a),ABS (2006), DIPNR (NSW) (2004), DSE (Vic) (2004), DLGPSR (Qld) (2006), DOP (SA) (2007), WAPC (2005) and BITRE estimates.

Figure 2.6 Comparison of population growth projections by regions, 1999 to 2020 and 2004 to 2030



Sources: ABS (2004*a*), ABS (2006) and BTRE (2006*a*).

national average annual population growth of 1.08 per cent per annum, between 2004 and 2030, compared to the ABS (2006, Series B) projections of 0.94 per cent per annum. At the state-level, the largest differences between the ABS projections and state-sourced projections are for Queensland and South Australia population growth.

Comparison with population projections used in BTRE (2006a)

Comparing the ABS (2006) projected population growth, between 2004 and 2030, with the population projections used in BTRE (2006*a*), between 1999 and 2020, the latest projections imply higher population growth in all jurisdictions except New South Wales, the Northern Territory and Australian Capital Territory. In particular, ABS (2006, Series B) implies population growth in Tasmania, where previously the projections used in BTRE (2006*a*) posited a decline in the population of Tasmania. The population is projected to grow significantly more strongly in Victoria, Queensland, South Australia and Western Australia. Table 2.5 presents, and Figure 2.6 illustrates, the comparison between the ABS (2006) and previous state and territory population projections. Figure 2.6 illustrates the projected population growth by SLA for the ABS (2006, Series B) and state-sourced population projections.

Table 2.5 Comparison of population growth projections by state/territory, 1999 to 2020 and 2004 to 2030

(per cent per annum)

State / Territory	*Projection period*	
	1999–2020	*2004–2030*
New South Wales	0.79	0.79
Victoria	0.65	0.96
Queensland	1.45	1.57
South Australia	0.22	0.30
Western Australia	1.30	1.42
Tasmania	–0.27	0.16
Northern Territory	1.46	0.64
Australian Capital Territory	0.64	0.63
Australia	0.88	0.94

Sources: ABS (2006) and BTRE (2006*a*).

Interregional passenger travel projections – ABS (2006) population projections

Under these assumptions, and using the ABS (2006) population projections, growth in total interregional passenger travel is projected to average 2.8 per cent per annum between 2005 and 2030. Air travel is projected to grow most strongly, by 3.6 per cent per annum between 2005 and 2030. Car trips, which constitute 86 per cent of total long-distance[4] passenger movements, are projected to grow by approximately 2.8 per cent per annum between 2005 and 2030. Coach trips are projected to grow by 2.2 per cent per annum, largely due to growth in coach travel by international visitors who comprise a large share of coach passenger travel in Queensland and the Northern Territory. Rail trips are projected to remain more or less at 2005 levels in 2030, with projected growth of 0.1 per cent per annum over that period. Ferry travel is projected to grow relatively quickly, albeit from a very small base. This is due to the assumed competitiveness index for ferry travel—1.0 for both domestic residents and international visitors—and the assumption that international visitor travel patterns remain unchanged. The projected growth in interregional passenger trips by transport mode, for the base year 2004 and at five-yearly intervals between 2005 and 2030, is shown in Table 2.6.

Importantly, readers comparing the interregional long-distance passenger travel projections in Table 2.6 with those in BTRE (2006*a*, Table 2.4, p. 19) should note that they are defined slightly differently. The estimates in Table 2.6 count the outbound and return leg of overnight trips by domestic residents as

4. The NVS records only 'long-distance' overnight passenger trips to a place 25 kilometres or more from the traveller's home involving one or more nights stay away from home and day trips to a place 50 kilometres or more from the traveller's place of residence for a duration of 4 hours or more. Regular commuting trips are not included in the NVS.

Table 2.6 Interregional long-distance passenger travel projections by transport mode, 2004 to 2030, ABS (2006)-based population projections

Year	*Air*	*Car*	*Rail*	*Bus*	*Ferry*	*Other*	*All modes*
			Passenger journeys (million)				
2004	30.1	302.9	9.2	12.2	1.1	0.6	356.2
2005	31.5	313.2	9.3	12.6	1.2	0.6	368.2
2010	38.2	370.5	9.6	14.1	1.4	0.6	434.5
2015	46.5	430.9	9.8	15.9	1.6	0.6	505.3
2020	55.4	490.1	9.8	17.7	1.9	0.6	575.4
2025	65.0	552.5	9.7	19.6	2.2	0.5	649.5
2030	75.7	619.8	9.5	21.6	2.5	0.5	729.6
			Average annual growth (per cent per annum)				
2005–2010	3.98	3.42	0.64	2.36	3.42	–0.08	3.36
2010–2015	4.00	3.06	0.37	2.41	3.43	–0.05	3.07
2015–2020	3.54	2.61	–0.05	2.17	3.06	–0.33	2.63
2020–2025	3.27	2.43	–0.21	2.04	2.84	–0.34	2.45
2025–2030	3.08	2.33	–0.28	1.92	2.68	–0.26	2.35
2005–2030	3.57	2.77	0.09	2.18	3.09	–0.21	2.77

Note: Long-distance overnight passenger trips are defined as overnight trips to a place 25 kilometres or more from the traveller's home involving one or more nights stay away from home and day trips to a place 50 kilometres or more from the traveller's place of residence for a duration of 4 hours or more. Regular commuting trips are not included in the estimates.

Source: BITRE projections.

separate journeys to and from the main destination. In other words, each overnight trip is recorded as two separate movements in Table 2.6, above. In contrast, BTRE (2006*a*, Table 2.4) included all trip legs of multiple destination overnight trips as separate travel movements. Hence the estimates in BTRE (2006*a*, Table 2.4) are slightly higher than those shown in Table 2.6. The reason for the difference in treatment between reports is that, unfortunately, separate information on travel between each destination, for multiple destination overnight trips, was not available for this analysis. There is no difference in treatment of day trips and domestic movements by international visitors between this report and BTRE (2006*a*)—day trips include the outbound and return leg as separate journeys. It is expected that the difference in treatment of passenger travel has only a slight impact on projected growth in interregional passenger travel, because travel by domestic residents comprises most of total movements.

Interregional passenger travel projections – NLTN intercity corridors

Tables 2.7 and 2.8 list 2004 actual and projected 2030 interregional long-distance OD passenger movements, between the end points of the NLTN

Table 2.7 Actual and projected origin – destination passenger journeys, NLTN interstate corridors by transport mode, 2004 and 2030

Corridor	*Air*	*Car*	*Rail*	*Bus*	*Other*[a]	*All modes*
2004 (*thousand passenger journeys*)						
Sydney–Melbourne	4 712.8	918.1	97.6	163.3	34.8	5 926.6
Sydney–Brisbane	2 017.9	405.7	65.0	44.8	7.5	2 540.9
Sydney–Adelaide	814.7	108.5	16.3	9.2	7.4	956.1
Canberra connectors	469.4	3 278.2	75.1	289.0	0.2	4 111.8
Melbourne–Brisbane	1 069.4	126.4	7.5	25.8	8.4	1 237.5
Melbourne–Adelaide	1 060.9	569.7	59.4	116.9	6.8	1 813.7
Brisbane–Darwin	53.9	2.6	2.1	0.0	0.0	58.7
Adelaide–Perth	210.7	20.5	18.3	4.6	3.9	258.0
Adelaide–Darwin	54.8	17.1	1.8	1.1	0.0	74.9
Perth–Darwin	52.6	7.0	1.1	0.3	1.2	62.1
2030 (*thousand passenger journeys*)						
Sydney–Melbourne	11 546.6	621.1	38.4	115.6	19.8	12 341.4
Sydney–Brisbane	5 746.3	319.5	30.5	34.1	5.7	6 136.1
Sydney–Adelaide	1 767.3	65.2	5.1	5.6	3.9	1 847.1
Canberra connectors	464.2	6 968.1	59.5	562.2	0.4	8 054.4
Melbourne–Brisbane	2 790.9	91.8	2.8	16.2	4.9	2 906.7
Melbourne–Adelaide	2 445.4	807.5	42.6	153.9	6.6	3 455.9
Brisbane–Darwin	128.5	1.8	0.5	0.0	0.0	130.9
Adelaide–Perth	534.9	14.1	11.4	3.6	2.3	566.3
Adelaide–Darwin	131.1	11.1	1.0	0.5	0.0	143.8
Perth–Darwin	137.1	5.0	0.4	0.2	0.7	143.4
Average annual growth (*per cent per annum*)						
Sydney–Melbourne	3.5	−1.5	−3.5	−1.3	−2.2	2.9
Sydney–Brisbane	4.1	−0.9	−2.9	−1.0	−1.0	3.4
Sydney–Adelaide	3.0	−1.9	−4.4	−1.9	−2.5	2.6
Canberra connectors	0.0	2.9	−0.9	2.6	3.9	2.6
Melbourne–Brisbane	3.8	−1.2	−3.7	−1.8	−2.0	3.3
Melbourne–Adelaide	3.3	1.4	−1.3	1.1	−0.1	2.5
Brisbane–Darwin	3.4	−1.4	−5.2	−0.7	..	3.1
Adelaide–Perth	3.6	−1.4	−1.8	−0.9	−2.0	3.1
Adelaide–Darwin	3.4	−1.7	−2.3	−2.7	..	2.5
Perth–Darwin	3.8	−1.3	−3.8	−0.7	−2.0	3.3

.. not applicable.
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.
Source: BITRE estimates.

intercity corridors, by corridor and transport mode, and the implied annual growth rate. The growth rates for each corridor and each transport mode are illustrated in Figures 2.7 and 2.8.

Some of the notable features of the OD level projections are:

- Strong growth in air travel between most major capital city pairs, with the exception of Sydney–Canberra, where air passenger numbers are projected to decline slightly. Most notably, air travel is projected to grow very strongly on the Brisbane–Cairns, Sydney–Brisbane, Melbourne–Brisbane, Adelaide–Perth, Perth–Darwin and Sydney–Melbourne routes.

Table 2.8 Actual and projected origin – destination passenger journeys, NLTN intrastate corridors by transport mode, 2004 and 2030

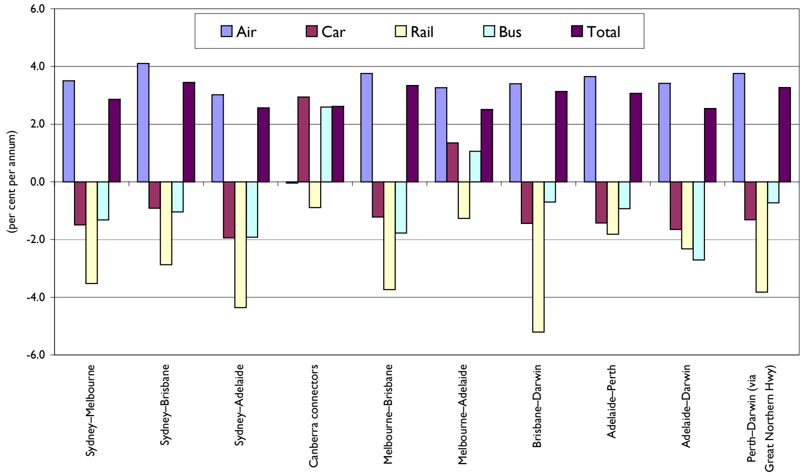
Corridor	*Air*	*Car*	*Rail*	*Bus*	*Other*[a]	*All modes*
			2004 (*thousand passenger journeys*)			
Sydney–Wollongong	2.9	6 301.0	584.5	103.8	2.3	6 994.6
Sydney–Dubbo	71.1	431.8	16.4	16.5	0.0	535.7
Melbourne–Sale	0.3	359.6	47.9	2.0	0.0	409.9
Melbourne–Geelong	19.2	4 049.7	276.7	144.3	21.9	4 511.8
Melbourne–Mildura	61.8	298.7	7.0	16.3	3.1	387.0
Brisbane–Cairns	310.4	62.9	11.4	9.1	3.2	397.0
Townsville–Mt Isa	14.1	38.5	0.0	6.1	0.0	58.7
Perth–Bunbury	0.5	1 200.2	40.4	40.8	1.0	1 282.9
Perth–Port Hedland[b]	25.2	14.8	0.0	0.3	0.0	40.4
Hobart–Devonport	4.5	193.0	0.0	1.8	0.2	199.5
Launceston–Bell Bay	0.0	195.1	0.0	4.9	1.5	201.5
			2030 (*thousand passenger journeys*)			
Sydney–Wollongong	0.8	12 839.9	556.7	144.7	4.5	13 546.7
Sydney–Dubbo	67.3	948.7	12.6	23.2	0.0	1 051.8
Melbourne–Sale	0.5	541.9	24.1	3.9	0.0	570.4
Melbourne–Geelong	2.7	8 046.7	248.5	181.2	40.2	8 519.3
Melbourne–Mildura	195.0	568.1	6.3	25.5	3.3	798.3
Brisbane–Cairns	975.2	53.1	4.6	8.4	3.1	1 044.4
Townsville–Mt Isa	35.3	40.9	0.0	5.0	0.0	81.2
Perth–Bunbury	0.1	2 890.9	43.9	62.5	2.2	2 999.6
Perth–Port Hedland[b]	55.4	10.7	0.0	0.4	0.0	66.5
Hobart–Devonport	3.2	276.1	0.0	3.9	0.5	283.7
Launceston–Bell Bay	0.0	263.4	0.0	5.7	2.4	271.5
			Average annual growth (*per cent per annum*)			
Sydney–Wollongong	–4.7	2.8	–0.2	1.3	2.6	2.6
Sydney–Dubbo	–0.2	3.1	–1.0	1.3	..	2.6
Melbourne–Sale	2.0	1.6	–2.6	2.6	..	1.3
Melbourne–Geelong	–7.2	2.7	–0.4	0.9	2.4	2.5
Melbourne–Mildura	4.5	2.5	–0.4	1.7	0.2	2.8
Brisbane–Cairns	4.5	–0.6	–3.4	–0.3	–0.2	3.8
Townsville–Mt Isa	3.6	0.2	..	–0.8	..	1.3
Perth–Bunbury	–5.3	3.4	0.3	1.7	3.1	3.3
Perth–Port Hedland[b]	3.1	–1.2	..	0.9	..	1.9
Hobart–Devonport	–1.4	1.4	..	3.1	4.0	1.4
Launceston–Bell Bay	..	1.2	..	0.5	1.8	1.2

.. not applicable.
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.
b. The Perth–Port Hedland link, via the North West Coastal Highway, is not part of the NLTN.
Source: BITRE estimates.

Not shown in Tables 2.7 and 2.8, is that air travel is also projected to grow strongly between Sydney, Melbourne, Brisbane and Perth. Amongst the smaller, regional routes, air travel is projected to grow most strongly on the Melbourne–Mildura and Townsville–Mount Isa routes.

- Declining passenger car travel between cities located more than 800 kilometres apart and reasonably strong growth in car travel between cities within 400 kilometres—reflecting the mode share input assumptions. In

Figure 2.7 Projected growth in origin–destination passenger travel, NLTN interstate corridors, by transport mode, 2004 to 2030



Source: BITRE estimates.

particular, car travel is projected to be particularly strong between Perth–Bunbury—reflecting strong population growth in the corridor south of Perth—Sydney–Canberra, Sydney–Wollongong and Sydney–Dubbo. The model also projects modest growth in OD car trips between Melbourne and Adelaide.

- Absolute declines in rail travel between most OD pairs.
- Growth in OD coach trips on the Sydney–Canberra, Melbourne–Adelaide intercapital OD pairs and also on some of the intrastate routes, notably Hobart–Burnie, Melbourne–Sale and Perth–Bunbury.

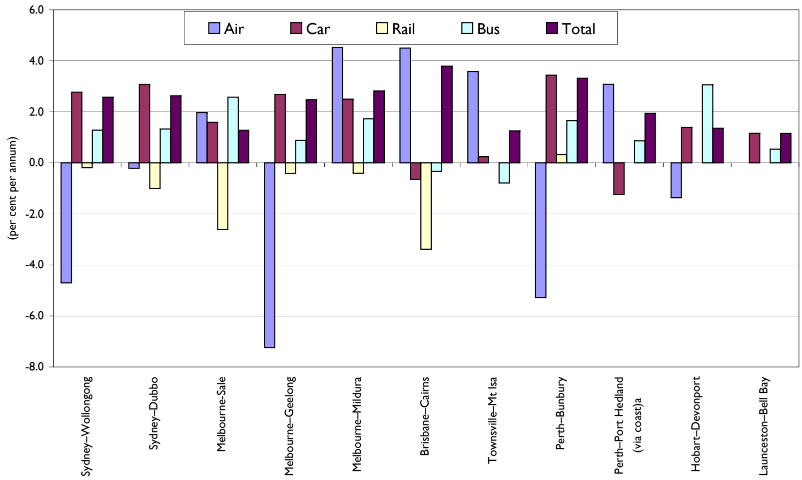
Rural local light vehicle travel projections

Table 2.9 shows the projected growth in rural local light vehicle travel—that is, light vehicle travel outside the state or territory capital city—by jurisdiction between 2005 and 2030. 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. In contrast to the results in BTRE (2006*a*), total rural local travel is now projected to increase in Tasmania and grow more strongly in most other jurisdictions.

Comparison with state-sourced population projection based passenger travel projections

Table 2.10 provides a comparison of the projected growth in interregional passenger trips, between 2005 and 2030, derived from OZPASS using the

Figure 2.8 Projected growth in origin–destination passenger travel, NLTN interstate corridors, by transport mode, 2004 to 2030



Source: BITRE estimates.

Table 2.9 Projected growth in rural local light vehicle travel, 2005 to 2030

(*per cent per annum*)

	State/Territory								
Year	*NSW*	*Vic.*	*Qld*	*SA*	*WA*	*Tas.*	*NT*	*ACT*	*Total*
2005–2010	1.11	1.19	2.05	0.63	1.74	0.56	1.65	1.07	1.34
2010–2015	0.97	1.02	1.80	0.50	1.53	0.38	1.51	0.96	1.17
2015–2020	0.88	0.92	1.63	0.41	1.38	0.27	1.43	0.85	1.06
2020–2025	0.71	0.75	1.40	0.25	1.17	0.07	1.29	0.69	0.88
2025–2030	0.58	0.62	1.21	0.12	1.01	–0.11	1.20	0.57	0.74
2005–2030	0.85	0.90	1.62	0.38	1.37	0.23	1.42	0.83	1.04

Source: BITRE projections.

ABS (2006) population projections and those derived using the state-sourced population projections. In brief, there is little significant difference between the two sets of projections. The state-sourced population projection based traffic projections imply slightly stronger growth in total passenger trips across all modes, but the difference is generally not larger than 0.1 per cent per annum (with the exception of rail).

Comparison with BTRE (2006a) passenger travel projections

In comparison with the projections presented in BTRE (2006*a*), the projections presented in this report imply slightly stronger overall growth in long-distance interregional passenger travel (see Table 2.11). By mode, however, air travel is projected to grow less quickly, by 3.6 per cent per annum, under the assumptions in this report compared to 3.9 per cent per annum projected in BTRE

Table 2.10 Comparison of ABS (2006) and state-sourced population projection based projected long-distance passenger trip growth, 2005 to 2030

	Mode					
Source	*Air*	*Car*	*Coach*	*Rail*	*Other*	*All modes*
ABS (2006)-based projected passenger travel growth	3.57	2.77	2.18	0.09	2.30	2.77
State-source based projected passenger trip growth	3.68	2.87	2.25	0.25	2.33	2.62

Source: BITRE projections.

Table 2.11 Comparison of projected long-distance passenger travel growth with BTRE (2006*a*) projections

	Mode					
Source	*Air*	*Car*	*Coach*	*Rail*	*Other*	*All modes*
ABS (2006)-based projected passenger travel growth, 2005–2030	3.57	2.77	2.18	0.09	2.30	2.77
BTRE (2006*a*) projected passenger trip growth 1999–2025	3.92	2.64	1.68	0.78	2.14	2.62

Sources: BTRE (2006*a*, Table 2.4, p. 19) and BITRE estimates.

(2006*a*). Updated projected growth in long-distance car trips is slightly higher than the projected in BTRE (2006*a*). And long-distance coach trips are now projected to grow slightly faster, by approximately 2.1 per cent per annum, than in BTRE (2006*a*). Projected long-distance rail travel is similar to the projections contained in BTRE (2006*a*).

The increase in projected future total long-distance passenger travel presented in this report, relative to the projections presented in BTRE (2006*a*), is primarily due to the higher assumed rate of population growth, implied by ABS (2006), and higher projected GDP growth. The slightly longer projection horizon used for this report, 2030 versus 2025, will act to slightly offset the impact of the higher population and GDP growth and differences in the base year travel distribution might have some affect on the relative projected growth rates.

At the corridor level, the differences between the updated passenger travel projections presented in this report and those of BTRE (2006*a*) generally mirror the results at the aggregate level. For example, on the Sydney–Melbourne corridor overall Sydney–Melbourne OD trips are projected to grow slightly less quickly in the updated projections than in BTRE (2006*a*). Air travel is projected to grow by 3.4 per cent per annum between 2004 and 2030, whereas BTRE (2006*a*) projected Sydney–Melbourne OD air travel would grow by 3.9 per cent per annum between 1999 and 2025. Similar relativities are observed for Sydney–Melbourne trips by other transport modes.

Overall, the OZPASS updated projections are reasonably similar to those derived in BTRE (2006*a*), albeit slightly higher in aggregate and across most OD pairs.

2.3 FreightSim: model structure, key assumptions and projections

FreightSim

FreightSim is designed to project the freight transport implications of alternative economic development scenarios. FreightSim uses a 'mass-balance' equilibrating process to project future interregional freight movements for 16 separate commodity classes—15 bulk commodity classes and one non-bulk commodity class. Under the mass-balance approach, total annual production plus regional imports (inflows), for each commodity class, must equal the sum of total annual consumption and regional exports (outflows) for each freight region.

Bulk commodity base year movements

FreightSim requires, as input, base year estimates of production, consumption and imports for each of the 16 commodity classes in each of the 132 separate regions and the base year freight transport movements, by transport mode, between each region pair. The base year production, consumption, imports and interregional freight movement estimates are based on the FreightInfo 1999 dataset, augmented by road freight data from the 2001 FMS (ABS 2002) and the 1998–99 ASF (BTE 2000). BITRE had planned to use the FreightInfo 2004 data for these projections, but the data was considered insufficiently accurate or reliable for use in the projections.

Bulk commodity production projections

For the projections, FreightSim requires, as input, projections of future regional production for each of the 15 bulk commodity classes. For the projections presented in this report, considerable efforts were made to include the latest published information on likely future output of agricultural produce, coal and metallic minerals, forest products and oil and gas. Appendix G outlines the updated production projections for major bulk commodities. The bulk commodity production projections that underpin the NLTN non-urban corridor freight traffic projections are listed in Table 2.12.

The major differences between the commodity production projections in Table 2.12 and those used in the previous BTRE (2006*a*) projections are for metallic minerals, oil and petroleum products and cement. For metallic minerals, total production is projected to grow by approximately 4.8 per cent

Table 2.12 FreightSim commodity production forecasts

Commodity		Year			Growth rate
Code	Description	1999	2015	2030	1999–2030
		(million tonnes)			(% pa)
2	Grains and oilseeds	38.6	47.2	51.7	0.95
3	Sheep live	1.2	1.4	1.5	0.74
4	Cattle live	5.0	5.5	5.6	0.40
5	Meat	6.6	7.8	8.2	0.70
6	Agricultural products	83.6	98.7	108.6	0.85
7	Coal and coke	290.7	413.6	557.3	2.12
8	Metallic minerals	186.0	551.7	799.2	4.81
9	Non-metallic minerals	690.8	948.3	1269.3	1.98
10	Oil and petroleum products	23.3	15.2	7.4	−3.64
11	Gas	26.6	54.4	88.9	3.97
12	Steel and metals	14.7	20.2	27.0	1.98
13	Fertilisers	1.3	1.8	2.4	1.98
14	Cement	7.3	9.5	12.1	1.66
15	Timber and timber products	18.4	26.7	33.9	1.99
16	Other bulk freight	2.9	4.0	5.3	1.99

Sources: FreightInfo 1999 and BITRE estimates.

per annum between 1999 and 2030, driven largely by growth in demand for iron ore, Australia's biggest export commodity by volume, but also reflecting strong growth in projected output across a range of metals. Gas production is also projected to grow quite strongly, also reflected in BTRE (2006*a*) production projections. Coal production is projected to grow by over 2.0 per cent per annum, also reflecting increasing demand for steaming and coking coal in Asia over the projection period. Oil and petroleum production from Australian oil fields is projected to decline over the projection horizon as resources from existing fields are depleted and with limited prospective new fields. The cement production projections have been revised to reflect historical growth in cement output. Table 2.12 shows that the latest projections imply growth in cement production of approximately 1.7 per cent per annum, instead of the 4.2 per cent per annum used in BTRE (2006*a*).

For some of these bulk commodities, particularly gas, oil, coal and iron ore, the major transport impact of increased production will be on rail and/or shipping. However, there may well be increased road freight movements during the construction/expansion phase of new or expanded mining projects.

Projected regional consumption and imports

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 population. Projected freight movements are computed as the level of freight transport necessary to transport commodities from regions where there is net excess supply—that is, where production plus imports exceeds

Table 2.13 Mode share competitiveness indexes for domestic bulk freight transport

Commodity		*Mode*					
Code	*Description*	*Road*	*Rail*	*Sea*	*Pipeline*	*Conveyer*	*Air*
..	Default	1.00	1.00	1.00	1.00	1.00	1.00
2	Grains	1.00	0.99	1.00			
4	Cattle (live)	1.00	0.95	1.00			
7	Coal and coke	1.00	1.01	1.00		1.01	
13	Fertilisers	1.00	0.92	1.00			
14	Cement	1.00	0.97	1.00			
15	Timber & timber products	1.00	0.94	1.00			

Source: BITRE estimates.

consumption—to regions where there is net excess demand. The model iterates until all excess consumption demands are satisfied. Any remaining net excess supply of any commodity is then transported to the nearest suitable port for export.

Modal assignment

FreightSim also 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 (refer to equation 2.4 for an example of the logistic substitution model). Table 2.13 lists the mode share competitiveness indexes for bulk freight movements, by commodity type, used in the model. 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 2.13, were applied.

Non-bulk commodity projections

In contrast to the bulk commodity projections, projected non-bulk (manufactured goods) freight movements are based on a gravity model functional form. In the gravity model, growth in interregional 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 2.14, 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 1500 kilometres.

Table 2.14 Mode share competitiveness indexes for domestic non-bulk freight

	Distance (km)				
Mode	*0–400*	*400–700*	*700–1500*	*1500–2200*	*>2200*
Road	1.00	1.00	1.00	1.00	1.00
Rail	0.9	0.925	0.965	1.005	1.015
Sea	0.75	0.7625	0.95	1.00	1.01
Pipeline	1.00	1.00	1.00	1.00	1.00
Conveyor	1.00	1.00	1.00	1.00	1.00
Air	0.98	1.00	1.00	1.00	1.00

Source: BITRE estimates.

- Rail transport is more attractive than road or coastal shipping for non-bulk freight movements over distances between 1500 kilometres and 2200 kilometres.
- Coastal shipping is more attractive than road for non-bulk freight movements over distances above 2200 kilometres.

The practical impact of these mode share competitiveness index assumptions is that on shorter distance intercapital routes, such as Sydney–Melbourne, Sydney–Brisbane and Melbourne–Adelaide, rail's share is projected to decline but intercapital non-bulk rail volumes are projected to remain relatively unchanged to 2030.

Impact of future infrastructure investment on the projections

OZPASS and FreightSim currently do not explicitly incorporate the impact of future infrastructure changes on travel times, travel reliability, safety and the general amenity of transport, and the consequent impact on transport mode choice. Instead, this must be handled implicitly through choice of mode share competitiveness index value.

Over the last three decades, there has been substantial investment in and improvement to the interurban road network—through the former National Highway System program and continued on under the AusLink initiative—but much less investment, in relative terms, in the interstate rail network. Over the near to medium term, however, budgeted rail expenditure is set to be significantly higher, with the Australian Rail Track Corporation (ARTC) spending up to $1.8 billion on track maintenance and renewal on the Defined Interstate Rail Network (DIRN) and in the Hunter Valley. This investment is expected to improve rail service levels and reduce rail operating costs, thereby improving rail's competitiveness in the intermodal freight transport task. At the same time, intercity road freight characteristics will also continue to improve, with the accelerated duplication of the Hume Highway and the Pacific Highway, as well as additional funding for several other NLTN highways.

Recognition of the relatively greater scope for improvement in intercity rail freight performance, as a result of actual and planned future infrastructure investment, has been factored into the mode share assumptions particularly on the longer (> 1500 kilometre) routes—Melbourne–Brisbane, Eastern States–Perth and Adelaide–Darwin. On these routes, the projections presented in this report assume that rail's share of long-distance intercity freight will increase relative to other modes, particularly road.

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

Road freight task estimates

In undertaking this analysis, BITRE investigated the reliability of the base year road freight flows in the FreightInfo 1999 dataset, comparing it to 'on-road' WIM estimates of road freight movements. Appendix D provides a comparison of the raw FreightInfo 1999 road freight task estimates and WIM data. That analysis, together with the analysis undertaken for BTRE (2006*a*, Appendix VII), suggests that the FreightInfo 1999 data under-estimates the intercity non-bulk road freight task quite significantly on most major interurban routes, 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 NLTN—as intercapital non-bulk freight is one of the fastest growing freight markets, so understating the base year intercapital non-bulk freight task could result in under-estimation of future growth in total heavy vehicle traffic.

In order to provide more reliable projections, BITRE substituted the intercapital and within capital non-bulk road freight estimates from the ABS (2002) Freight Movements Survey (FMS), appropriately scaled to account for rigid trucks and apparent under-enumeration in the FMS, for the FreightInfo 1999 intercapital and within capital manufactured product road freight estimates. This provided more realistic estimates of total intercapital road freight movements than the raw FreightInfo 1999 estimates. The urban regions for which the FMS non-bulk freight movements were substituted for the equivalent FreightInfo 1999 data included:

- Sydney (Region 210)
- Melbourne (310)
- Brisbane (410)
- Adelaide (510)
- Darwin (810)
- Canberra (110)
- Gosford (215)
- Newcastle (221)
- Wollongong (231)
- Tweed Heads (241)
- Geelong (321)
- Sunshine Coast (423)
- Townsville (471)
- Cairns (481)

Coastal shipping freight task estimates

At the aggregate level, the FreightInfo 1999 coastal shipping freight task estimates are approximately 3 million tonnes less than the 1998–99 ASF estimates (BTE 2000). The FreightInfo 1999 non-bulk coastal shipping estimates also appear to understate non-bulk coastal shipping flows between the major capital city ports. BITRE also either augmented or adjusted the non-bulk coastal shipping movement data in the base year FreightInfo data set with non-bulk coastal shipping estimates from the 1998–99 ASF statistics (BTE 2000).

Freight task projections

This section provides an overview of the aggregate freight task projections. Most of the discussion focuses on the road, rail and coastal 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.

Aggregate level freight projections

The aggregate FreightSim projections, listed in Table 2.15, imply growth in the total domestic freight task, measured in tonnes uplifted, of 2.75 per cent per annum over the period 1999 to 2030. Total road freight tonnages are projected to grow by 2.4 per cent per annum over that period. The total rail freight task is projected to grow by 4.0 per cent per annum, driven largely by strong projected growth in iron ore and coal output over the next 20 years. Coastal shipping freight is projected to grow by approximately 1.7 per cent per annum between 1999 and 2030. Air freight is projected to grow by approximately 4.0 per cent per annum, albeit from a very low base.

Table 2.16 lists the actual 1999 and projected 2030 road and rail freight tasks by commodity. Considering first the projected growth in the rail freight task, metallic minerals and coal comprised approximately 85 per cent of the total rail freight uplifted in 1999. Consequently, the projected growth in the total rail freight task, growth of 4.8 per cent per annum, largely reflects the projected growth in coal and metallic minerals output. Growth in non-bulk (manufactured products) rail freight is projected to average 1.8 per cent per annum between 1999 and 2030.

By contrast, the road freight task is predominated by non-metallic minerals and non-bulk goods. Non-bulk road freight tonnages are projected to grow by 4.1 per cent per annum between 1999 and 2030 and road freight movements of non-metallic minerals are projected to grow by 2.8 per cent per annum. Agricultural commodity road freight is projected to grow by approximately 1.3 per cent per annum, in line with projected growth in agricultural commodity output.

Table 2.15 Interregional freight movement projections, by transport mode, 1999 to 2030, ABS (2006)-based population projections

	Mode						
Year	*Road*	*Rail*	*Sea*	*Air*	*Pipeline*	*Conveyer*	*All modes*
			Freight uplifted (million tonnes)				
1999	1 337.8	443.2	47.2	0.3	47.9	108.3	1 984.8
2005	1 607.2	612.2	50.4	0.5	46.8	118.1	2 435.1
2010	1 811.1	824.4	55.5	0.6	49.8	132.4	2 873.7
2015	2 026.8	1 006.4	61.4	0.7	49.4	144.7	3 289.5
2020	2 255.6	1 172.7	66.9	0.9	49.6	158.6	3 704.2
2025	2 503.6	1 340.2	72.5	1.0	51.1	173.8	4 142.2
2030	2 770.6	1 509.4	78.3	1.2	52.1	190.8	4 602.3
			Average annual growth (per cent per annum)				
1999–2005	3.10	5.53	1.12	4.94	−0.39	1.45	3.47
2005–2010	2.42	6.13	1.92	4.94	1.28	2.30	3.37
2010–2015	2.28	4.07	2.06	4.29	−0.17	1.80	2.74
2015–2020	2.16	3.11	1.73	3.48	0.08	1.84	2.40
2020–2025	2.11	2.71	1.62	3.16	0.59	1.85	2.26
2025–2030	2.05	2.41	1.55	2.91	0.38	1.88	2.13
1999–2030	2.38	4.03	1.65	3.98	0.27	1.84	2.75

Source: BITRE estimates.

Interregional freight projections

Interregional freight, that is freight moved between two different freight regions, accounted for approximately 30 per cent of total tonnes uplifted in 1999. Table 2.17 shows the actual 1999 and projected 2030 interregional road and rail freight movements. The interregional freight task is generally projected to grow more strongly than shorter distance freight. For both modes, the total tonnes uplifted are projected to grow by approximately 2.9 per cent per annum between 1999 and 2030. (Note that most of the iron ore and coal moved by rail is classified as intra-regional freight under the freight region definitions used in this report, and so the growth in iron ore and coal freight is not reflected in the interregional estimates.)

Table 2.16 Actual and projected total road and rail freight task by commodity, 1999 and 2030, ABS (2006)-based population projections

Commodity		*Road*			*Rail*			*Road & Rail*		
Code	*Description*	*1999 (Mt)*	*2030 (Mt)*	*Growth 1999–2030 (% pa)*	*1999 (Mt)*	*2030 (Mt)*	*Growth 1999–2030 (% pa)*	*1999 (Mt)*	*2030 (Mt)*	*Growth 1999–2030 (% pa)*
1	Manufactured products	226.7	646.2	4.1	13.4	21.4	1.8	240.1	667.6	4.0
2	Grains and oilseeds	50.6	75.8	1.6	18.4	23.3	0.9	69.1	99.2	1.4
3	Sheep live	2.5	3.3	1.1	0.0	0.0	NA	2.5	3.3	1.1
4	Cattle live	4.8	5.7	0.7	0.2	0.3	0.5	5.0	6.0	0.7
5	Meat	7.2	9.6	1.1	0.3	0.4	0.5	7.6	9.9	1.1
6	Agricultural products	92.5	128.7	1.3	4.5	7.4	1.9	97.0	136.0	1.3
7	Coal and coke	16.7	21.4	1.0	193.1	443.7	3.3	209.8	465.1	3.1
8	Metallic minerals	15.1	34.3	3.2	190.3	974.0	6.5	205.4	1 008.3	6.3
9	Non-metallic minerals	753.2	1 537.1	2.8	7.1	14.5	2.8	760.3	1 551.6	2.8
10	Oil and petroleum products	48.5	75.4	1.7	2.5	3.3	1.1	51.0	78.7	1.7
11	Gas	0.1	0.3	4.2	0.0	0.0	na	0.1	0.3	4.1
12	Steel and metals	57.3	103.6	2.3	4.7	8.5	2.3	62.0	112.1	2.3
13	Fertilisers	9.3	16.8	2.3	1.0	1.1	0.1	10.3	17.9	2.1
14	Cement	7.8	15.2	2.6	2.6	3.6	1.2	10.5	18.8	2.3
15	Timber and timber products	42.0	91.3	3.0	2.1	2.8	1.0	44.1	94.1	3.0
16	Other bulk	3.4	5.8	2.0	2.8	5.2	2.5	6.2	11.1	2.2
	Total	1 337.8	2 770.6	2.8	443.2	1 509.4	4.8	1 781.0	4 280.0	3.4

na Not applicable.
Source: BITRE estimates.

Table 2.17 Actual and projected interregional road and rail freight movements by commodity, 1999 and 2030, ABS (2006)-based population projections

Commodity		*Road*			*Rail*			*Road & Rail*		
Code	*Description*	*1999 (Mt)*	*2030 (Mt)*	*Growth 1999–2030 (% pa)*	*1999 (Mt)*	*2030 (Mt)*	*Growth 1999–2030 (% pa)*	*1999 (Mt)*	*2030 (Mt)*	*Growth 1999–2030 (% pa)*
1	Manufactured products	49.5	158.0	4.6	12.9	21.3	1.9	62.4	179.3	4.1
2	Grains and oilseeds	7.2	11.8	1.9	14.4	18.5	1.0	21.6	30.2	1.3
3	Sheep live	1.0	1.2	1.0	0.0	0.0	NA	1.0	1.2	1.0
4	Cattle live	2.1	2.5	0.8	0.2	0.3	0.5	2.3	2.8	0.8
5	Meat	3.6	4.3	0.7	0.3	0.4	0.5	3.9	4.7	0.7
6	Agricultural products	31.9	44.8	1.3	4.5	7.3	1.9	36.4	52.1	1.4
7	Coal and coke	6.7	8.8	1.0	125.2	291.8	3.3	131.9	300.5	3.2
8	Metallic minerals	3.1	6.8	3.0	14.1	31.3	3.1	17.3	38.1	3.1
9	Non-metallic minerals	76.9	159.0	2.8	5.2	10.4	2.7	82.1	169.4	2.8
10	Oil and petroleum products	12.8	20.3	1.8	2.4	3.2	1.1	15.2	23.5	1.7
11	Gas	0.0	0.0	1.2	0.0	0.0	NA	0.0	0.0	0.6
12	Steel and metals	12.9	22.5	2.2	4.7	8.5	2.3	17.6	31.0	2.2
13	Fertilisers	2.4	3.9	1.9	1.0	1.1	0.3	3.4	4.9	1.5
14	Cement	3.5	6.9	2.6	2.6	3.6	1.2	6.2	10.5	2.1
15	Timber and timber products	17.2	31.8	2.4	2.1	2.8	1.1	19.3	34.5	2.3
16	Other bulk	1.0	1.7	2.0	2.0	3.5	2.3	3.0	5.2	2.2
	Total	231.9	484.3	2.9	191.6	403.9	2.9	423.5	888.2	2.9

na Not applicable.
Sources: ABS (2006) and BTRE (2006*a*).

NLTN corridor road freight task growth

Tables 2.18 and 2.19 show the actual 1999 and projected 2030 OD modal specific freight traffic tasks, and the implied average rate of growth, for each of the interstate and intrastate NLTN corridors, as well as for the Perth–Port Hedland corridors and the Melbourne–Perth and Sydney–Perth OD pairs. For OD pair traffic, the projections generally imply relatively strong growth in the road freight transport task, averaging around 3.0 per cent per annum across most corridors, except on the longest east–west corridors. The reverse is the case for OD rail freight traffic with rail freight projected to remain more or less unchanged on some of the shorter routes, but projected to grow by 3 per cent per annum and more on longer routes, due to the mode share assumptions. Projected growth in coastal shipping OD freight movements varies significantly across different corridors—the decline in coastal shipping movements between Sydney and Melbourne, for example, is due to projected reduction in Bass Strait oil production, some of which is currently shipped from the Port of Hastings (Westernport, Victoria) to Sydney. Air freight traffic, is projected to grow relatively strongly, albeit from a low base. Figure 2.9 illustrates the growth in the OD pair freight movements, shown in Table 2.18, for interstate NLTN corridors and Figure 2.10 that for intrastate NLTN corridors.

Tables 2.20 and 2.21 show the actual and projected OD non-bulk (manufactured products) freight task, as well as the implied growth, on each of the NLTN 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 2030. The OD rail freight task is projected to grow by 1.8 per cent per annum. Coastal shipping (sea) freight is projected to grow by 2.3 per cent per annum, largely due to east-west freight, and air freight to grow by 3.5 per cent per annum.

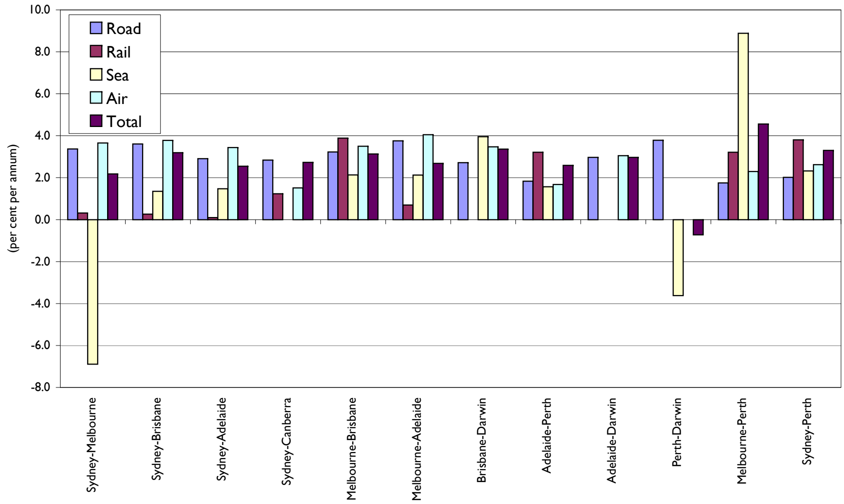
Local road freight task projections

Base year 'local' road freight traffic is calculated as the residual of total heavy vehicles and the assigned base year interregional freight traffic (described in the next section). Projected local freight vehicle traffic growth is derived from the FreightSim estimate of growth in intra-regional road freight tonnages—in the model this local road freight traffic growth is a weighted average function of growth in production, consumption, total inflows and total outflows. In the absence of a more detailed model, the growth in local freight traffic is assumed to be uniformly distributed across all road segments within each SLA.

Comparison with state-sourced population projection based freight movement projections

Table 2.22 provides a comparison of the projected growth in interregional freight movements, between 1999 and 2030, derived from FreightSim using the

Figure 2.9 Projected annual growth in origin–destination freight traffic for NLTN interstate corridors by transport mode, 1999 to 2030



Source: BITRE estimates.

ABS (2006) population projections and those derived using the state-sourced population projections. In brief, there is very little difference between the two sets of projections. The state-sourced population projection based projections imply slightly stronger growth in interregional freight carried by rail, coastal shipping and air, and similar interregional road freight growth.

Comparison with other BTRE freight task projections

The FreightSim-derived freight task projections presented here are broadly similar to previous BITRE freight task projections, provided in BTRE (2006*a*) and BTRE (2006*b*), albeit with slight differences between the overall rate of growth, due to the different projection horizon and differences resulting from the modal split assumptions.

BTRE (2006*b*) outlines the different models that BITRE uses for projecting future trends in the aggregate Australian freight task at the national level, state/territory level, intercapital freight and capital city freight.

The following two subsections provide a comparison of the FreightSim based projections with other BITRE projections at the national level and for selected intercapital city pairs.

Total freight task projection comparison

At the national level, BITRE uses separate mode specific econometric models to project growth in the total road, rail and coastal shipping freight tasks. BTRE (2006*b*), which provides the latest published national level freight task

Table 2.18 Actual and projected origin–destination freight movements by transport mode, NLTN interstate corridors, 1999 and 2030

Corridor	*Road*	*Rail*	*Sea*	*Air*	*All modes*
		1999 *(thousand tonnes)*			
Sydney–Melbourne	7 310.7	1 462.1	2 735.4	96.0	11 604.2
Sydney–Brisbane	4 275.2	860.0	173.9	53.0	5 362.1
Sydney–Adelaide	1 527.8	251.0	175.9	17.0	1 971.7
Sydney–Canberra	1 812.1	168.0	0.0	7.0	1 987.1
Melbourne–Brisbane	2 129.9	629.2	861.0	19.0	3 639.1
Melbourne–Adelaide	3 361.5	2 570.0	787.5	17.0	6 736.0
Brisbane–Darwin	48.2	0.0	43.5	4.0	95.6
Adelaide–Perth	423.0	633.5	160.7	6.0	1 223.2
Adelaide–Darwin	341.2	0.0	0.0	4.0	345.2
Perth–Darwin	71.4	0.0	351.9	0.0	423.3
Melbourne–Perth	383.9	1 630.4	306.0	21.0	2 341.3
Sydney–Perth	55.6	236.0	65.5	23.0	380.1
		2030 *(thousand tonnes)*			
Sydney–Melbourne	20 438.5	1 612.5	299.2	292.1	22 642.2
Sydney–Brisbane	12 837.9	933.4	263.6	167.4	14 202.3
Sydney–Adelaide	3 716.9	258.7	276.5	48.5	4 300.6
Sydney–Canberra	4 321.0	245.6	0.0	11.2	4 577.7
Melbourne–Brisbane	5 698.1	2 050.7	1 657.5	55.2	9 461.6
Melbourne–Adelaide	10 551.5	3 188.0	1 511.8	58.2	15 309.6
Brisbane–Darwin	110.6	0.0	144.8	11.5	266.9
Adelaide–Perth	743.5	1 689.3	260.1	10.0	2 703.0
Adelaide–Darwin	844.5	0.0	0.0	10.1	854.7
Perth–Darwin	225.8	0.0	112.3	0.0	338.1
Melbourne–Perth	658.0	4 346.5	4 282.3	42.5	9 329.3
Sydney–Perth	103.1	751.8	133.4	51.3	1 039.6
		Average annual growth *(per cent per annum)*			
Sydney–Melbourne	3.4	0.3	−6.9	3.7	2.2
Sydney–Brisbane	3.6	0.3	1.4	3.8	3.2
Sydney–Adelaide	2.9	0.1	1.5	3.4	2.5
Sydney–Canberra	2.8	1.2	na	1.5	2.7
Melbourne–Brisbane	3.2	3.9	2.1	3.5	3.1
Melbourne–Adelaide	3.8	0.7	2.1	4.0	2.7
Brisbane–Darwin	2.7	na	4.0	3.5	3.4
Adelaide–Perth	1.8	3.2	1.6	1.7	2.6
Adelaide–Darwin	3.0	na	na	3.0	3.0
Perth–Darwin	3.8	na	−3.6	na	−0.7
Melbourne–Perth	1.8	3.2	8.9	2.3	4.6
Sydney–Perth	2.0	3.8	2.3	2.6	3.3

.. not applicable.
na not available.
a. The FreightSim Adelaide–Darwin rail freight projection is based on projecting from 1999 rail freight traffic levels, which was prior to the completion of the Adelaide–Darwin rail line. BITRE has assumed Adelaide–Darwin rail OD freight traffic will grow on average by 3.0 per cent per annum, between 2004 and 2030.
Sources: BTRE (2007*a*) and BITRE estimates.

Table 2.19 Actual and projected origin–destination freight movements by transport mode, NLTN intrastate corridors, 1999 and 2030

Corridor	*Road*	*Rail*	*Sea*	*Air*	*All modes*
	1999 *(thousand tonnes)*				
Sydney–Wollongong	23 877.0	5 574.1	6.8	0.0	29 458.0
Sydney–Dubbo	858.3	279.0	0.0	0.0	1 137.2
Melbourne–Sale	1 011.8	49.0	0.0	0.0	1 060.8
Melbourne–Geelong	4 329.7	333.8	271.9	0.0	4 935.4
Melbourne–Mildura	215.8	253.1	0.0	0.0	468.9
Brisbane–Cairns	317.5	277.0	252.3	7.0	853.8
Townsville–Mt Isa	65.2	456.0	0.0	0.0	521.2
Perth–Bunbury	1 482.2	1 565.0	19.2	0.0	3 066.4
Perth–Port Headland	59.7	0.0	217.4	1.0	278.2
Hobart–Devonport	294.8	174.0	303.6	0.0	772.5
Launceston–Bell Bay	761.6	0.0	0.0	0.0	761.6
	2030 *(thousand tonnes)*				
Sydney–Wollongong	45 312.7	8 584.3	15.7	0.0	53 912.7
Sydney–Dubbo	1 539.4	356.1	0.0	0.0	1 895.5
Melbourne–Sale	2 086.0	40.4	0.0	0.0	2 126.4
Melbourne–Geelong	9 677.6	375.0	390.8	0.0	10 443.3
Melbourne–Mildura	445.6	639.7	0.0	0.0	1 085.3
Brisbane–Cairns	727.4	983.4	464.8	22.6	2 198.3
Townsville–Mt Isa	91.4	688.2	0.0	0.0	779.5
Perth–Bunbury	3 318.6	2 413.4	24.0	0.0	5 756.0
Perth–Port Headland	90.0	0.0	276.0	1.9	367.9
Hobart–Devonport	723.7	132.5	378.8	0.0	1 235.1
Launceston–Bell Bay	1 291.6	0.0	0.0	0.0	1 291.6
	Average annual growth *(per cent per annum)*				
Sydney–Wollongong	2.1	1.4	2.7	na	2.0
Sydney–Dubbo	1.9	0.8	na	na	1.7
Melbourne–Sale	2.4	–0.6	na	na	2.3
Melbourne–Geelong	2.6	0.4	1.2	na	2.4
Melbourne–Mildura	2.4	3.0	na	na	2.7
Brisbane–Cairns	2.7	4.2	2.0	3.9	3.1
Townsville–Mt Isa	1.1	1.3	na	na	1.3
Perth–Bunbury	2.6	1.4	0.7	na	2.1
Perth–Port Headland	1.3	na	0.8	2.0	0.9
Hobart–Devonport	2.9	–0.9	0.7	na	1.5
Launceston–Bell Bay	1.7	na	na	na	1.7

.. not applicable.
na not available.
Sources: BTRE (2007*a*) and BITRE estimates.

Table 2.20 Actual and projected origin–destination non-bulk freight movements by transport mode, NLTN interstate corridors, 1999 and 2030

Corridor	Road	Rail	Sea	Air	All modes
		1999 *(thousand tonnes)*			
Sydney–Melbourne	6 270.6	1 218.1	8.8	96.0	7 593.5
Sydney–Brisbane	3 845.5	848.0	19.9	53.0	4 766.3
Sydney–Adelaide	1 104.5	229.0	6.9	17.0	1 357.5
Sydney–Canberra	1 205.7	8.0	0.0	7.0	1 220.7
Melbourne–Brisbane	1 803.9	421.8	16.3	19.0	2 261.0
Melbourne–Adelaide	2 899.8	2 048.1	8.8	17.0	4 973.7
Brisbane–Darwin	26.4	0.0	32.7	4.0	63.1
Adelaide–Perth	339.2	617.5	14.2	6.0	976.9
Adelaide–Darwin	324.9	0.0	0.0	4.0	328.9
Perth–Darwin	70.2	0.0	19.9	0.0	90.0
Melbourne–Perth	204.2	1 117.9	100.5	21.0	1 443.7
Sydney–Perth	27.5	226.0	33.6	23.0	310.1
		2030 *(thousand tonnes)*			
Sydney–Melbourne	19 025.5	1 224.4	5.4	292.1	20 547.4
Sydney–Brisbane	12 351.3	917.3	12.0	167.4	13 447.9
Sydney–Adelaide	3 082.7	221.9	4.3	48.5	3 357.4
Sydney–Canberra	3 416.5	0.8	0.0	11.2	3 428.5
Melbourne–Brisbane	5 259.0	1 392.8	44.5	55.2	6 751.6
Melbourne–Adelaide	9 906.3	2 320.3	6.5	58.2	12 291.2
Brisbane–Darwin	79.8	0.0	125.1	11.5	216.5
Adelaide–Perth	611.3	1 687.3	34.7	10.0	2 343.4
Adelaide–Darwin	817.9	0.0	0.0	10.1	828.0
Perth–Darwin	224.4	0.0	87.2	0.0	311.5
Melbourne–Perth	415.9	3 445.3	257.3	42.5	4 161.0
Sydney–Perth	62.7	732.9	90.7	51.3	937.6
		Average annual growth *(per cent per annum)*			
Sydney–Melbourne	3.6	0.0	−1.6	3.7	3.3
Sydney–Brisbane	3.8	0.3	−1.6	3.8	3.4
Sydney–Adelaide	3.4	−0.1	−1.5	3.4	3.0
Sydney–Canberra	3.4	−7.1	na	1.5	3.4
Melbourne–Brisbane	3.5	3.9	3.3	3.5	3.6
Melbourne–Adelaide	4.0	0.4	−1.0	4.0	3.0
Brisbane–Darwin	3.6	na	4.4	3.5	4.1
Adelaide–Perth	1.9	3.3	2.9	1.7	2.9
Adelaide–Darwin	3.0	na	na	3.0	3.0
Perth–Darwin	3.8	na	4.9	na	4.1
Melbourne–Perth	2.3	3.7	3.1	2.3	3.5
Sydney–Perth	2.7	3.9	3.3	2.6	3.6

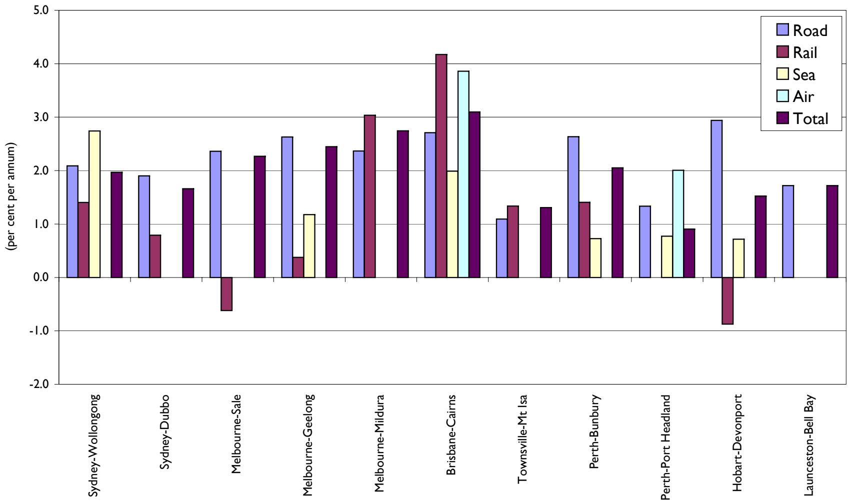
.. not applicable.
na not available.
a. The FreightSim Adelaide–Darwin rail freight projection is based on projecting from 1999 rail freight traffic levels, which was prior to the completion of the Adelaide–Darwin rail line. BITRE has assumed Adelaide–Darwin rail OD freight traffic will grow on average by 3.0 per cent per annum, between 2004 and 2030.
Sources: BTRE (2007*a*) and BITRE estimates.

Table 2.21 Actual and projected origin–destination non-bulk freight movements by transport mode, NLTN intrastate corridors, 1999 and 2030

Corridor	*Road*	*Rail*	*Sea*	*Air*	*All modes*
			2030 *(thousand tonnes)*		
Sydney–Wollongong	2 604.5	0.0	0.0	0.0	2 604.5
Sydney–Dubbo	155.6	13.0	0.0	0.0	168.6
Melbourne–Sale	59.9	49.0	0.0	0.0	108.9
Melbourne–Geelong	1 721.8	0.0	37.9	0.0	1 759.7
Melbourne–Mildura	13.9	253.1	0.0	0.0	267.0
Brisbane–Cairns	114.1	246.0	12.1	7.0	379.2
Townsville–Mt Isa	2.1	36.0	0.0	0.0	38.1
Perth–Bunbury	205.0	117.0	0.0	0.0	322.0
Perth–Port Headland	24.9	0.0	8.2	1.0	34.2
Hobart–Devonport	201.3	94.0	27.2	0.0	322.5
Launceston–Bell Bay	24.0	0.0	0.0	0.0	24.0
			2030 *(thousand tonnes)*		
Sydney–Wollongong	6 567.6	0.0	0.0	0.0	6 567.6
Sydney–Dubbo	523.2	1.4	0.0	0.0	524.6
Melbourne–Sale	151.6	40.4	0.0	0.0	192.0
Melbourne–Geelong	4 790.9	0.0	0.0	0.0	4 790.9
Melbourne–Mildura	173.5	639.7	0.0	0.0	813.2
Brisbane–Cairns	368.8	929.3	39.1	22.6	1 359.9
Townsville–Mt Isa	12.6	70.0	0.0	0.0	82.6
Perth–Bunbury	1 023.6	34.3	0.0	0.0	1 057.9
Perth–Port Headland	46.1	0.0	15.1	1.9	63.1
Hobart–Devonport	605.6	10.8	0.0	0.0	616.5
Launceston–Bell Bay	45.0	0.0	0.0	0.0	45.0
			Average annual growth *(per cent per annum)*		
Sydney–Wollongong	3.0	na	na	na	3.0
Sydney–Dubbo	4.0	−6.9	na	na	3.7
Melbourne–Sale	3.0	−0.6	na	na	1.8
Melbourne–Geelong	3.4	na	−22.3	na	3.3
Melbourne–Mildura	8.5	3.0	na	na	3.7
Brisbane–Cairns	3.9	4.4	3.9	3.9	4.2
Townsville–Mt Isa	5.9	2.2	na	na	2.5
Perth–Bunbury	5.3	−3.9	na	na	3.9
Perth–Port Headland	2.0	na	2.0	2.0	2.0
Hobart–Devonport	3.6	−6.7	−22.2	na	2.1
Launceston–Bell Bay	2.1	na	na	na	2.1

.. not applicable.
na not available.
Sources: BTRE (2007*a*) and BITRE estimates.

Figure 2.10 Projected annual growth in origin–destination freight traffic for NLTN intrastate corridors by transport mode, 1999 to 2030



Source: BITRE estimates.

Table 2.22 Comparison of ABS (2006) and state-sourced population projection based projected interregional freight growth, 1999 to 2030

(per cent per annum)

	Mode						
	Road	*Rail*	*Sea*	*Air*	*Pipeline*	*Conveyer*	*All modes*
ABS (2006)-based projected freight growth	2.38	4.03	1.65	3.98	0.27	1.84	2.75
State-sourced based projected freight growth	2.37	4.04	1.68	4.09	0.39	1.84	2.75

Sources: ABS (2006) and BTRE (2006*a*).

projections, projected growth in the total tonne-kilometre road freight task of approximately 3.9 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 2.7 per cent per annum between 1999 and 2030 (and the same between 1999 and 2020) and growth in the total rail freight task of 3.4 per cent per annum (4.0 per cent per annum between 1999 and 2020). The differences between the BTRE (2006*b*) projections and the FreightSim projections is due partly to differences in the projected rate of economic activity—BTRE (2006*b*) projections assumed GDP growth of 3.25 per cent per annum—and partly to the differences in modelling approach—that is, use of single equation models in BTRE (2006*b*) versus the FreightSim

Table 2.23 BTRE (2006*b*) projected growth in intercapital OD freight, 2001 to 2020

(per cent per annum)

	Mode			
Corridor	*Road*	*Rail*	*Sea*	*All modes*
Mel–Syd	4.2	−0.5	−7.4	3.8
Syd–Bne	4.6	−0.6	−1.1	4.0
Mel–Bne	3.7	4.1	−10.1	3.8
Syd–Adl	3.8	−0.1	2.9	3.2
Mel–Adl	4.0	−1.3	3.3	3.2
ES–Per[a]	3.0	3.7	5.5	3.9
Syd–Cbr	3.6	na	na	3.6
All corridors	4.1	1.9	4.5	3.7

a. Eastern States (ES) include Eastern Capitals (Sydney, Melbourne, Adelaide and Brisbane) to Perth.
Source: BTRE (2003*a*).

model which projects the future transport task 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, but stronger growth in projected rail freight, incorporating the planned increases in mining production capacity.

Intercapital non-bulk freight task comparison

BTRE (2006*b*) also provides projections of intercapital non-bulk freight for seven intercapital city pairs, based on individual city-specific gravity model relationships. BTRE (2006*b*) projected that the total intercapital non-bulk freight task, in tonnage terms, would grow by approximately 3.7 per cent per annum between 2000 and 2020, with the road non-bulk freight task projected to grow by 4.1 per cent per annum and the intercapital rail non-bulk freight task projected to grow by 1.9 per cent per annum over that same period. The projected growth in the intercapital non-bulk freight task implied by BTRE (2006*b*) projections is reproduced in Table 2.23.

Table 2.24 summarises the intercapital non-bulk freight growth implied by this FreightSim simulation, for the same seven intercapital OD pairs. The FreightSim projections imply growth in the total intercapital freight task of 3.4 per cent per annum between 1999 and 2030, which is less than BTRE (2006*b*) projected growth—3.7 per cent per annum. This difference is partly explained by the higher assumed rate of GDP growth used in BTRE (2006*b*) and the longer projection horizon used in this report, with the GDP growth projections used here projected to slow over this period. For similar reasons, these projections imply slower growth in intercapital non-bulk freight on each of the intercapital corridors in comparison to the BTRE (2006*b*) projections.

The most significant difference between BTRE (2006*b*) projections and these projections is the projected growth in the intercapital non-bulk road freight

Table 2.24 FreightSim projected growth in intercapital OD freight, 1999 to 2030

(per cent per annum)

	Mode			
Corridor	*Road*	*Rail*	*Sea*	*All modes*
Mel–Syd	3.6	0.0	−1.6	3.3
Syd–Bne	3.8	0.3	−1.6	3.4
Mel–Bne	3.5	3.9	3.3	3.6
Syd–Adl	3.4	−0.1	−1.5	3.0
Mel–Adl	4.0	0.4	−1.0	3.0
ES–Per[a]	2.1	3.6	3.1	3.3
Syd–Cbr	3.4	−7.1	na	3.4
All corridors	3.7	1.9	2.5	3.3

a. Eastern States (ES) include Eastern Capitals (Sydney, Melbourne, Adelaide and Brisbane) to Perth.
Source: BITRE estimates.

task. In BTRE (2006*b*), the intercapital non-bulk road freight was projected to grow by between 3.7 and 4.6 per cent per annum on the major intercapital corridors (and 3.0 per cent per annum between the eastern state capitals and Perth). These projections imply intercapital non-bulk road freight growth of between 3.4 and 4.0 per cent per annum on the major intercapital corridors. Again, most of the difference is attributable to differences between the rate of GDP growth assumed in BTRE (2006*b*) and that assumed for these projections.

2.4 Summary

BITREs OZPASS and FreightSim models were used to derive the non-urban passenger travel and freight transport projections that underpin the NLTN non-urban corridor traffic projections.

OZPASS projects future long-distance passenger travel for the five major motorised transport modes—air, passenger car, rail, coach and ferry. The long-distance passenger travel source data is from TRA's NVS and IVS, which together cover all non-commuting trips undertaken in Australia (by persons aged 15 years and above.)

FreightSim projects non-urban freight movements for six transport modes—air, rail, road, coastal shipping, pipeline and conveyor—using projected growth in regional production, consumption and imports. Base year inter-regional freight movements are sourced from the FreightInfo 1999 database of national freight flows, supplemented by road freight estimates from the ABS (2002) Freight Movements Survey (FMS) and sea freight estimates from BITRE's 1998-99 Australian Sea Freight (ASF) statistics.

Two sets of projections are presented in the report: (i) the 'main' projections, based on the ABS (2006) population projections; and (ii) a second set of projections based on the latest available state-sourced regional population projections. The state-sourced population projections imply slightly faster population growth than the ABS (2006) projections, resulting in slightly stronger projected growth in future passenger travel and freight movements. The differences between the two sets of projections, however, are not significant.

The major assumptions that underpin the projections are:

- average population growth of 0.94 per cent per annum between 2005 and 2030
- average GDP growth of 2.67 per cent per annum between 2005 and 2030
- no change in future real average passenger travel costs
- average growth in short-term international visitor arrivals of 4.9 per cent per annum between 2005 and 2030
- strong growth in major mineral export commodity production

The OZPASS projections imply growth in total interregional passenger travel of 2.8 per cent per annum between 2005 and 2030. Air travel is projected to grow fastest, with growth projected to average 3.6 per cent per annum over this period. Interregional car passenger trips are projected to grow by 2.8 per cent per annum and rural local car travel is projected to grow by 1.0 per cent per annum over this same period.

The FreightSim projections imply growth in total interregional freight of 2.8 per cent per annum between 1999 and 2030. Interregional road freight tonnages are projected to grow by 2.4 per cent per annum and interregional rail freight by 4.0 per cent per annum over the same period. Intercapital OD non-bulk road freight movements are projected to grow by 3.7 per cent per annum and intercapital non-bulk rail freight by 1.9 per cent per annum between 1999 and 2030.

Chapter 3 Road traffic projections

The OZPASS and FreightSim models provide projections of future passenger travel and freight movements between every OD pair. The OD-based projections need to be converted into equivalent vehicle movements and assigned to the road network in order to derive estimates of traffic growth on the NLTN non-urban road corridors. This chapter provides an overview of the methodology used to convert the OD-based passenger and freight movement projections, produced by the OZPASS and FreightSim models, to road traffic volumes (Section 3.1). Section 3.2 presents the updated NLTN non-urban corridor traffic projections, by corridor. Section 3.3 provides a brief comparison of the ABS (2006) population projection based non-urban corridor traffic projections and the state-sourced population projection based counterparts. Lastly, Section 3.4 provides a brief comparison of these traffic projections with those in BTRE (2006*a*).

3.1 Traffic projections: an overview

In BITRE's non-urban corridor traffic projection methodology, total traffic on each non-urban road section is separated into four separate components:

- interregional (through) passenger traffic
- rural local passenger traffic
- interregional (through) freight traffic
- rural local freight traffic.

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

The OZPASS and FreightSim results reported in Chapter 2 provide estimates of growth in interregional passenger travel (measured by growth in passenger trips), growth in rural local car travel, interregional freight movements and growth in rural local freight (the last two measured by growth in freight tonnes). In order to derive projected future traffic growth on any road section, it is first necessary to derive the base year traffic shares of the four different traffic components. This is done by first converting base year interregional passenger trips to light vehicle movements and base year interregional freight movements in equivalent heavy vehicle movements and assigning these movements to the Australian road network. BITRE uses the traffic assignment algorithms embedded in TransCAD—the Transportation GIS software package (Caliper Corporation 2004)—for this step. The assigned OD pair traffic is treated as the interregional (through) traffic and the difference between the measured total on-road traffic and the assigned interregional traffic is 'local' traffic. Ideally, the assigned interregional traffic should be less than the total measured traffic levels on each road section, which is true for most NLTN non-urban corridor sections.

Interregional passenger travel is converted to equivalent vehicle movements using information on trips and travel party composition from the 2004 NVS. Interregional freight movements are converted to equivalent heavy vehicle movements using FDF's FreightTrucks model.

The remainder of this section provides further details on the assumptions and methods used to convert passenger and freight movements to on-road vehicle equivalents.

Passenger traffic assignment

Conversion to vehicle numbers

In assigning interregional passenger movements to vehicle movements, BITRE assumed the average vehicle occupancy for long-distance interregional passenger vehicle trips was 2.7 persons per vehicle. This estimate is based on the average party size of overnight car passenger trips recorded in the 2004 NVS, and includes children.

This estimate is necessarily a simple average applied across all interregional passenger trips. Table 3.1 shows the estimated average interregional car passenger vehicle occupancies estimated from the 2004 NVS data for trips between capital cities and trips between non-capital city regions by state and territory. The figures in Table 3.1 indicate some variation in the average vehicle occupancy across the different OD pairs. For example, the average vehicle occupancy estimates for intercapital overnight trips varies from as low as 1.6 persons per vehicle to 3.7 persons per vehicle—the passenger vehicle occupancies for trips to and from Darwin are even higher. Averaged across all intercapital trips, the average vehicle occupancy is approximately 2.7 persons per vehicle. The average vehicle occupancy for overnight trips between non-capital city regions (Table 3.2) ranges between 1.9 and 3.6 persons per vehicle, with an average of 2.8 persons per vehicle.

The passenger vehicle occupancy for long-distance interregional passenger vehicle trips assumed for these corridor projections differs significantly from the assumed average vehicle occupancy used in BTRE (2006*a*), 1.8 persons per vehicle. Those estimates were based on evidence from the 1985 Survey of Mo-

Table 3.1 Estimated average passenger car occupancy, intercapital overnight trips by capital city OD pairs, 2004

(persons per vehicle)

	Syd	*Mel*	*Bne*	*Adl*	*Per*	*Hob*	*Dar*	*Cbr*	*All OD pairs*
Syd	2.54	3.01	2.39	2.39	1.65	3.68	5.00	2.45	2.56
Mel	..	2.13	2.11	2.69	3.06	2.8	1.00	2.60	2.46
Bne	..	..	3.15	3.62	2.95	2.74	4.00	1.66	2.97
Adl	..	..	..	3.33	2.33	2.00	na	2.92	3.07
Per	..	..	..	..	2.75	3.20	na	2.00	2.74
Hob	..	..	..	..	..	3.08	na	2.00	3.05
Dar	..	..	..	..	..	..	na	1.60	2.72
Cbr	..	..	..	..	..	..	..	na	2.45
All OD pairs	..	..	..	..	..	..	..	..	2.66

.. not applicable.
na not available.
Sources: TRA (2004) and BITRE estimates.

Table 3.2 Estimated average passenger car occupancy, non intercapital overnight trips by capital city OD pairs, 2004

(persons per vehicle)

	NSW	*Vic.*	*Qld*	*SA*	*WA*	*Tas.*	*NT*	*All OD pairs*
NSW	2.8	2.78	2.95	2.86	3.43	4.22	3.27	2.82
Vic.	..	2.92	3.05	2.9	3.14	3.61	2.83	2.91
Qld	..	..	2.69	3.5	2.64	1.94	3.46	2.73
SA	..	..	..	2.54	2.04	2.54	2.66	2.6
WA	..	..	..	..	2.81	2.38	2.48	2.81
Tas.	..	..	..	..	..	2.85	..	2.85
NT	..	..	..	..	..	..	2.47	2.56
All OD pairs	..	..	..	..	..	..	..	2.79

.. not applicable.
na not available.
Sources: TRA (2004) and BITRE estimates.

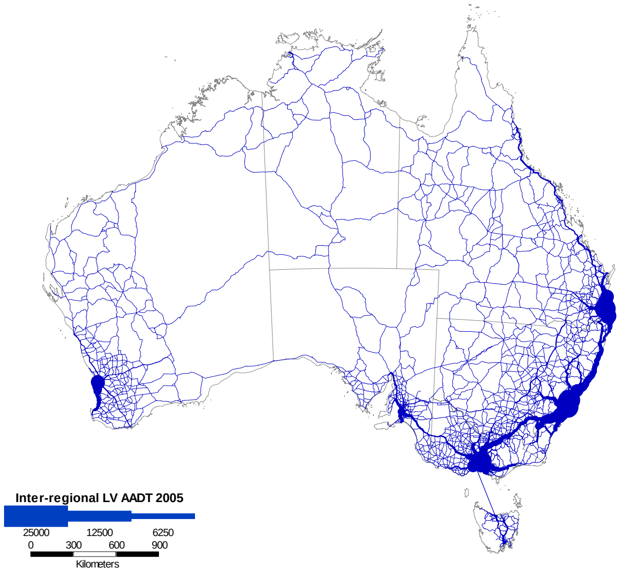
tor Vehicle Use (SMVU) (ABS 1986, Table 28, p. 31), the last SMVU to ask respondents for information on vehicle occupancy.

The NVS-based passenger car trip estimates, derived from the NVS passenger travel and average vehicle occupancy, provide a reasonable match to measured light vehicle traffic volumes—assigned interregional traffic generally comprises between 70 and 90 per cent of total light vehicle traffic on most NLTN non-urban corridor sections.

Network assignment

Assignment of the road passenger travel projections to the road network was undertaken using the stochastic user equilibrium (SUE) traffic assignment method in TransCAD. The SUE assignment algorithm uses a probabilistic traffic assignment approach, with the probability density inversely proportional to the cost of travel via different paths between OD pairs. For trips between

Figure 3.1 Interregional passenger vehicle traffic assignment, 2005



Source: BITRE estimates.

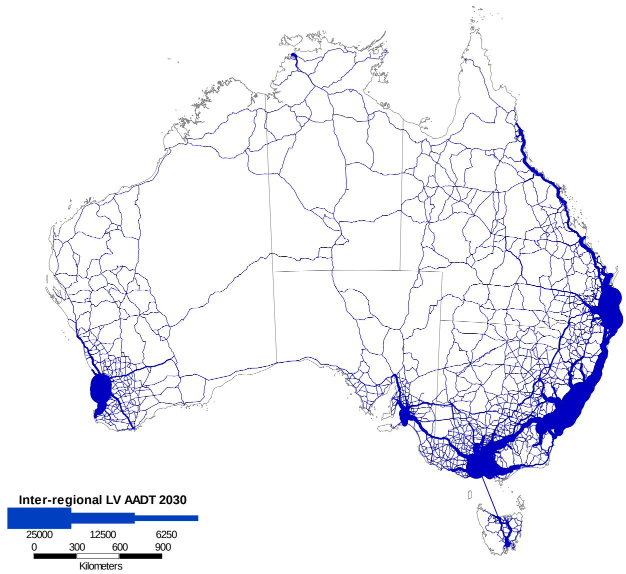
any OD pair, the algorithm assigns most trips via the least cost route path and a smaller proportion of trips via more costly travel paths. The probabilistic approach reflects the fact that trip patterns may not generally follow the least cost path either because people have imperfect information, perceive travel costs in different ways or, in the case of tourist trips, may deliberately travel via longer, more scenic routes.

The road layer in the GA (2004) GEODATA TOPO-2.5M vector topographic data set was used for the non-urban traffic assignment. The GA (2004) road layer comprises approximately 250 000 kilometres of roads and covers most significant non-urban highways, including all NLTN non-urban corridor highways. In assigning traffic to non-urban highways, BITRE assumed no capacity restrictions—on most NLTN non-urban corridor sections traffic is unlikely to be capacity constrained.

In assigning traffic to the network, BITRE assumed travel costs on each road segment were proportional to the weighted length of the segment, where the weights reflect the road class and surface type. (The weights are listed in Appendix J.)

The interregional road passenger vehicle traffic assignment settings are listed in Appendix J, along with a summary of the assignment results. Figures 3.1 and 3.2 illustrate the interregional passenger traffic assignment results for 2005 and 2030.

Figure 3.2 Interregional passenger vehicle traffic assignment, 2030



Source: BITRE estimates.

Estimated interregional and local passenger vehicle traffic

As mentioned above, local base year light vehicle traffic is derived as the difference between total base year light vehicle traffic and assigned base year interregional light vehicle traffic on each highway section.

Where the assigned interregional passenger vehicle traffic exceeds the total light vehicle traffic count in the base year, the interregional passenger traffic is constrained to equal the total light vehicle traffic count and local passenger vehicle traffic is assumed to be zero. This assumption ensures that the base year traffic levels, from which traffic is projected, match measured road traffic volumes. This circumstance generally only occurs on very remote, more sparsely trafficked sections of the NLTN—such as the Eyre and Stuart Highways—and on most NLTN non-urban sections, assigned interregional light vehicle traffic is less than the measured on-road traffic.

The over-estimation of interregional traffic on these remote highway sections is most likely due to the use of trip level data for these projections, which records only the main transport mode, as opposed to more detailed 'stop-stop' travel data, which includes transport between stops for multiple stop trips. For example, for a trip from Sydney to Western Australia, involving air travel to Perth and subsequent travel by hire car in Western Australia, the main destination will be somewhere in Western Australia and the main transport mode may well be recorded as car. For the base year travel estimates, such a trip will appear as travel between Sydney and Western Australia by car. The impact of this for the base year traffic estimates is to overstate interregional car passenger trips.

Freight traffic assignment

Conversion to freight vehicle traffic using the FreightTrucks model

Conversion of OD road freight movements to equivalent 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 nine 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:

- Intercapital (OCDC)
- Within capital (WC)
- Rural interregional (ORDR)
- Rural-to-capital (ORDC)
- Capital-to-rural (OCDR).

For each freight vehicle class, trip type and commodity group, FreightTrucks 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

For these projections, BITRE re-engineered the FreightTrucks model into a relational database. The relational database format is ideal for FreightTrucks, since it essentially comprises a series of 'lookup' tables to convert freight into vehicle movements, and it is most efficient and effective for handling the large volume of data produced by FreightSim.

Additionally, the original FreightTrucks model appeared to overstate the number of trucks on the road for a given task. For this analysis, BITRE increased the assumed average load for rural interregional (ORDR), rural-to-capital (ORDC) and capital-to-rural (OCDR) trips for the following commodity types to better reflect average loads and vehicle movements:

- manufactured products
- agricultural products
- timber and timber products
- other bulk freight.

FreightTrucks, growth in average loads and freight vehicle type

The productivity of heavy road freight vehicles—that is, the average freight carried per vehicle by rigid and articulated trucks—increased by approximately 5.2 per cent per annum between 1971 and 2005, due to a combination of a shift to larger heavy vehicles, heavier average vehicle loads and increasing vehicle utilisation. Even over the decade and a half since 1991, the productivity of heavy road freight vehicles has increased by an average of 3.7 per cent per annum. Average loads carried by heavy road freight vehicles have also increase significantly, from around 8.3 tonnes per vehicle kilometre travelled (VKT) in 1991 to around 11.2 tonnes per VKT in 2005, as a result largely of the increasing use of B-doubles, in place of six-axle articulated trucks, for long-distance road freight movements. (The average load of articulated trucks has increased from 15.9 tonnes per VKT in 1991 to 20.1 tonnes per VKT in 2005.) Arguably, there remains scope for further substitution to B-doubles, and the possible introduction of Performance Based Standards (PBS) for heavy freight vehicles will result in increased use of larger heavy vehicle combinations—such as B-triples and quad-axle trailers.

BTRE (2002) previously assumed that the road freight task would be undertaken by larger and more heavily laden vehicles and, as a consequence, the average load carried by rigid and articulated trucks would increase by approximately 1.0 and 1.6 per cent per annum, respectively, between 2000 and 2020, slightly less quickly than historical growth in average vehicle loads. Since 1991, the average load of rigid and articulated trucks operating outside urban areas has increased by 1.2 and 2.0 per cent per annum, respectively. The growth in average vehicle loads has largely reflected the increased use of large heavy vehicle combinations, particularly B-doubles. Taking into account these broad historical trends, and the potential impact of increased vehicle mass and dimension limits available under PBS, BITRE assumed that the average load of heavy freight vehicles carrying freight between different regions will increase by 2.0 per cent per annum across all areas. The implication is that the number of trucks required to handle the road freight task will grow by approximately 2 per cent less than growth in the road freight task. For intra-regional freight, BITRE assumed the average load of heavy vehicles would increase by 1.0 per cent per annum.

The FreightTrucks model does not presently incorporate changes in future vehicle average loads or vehicle mix over time. For these projections, the trends in average vehicle loads were applied to the FreightTrucks results uniformly across the entire network.

Network assignment

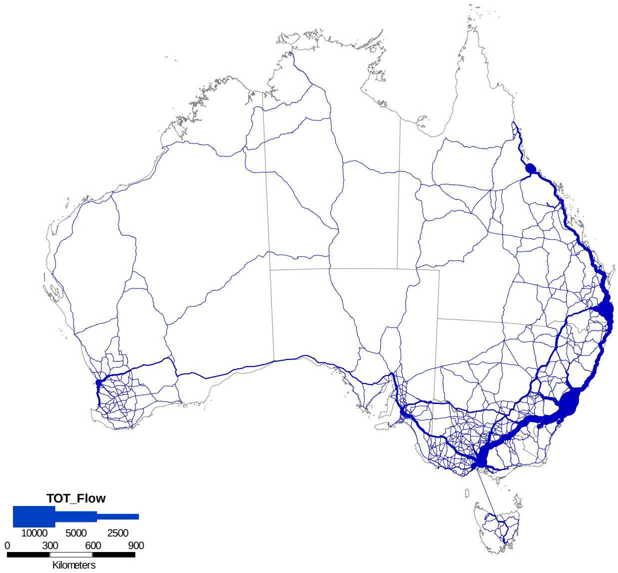
Assignment of the road freight task to the road network is undertaken using essentially the same procedures as those used in assigning the passenger traffic task, outlined above. Again, no capacity constraints are imposed on the assignment process. However, the weights applied to the road lengths, used to reflect relative road freight transport costs, differ from those used in assigning interregional passenger travel—major highways are given a relatively lower weighting which has the effect of concentrating road freight vehicle movements on the major highways. The road section weights, freight vehicle assignment settings and a summary of the traffic assignment results are listed in Appendix J. Figures 3.3 and 3.4, below, illustrate the freight vehicle assignment results for 2005 and 2030.

Estimated interregional and local freight vehicle traffic

As for the case of light vehicles, local freight vehicle traffic is assumed equal to the difference between base year measured heavy vehicle traffic volumes and the assigned interregional freight vehicle traffic. Where the assigned interregional freight vehicle traffic exceeds the commercial vehicle traffic count, the interregional freight traffic is constrained to equal the total commercial vehicle traffic count and local freight vehicle traffic is assumed to be zero.

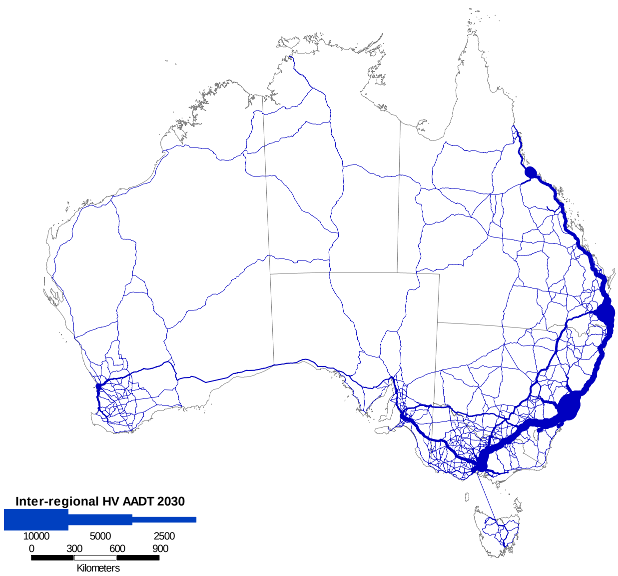
Again, the assigned interregional traffic volumes exceed the total measured freight vehicles generally only on remote, low trafficked sections. For example, assigned base year interregional freight vehicle movements on the Eyre Highway generally exceed measured heavy vehicle traffic volumes on this corridor. This is likely to be due to the natural variability of the FMS survey sample, and over-estimation of total road freight between Western Australia and the eastern states. Interregional freight vehicle movements are constrained to be no greater than total heavy vehicle traffic and local heavy vehicle traffic set to zero on these road sections. This is likely to be a realistic reflection of the nature of freight vehicle movements across most of the Eyre Highway.

Figure 3.3 Interregional freight vehicle traffic assignment, 2005



Source: BITRE estimates.

Figure 3.4 Interregional freight vehicle traffic assignment, 2030



Source: BITRE estimates.

3.2 NLTN non-urban corridor traffic projections

This section presents a summary of the NLTN non-urban corridor passenger and freight vehicle traffic projections derived using the ABS (2006) regional population projections. A separate summary of the NLTN non-urban corridor traffic projections derived using the state-sourced regional population projections is provided in Appendix H. The updated NLTN non-urban corridor passenger vehicle traffic projections are broadly similar to those derived in BTRE (2003*a*) and BTRE (2006*a*). The road freight vehicle traffic projections are slightly different to those of BTRE (2006*a*), due in part to the incorporation of updated commodity production information and in part to the assumed improvement in road freight vehicle productivity.

State and territory level summary

Table 3.3 shows the projected light and heavy (freight) vehicle traffic levels across the NLTN non-urban corridors, for 2005 and 2030, averaged across states and territories. The projections imply average annual light (passenger) vehicle traffic growth of approximately 1.7 per cent per annum and heavy vehicle traffic growth of approximately 0.5 per cent per annum across the NLTN non-urban road network. These projections include the assumed growth in heavy vehicle productivity. In the absence of any change in heavy vehicle productivity, heavy vehicle traffic volumes would be projected to grow by 2.3 per cent per annum (see Appendix Table H.26).

The projections imply that total traffic growth between 2005 and 2030 is likely to be strongest on the Northern Territory and Queensland non-urban sections of the NLTN. Growth in passenger and freight traffic is also projected to be reasonably strong on Victorian and Western Australian corridors. Excluding the short Australian Capital Territory sections, New South Wales and Victoria have the highest average traffic levels across the non-urban NLTN, and total traffic on the non-urban corridors in these states is projected to grow by 1.3 and 1.8 per cent per annum, respectively.

Corridor level summary

Interstate corridors

Table 3.4, and Figures 3.5 to 3.8, present the road traffic projections for each of the defined NLTN non-urban corridors. Interstate corridors where traffic growth is projected to be relatively strong include Sydney–Brisbane (via Pacific Highway), Perth–Darwin, Adelaide–Darwin and Melbourne–Adelaide. On all these corridors heavy vehicle traffic growth is projected to be above 0.5 per cent per annum between 2005 and 2030.

Across each of the interstate NLTN corridors light vehicle traffic is projected to grow more strongly than heavy vehicle traffic, due to the future heavy vehicle productivity assumptions. Heavy vehicle traffic growth is projected to be strongest on the Perth–Darwin corridor, due to the additional mining related traffic. Heavy vehicle traffic growth is also projected to be relatively strong on the Brisbane–Darwin, Adelaide–Perth, Sydney–Brisbane (via Pacific Highway) and Melbourne–Adelaide corridors.

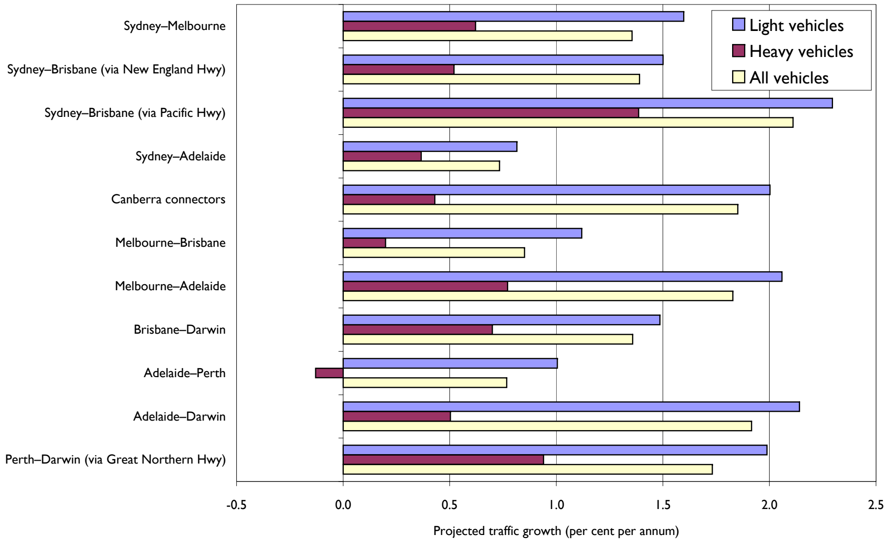
Light vehicle traffic growth is projected to grow most strongly on the Sydney–Brisbane (via Pacific Highway) corridor, along which there is already a large population base and where future population growth is projected to be relatively strong. Light vehicle traffic growth is also projected to be relatively strong on some of the shorter corridors, such as Melbourne–Adelaide and on the Federal Highway, which links Canberra and Sydney, and also on the Adelaide–Darwin and Perth–Darwin corridors, due to relatively strong growth in international and domestic tourism travel.

Intrastate corridors

Traffic growth is projected to be even stronger on some of the intrastate links (see Table 3.5), particularly for the peri-urban Melbourne–Geelong, Melbourne–Sale and Perth–Bunbury corridors—which link fast growing population centres on the periphery of Melbourne and Perth. On these corridors, light vehicle traffic is projected to grow by more than 2.0 per cent per annum between 2005 and 2030. Care should be taken when using these peri-urban corridor projections, as the OZPASS and FreightSim models are not designed to model urban traffic, and specifically do not take into account the potential impact of traffic on congestion and route choice, and the consequent impact on future traffic growth. Total traffic is also projected to grow strongly on the Brisbane–Cairns corridor.

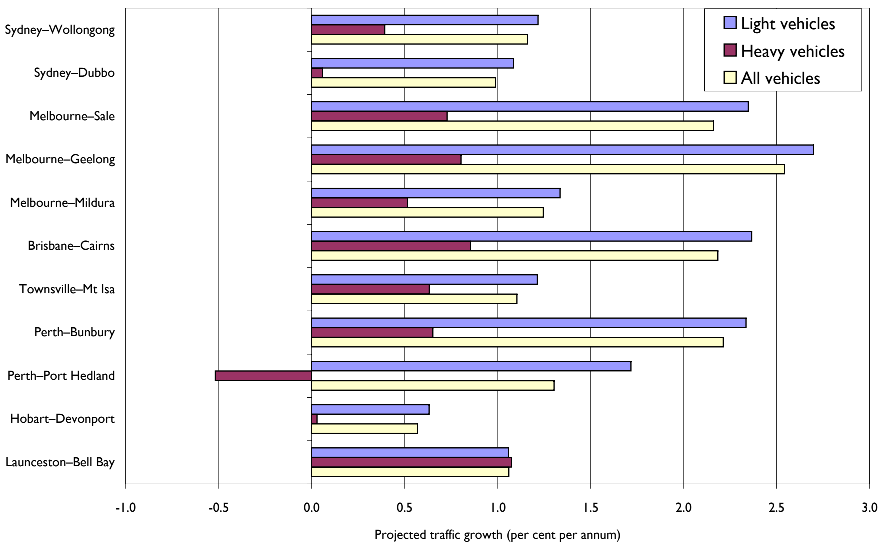
Heavy vehicle traffic is projected to grow strongly, on the Brisbane–Cairns and Townsville–Mt Isa corridors—the former due to projected population growth and economic activity and the latter due to increased mining activity in north–west Queensland. Of the other corridors, Sydney–Wollongong, Melbourne–Sale, Melbourne–Geelong, Perth–Bunbury and the Launceston–Bell Bay corridor are also projected to experience relatively strong heavy vehicle traffic growth over the long term.

Figure 3.5 Projected traffic growth, NLTN non-urban interstate corridors, 2005 to 2030



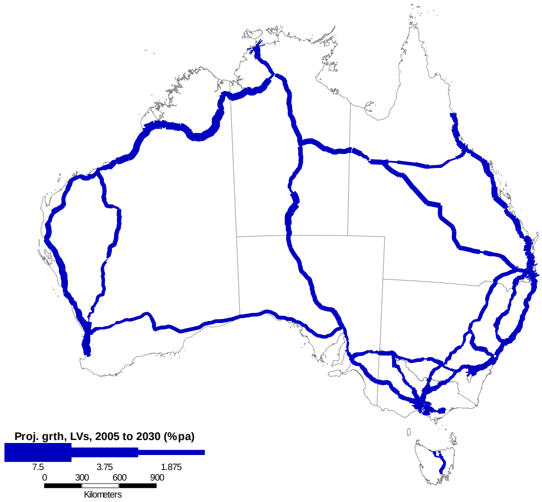
Source: BITRE estimates.

Figure 3.6 Projected traffic growth, NLTN non-urban intrastate corridors, 2005 to 2030



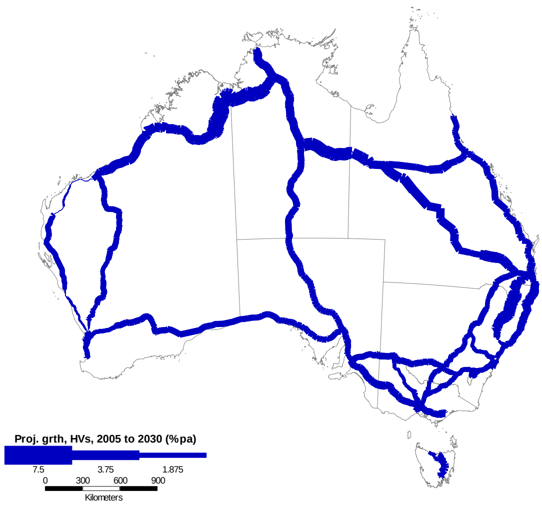
Source: BITRE estimates.

Figure 3.7 Projected growth in light vehicle traffic, 2005 to 2030



Source: BITRE estimates.

Figure 3.8 Projected growth in heavy vehicle traffic, 2005 to 2030



Source: BITRE estimates.

Table 3.3 Projected growth in vehicle traffic, NLTN non-urban corridors, by state and territory, 2005 and 2030

		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*
State	*(km)*	*2005*	*2030*	*2005*	*2030*	*2005*	*2030*			
New South Wales	4 104.6	7 988	11 465	1 531	1 734	9 519	13 199	1.46	0.50	1.32
Victoria	1 733.4	8 432	14 191	1 910	2 123	10 342	16 314	2.10	0.42	1.84
Queensland	4 954.1	4 133	7 411	1 062	1 302	5 195	8 713	2.36	0.82	2.09
South Australia	2 724.2	1 966	2 526	421	442	2 388	2 968	1.01	0.20	0.87
Western Australia[a]	6 466.7	1 056	1 696	254	257	1 310	1 953	1.91	0.06	1.61
Tasmania	365.1	6 515	7 511	825	804	7 340	8 316	0.57	–0.10	0.50
Northern Territory	2 674.0	555	957	95	117	650	1 074	2.21	0.84	2.03
Australian Capital Territory	19.0	14 855	23 359	2 443	2 744	17 298	26 103	1.83	0.47	1.66
Australia[a]	23 041.0	3 655	5 727	792	902	4 447	6 629	1.74	0.50	1.55

a. Estimates include the Brand and North West Coastal Highways (1662 kilometres), which are not part of the NLTN.
Source: BITRE estimates.

Table 3.4 Projected growth in vehicle traffic, NLTN non-urban interstate corridors, 2005 and 2030

		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)*	*2005*	*2030*	*2005*	*2030*	*2005*	*2030*			
Sydney–Melbourne	814.5	9 992	14 852	3 696	4 315	13 688	19 167	1.6	0.6	1.4
Sydney–Brisbane (via New England Hwy)	932.6	10 807	15 686	1 537	1 750	12 345	17 436	1.5	0.5	1.4
Sydney–Brisbane (via Pacific Hwy)	765.9	16 718	29 487	4 753	6 706	21 471	36 192	2.3	1.4	2.1
Sydney–Adelaide	984.0	2 779	3 405	646	708	3 426	4 113	0.8	0.4	0.7
Canberra connectors	126.3	10 109	16 595	1 285	1 431	11 394	18 026	2.0	0.4	1.9
Melbourne–Brisbane	1 434.8	1 823	2 408	836	879	2 659	3 287	1.1	0.2	0.9
Melbourne–Adelaide	700.4	6 234	10 376	1 577	1 911	7 811	12 287	2.1	0.8	1.8
Brisbane–Darwin	2 419.0	1 240	1 792	263	313	1 502	2 105	1.5	0.7	1.4
Adelaide–Perth	2 666.9	1 149	1 476	348	337	1 497	1 813	1.0	–0.1	0.8
Adelaide–Darwin	2 697.9	599	1 017	115	131	714	1 147	2.1	0.5	1.9
Perth–Darwin (via Great Northern Hwy)	3 690.9	377	617	138	174	515	791	2.0	0.9	1.7
All interstate corridors	17 233.3	2 964	4 571	787	952	3 752	5 523	1.7	0.8	1.6

Source: BITRE estimates.

Table 3.5 Projected growth in vehicle traffic, NLTN non-urban intrastate corridors, 2005 and 2030

		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)*	*2005*	*2030*	*2005*	*2030*	*2005*	*2030*			
Sydney–Wollongong	63.4	41 181	55 722	3 349	3 694	44 530	59 416	1.2	0.4	1.2
Sydney–Dubbo	369.8	12 324	16 144	1 446	1 467	13 770	17 611	1.1	0.1	1.0
Melbourne–Sale	172.1	14 832	26 495	2 351	2 819	17 183	29 313	2.3	0.7	2.2
Melbourne–Geelong	48.5	56 803	110 537	6 349	7 754	63 152	118 292	2.7	0.8	2.5
Melbourne–Mildura	528.6	5 579	7 774	763	868	6 343	8 642	1.3	0.5	1.2
Brisbane–Cairns	1 675.2	6 427	11 531	1 048	1 296	7 474	12 828	2.4	0.9	2.2
Townsville–Mt Isa	762.5	551	745	137	161	688	905	1.2	0.6	1.1
Perth–Bunbury	160.3	17 678	31 480	1 678	1 974	19 356	33 454	2.3	0.7	2.2
Perth–Port Hedland[a]	1 662.4	785	1 201	230	202	1 015	1 403	1.7	–0.5	1.3
Hobart–Devonport	319.8	6 700	7 843	843	850	7 544	8 693	0.6	0.0	0.6
Launceston–Bell Bay	45.2	5 202	6 768	696	909	5 898	6 077	1.1	1.1	1.1
All intrastate corridors	5 807.8	5 704	9 172	805	922	6 509	10 082	1.9	0.5	1.8

a. Via the Brand and North West Coastal Highways, which are not part of the NLTN.
Source: BITRE estimates.

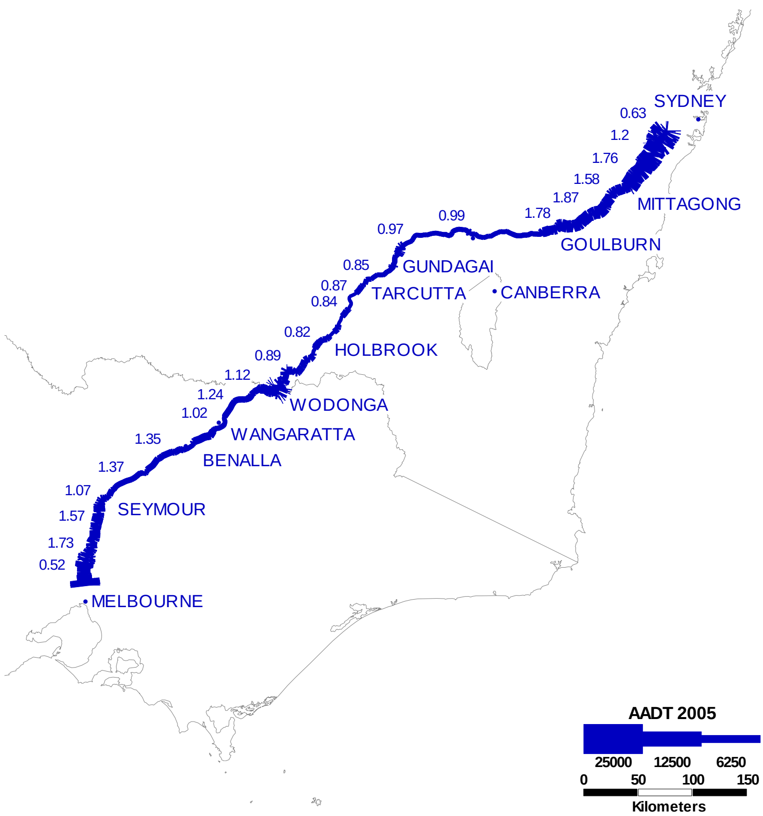
Corridor specific projections

This section provides more detailed projection results, at corridor section level, for light and heavy vehicle traffic growth separately for each of the non-urban NLTN corridors. The corridor sections broadly relate to major road sections between selected population centres or major junctions on the corridors. For each corridor, there is a table listing the daily average light, heavy and total vehicle traffic in 2005 and projections in 2030 and a figure which illustrates total traffic volumes in 2005 and lists the projected annual average rate of growth in total traffic between 2005 and 2030. Where the corridor strategies provide separate projections of future traffic growth, these are compared with the projections listed here.

Sydney–Melbourne corridor

Table 3.6 lists base year 2005 and projected 2030 traffic levels and Figure 3.9 illustrates base year traffic and projected average annual traffic growth on the Sydney–Melbourne corridor between 2005 and 2030. Total traffic on the Sydney–Melbourne corridor is projected to grow by approximately 1.4 per cent per annum between 2005 and 2030. On a length-weighted basis, total freight vehicle traffic is projected to grow by approximately 0.6 per cent per annum and total light vehicle traffic by 1.6 per cent per annum over the corridor. The assumed growth in average heavy vehicle loads implies total heavy vehicle traffic is projected to grow less quickly than light vehicle traffic across all sections of the corridor. (The average road freight task across this corridor, in tonne kilometre terms, is projected to grow by approximately 2.5 per cent per annum, between 2005 and 2030, and total interregional freight traffic by 2.8 per cent per annum.) Light vehicle traffic growth is projected to be relatively stronger on those road sections on the periphery of Sydney and Melbourne. The Sydney–Melbourne corridor strategy did not undertake separate, independent traffic projections for the corridor, and reported BTRE (2006*a*) traffic projections.

Figure 3.9 Sydney–Melbourne corridor: base year traffic levels and projected traffic growth between 2005 and 2030



Note: Figures denote average annual traffic growth, between 2005 and 2030, for separate road sections.
Source: BITRE estimates.

Table 3.6 Sydney–Melbourne corridor: base year and projected traffic levels, 2005 and 2030

		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)*	*2005*	*2030*	*2005*	*2030*	*2005*	*2030*			
Sydney–Federal Hwy	166.8	22 043	33 575	5 146	6 213	27 188	39 788	1.70	0.76	1.53
Federal Hwy–Barton Hwy	64.8	4 501	5 994	3 014	3 448	7 515	9 442	1.15	0.54	0.92
Barton Hwy–Sturt Hwy	139.2	4 766	6 390	2 784	3 152	7 550	9 542	1.18	0.50	0.94
Sturt Hwy–Holbrook	79.4	3 237	4 078	1 817	2 170	5 054	6 248	0.93	0.71	0.85
Holbrook–Vic. border	67.3	6 123	7 945	3 034	3 637	9 156	11 582	1.05	0.73	0.94
NSW border–Wangaratta	67.8	8 403	11 808	3 688	4 392	12 091	16 201	1.37	0.70	1.18
Wangaratta–Euroa	90.5	6 535	9 514	3 401	3 906	9 935	13 420	1.51	0.56	1.21
Euroa–Goulburn Valley Hwy	51.0	5 736	8 911	3 166	3 579	8 902	12 489	1.78	0.49	1.36
Goulburn Valley Hwy–Western Ring Road	87.7	15 777	25 586	5 718	6 443	21 495	32 028	1.95	0.48	1.61
Total	814.5	9 992	14 852	3 696	4 315	13 688	19 167	1.60	0.62	1.36

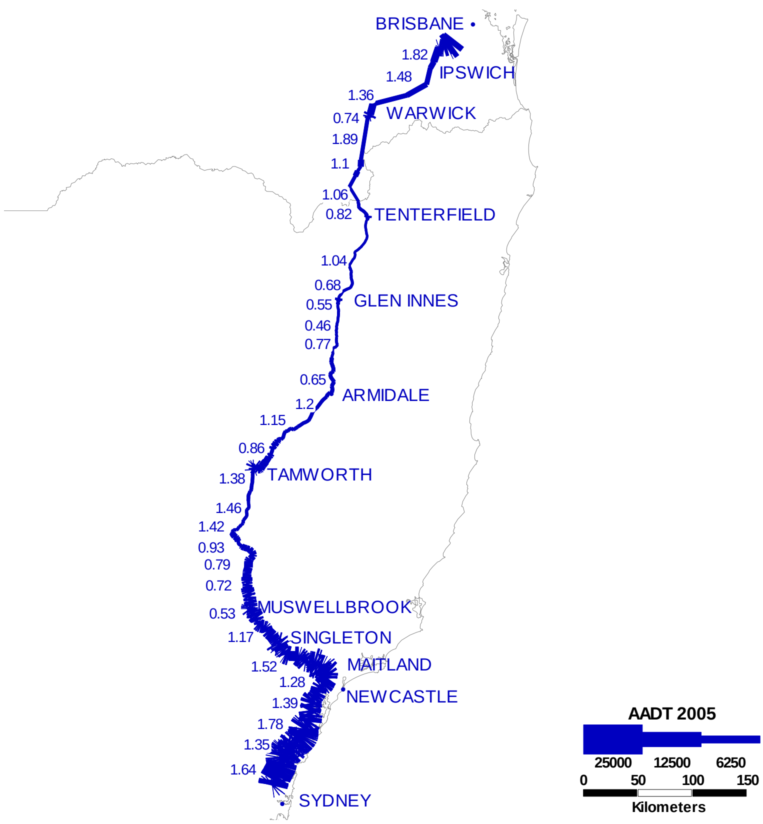
Source: BITRE estimates.

Sydney–Brisbane (Inland) corridor

Table 3.7 lists the base year 2005 and projected 2030 traffic levels and Figure 3.10 illustrates base year traffic and lists projected average annual traffic growth on the Sydney–Brisbane (inland) corridor between 2005 and 2030. Total traffic on the Sydney–Brisbane route—comprising the F3 (Sydney–Newcastle Freeway), New England Highway and Cunningham Highway (from Warwick to Ipswich)—is projected to grow by 1.4 per cent per annum between 2005 and 2030. Light vehicle traffic is projected to grow by around 1.5 per cent per annum and heavy vehicle traffic is projected to grow by 0.5 per cent per annum. Like the Sydney–Melbourne corridor, traffic growth is projected to be relatively stronger on those sections closest to Sydney, Brisbane and Newcastle. Light vehicle traffic is projected to grow by an average of 1.0 per cent per annum over the middle of the corridor—between Muswellbrook and the Queensland border. (The average road freight task across this corridor, in tonne kilometre terms, is projected to grow by approximately 2.2 per cent per annum, between 2005 and 2030, and total interregional road freight by 2.7 per cent per annum.)

The Sydney–Brisbane corridor strategy (DOTARS, DOP (NSW), RTA (NSW), MOT (NSW), QDMR, and QT 2006) projected an increase in total freight on the Sydney–Brisbane corridors—including both the Pacific and New England Highways for road freight—of 2.4 times between 1999 and 2029, an average annual growth rate of 3.0 per cent per annum. The corridor projections presented here, however, imply slightly slower overall freight growth, and more muted increases in heavy vehicle traffic due to assumed continuing increases in average heavy vehicle loads.

Figure 3.10 Sydney–Brisbane corridor: base year traffic levels and projected traffic growth between 2005 and 2030



Note: Figures denote average annual traffic growth, between 2005 and 2030, for separate road sections.
Source: BITRE estimates.

Table 3.7 Sydney–Brisbane corridor: base year and projected traffic levels, 2005 and 2030

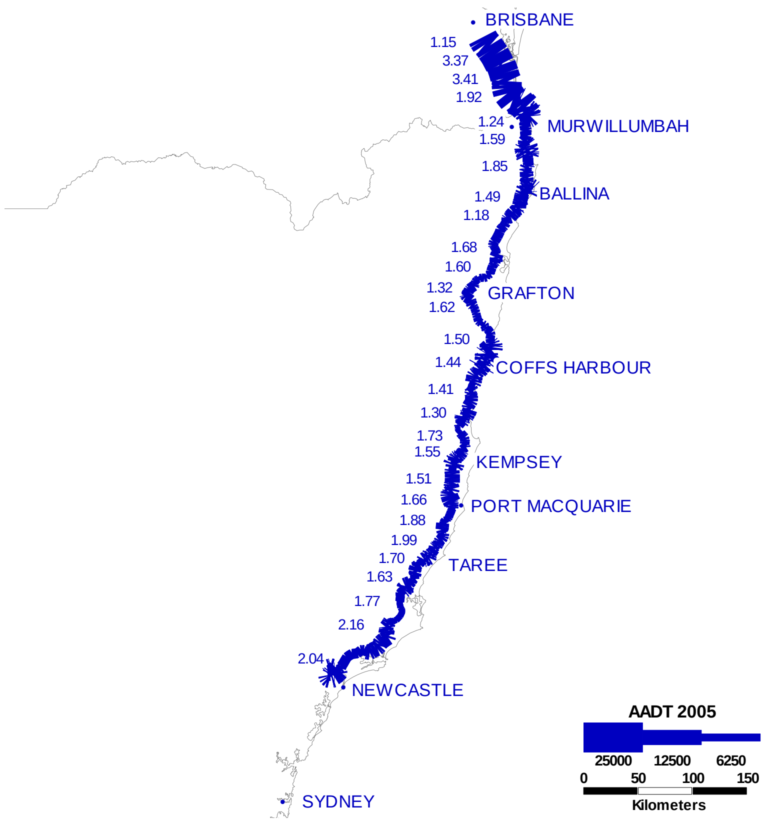
Section	Length (km)	Average traffic levels (vehicles per day) Light vehicles 2005	Light vehicles 2030	Heavy vehicles 2005	Heavy vehicles 2030	All vehicles 2005	All vehicles 2030	Average annual traffic growth (per cent per annum) Light vehicles	Heavy vehicles	All vehicles
Sydney–Newcastle	126.0	48 077	72 043	4 857	5 640	52 934	77 683	1.63	0.60	1.55
Newcastle–Maitland	14.7	33 047	47 788	2 814	3 467	35 860	51 255	1.49	0.84	1.44
Maitland–Singleton	46.1	16 019	22 797	2 386	2 696	18 405	25 494	1.42	0.49	1.31
Singleton–Muswellbrook	47.2	9 596	12 453	2 244	2 362	11 840	14 815	1.05	0.21	0.90
Muswellbrook–Tamworth	155.8	4 334	5 615	1 120	1 181	5 455	6 796	1.04	0.21	0.88
Tamworth–Armidale	112.1	3 229	4 398	642	648	3 870	5 047	1.24	0.04	1.07
Armidale–Glen Innes	93.9	2 003	2 422	466	470	2 469	2 892	0.76	0.03	0.63
Glen Innes–Qld border	111.1	1 722	2 189	523	557	2 246	2 746	0.96	0.25	0.81
NSW border–Warwick	97.1	2 571	3 870	546	623	3 117	4 494	1.65	0.53	1.47
Warwick–Ipswich	128.6	5 281	7 759	1 268	1 645	6 549	9 403	1.55	1.05	1.46
Total	932.6	10 807	15 686	1 537	1 750	12 345	17 436	1.50	0.52	1.39

Source: BITRE estimates.

Sydney–Brisbane (coastal) corridor

Table 3.8 lists the base year 2005 and projected traffic levels in 2030 and Figure 3.11 illustrates base year traffic and projected traffic growth on the Sydney–Brisbane (coastal) corridor between 2005 and 2030. Total traffic along the corridor, which comprises the Pacific Highway from Newcastle to Brisbane, is projected to grow by approximately 2.1 per cent per annum between 2005 and 2030, with growth projected to be strongest around the major population centres of Tweed Heads, Gold Coast and Brisbane. Traffic growth is projected to be relatively strong across the entire corridor, above 1.5 per cent per annum on most sections of the corridor, reflecting strong population and economic growth along the mid- and northern New South Wales coast. Light vehicle traffic is projected to grow, on average, by 2.3 per cent per annum, with strong projected light vehicle traffic growth in south east Queensland being a significant influence. Heavy vehicle traffic is projected to grow by 1.4 per cent per annum over this corridor, allowing for increased average truck size and average load carried. The average road freight task across this corridor, in tonne kilometre terms, is projected to grow by approximately 2.8 per cent per annum, between 2005 and 2030, and total interregional road freight by 3.3 per cent per annum, which is slightly higher than the average rate of total freight growth assumed in the Sydney–Brisbane Corridor Strategy (DOTARS, DOP (NSW), RTA (NSW), MOT (NSW), QDMR, and QT 2006).

Figure 3.11 Sydney–Brisbane (coastal) corridor: base year traffic levels and projected traffic growth between 2005 and 2030



Note: Figures denote average annual traffic growth, between 2005 and 2030, for separate road sections.
Source: BITRE estimates.

Table 3.8 Sydney–Brisbane (coastal) corridor: base year and projected traffic levels, 2005 and 2030

		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)*	*2005*	*2030*	*2005*	*2030*	*2005*	*2030*			
Sydney–Newcastle Fwy–Bulahdelah	87.7	15 683	25 719	2 457	3 218	18 140	28 937	2.00	1.09	1.89
Bulahdelah–Port Macquarie	141.3	10 337	16 562	1 853	2 440	12 190	19 002	1.90	1.11	1.79
Port Macquarie–Kempsey	42.4	11 063	16 581	2 035	2 821	13 097	19 402	1.63	1.32	1.58
Kempsey–Nambucca Heads	62.9	8 165	12 052	1 448	2 022	9 613	14 074	1.57	1.35	1.54
Nambucca Heads–Coffs Harbour	47.1	11 820	17 121	1 639	2 259	13 460	19 380	1.49	1.29	1.47
Coffs Harbour–Grafton	84.9	9 810	13 863	1 568	2 158	11 378	16 020	1.39	1.28	1.38
Grafton–Ballina	126.7	8 066	11 465	1 382	1 965	9 448	13 430	1.42	1.42	1.42
Ballina–Qld border	90.5	16 189	25 502	2 041	2 697	18 230	28 199	1.83	1.12	1.76
NSW border–Brisbane	82.5	61 972	130 788	29 298	42 203	91 269	172 990	3.03	1.47	2.59
Total	765.9	16 718	29 487	4 753	6 706	21 471	36 192	2.30	1.39	2.11

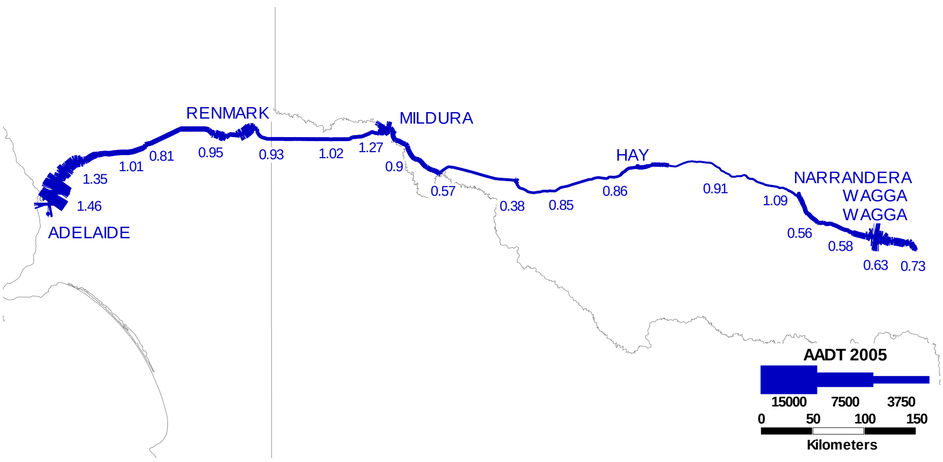
Source: BITRE estimates.

Sydney–Adelaide corridor

Table 3.9 lists the base year 2005 and projected 2030 traffic levels and Figure 3.12 illustrates base year traffic and lists the projected traffic growth rates on the Sydney–Adelaide corridor between 2005 and 2030. Total traffic along the Sydney–Adelaide corridor—comprising the Sturt Highway from the Hume Highway turnoff to Adelaide—is projected to grow by 0.7 per cent per annum between 2005 and 2030. Light vehicle traffic is projected to grow by 0.8 per cent per annum, with only those sections between Mildura and Paringa/Renmark, Waikerie and Truro, and Hay to Balranald projected to experience light vehicle traffic growth above 1.0 per cent per annum between 2005 and 2030. Heavy vehicle traffic volumes are projected to grow by approximately 0.4 per cent per annum, reflecting average interregional freight growth of 2.4 per cent per annum (and average freight growth of 2.3 per cent per annum across the corridor), and an increase in average loads of just under 2 per cent per annum. Projected heavy vehicle traffic growth is relatively consistent across most of the corridor, reflecting the relatively large share of traffic traversing the full length of the corridor.

By comparison, the Sydney–Adelaide corridor strategy (DOTARS, DOP (NSW), RTA (NSW), MOT (NSW), DOI (Vic), VicRoads, and DTEI (SA) 2006) estimated that light vehicle would most likely grow by 0.81 per cent per annum between 2005 and 2025, identical to the rate of growth projected here, and that freight vehicle traffic would most likely grow by 1.6 per cent per annum, which does not appear to include any allowance for increases in heavy vehicle productivity.

Figure 3.12 Sydney–Adelaide corridor: base year traffic levels and projected traffic growth between 2005 and 2030



Note: Figures denote average annual traffic growth, between 2005 and 2030, for separate road sections.
Source: BITRE estimates.

Table 3.9 Sydney–Adelaide corridor: base year and projected traffic levels, 2005 and 2030

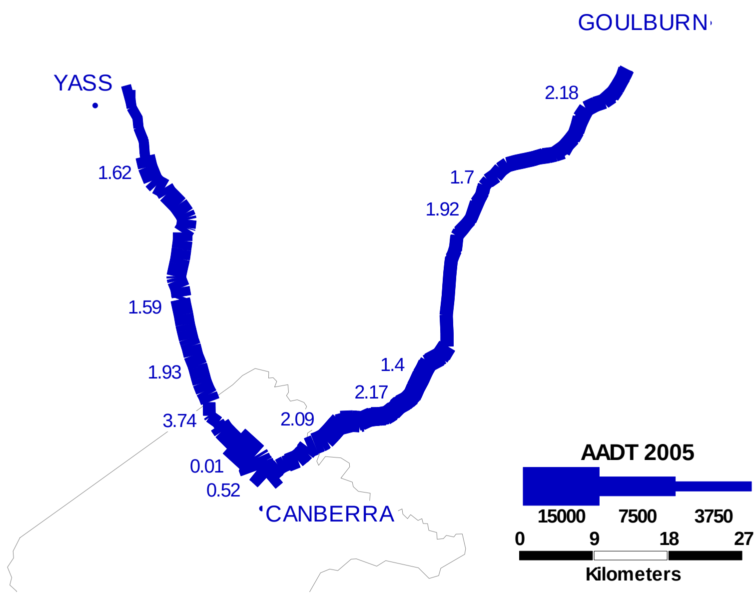
		Average traffic levels (vehicles per day)						*Average annual traffic growth (per cent per annum)*		
	Length	*Light vehicles*		*Heavy vehicles*		*All vehicles*		*Light vehicles*	*Heavy vehicles*	*All vehicles*
Section	*(km)*	*2005*	*2030*	*2005*	*2030*	*2005*	*2030*			
Hume Highway–Wagga Wagga	45.5	4 010	4 789	1 011	1 040	5 021	5 829	0.71	0.11	0.60
Wagga Wagga–Newell Highway (Narrandera)	94.4	2 120	2 482	652	703	2 772	3 185	0.63	0.30	0.56
Newell Highway (Narrandera)–Hay	169.3	643	823	423	466	1 065	1 289	0.99	0.39	0.76
Hay–Balranald	131.7	749	993	503	548	1 252	1 541	1.14	0.34	0.84
Balranald–Mildura	156.4	1 580	1 918	452	496	2 032	2 414	0.78	0.38	0.69
Mildura–SA border	117.4	1 239	1 789	777	850	2 016	2 639	1.48	0.36	1.08
Vic. border–Renmark	26.3	1 640	2 005	562	606	2 201	2 611	0.81	0.30	0.68
Renmark–Waikerie turnoff	76.8	2 882	3 408	631	667	3 513	4 075	0.67	0.23	0.60
Waikerie turnoff–Truro	87.9	1 894	2 516	663	702	2 557	3 219	1.14	0.23	0.93
Truro–Adelaide	78.3	16 881	20 215	1 370	1 608	18 251	21 824	0.72	0.64	0.72
Total	984.0	2 779	3 405	646	708	3 426	4 113	0.82	0.37	0.73

Source: BITRE estimates.

Canberra Connectors

Table 3.10 lists the base year 2005 and projected 2030 traffic levels and Figure 3.13 illustrates base year traffic and projected traffic growth for the Canberra connectors. The Canberra connectors comprise the Barton Highway and the Federal Highway, and link Canberra to the Hume Highway. Traffic levels on the Barton Highway are projected to grow by 1.6 per cent per annum in New South Wales and by approximately 1.8 per cent per annum in the Australian Capital Territory, the latter influenced in part by development of new residential suburbs to the north of Canberra. Traffic on the Federal Highway is projected to grow by around 2.0 per cent per annum in New South Wales and 1.6 per cent per annum in the Australian Capital Territory. This differential growth rate reflects a combination of reasonably strong growth in long-distance passenger trips and freight movements, largely between Sydney and Canberra, along the Federal Highway and slower growing commuter traffic on the Australian Capital Territory sections. Total road freight is projected to grow by approximately 2.1 per cent per annum between 2005 and 2030, with interregional road freight growth projected to be even higher at 2.2 per cent per annum. However, with the assumed growth in heavy vehicle average loads, heavy vehicle traffic is projected to grow less quickly than light vehicle traffic on both the Barton and Federal Highways.

Figure 3.13 Canberra connectors: base year traffic levels and projected traffic growth between 2005 and 2030



Note: Figures denote average annual traffic growth, between 2005 and 2030, for separate road sections.
Source: BITRE estimates.

Table 3.10 Canberra connectors: base year and projected traffic levels, 2005 and 2030

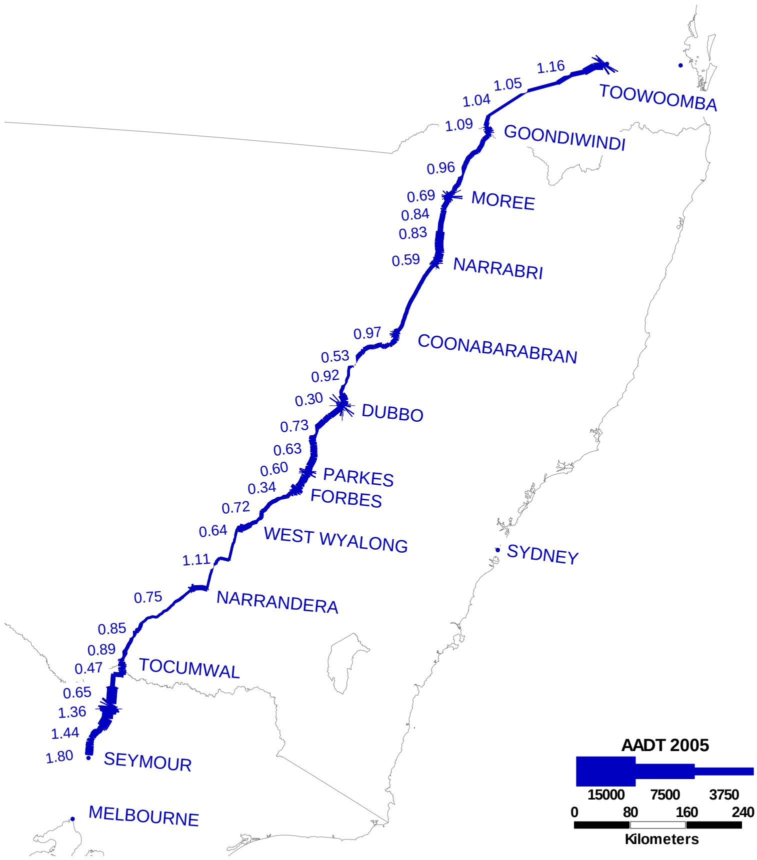
		Average traffic levels (vehicles per day)						*Average annual traffic growth (per cent per annum)*		
	Length	*Light vehicles*		*Heavy vehicles*		*All vehicles*		*Light vehicles*	*Heavy vehicles*	*All vehicles*
Section	*(km)*	*2005*	*2030*	*2005*	*2030*	*2005*	*2030*			
Hume Hwy–ACT border	65.8	10 779	18 489	1 332	1 372	12 111	19 861	2.18	0.12	2.00
Hume Hwy–ACT border	7.1	12 549	19 590	2 615	2 988	15 165	22 578	1.80	0.53	1.60
ACT border–Barton Hwy	41.4	6 858	10 468	678	800	7 536	11 268	1.71	0.66	1.62
ACT border–Federal Hwy	11.9	16 233	25 610	2 340	3 016	18 573	28 625	1.84	1.02	1.75
Total	126.3	10 109	16 595	1 285	1 431	11 394	18 026	2.00	0.43	1.85

Source: BITRE estimates.

Melbourne–Brisbane corridor

Table 3.11 lists the base year 2005 and projected traffic levels in 2030 and Figure 3.14 illustrates base year traffic and projected traffic growth on the Melbourne–Brisbane corridor between 2005 and 2030. Traffic along the Melbourne–Brisbane corridor—comprising the Goulburn Valley Highway from the Hume Highway to the NSW border (Tocumwal), the Newell Highway, a short section of the Cunningham Highway and the Gore Highway to Toowoomba—is projected to grow on average by 0.9 per cent per annum between 2005 and 2030. Light vehicle traffic growth is projected to be relatively low along most of the corridor, averaging around 1.1 per cent per annum, with growth projected to be slightly higher on sections in Queensland and on the section from the Hume Highway to Shepparton, the latter reflecting growth in travel between Melbourne and Shepparton. Heavy vehicle traffic is projected to grow by an average of only 0.2 per cent per annum across the corridor. On this corridor, total road freight is projected to grow by approximately 2.1 per cent per annum, with interregional road freight growth projected to be 2.4 per cent per annum. Rail freight is projected to capture an increasing share of the intercapital freight task, taking freight from road. The Melbourne–Brisbane draft corridor strategy (DOTARS, DOP (NSW), RTA (NSW), MOT (NSW), DOI (Vic), VicRoads, QDMR, and QT 2006) projected that end-to-end freight traffic would grow by approximately 3.8 per cent per annum between 2004 and 2029, which is consistent with the OD freight task projections presented in Chapter 2.

Figure 3.14 Melbourne–Brisbane corridor: base year traffic levels and projected traffic growth between 2005 and 2030



Note: Figures denote average annual traffic growth, between 2005 and 2030, for separate road sections.
Source: BITRE estimates.

Table 3.11 Melbourne–Brisbane corridor: base year and projected traffic levels, 2005 and 2030

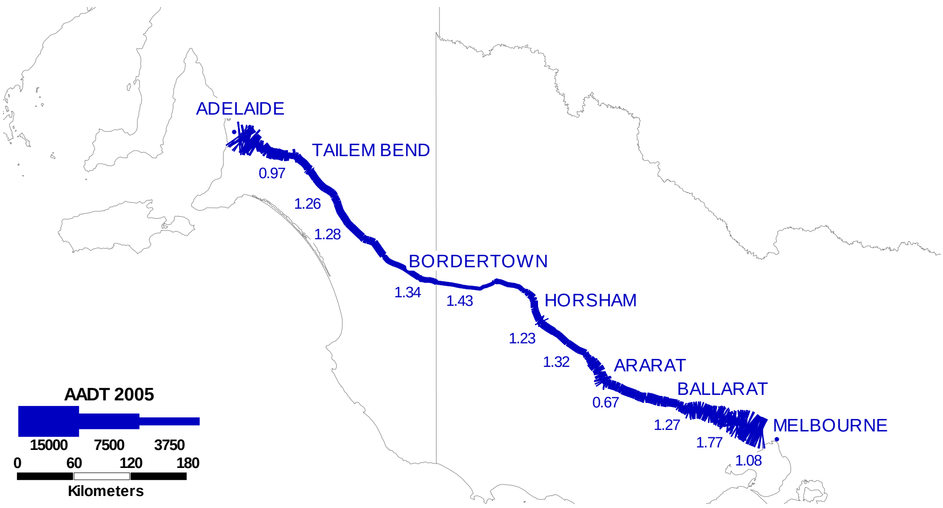
Section	Length (km)	Average traffic levels (vehicles per day): Light vehicles 2005	Light vehicles 2030	Heavy vehicles 2005	Heavy vehicles 2030	All vehicles 2005	All vehicles 2030	Average annual traffic growth (per cent per annum): Light vehicles	Heavy vehicles	All vehicles
Hume Highway–Shepparton	74.3	4 930	7 291	1 456	1 529	6 386	8 820	1.58	0.20	1.30
Shepparton–NSW border	78.6	3 502	4 563	908	937	4 411	5 500	1.06	0.13	0.89
Vic. border–Narrandera	163.2	1 092	1 404	535	554	1 627	1 958	1.01	0.14	0.74
Narrandera–West Wyalong	138.3	1 000	1 234	442	462	1 443	1 696	0.84	0.17	0.65
West Wyalong–Parkes	137.5	1 809	2 209	951	986	2 760	3 195	0.80	0.14	0.59
Parkes–Dubbo	121.0	2 578	3 211	1 016	1 050	3 594	4 261	0.88	0.13	0.68
Dubbo–Coonabarabran	157.2	1 449	1 801	725	751	2 173	2 552	0.87	0.15	0.65
Coonabarabran–Narrabri	119.4	1 193	1 613	781	837	1 974	2 450	1.22	0.28	0.87
Narrabri–Moree	100.3	2 122	2 712	1 446	1 504	3 567	4 216	0.99	0.16	0.67
Moree–Qld border	122.0	1 476	2 049	984	1 039	2 460	3 087	1.32	0.22	0.91
NSW border–Toowoomba	222.9	1 497	2 084	654	722	2 151	2 807	1.33	0.40	1.07
Total	1 434.9	1 823	2 408	836	879	2 659	3 287	1.12	0.20	0.85

Source: BITRE estimates.

Melbourne–Adelaide corridor

Table 3.12 lists base year 2005 and projected 2030 traffic levels and Figure 3.15 illustrates base year traffic and projected traffic growth on the Melbourne–Adelaide corridor between 2005 and 2030. Traffic along the Melbourne–Adelaide corridor, comprising the Western and Dukes Highways, is projected to grow by 1.8 per cent per annum, on average, between 2005 and 2030. Traffic growth is projected to be significantly higher (2.7 per cent per annum) on the Melbourne–Ballarat part of the corridor than elsewhere, principally because of stronger growth in light vehicle traffic along this segment, largely reflecting projected growth in car trips between Melbourne and Ballarat. Averaged across the whole corridor, heavy vehicle traffic is projected to grow by 0.8 per cent per annum and light vehicle traffic by 2.1 per cent per annum. Excluding the Melbourne—Ballarat segment, average light vehicle traffic growth is projected to be 1.2 per cent per annum. Projected heavy vehicle traffic growth is fairly even across the corridor, reflecting the relative importance of road freight traffic traversing the full length of the corridor. Total traffic growth is projected to be 2.7 per cent per annum, with interregional road freight projected to grow by 3.1 per cent per annum between 2005 and 2030. Average heavy vehicle loads are projected to grow by almost 2 per cent per annum on this corridor. The Melbourne–Adelaide corridor strategy referred to BTRE (2006*a*) projections of light and heavy vehicle traffic.

Figure 3.15 Melbourne–Adelaide corridor: base year traffic levels and projected traffic growth between 2005 and 2030



Note: Figures denote average annual traffic growth, between 2005 and 2030, for separate road sections.
Source: BITRE estimates.

Table 3.12 Melbourne–Adelaide corridor: base year and projected traffic levels, 2005 and 2030

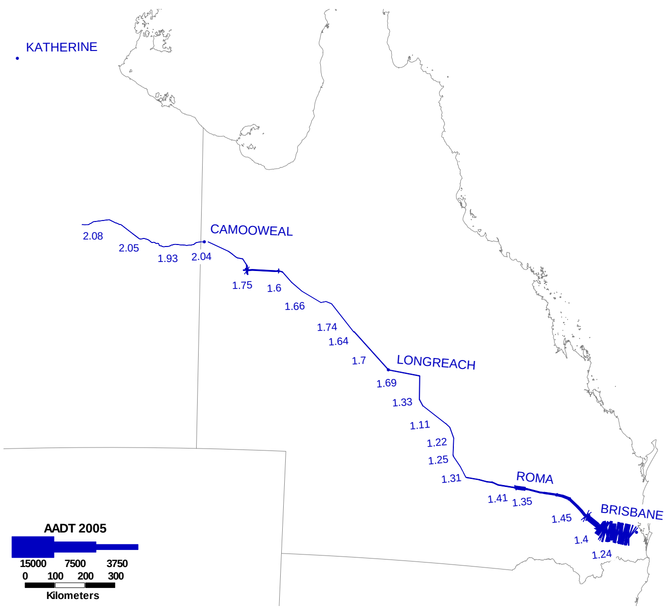
		Average traffic levels (vehicles per day)						*Average annual traffic growth (per cent per annum)*		
	Length	*Light vehicles*		*Heavy vehicles*		*All vehicles*		*Light vehicles*	*Heavy vehicles*	*All vehicles*
Section	*(km)*	*2005*	*2030*	*2005*	*2030*	*2005*	*2030*			
Melbourne–Ballarat	87.6	21 927	45 205	3 407	4 153	25 335	49 358	2.94	0.79	2.70
Ballarat–Ararat	96.0	3 501	5 028	1 581	1 881	5 082	6 910	1.46	0.70	1.24
Ararat–Horsham	95.7	2 974	3 996	1 289	1 562	4 262	5 558	1.19	0.77	1.07
Horsham–SA border	137.6	1 425	2 017	945	1 240	2 370	3 258	1.40	1.09	1.28
Vic. border–Keith	63.9	1 622	2 386	986	1 274	2 608	3 660	1.56	1.03	1.37
Keith–Tailem Bend	126.8	2 392	3 516	1 228	1 454	3 620	4 970	1.55	0.68	1.28
Tailem Bend–Adelaide	92.8	13 173	16 889	1 963	2 245	15 136	19 134	1.00	0.54	0.94
Total	700.4	6 234	10 376	1 577	1 911	7 811	12 287	2.06	0.77	1.83

Source: BITRE estimates.

Brisbane–Darwin corridor

Table 3.13 lists the base year 2005 and projected 2030 traffic levels and Figure 3.16 illustrates base year traffic and projected traffic growth on the Brisbane–Darwin corridor between 2005 and 2030. Traffic on the Brisbane–Darwin corridor, which comprises the Warrego, Landsborough, Flinders and Barkly Highways, is projected to grow by approximately 1.4 per cent per annum between 2005 and 2030. Light vehicle traffic is projected to grow by approximately 1.5 per cent per annum between 2005 and 2030, and heavy vehicle traffic by 0.7 per cent per annum over the same period. Heavy vehicle average load increases dampen the projected growth in heavy vehicle traffic, as total freight movements are projected to grow by 2.4 per cent per annum and interregional freight by 3.1 per cent per annum. Total traffic growth is projected to be strongest on the Barkly Highway sections (Mount Isa to Stuart Highway turn-off) due to projected strong growth in non-bulk road freight between Townsville and Darwin.

Figure 3.16 Brisbane–Darwin corridor: base year traffic levels and projected traffic growth between 2005 and 2030



Note: Figures denote average annual traffic growth, between 2005 and 2030, for separate road sections.
Source: BITRE estimates.

Table 3.13 Brisbane–Darwin corridor: base year and projected traffic levels, 2005 and 2030

		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)*	*2005*	*2030*	*2005*	*2030*	*2005*	*2030*			
Ipswich–Toowoomba	96.6	16 443	23 923	2 694	2 956	19 137	26 879	1.51	0.37	1.37
Toowoomba–Miles	211.4	3 115	4 441	640	733	3 755	5 174	1.43	0.54	1.29
Miles–Morven	318.3	784	1 080	222	248	1 006	1 328	1.29	0.44	1.12
Morven–Winton	699.4	270	414	107	130	377	544	1.73	0.79	1.48
Winton–Mount Isa	470.2	365	534	125	177	491	711	1.54	1.38	1.50
Mount Isa–NT border	189.5	329	392	116	192	445	584	0.70	2.04	1.09
Qld. border–Stuart Highway	433.7	184	294	33	63	217	357	1.89	2.67	2.02
Total	2 419.0	1 240	1 792	263	313	1 502	2 105	1.48	0.70	1.36

Source: BITRE estimates.

Adelaide–Perth corridor

Table 3.14 lists the base year 2005 and projected 2030 traffic levels and Figure 3.17 illustrates base year traffic and projected traffic growth on the Adelaide–Perth corridor between 2005 and 2030. Traffic along the Adelaide–Perth corridor—which for this study comprises the Princes Highway, between Adelaide and Port Augusta, and the Eyre and Great Eastern Highways—is projected to grow by approximately 0.8 per cent per annum, on average, between 2005 and 2030. Light vehicle traffic growth is projected to average approximately 1.0 per cent per annum, with, perhaps surprisingly, slightly stronger growth on the more remote sections between Kimba (SA) and Coolgardie (WA). Road freight volumes are projected to grow by around 1.8 per cent per annum on this corridor, with most of this comprising long-distance freight. The FreightSim model, while projecting stronger growth in rail freight relative to road, projects non-bulk road freight of growth of 1.9 per cent per annum for Adelaide–Perth OD freight, 2.3 per cent per annum for Melbourne–Perth OD freight and 2.7 per cent per annum for Sydney–Perth OD freight (see Table 2.18). However, after taking into account assumed increases in heavy vehicle loads, total heavy vehicle traffic is projected to decline slightly on current levels. This is consistent with observed trends in heavy vehicle traffic volumes between 1995 and 2005, where heavy vehicle traffic volumes have, if anything, declined slightly, from around 180 vehicles per day to around 150 vehicle per day, over that period.

Figure 3.17 Adelaide–Perth corridor: base year traffic levels and projected traffic growth between 2005 and 2030

Note: Figures denote average annual traffic growth, between 2005 and 2030, for separate road sections.
Source: BITRE estimates.

Table 3.14 Adelaide–Perth corridor: base year and projected traffic levels, 2005 and 2030

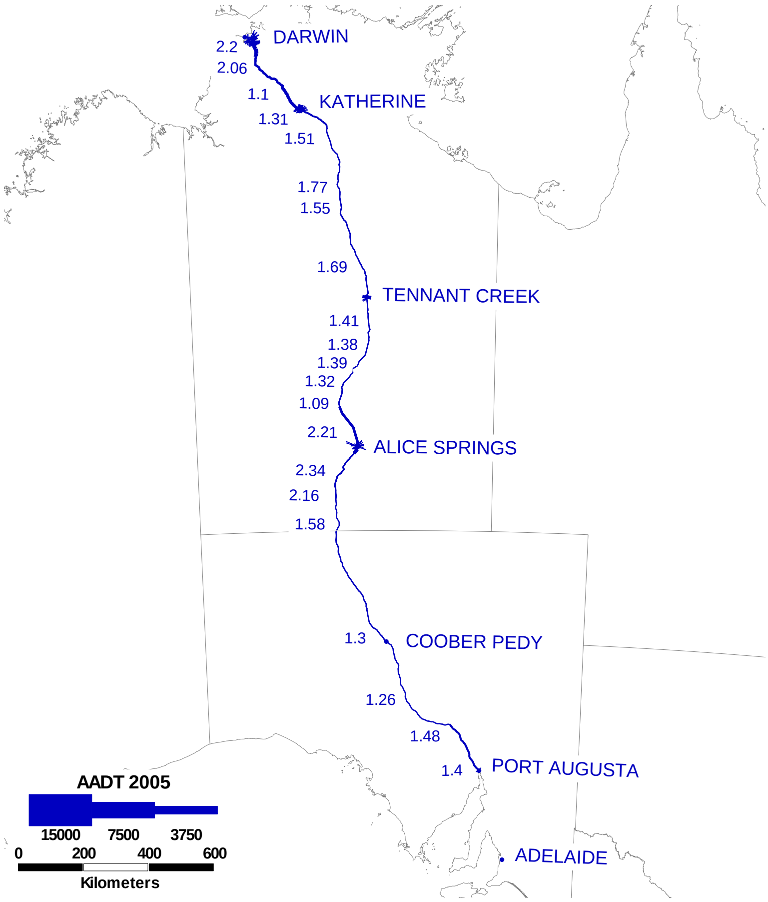
		Average traffic levels (vehicles per day)						*Average annual traffic growth (per cent per annum)*		
	Length	*Light vehicles*		*Heavy vehicles*		*All vehicles*		*Light vehicles*	*Heavy vehicles*	*All vehicles*
Section	*(km)*	*2005*	*2030*	*2005*	*2030*	*2005*	*2030*			
Adelaide–Port Augusta	294.7	4 409	5 539	895	870	5 304	6 410	0.92	–0.11	0.76
Port Augusta–Kimba	154.2	618	804	219	204	837	1 008	1.06	–0.28	0.75
Kimba–Ceduna	313.2	384	524	210	198	594	722	1.25	–0.23	0.79
Ceduna–WA border	482.2	273	375	130	123	402	498	1.29	–0.20	0.86
SA border–Norseman	720.7	187	256	152	145	339	401	1.27	–0.21	0.67
Norseman–Coolgardie	164.2	387	529	235	222	622	750	1.25	–0.23	0.75
Coolgardie–Merredin	296.1	1 182	1 476	562	564	1 744	2 040	0.89	0.02	0.63
Merredin–Northam	162.2	1 723	2 111	672	633	2 396	2 744	0.81	–0.24	0.54
Northam–Perth	79.3	7 458	9 883	974	983	8 431	10 867	1.13	0.04	1.02
Total	2 666.9	1 149	1 476	348	337	1 497	1 813	1.01	–0.13	0.77

Source: BITRE estimates.

Adelaide–Darwin corridor

Table 3.15 lists the base year 2005 and projected 2030 traffic levels and Figure 3.18 illustrates base year traffic and projected traffic growth on the Adelaide–Darwin corridor between 2005 and 2030. Traffic growth along the Stuart Highway, between Adelaide–Darwin, is projected to grow at a rate of 1.9 per cent per annum between 2005 and 2030. Light vehicle traffic is projected to grow by between 1.2 and 3.3 per cent per annum, with the highest rate of growth on the section between Katherine and Darwin. Heavy vehicle traffic is projected to grow by 0.5 per cent per annum. The projections imply a slight decline in heavy vehicle traffic in South Australia and a slight increase in heavy vehicle traffic in the Northern Territory. Total interregional road freight is projected to grow by 2.3 per cent per annum across this corridor and total road freight by 2.5 per cent per annum. The Adelaide–Darwin draft corridor strategy (DOTARS, DTEI (SA), and DPI (NT) 2006) implies road freight task growth of approximately 2.1 per cent per annum between 2005 and 2025, slightly less than the rate of growth underlying the freight traffic projections presented in Table 3.15.

Figure 3.18 Adelaide–Darwin corridor: base year traffic levels and projected traffic growth between 2005 and 2030



Note: Figures denote average annual traffic growth, between 2005 and 2030, for separate road sections.
Source: BITRE estimates.

Table 3.15 Adelaide–Darwin corridor: base year and projected traffic levels, 2005 and 2030

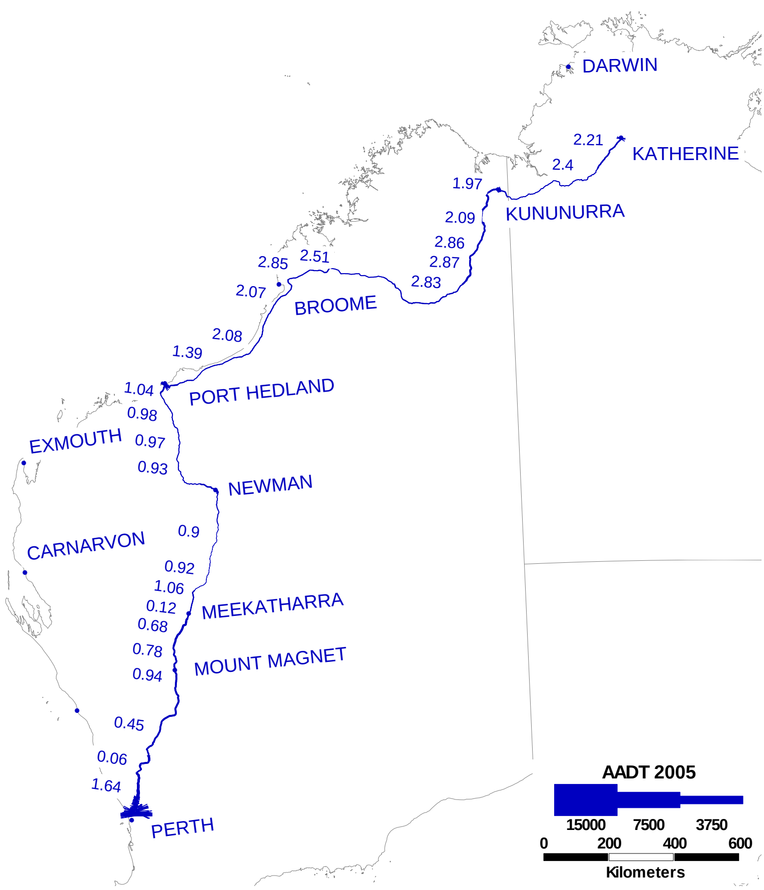
		Average traffic levels (vehicles per day)						*Average annual traffic growth (per cent per annum)*		
	Length	*Light vehicles*		*Heavy vehicles*		*All vehicles*		*Light vehicles*	*Heavy vehicles*	*All vehicles*
Section	*(km)*	*2005*	*2030*	*2005*	*2030*	*2005*	*2030*			
Port Augusta–Pimba	169.6	547	854	168	160	714	1 014	1.80	–0.19	1.41
Pimba–Coober Pedy	369.0	283	422	89	85	372	508	1.62	–0.16	1.26
Coober Pedy–NT border	388.5	340	503	80	76	420	580	1.58	–0.17	1.30
SA border–Lasseter Highway	91.7	255	401	45	43	300	444	1.83	–0.17	1.58
Lasseter Highway–Alice Springs	199.2	661	1 107	117	122	778	1 229	2.08	0.18	1.85
Alice Springs–Barkly Highway	531.2	602	809	103	114	705	923	1.19	0.42	1.08
Barkly Highway–Katherine	647.4	457	614	80	105	538	719	1.18	1.07	1.17
Katherine–Darwin	301.2	1 710	3 860	280	355	1 990	4 215	3.31	0.96	3.05
Total	2 697.9	599	1 017	115	131	714	1 147	2.14	0.52	1.91

Source: BITRE estimates.

Perth–Darwin corridor

Table 3.16 lists the base year 2005 and projected 2030 traffic levels and Figure 3.19 illustrates base year traffic and projected traffic growth on the Perth–Darwin corridor between 2005 and 2030. The Perth–Darwin corridor consists of the Great Northern Highway, from Perth to Kununurra (WA) and the Victoria Highway from Kununurra to Katherine (NT). Total traffic on this corridor is projected to grow by approximately 1.7 per cent per annum between 2005 and 2030. Light vehicle traffic is projected to grow by 2.0 per cent per annum between 2005 and 2030, with growth in traffic projected to be reasonably strong on those sections between Broome, Halls Creek and the Northern Territory border, albeit from a low base. Heavy vehicle traffic is projected to grow by approximately 0.9 per cent per annum, with the average load of heavy vehicles assumed to grow by just under 2 per cent per annum. Freight traffic is projected to grow most strongly on the Western Australian and Northern Territory sections north and east of Port Hedland. The growth in freight traffic on this corridor includes the assumed commencement of iron ore transport from Argyle Iron Ore mine to Wyndham by road, which is expected to involve an additional 41 truck movements per day, in each direction, carrying approximately 100 tonnes per vehicle. Total road freight tonne kilometre traffic on this corridor is projected to grow by approximately 4.2 per cent per annum, fuelled, in large part, by the Argyle Iron Ore traffic. Excluding this traffic, total road freight is projected to increase by approximately 2.5 per cent per annum on this corridor. By way of comparison, the Perth–Darwin Draft Corridor Strategy (DOTARS, DPI (WA), MRWA, and DPI (NT) 2007) also projected freight growth of 4.2 per cent per annum, between 2005 and 2025, for this corridor, and growth of over 7.0 per cent on the Kununurra to Katherine section.

Figure 3.19 Perth–Darwin corridor: base year traffic levels and projected traffic growth between 2005 and 2030



Note: Figures denote average annual traffic growth, between 2005 and 2030, for separate road sections.
Source: BITRE estimates.

Table 3.16 Perth–Darwin corridor: base year and projected traffic levels, 2005 and 2030

		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)*	*2005*	*2030*	*2005*	*2030*	*2005*	*2030*			
Perth–Brand Highway turnoff	33.6	9 302	16 962	1 869	2 591	11 171	19 552	2.43	1.32	2.26
Brand Highway turnoff–Mount Magnet	513.1	553	764	277	280	830	1 044	1.30	0.05	0.92
Mount Magnet–Meekatharra	194.9	424	517	245	254	668	771	0.80	0.14	0.57
Meekatharra–Newman	420.2	103	142	77	81	180	224	1.29	0.22	0.87
Newman–North West Coastal Highway	409.7	160	220	81	81	241	301	1.28	–0.01	0.89
North West Coastal Highway–Port Hedland	33.3	1 101	1 277	147	170	1 249	1 447	0.60	0.56	0.59
Port Hedland–Broome	565.6	212	362	96	124	308	486	2.15	1.03	1.84
Broome–Halls Creek	650.9	228	469	62	92	290	561	2.92	1.61	2.68
Halls Creek–NT border	400.1	450	813	178	321	629	1 134	2.39	2.37	2.39
WA border–Katherine	469.4	251	395	44	69	295	464	1.84	1.78	1.83
Total	3 690.9	377	617	138	174	515	791	1.99	0.93	1.73

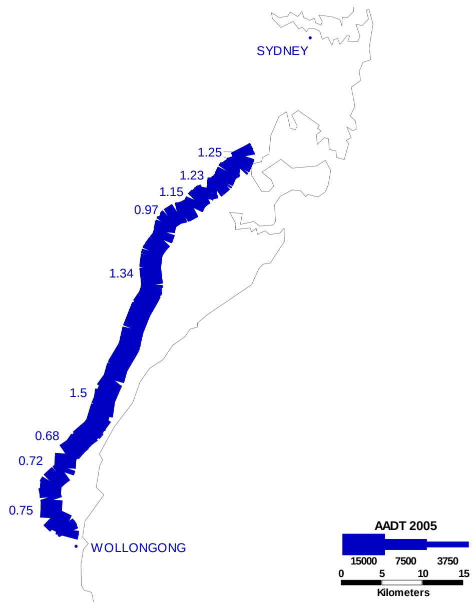
Source: BITRE estimates.

Intrastate corridors

Sydney–Wollongong corridor

Table 3.17 lists the base year 2005 and projected 2030 traffic levels and Figure 3.20 illustrates base year traffic and projected traffic growth on the Sydney–Wollongong corridor between 2005 and 2030. Total traffic is projected to grow by approximately 1.2 per cent per annum between 2005 and 2030, with heavy vehicle traffic projected to grow by 0.4 per cent per annum and light vehicle traffic by 1.2 per cent per annum over that period. Total road freight tonne kilometres are projected to grow by approximately 2.1 per cent per annum in this corridor, with the assumed growth in average vehicle loads constraining growth in heavy vehicle numbers. By way of comparison, the Sydney–Wollongong Corridor Strategy (DOTARS, DOP (NSW), RTA (NSW), and MOT (NSW) 2007*b*) implies that freight growth of 3.3 per cent per annum between 2000 and 2025 (BTRE 2006*a*), fuelled in part by the closure of Port Jackson container terminal and increased container movements through Port Kembla, some of which will be carried by road and some by rail to/from Sydney. The corridor strategy notes that the diversion of port traffic will add less than one per cent to overall traffic. The projections presented here do not explicitly account for the long-term diversion of port traffic to Port Kembla, and consequently may understate future growth in interregional heavy vehicle traffic on this corridor.

Figure 3.20 Sydney–Wollongong corridor: base year traffic levels and projected traffic growth between 2005 and 2030



Note: Figures denote average annual traffic growth, between 2005 and 2030, for separate road sections.
Source: BITRE estimates.

Table 3.17 Sydney–Wollongong corridor: base year and projected traffic levels, 2005 and 2030

		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)*	*2005*	*2030*	*2005*	*2030*	*2005*	*2030*			
Sydney–Wollongong	63.4	41 181	55 722	3 349	3 694	44 530	59 416	1.22	0.39	1.16

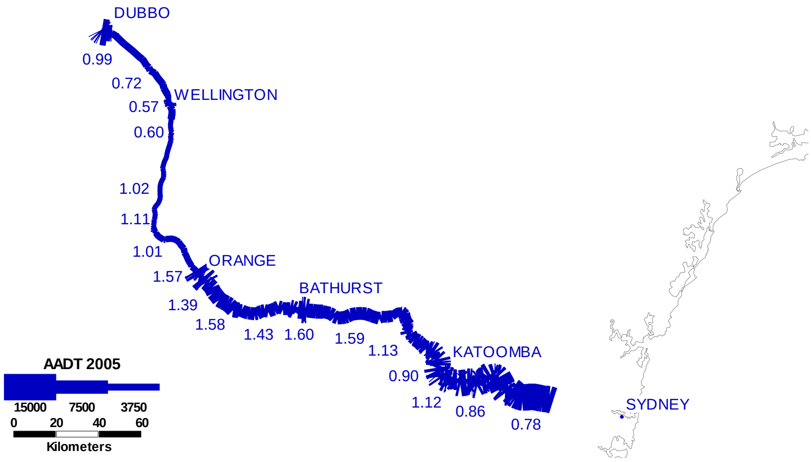
Source: BITRE estimates.

Table 3.18 Sydney–Dubbo corridor: base year and projected traffic levels, 2005 and 2030

		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)*	*2005*	*2030*	*2005*	*2030*	*2005*	*2030*			
Sydney–Katoomba	65.7	42 549	52 855	3 675	4 231	46 224	57 087	0.87	0.57	0.85
Katoomba–Bathurst	97.8	8 396	12 011	1 370	1 250	9 766	13 260	1.44	–0.37	1.23
Bathurst–Orange	54.0	7 274	10 897	1 147	1 013	8 422	11 910	1.63	–0.50	1.40
Orange–Dubbo	152.3	3 604	4 828	640	576	4 243	5 404	1.18	–0.42	0.97
Total	369.8	12 324	16 144	1 446	1 467	13 770	17 611	1.09	0.06	0.99

Source: BITRE estimates.

Figure 3.21 Sydney–Dubbo corridor: base year traffic levels and projected traffic growth between 2005 and 2030



Note: Figures denote average annual traffic growth, between 2005 and 2030, for separate road sections.
Source: BITRE estimates.

Sydney–Dubbo corridor

Table 3.18 lists the base year 2005 and projected 2030 traffic levels and Figure 3.21 illustrates base year traffic and projected traffic growth over the Sydney–Dubbo corridor between 2005 and 2030. The Sydney–Dubbo corridor comprises the Great Western Highway, to Bathurst, and Mitchell Highway between Bathurst and Dubbo. Traffic along the corridor is projected to grow by approximately 1.0 per cent per annum between 2005 and 2030. Light vehicle traffic is projected to grow by 1.1 per cent per annum between 2005 and 2030, with slightly higher growth projected on those sections west of Katoomba. Average heavy vehicle traffic levels across the corridor are projected to remain more or less at current levels, albeit with heavy vehicle traffic projected to grow slightly on the Sydney–Katoomba section and decline slightly on those sections west of Katoomba. Again, total freight on this corridor is projected to grow by approximately 1.7 per cent per annum. The Sydney–Dubbo Corridor Strategy (DOTARS, DOP (NSW), RTA (NSW), and MOT (NSW) 2007*a*) projects that light vehicle traffic will grow by 1.3 per cent per annum between 2000 and 2025 and truck traffic by 3.0 per cent per annum. The latter figure does not appear to make any adjustment for improvements in heavy vehicle productivity.

Readers should note that the Sydney–Katoomba section of this corridor lies within the greater Sydney urban area, and will carry significant amounts of intra-urban traffic movements. The OZPASS and FreightSim models were not designed to model urban traffic movements, and specifically do not take into account congestion, route choice and local industry location factors that may influence future traffic growth. Consequently, readers should use their judgement in applying the traffic projections for the near-urban sections of this corridor.

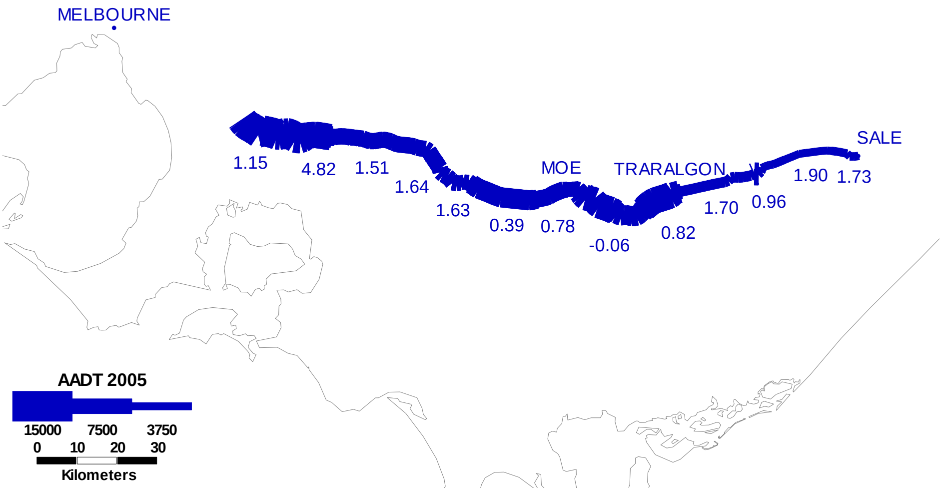
Melbourne–Sale corridor

Table 3.19 lists the base year 2005 and projected 2030 traffic levels and Figure 3.22 illustrates base year traffic and projected traffic growth on the Melbourne–Sale corridor, between 2005 and 2030. The corridor extends from the end of the Monash Freeway at Berwick (on the south eastern edge of the greater Melbourne area) to Sale in eastern Victoria. Total traffic along the Princes Highway between Berwick and Sale is projected to grow by 2.2 per cent per annum between 2005 and 2030, with significantly higher light vehicle traffic growth projected for the section between Berwick and Moe, due mainly to higher forecast population growth on Melbourne's periphery. East of Moe, light vehicle traffic is projected to grow by approximately 0.8 per cent per annum between 2005 and 2030. Freight vehicle traffic is projected to grow on average by 0.7 per cent per annum over the corridor. Total road freight movements are projected to grow by 2.1 per cent per annum over the same period. The Melbourne–Sale Corridor Strategy (DOTARS, DOI (Vic), and VicRoads 2007*c*) cites BTRE (2006*a*) projected growth in light vehicle traffic of approximately 2.0 per cent per annum between 2000 and 2025 and heavy vehicle traffic of 2.7 per cent per annum. The corridor strategy light vehicle projections are less than those presented here and the heavy vehicle projections are greater than those presented here.

Melbourne–Geelong corridor

Table 3.20 lists the base year 2005 and projected 2030 traffic levels and Figure 3.23 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 approximately 2.5 per cent per annum between 2005 and 2030. Light vehicle traffic is projected to grow by approximately 2.7 per cent per annum, reflecting relatively strong projected population growth in metropolitan areas. Heavy vehicle traffic is projected to grow by 0.8 per cent per annum between 2005 and 2030. This result again includes the impact of assumed improvement in heavy vehicle productivity—total road freight is projected to grow by 2.2 per cent per annum over this period. Readers should note that the OZPASS and FreightSim models are not designed to model urban traffic, and specifically do not take into account congestion, route choice and industry location factors that may influence future traffic growth. Consequently, readers are advised to use their judgement in applying the traffic projections for the Melbourne–Geelong corridor. The

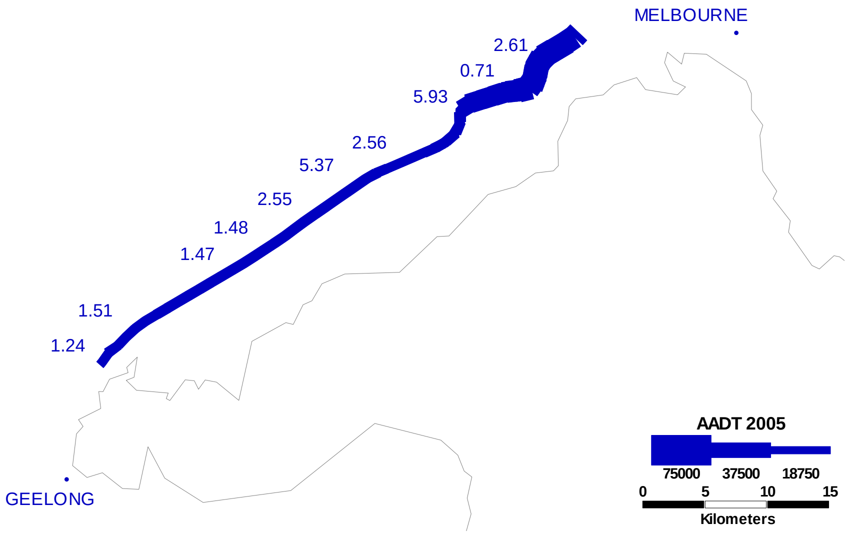
Figure 3.22 Melbourne–Sale corridor: base year traffic levels and projected traffic growth between 2005 and 2030



Note: Figures denote average annual traffic growth, between 2005 and 2030, for separate road sections.
Source: BITRE estimates.

Melbourne–Geelong Corridor Strategy (DOTARS, DOI (Vic), and VicRoads 2007*a*) cites BTRE (2006*a*) traffic growth projections, which implied light vehicle traffic growth of 2.25 per cent per annum between 2000 and 2025 and heavy vehicle traffic growth of 2.6 per cent per annum over the same period.

Figure 3.23 Melbourne–Geelong corridor: base year traffic levels and projected traffic growth between 2005 and 2030



Note: Figures denote average annual traffic growth, between 2005 and 2030, for separate road sections.
Source: BITRE estimates.

Table 3.19 Melbourne–Sale corridor: base year and projected traffic levels, 2005 and 2030

		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)	2005	2030	2005	2030	2005	2030			
Sale–Moe	80.0	10 372	12 565	1 451	1 684	11 822	14 249	0.77	0.60	0.75
Moe–Melbourne	92.1	18 707	38 595	3 133	3 805	21 841	42 400	2.94	0.78	2.69
Total	172.1	14 832	26 495	2 351	2 819	17 183	29 313	2.35	0.73	2.16

Source: BITRE estimates.

Table 3.20 Melbourne–Geelong corridor: base year and projected traffic levels, 2005 and 2030

		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)	2005	2030	2005	2030	2005	2030			
West Gate Freeway–Geelong	48.5	56 803	110 537	6 349	7 754	63 152	118 292	2.70	0.80	2.54

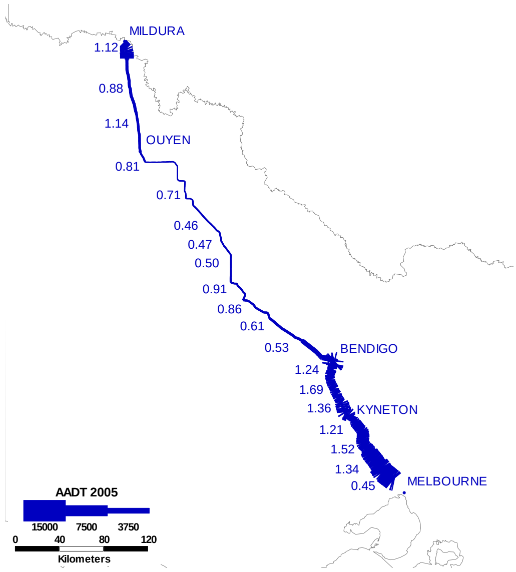
Source: BITRE estimates.

Table 3.21 Melbourne–Mildura corridor: base year and projected traffic levels, 2005 and 2030

		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)*	*2005*	*2030*	*2005*	*2030*	*2005*	*2030*			
Melbourne–Bendigo	131.2	17 996	25 544	1 969	2 303	19 964	27 848	1.41	0.63	1.34
Bendigo–Sea Lake	210.1	1 300	1 590	367	402	1 666	1 992	0.81	0.37	0.72
Sea Lake–Mildura	187.2	1 680	2 259	364	385	2 044	2 644	1.19	0.23	1.04
Total	528.6	5 579	7 774	763	868	6 343	8 642	1.34	0.52	1.24

Source: BITRE estimates.

Figure 3.24 Melbourne–Mildura corridor: base year traffic levels and projected traffic growth between 2005 and 2030



Note: Figures denote average annual traffic growth, between 2005 and 2030, for separate road sections.
Source: BITRE estimates.

Melbourne–Mildura corridor

Table 3.21 lists the base year 2005 and projected 2030 traffic levels and Figure 3.24 illustrates base year traffic and projected traffic growth along the Melbourne–Mildura corridor. Traffic levels along the Melbourne–Mildura corridor, which comprises the Calder Highway between Melbourne and Mildura, are projected to grow by 1.2 per cent per annum between 2005 and 2030, with the most significant growth projected to occur along the section between Bendigo and Melbourne, reflecting stronger passenger and freight vehicle movements between these urban areas. Averaged across the whole corridor, total light vehicle traffic is projected to grow by 1.3 per cent per annum and heavy vehicle traffic by 0.5 per cent per annum. The heavy vehicle traffic growth projections include the assumed increase in heavy vehicle productivity—over the period 2005 to 2030, total road freight is projected to grow by approximately 2.0 per cent per annum. The Melbourne–Mildura Corridor Strategy (DOTARS, DOI (Vic), and VicRoads 2007*b*) cites BTRE (2006*a*) traffic projections.

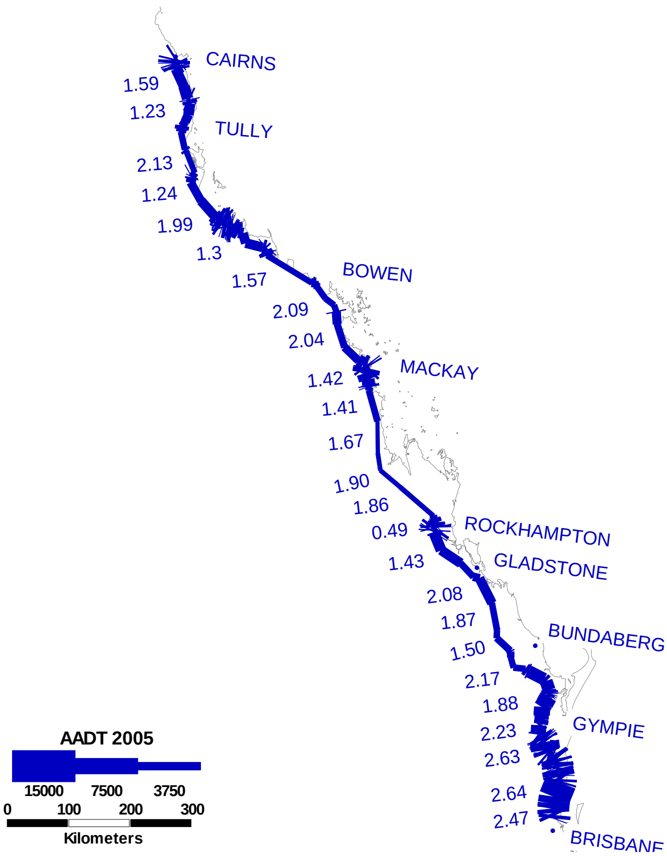
Brisbane–Cairns corridor

Table 3.22 lists the base year 2005 and projected 2030 traffic levels and Figure 3.25 illustrates base year traffic and projected traffic growth for the Brisbane–Cairns corridor. Averaged across the length of the corridor, total traffic along the Brisbane–Cairns corridor is projected to grow by 2.2 per cent per annum between 2005 and 2030. Light vehicle traffic is projected to grow by 2.4 per cent per annum averaged over the whole corridor, reflecting relatively stronger growth between Brisbane and Gladstone, Mackay–Bowen and Townsville–Cairns. Heavy vehicle traffic is projected to grow by approximately 0.9 per cent per annum between 2005 and 2030, with growth projected to be relatively consistent across the corridor. Total road freight is projected to grow by almost 2.8 per cent per annum across this corridor, with the difference accounted for by the assumed increase in heavy vehicle productivity. The Brisbane–Cairns Corridor Strategy (DOTARS, QDMR, and QT 2006) drew on BTRE (2006*a*) projections, which implied growth in light vehicle traffic of 2.8 per cent per annum between 2000 and 2025 and growth in heavy vehicle traffic of 3.1 per cent per annum, assuming no change in heavy vehicle productivity. The latest projections imply slightly lower rates of growth in total traffic on the corridor, albeit over a slightly longer projection horizon.

Townsville–Mt Isa corridor

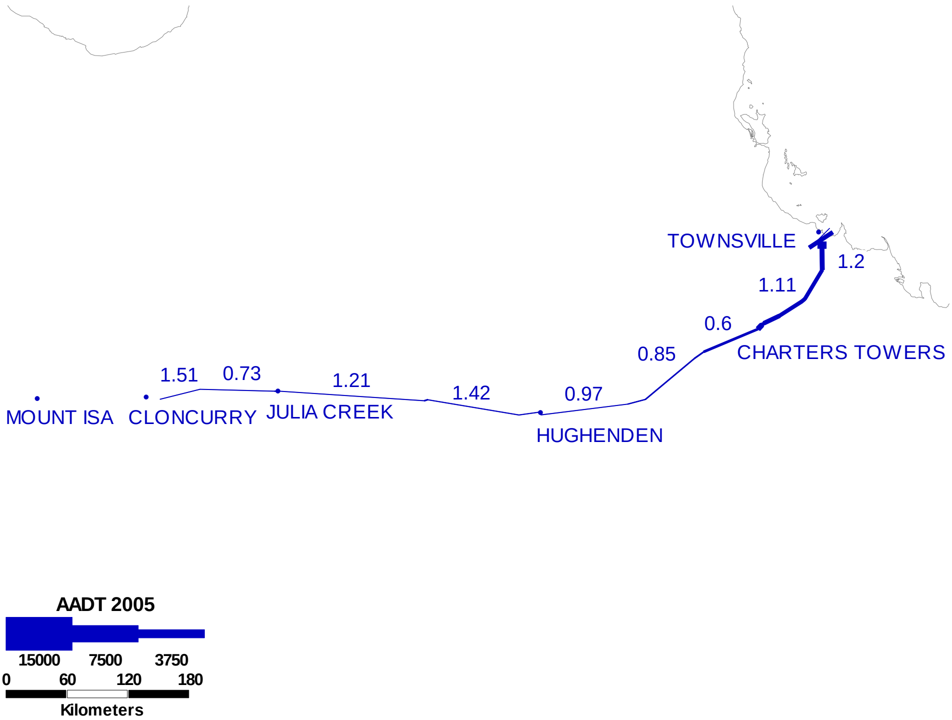
Table 3.23 lists the base year 2005 and projected 2030 traffic levels and Figure 3.26 illustrates base year traffic and projected traffic growth for the Townsville–Mt Isa corridor. Total traffic along the Townsville–Mt Isa corridor, comprising the Flinders and part of the Barkly Highways, is projected to grow by 1.1 per cent per annum between 2005 and 2030, albeit from a low base. Traffic levels west of Charters Towers are between 200 and 600 vehicles per day and are projected to not exceed 700 vehicles per day by 2030. Light vehicle traffic is projected to grow by 1.2 per cent per annum across the corridor. Heavy vehicle traffic is projected to grow by approximately 0.7 per cent per annum across the corridor, with stronger heavy vehicle traffic growth projected on those sections west of Charters Towers. The projections imply strong growth in zinc, lead and silver production from the Mt Isa region. Again, the projected heavy vehicle traffic growth includes the impact of the assumed annual improvement in heavy vehicle productivity. The Mt Isa–Townsville Corridor Strategy (DOTARS, QDMR, QT, QR, QCG, and QDNRM 2007) projected an increase in the overall freight task of between 2 and 4 per cent per annum for this corridor, but does not appear to provide separate estimates for road freight.

Figure 3.25 Brisbane–Cairns corridor: base year traffic levels and projected traffic growth between 2005 and 2030



Note: Figures denote average annual traffic growth, between 2005 and 2030, for separate road sections.
Source: BITRE estimates.

Figure 3.26 Townsville–Mt Isa corridor: base year traffic levels and projected traffic growth between 2005 and 2030



Note: Figures denote average annual traffic growth, between 2005 and 2030, for separate road sections.
Source: BITRE estimates.

Table 3.22 Brisbane–Cairns corridor: base year and projected traffic levels, 2005 and 2030

Section	Length (km)	Average traffic levels (vehicles per day): Light vehicles 2005	Light vehicles 2030	Heavy vehicles 2005	Heavy vehicles 2030	All vehicles 2005	All vehicles 2030	Average annual traffic growth (per cent per annum): Light vehicles	Heavy vehicles	All vehicles
Brisbane–Gympie	146.3	31 803	66 223	2 934	3 736	34 737	69 959	2.98	0.97	2.84
Gympie–Gladstone turnoff	343.5	3 968	6 796	1 007	1 217	4 975	8 013	2.18	0.76	1.93
Gladstone turnoff–Rockhampton	121.0	3 643	5 274	975	1 190	4 618	6 464	1.49	0.80	1.35
Rockhampton–Mackay	333.9	3 173	4 561	763	953	3 936	5 514	1.46	0.89	1.36
Mackay–Bowen	187.2	3 441	5 638	722	902	4 162	6 539	1.99	0.90	1.82
Bowen–Townsville	194.3	3 683	5 325	603	745	4 286	6 070	1.49	0.85	1.40
Townsville–Cairns	349.0	5 417	8 723	1 018	1 234	6 435	9 957	1.92	0.77	1.76
Total	1 675.2	6 427	11 531	1 048	1 296	7 474	12 828	2.37	0.85	2.18

Source: BITRE estimates.

Table 3.23 Townsville–Mt Isa corridor: base year and projected traffic levels, 2005 and 2030

Section	Length (km)	Average traffic levels (vehicles per day): Light vehicles 2005	Light vehicles 2030	Heavy vehicles 2005	Heavy vehicles 2030	All vehicles 2005	All vehicles 2030	Average annual traffic growth (per cent per annum): Light vehicles	Heavy vehicles	All vehicles
Townsville–Charters Towers	123.9	1 888	2 682	330	335	2 218	3 017	1.41	0.05	1.24
Charters Towers–Hughenden	251.3	423	509	138	165	561	675	0.74	0.73	0.74
Hughenden–Landsborough Highway	387.3	206	278	75	102	281	380	1.20	1.23	1.21
Total	762.5	551	745	137	161	688	905	1.21	0.65	1.10

Source: BITRE estimates.

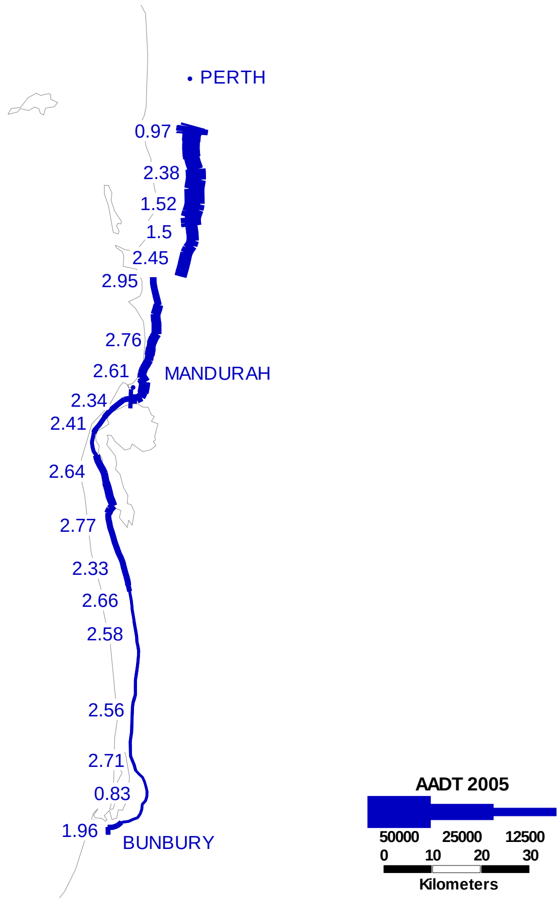
Perth–Bunbury corridor

Table 3.24 lists the base year 2005 and projected 2030 traffic levels and Figure 3.27 illustrates base year traffic and projected traffic growth for the Perth–Bunbury corridor, which follows the Old Coast Road between Perth and Bunbury. Total traffic is projected to grow by approximately 2.2 per cent per annum between 2005 and 2030. Light vehicle traffic is projected to grow by approximately 2.3 per cent per annum between 2005 and 2030, influenced by strong projected population growth south of Perth. Heavy vehicle traffic is projected to grow by approximately 0.7 per cent per annum, reflecting stronger growth, of 1.0 per cent per annum, on the section between Perth and Mandurah but relatively slower growth, 0.1 per cent per annum, south of Mandurah. The Perth–Bunbury Corridor Strategy (DOTARS, DPI (WA), and MRWA 2007) does not provide comparable traffic projections.

Perth–Port Hedland corridor

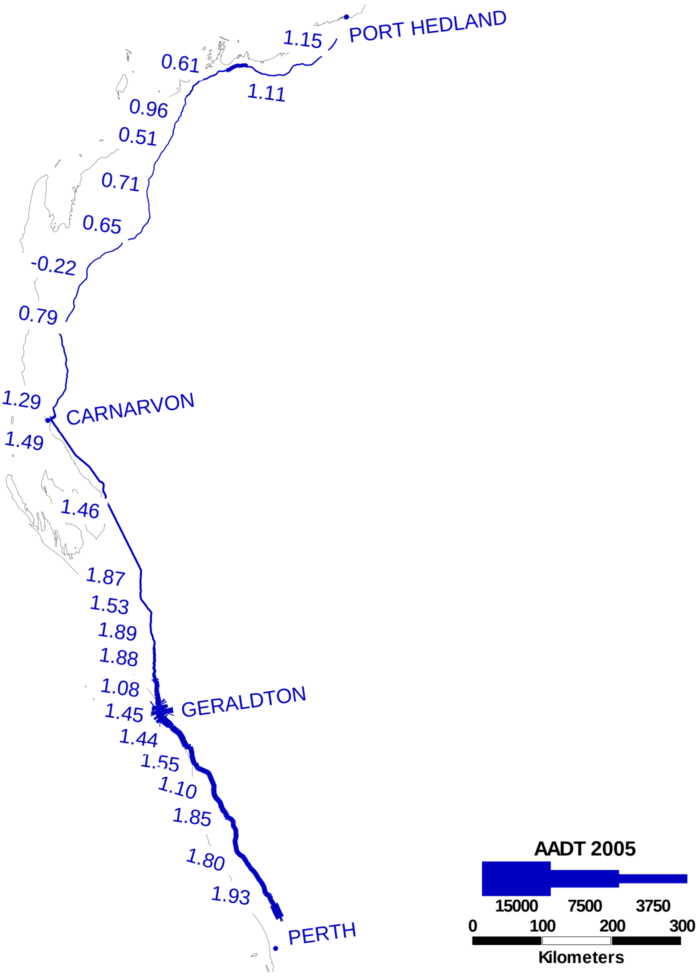
Table 3.25 lists the base year 2005 and projected 2030 traffic levels and Figure 3.28 illustrates base year traffic and projected traffic growth for the Perth–Port Hedland corridor. The Perth–Port Hedland road corridor consists of the Brand Highway to Geraldton and the North West Coastal Highway between Geraldton and Port Hedland. It is not formally part of the NLTN, but is included here because it is a significant alternative to the Great Northern Highway. Total traffic is projected to grow by approximately 1.3 per cent per annum between 2005 and 2030. Light vehicle traffic is projected to grow by approximately 1.7 per cent per annum, with relatively strong growth on the Perth–Geraldton and between the connectors to Monkey Mia and Exmouth. Heavy vehicle traffic is projected to decline by approximately 0.5 per cent per annum, but this is the result of two effects, growth in road freight volumes of approximately 1.5 per cent per annum and improvements in heavy vehicle productivity. The relatively strong decline in heavy vehicle traffic projected for the sections between Karratha and the Great Northern Highway is due, in part, to the projected depletion of resources at Whim Creek copper mine, which lies between Karratha and Port Hedland.

Figure 3.27 Perth–Bunbury corridor: base year traffic levels and projected traffic growth between 2005 and 2030



Note: Figures denote average annual traffic growth, between 2005 and 2030, for separate road sections.
Source: BITRE estimates.

Figure 3.28 Perth–Pt Hedland corridor: base year traffic levels and projected traffic growth between 2005 and 2030



Note: Figures denote average annual traffic growth, between 2005 and 2030, for separate road sections.
Source: BITRE estimates.

Table 3.24 Perth–Bunbury corridor: base year and projected traffic levels, 2005 and 2030

		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)*	*2005*	*2030*	*2005*	*2030*	*2005*	*2030*			
Perth–Mandurah	54.8	34 215	59 419	2 767	3 569	36 982	62 988	2.23	1.02	2.15
Mandurah–Bunbury	105.5	9 095	16 979	1 113	1 146	10 208	18 126	2.53	0.12	2.32
Total	160.3	17 678	31 480	1 678	1 974	19 356	33 454	2.33	0.65	2.21

Source: BITRE estimates.

Table 3.25 Perth–Pt Hedland corridor: base year and projected traffic levels, 2005 and 2030

		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)*	*2005*	*2030*	*2005*	*2030*	*2005*	*2030*			
Perth–Geraldton	367.6	1 809	2 961	436	403	2 245	3 363	1.99	–0.32	1.63
Geraldton–Overland Roadhouse	280.7	1 223	1 654	314	242	1 537	1 895	1.21	–1.04	0.84
Overland Roadhouse–Carnarvon	193.7	400	642	233	270	633	912	1.91	0.58	1.47
Carnarvon–Minilya Exmouth Road	142.2	272	437	175	168	447	606	1.91	–0.16	1.22
Minilya Exmouth Road–Karratha Road	487.7	187	271	96	68	283	339	1.49	–1.35	0.73
Karratha Road–Great Northern Highway	190.5	465	655	91	56	556	711	1.38	–1.89	0.99
Total	1 662.4	785	1 201	230	202	1 015	1 403	1.72	–0.52	1.30

Source: BITRE estimates.

Hobart–Burnie corridor

Table 3.26 lists the base year 2005 and projected 2030 traffic levels and Figure 3.29 illustrates base year traffic and projected traffic growth for the Hobart–Burnie corridor. Total traffic is projected to grow by approximately 0.6 per cent per annum between 2005 and 2030. Light vehicle traffic is projected to grow by 0.6 per cent per annum, with proportionately stronger growth in traffic projected for the Hobart–Launceston section. Heavy vehicle traffic, however, is projected to more or less remain at current levels by 2030. The total road freight task is projected to grow by approximately 1.7 per cent per annum between 2005 and 2030.

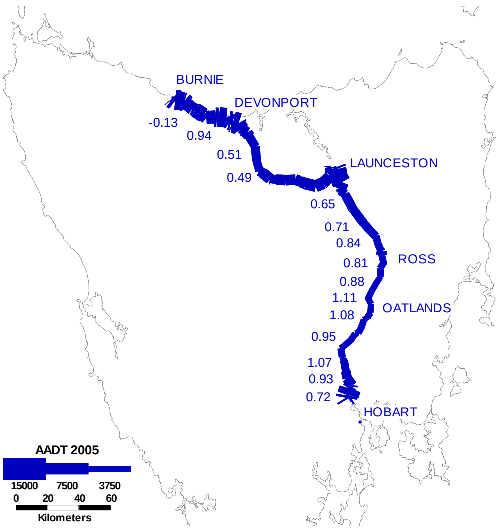
The Tasmanian Corridor Strategy (DOTARS and DIER 2007) projected that total road freight on the NLTN corridors would grow by approximately 70 per cent between 2005 and 2030—equivalent to average annual freight growth of 2.1 per cent per annum, slightly higher than these projections. The different rate of growth in traffic reflects differences in the underlying assumptions. In particular, in contrast to this study, the corridor strategy (DOTARS and DIER 2007) assumed no change in the average heavy vehicle productivity. Additionally, as far as practicable, the commodity-based production assumptions underpinning these projections were matched to those used in the strategy, however, some differences remain—in particular the corridor strategy implies stronger growth in non-bulk and other non-measured road freight in comparison with these projections. The residual difference between the revised heavy vehicle traffic projections and comparable projections from the Tasmanian Corridor Strategy are approximately 0.5 per cent per annum—equal to the assumed rate of heavy vehicle productivity growth.

The Tasmanian Corridor Strategy (DOTARS and DIER 2007) projected that passenger traffic would grow by between 31 and 36 per cent, in total, between 2005 and 2030 across most non-urban sections. This implies growth of 1.2 per cent per annum between 2005 and 2030, slightly faster than the rate of light vehicle traffic growth projected here—0.6 per cent per annum (Table 3.23). The reasons for this difference also appear to due to different input assumptions:

1. The Tasmanian corridor strategy used projected regional population growth for only the three largest urban regions—Greater Hobart, Greater Launceston and Devonport-Burnie, two of which also happen to be the fastest growing regions in Tasmania—applied to total traffic on the corridor. In contrast, the BITRE methodology applies projected population growth for every Tasmanian region, including slower growing (declining) rural regions, to the relevant traffic flows.
2. Maunsell | AECOM (2006) also includes an explicit 'doughnut effect' multiplier applied to light vehicle traffic growth on urban and semi-urban segments—equal to 1.5. The effect of this is to increase the projected traffic growth on urban and semi-urban segments, and, because of the volume of traffic on these segments, increase the corridor average pro-

jected traffic growth. The BITRE projections, by contrast, do not include any multiplier effect for light vehicle traffic growth in urban or semi-urban areas.

Figure 3.29 Hobart – Burnie–Devonport corridor: base year traffic levels and projected traffic growth between 2005 and 2030



Note: Figures denote average annual traffic growth, between 2005 and 2030, for separate road sections.
Source: BITRE estimates.

Table 3.26 Hobart – Burnie–Devonport corridor: base year and projected traffic levels, 2005 and 2030

		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)*	*2005*	*2030*	*2005*	*2030*	*2005*	*2030*			
Hobart–Launceston	178.3	5 603	7 017	717	727	6 320	7 744	0.90	0.06	0.82
Launceston–Burnie	141.5	8 083	8 884	1 003	1 004	9 086	9 889	0.38	0.00	0.34
Total	319.8	6 700	7 843	843	850	7 544	8 693	0.63	0.03	0.57

Source: BITRE estimates.

Table 3.27 Launceston–Bell Bay corridor: base year and projected traffic levels, 2005 and 2030

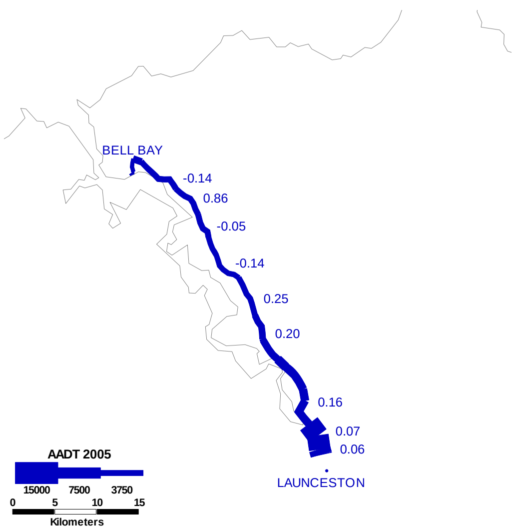
		Average traffic levels (vehicles per day)						*Average annual traffic growth (per cent per annum)*		
	Length	*Light vehicles*		*Heavy vehicles*		*All vehicles*		*Light vehicles*	*Heavy vehicles*	*All vehicles*
Section	*(km)*	*2005*	*2030*	*2005*	*2030*	*2005*	*2030*			
Launceston–Bell Bay	45.23	5 202	6 768	696	909	5 898	7 677	1.06	1.07	1.06

Source: BITRE estimates.

Launceston–Bell Bay corridor

Table 3.27 lists the base year and projected traffic levels in 2030 and Figure 3.30 illustrates base year traffic and projected traffic growth on the Launceston–Bell Bay corridor. Total traffic is projected to grow by 1.1 per cent per annum between 2005 and 2030. Both light and heavy vehicle traffic are projected to grow by 1.1 per cent per annum. The projected growth in light vehicle is due principally to the additional local traffic expected to be generated by the development of the proposed Pulp Mill, between Launceston and George Town. In the absence of the Pulp Mill, light vehicle traffic growth would remain essentially unchanged over the projection period. Heavy vehicle traffic growth includes the impact of increased average vehicle loads. By way of comparison, the Tasmanian Corridor Strategy (DOTARS and DIER 2007) projected that light vehicle traffic on this corridor would grow by 40 per cent between 2005 and 2030, or 1.3 per cent per annum, and freight vehicle traffic volumes by 62 per cent, or 1.95 per cent per annum.

Figure 3.30 Launceston–Bell Bay corridor: base year traffic levels and projected traffic growth between 2005 and 2030



Note: Figures denote average annual traffic growth, between 2005 and 2030, for separate road sections.
Source: BITRE estimates.

3.3 Comparison with state-sourced population projection based traffic projections

Traffic projections were also produced using the latest available state-sourced regional population projections in place of the ABS (2006) population projections. Appendix H provides a summary of the state-sourced population based traffic projections, in a similar format to that adopted in this chapter. This section provides a brief comparison of the two sets of traffic projections, at the corridor level.

Chapter 2 provided a brief discussion of the differences between the ABS (2006) and state-sourced population projections. In brief, the state-sourced projections imply only slightly faster growth between 2004 and 2030—1.08 per cent per annum rather than 0.94 per cent per annum. At the state-level, the two sets of population projections imply relatively similar population growth for New South Wales and Victoria, and slightly faster population growth in each of Queensland, South Australia and Western Australia.

The South Australian population projections imply significantly stronger population growth (or less rapid decline) across all but remote areas. Population growth is projected to be significantly faster for Adelaide. The Western Australian population projections imply faster population growth in coastal, inland and remote regions in that state. The Queensland projections imply faster population growth in coastal and remote areas.

The impact of these alternate assumptions in the OZPASS and FreightSim models should produce stronger passenger travel and freight movement estimates. Table 3.28 provides a comparison of the projected light, heavy and total vehicle traffic growth derived from these two sets of population projections.

In brief, for most corridors, projected light and heavy vehicle traffic growth is slightly higher, but not significantly so, when OZPASS and FreightSim were run using the state-sourced population projections. Corridors where there are significant differences between the two sets of projections include:

- Sydney–Melbourne: Heavy vehicle traffic is projected to grow slightly faster (2.4 per cent per annum) under the state-sourced population projections
- Sydney–Adelaide: Light vehicle traffic is projected to grow slightly faster across much of the corridor (1.3 per cent per annum) under the state-sourced population projections and significantly more strongly on the section between Adelaide and Truro (1.7 per cent per annum).
- Brisbane–Darwin: Stronger projected population growth in Brisbane and surrounds produces much higher projected passenger travel growth for the section between Ipswich and Toowoomba.
- Adelaide–Perth: Road freight vehicle traffic is projected to grow more

Table 3.28 Comparison of projected traffic growth, ABS (2006)-based and state-based population projections, by NLTN non-urban corridor

(per cent per annum)

Corridor	ABS (2006) population based traffic projections			State-sourced population based traffic projections		
	Light vehicles	Heavy vehicles	All vehicles	Light vehicles	Heavy vehicles	All vehicles
Interstate corridors						
Sydney–Melbourne	1.6	0.6	1.4	1.7	0.6	1.4
Sydney–Brisbane (via New England Hwy)	1.5	0.5	1.4	1.5	0.5	1.4
Sydney–Brisbane (via Pacific Hwy)	2.3	1.4	2.1	2.3	1.4	2.1
Sydney–Adelaide	0.8	0.4	0.7	1.4	0.3	1.2
Canberra connectors	2.0	0.4	1.9	2.0	0.4	1.8
Melbourne–Brisbane	1.1	0.2	0.9	1.2	0.4	1.0
Melbourne–Adelaide	2.1	0.8	1.8	2.0	0.8	1.8
Brisbane–Darwin	1.5	0.7	1.4	2.4	0.7	2.2
Adelaide–Perth	1.0	–0.1	0.8	1.7	0.0	1.3
Adelaide–Darwin	2.1	0.5	1.9	2.1	0.6	1.9
Perth–Darwin (via Great Northern Hwy)	2.0	0.9	1.7	2.2	1.0	1.9
Intrastate corridors						
Sydney–Wollongong	1.2	0.4	1.2	1.2	0.4	1.2
Sydney–Dubbo	1.1	0.1	1.0	1.1	0.0	1.0
Melbourne–Sale	2.3	0.7	2.2	2.3	0.8	2.2
Melbourne–Geelong	2.7	0.8	2.5	2.2	0.8	2.1
Melbourne–Mildura	1.3	0.5	1.2	1.4	0.5	1.3
Brisbane–Cairns	2.4	0.9	2.2	2.5	0.9	2.3
Townsville–Mt Isa	1.2	0.6	1.1	1.2	0.9	1.1
Perth–Bunbury	2.3	0.7	2.2	2.5	0.6	2.4
Perth–Port Hedland	1.7	–0.5	1.3	2.0	–0.4	1.5
Hobart–Burnie	0.6	0.0	0.6	0.6	0.0	0.6
Launceston–Bell Bay	1.1	1.1	1.1	0.0	1.1	0.1

Note: The Brand and North West Coastal Highways are not part of the NLTN.
Source: BITRE estimates.

strongly across the corridor under the state-sourced population projections, while light vehicle traffic growth is projected to grow more strongly on the sections around Adelaide and Perth, but not on the more remote sections.

- Adelaide–Darwin: On this corridor light vehicle traffic is projected to grow slightly faster on the Port Augusta–Pimba section under the state-sourced population projections, but less quickly on the more remote South Australian road sections. Overall, projected light and heavy vehicle traffic growth are little different under the two sets of population projections.
- Melbourne–Geelong: On this corridor, total light vehicle traffic growth is projected to be lower under the state-sourced population projections.

In overall terms, the projected traffic growth derived using the different population projections is little different, with variation more significant at the regional level, where differences in the ABS (2006) and state-sourced population

Table 3.29 Comparison of projected traffic growth with BTRE (2006*a*) projections, by state and territory

(per cent per annum)

Corridor	*ABS (2006) population based traffic projections 2005–2030*			*BTRE (2006a) traffic projections 1999–2025*		
	Light vehicles	*Heavy vehicles*	*All vehicles*	*Light vehicles*	*Heavy vehicles*	*All vehicles*
Interstate corridors						
New South Wales	1.46	0.50	1.32	1.72	2.49	1.89
Victoria	2.10	0.42	1.84	2.14	2.30	2.17
Queensland	2.36	0.82	2.09	2.71	3.18	2.78
South Australia	1.01	0.20	0.87	1.42	1.40	1.42
Western Australia	1.91	0.06	1.61	2.46	2.18	2.43
Tasmania	0.57	−0.10	0.50	0.54	1.69	0.78
Northern Territory	2.21	0.84	2.03	3.00	1.31	2.68
Australian Capital Territory	1.83	0.47	1.66	1.17	3.06	1.30
Australia	1.74	0.50	1.55	2.08	2.45	2.14

Note: The Brand and North West Coastal Highways are not part of the NLTN.
Sources: BTRE (2006*a*, Table 3.1, p. 54) and BITRE estimates.

projections are more significant. (Again, Appendix H presents more detailed traffic projections based on the state-sourced population projections.)

3.4 Comparison with BTRE (2006*a*) traffic projections

Table 3.29 presents the projected growth rates in total light (passenger) and heavy vehicle traffic on NLTN non-urban corridors, by state and territory, derived for this report (for the period 2005 to 2030) and the equivalent BTRE (2006*a*) projections, which covered the period 1999 to 2025. Across all states and territories, except for the Australian Capital Territory, projected light vehicle traffic growth, between 2005 and 2030, is generally less than the projected growth over the period 1999 to 2025. Heavy vehicle traffic growth between 2005 and 2030 is projected to be much less than that projected in BTRE (2006*a*), due to the incorporation of increasing future heavy vehicle productivity. (BTRE (2006*a*) implicitly assumed no change in average heavy vehicle productivity between 2000 and 2025.) In terms of the growth in total road freight carried on these corridors, these projections are generally similar to those of BTRE (2006*a*), albeit slightly higher for South Australia and Northern Territory, and slightly lower for Queensland and Western Australia.

Table 3.30 provides a comparison of projected light and heavy vehicle traffic growth by NLTN non-urban corridor (2005 to 2030) with the equivalent BTRE (2006*a*) projections (1999–2025). For most corridors, these updated projections imply either similar or slightly slower growth in total light vehicle traffic, between 2005 and 2030 relative to BTRE (2006*a*) projections—the major exceptions being the Melbourne–Brisbane, Melbourne–Sale, Melbourne–Geelong and Hobart–Burnie corridors, where average light vehicle traffic growth is projected to be higher than in BTRE (2006*a*).

The reason for the slightly lower passenger travel projections are due to the re-estimated parameter controlling the impact of changes in earnings/GDP on the propensity to travel. In the version of OZPASS used in BTRE (2006*a*), the income variable: real average weekly earnings, was assumed to grow by 1.4 per cent per annum between 1999 and 2025, and the average weekly earnings parameter value was 1.25. For the current projections, the income variable is GDP per capita, which is also projected to grow by approximately 1.4 per cent per annum between 2005 and 2030. However, the revised income parameter is effectively 1.05 for interregional trips. All else equal, the effect of this change would be to reduce projected growth in total trips and, consequently, car passenger trips. Complicating the story are differences between the projected regional population growth used for these projections and those used in BTRE (2006*a*). BITRE has not analysed the impact of any differences in projected regional population growth.

For heavy vehicles, these projections imply much slower growth in total heavy numbers than implied by BTRE (2006*a*) for each non-urban NLTN corridor, due the assumed improvement in future heavy vehicle productivity. A more meaningful comparison is with the projected growth in total road freight (reflected by growth in total heavy vehicle numbers in the absence of any increase in heavy vehicle productivity, see Tables H.27 and H.28) and BTRE (2006*a*) heavy vehicle traffic projections. On that basis, these projections imply stronger growth in road freight on all interstate corridors except the Sydney–Brisbane corridors and Canberra connectors. Conversely, these projections imply slightly slower growth in total road freight on most intrastate corridors, the exception is the Townsville–Mt Isa corridor, for which these projections imply stronger average annual growth in road freight traffic, between 2005 and 2030, than the BTRE (2006*a*) projections.

The differences in projected annual growth in road freight activity across the NLTN non-urban corridors, between this study and BTRE (2006*a*), will reflect the aggregation of a significant number of changes in projected regional commodity production growth as well as changes in regional population growth.

3.5 Cautionary notes

The OZPASS and FreightSim models are designed to provide projections of Australia-wide growth in long-distance passenger travel and freight movements. The relative strength of the models is projecting long-term trend growth in long-distance interregional freight movements between major population centres. However, the simple structure of the models and the accuracy and degree of aggregation inherent in the input data, particularly

Table 3.30 Comparison of projected traffic growth with BTRE (2006*a*) projections, by NLTN non-urban corridor

(per cent per annum)

Corridor	ABS (2006) population based traffic projections 2005–2030			BTRE (2006a) traffic projections 1999–2025		
	Light vehicles	Heavy vehicles	All vehicles	Light vehicles	Heavy vehicles	All vehicles
Interstate corridors						
Sydney–Melbourne	1.6	0.6	1.4	1.6	2.4	1.8
Sydney–Brisbane (via New England Hwy)	1.5	0.5	1.4	1.6	2.6	1.8
Sydney–Brisbane (via Pacific Hwy)	2.3	1.4	2.1	2.9	3.4	3.0
Sydney–Adelaide	0.8	0.4	0.7	1.0	1.8	1.2
Canberra connectors	2.0	0.4	1.9	2.0	3.0	2.1
Melbourne–Brisbane	1.1	0.2	0.9	0.3	2.0	0.9
Melbourne–Adelaide	2.1	0.8	1.8	2.5	1.9	2.4
Brisbane–Darwin	1.5	0.7	1.4	1.6	1.9	1.6
Adelaide–Perth	1.0	−0.1	0.8	1.6	1.4	1.6
Adelaide–Darwin	2.1	0.5	1.9	2.8	1.0	2.5
Perth–Darwin (via Great Northern Hwy)	2.0	0.9	1.7	2.7	1.6	2.5
Intrastate corridors						
Sydney–Wollongong	1.2	0.4	1.2	1.7	2.7	2.0
Sydney–Dubbo	1.1	0.1	1.0	2.0	2.6	2.1
Melbourne–Sale	2.3	0.7	2.2	2.0	2.7	2.1
Melbourne–Geelong	2.7	0.8	2.5	2.3	2.6	2.3
Melbourne–Mildura	1.3	0.5	1.2	2.0	2.2	2.0
Brisbane–Cairns	2.4	0.9	2.2	2.8	3.4	2.9
Townsville–Mt Isa	1.2	0.6	1.1	1.5	1.2	1.5
Perth–Bunbury	2.3	0.7	2.2	3.0	3.5	3.0
Perth–Port Hedland	1.7	−0.5	1.3	na	na	na
Hobart–Devonport	0.6	0.0	0.6	0.5	1.7	0.8
Launceston–Bell Bay	1.1	1.1	1.1	na	na	na

na not available.
Note: The Brand and North West Coastal Highways are not part of the NLTN.
Sources: BTRE (2006*a*, Table 3.2, p. 55) and BITRE estimates.

the FreightInfo freight movement data, mean the projections will necessarily abstract from some of the small-area, local-level influences that may affect growth in traffic. For the current projections, BITRE has attempted to augment the future regional production trends by including those significant new commodity production developments in the model input data. However, there are likely to be many smaller local developments that could not be explicitly included, such as new mines, processing centres or regional warehouse/distribution centres, that may affect local traffic flows. In these cases, it may be appropriate to augment or substitute these projections with more detailed local-level information, where it is available.

Similarly, the NLTN non-urban corridors include road sections within either urban or peri-urban areas where regular commuting type trips are likely to be a large share of total traffic flows. The OZPASS and FreightSim models are not designed to model all the complexities of urban traffic flows, and simply project the growth in local traffic using overall population and economic growth. In some cases, there might be local developments or road network changes that may have a significant effect on total traffic flows along particular highway sections. In these cases, the OZPASS and FreightSim long-distance traffic projections and the local traffic projections should be augmented by information from local area road network models.

3.6 Summary

The OZPASS and FreightSim models provide projections of total interregional OD passenger travel, in terms of passenger numbers, and freight movements, in terms of tonnages. In the BITRE projections method, the OZPASS and FreightSim outputs are converted to equivalent vehicle movements and assigned to the road network in order to project growth in traffic across the NLTN non-urban corridors.

The average vehicle occupancy for long-distance passenger car trips is 2.7 persons per vehicle, including children under 15 years of age. This estimate is based on the average travel party size for overnight trips recorded in the 2004 NVS. For freight movements, BITRE used a revised version of FDF Pty Ltd's FreightTrucks model to convert interregional freight tonnages into equivalent heavy vehicle movements.

BITRE's traffic projection method splits traffic into four components—interregional and local traffic for each of passenger and freight vehicle traffic—and projects growth separately for each component. Local light and heavy vehicle traffic are the difference between measured total light and heavy vehicle movements and assigned interregional (through) passenger and freight vehicle movements.

The traffic projections presented in this chapter imply growth in total traffic across the NLTN non-urban corridors of 1.6 per cent per annum between 2005 and 2030. Growth in light vehicle traffic is projected to be 1.7 per cent per annum, higher than growth in heavy vehicle traffic, projected to grow by 0.5 per cent per annum.

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 relatively strong growth in light vehicle traffic, albeit from a very

low base, as a result of projected population growth around these urban areas and also foreign tourist growth.

OZPASS and FreightSim necessarily abstract from local-level detail, especially in and around urban areas. Local-level information, where it is available, may be used to augment the OZPASS and FreightSim long-distance traffic projections to derive better estimates of local traffic growth.

Chapter 4 Concluding remarks

This report presents updated long-term light and heavy vehicle traffic projections for NLTN non-urban corridors, derived using BITRE's OZPASS and FreightSim models. The projections build from base year (circa 2005) measured light and heavy vehicle traffic volumes—supplied by state and territory road authorities—and the more recent projections of future regional population growth and economic activity. These projections update the projections presented in BTRE (2006*a*).

The main differences between the projections presented here and BTRE (2006*a*) projections are:

- different projection horizon—2005 to 2030—compared to 1999 to 2025 in BTRE (2006*a*)
- updated, and slightly stronger, projected future population growth
- updated, and slightly stronger, projected future national average GDP growth—based on the Intergenerational Report 2007 (Treasury 2007*a*)
- incorporation of more up-to-date medium to long-term projections of future Australian production of major commodities
- assumed annual improvements in heavy road freight vehicle productivity—that is, these projections assume increase average heavy vehicle size and loads.

Inclusion of the updated information and assumptions results in:

- slightly higher projected growth in total long-distance interregional passenger trips—with average annual growth of 2.8 per cent per annum between 2005 and 2030, compared to BTRE (2006*a*) projected growth of 2.6 per cent per annum, between 1999 and 2025
- slightly higher projected growth in rural local light vehicle travel—with average annual growth of 1.0 per cent per annum between 2005 and 2030, compared to BTRE (2006*a*) projected growth of 0.9 per cent per annum, between 1999 and 2025
- higher projected growth in total interregional rail and coastal shipping freight movements, but lower projected growth in total interregional road and air freight movements.

The rest of this chapter provides some final remarks about some of the limitations of the existing OZPASS and FreightSim models and data currency issues. Some of the issues covered here are unchanged from BTRE (2006*a*).

4.1 OZPASS and FreightSim: modelling issues

OZPASS and FreightSim are designed to project long-term trend growth in interregional passenger travel and freight movements, for all major transport modes, across Australia. The models were specifically designed for use in projecting future light and heavy vehicle traffic growth across non-urban highways.

The relative strength of OZPASS and FreightSim is that they provide a consistent, national approach to projecting interregional passenger travel and freight movements across Australia, using the best available data on OD passenger and freight flows. However, because of their scope, OZPASS and FreightSim necessarily abstract from some of the small-area, local-level detail that may strongly influence traffic growth on particular corridor sections—especially sections within or on the fringe of urban areas. The discussion in Chapter 3 highlighted those corridor sections where local level information could be used to augment the OZPASS and FreightSim based traffic projections.

Both OZPASS and FreightSim abstract from certain factors that influence interregional passenger and freight transport. In particular, neither model explicitly accounts for the impact of changes to the transport network on total travel, mode choice is not explicitly linked to prices or other relevant factors, the impact of an aging population is not explicitly treated in OZPASS and the transport supply chain is not modelled in great detail in FreightSim.

Exogenous mode share assumptions

In both OZPASS and FreightSim, future mode shares are determined exogenously by 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. Endogenising mode choice would be a desirable feature for both the OZPASS and FreightSim models and enhance their applicability to short-term policy analysis.

Heavy vehicle productivity, freight mode/vehicle choice and FreightTrucks

The present version of FreightTrucks does not explicitly allow for changes in vehicle type mix and average vehicle loads over time. Previous BITRE non-urban corridor projections assumed no change in vehicle mix and average loads over the projection horizon (BTRE 2006*a*). For these projections, BITRE assumed that the average load carried by heavy vehicles would increased by 2 per cent per annum for interregional freight and 1 per cent per annum for intra-regional freight, between 2005 and 2030. These assumptions have had to be imposed outside the FreightTrucks model. Allowing for explicit changes in the heavy vehicle type mix and average vehicle loads in FreightTrucks, potentially linked to the relative cost of moving different commodities by different vehicle types would be a desirable feature.

Travel propensity of an aging population

Presently, OZPASS does not allow for different travel propensities by households at different stages of the life cycle. With significant ageing of the Australian population projected over the next 20–30 years, explicitly incorporating differences in age-specific travel propensities and trip type would improve the reliability of the projections.

FreightSim and national freight models

Austroads (2007) noted there are significant overseas efforts to develop national freight models which include details of the economic factors, logistics chain and alternative transport modes involved in the transport of freight within national boundaries. FreightSim is currently the only national-level freight modelling tool currently developed for Australia. However, it has a relatively simple mechanism for modelling national freight flows and is not well-suited to short-term policy analysis. For these projections, BITRE made considerable efforts to update future commodity production trends, supplied as exogenous inputs to the model.

In order to transform FreightSim into a national freight model, it would be necessary to model in more detail the regional commodity supply and demands by industry sector. Endogenising mode choice and linking to transport costs would also be a necessary feature of a national freight model. Austroads (2007) suggests the Melbourne Freight Movements Model (FMM), (IMIS 2006) is the most sophisticated urban freight movement model presently available in Australia, incorporating production and distribution supply chains and the factors influencing urban freight movements. The FMM considers only road transport, and does not have to treat freight mode choice.

For any such model, whether it be FreightSim or a more sophisticated national freight model, current and comprehensive freight movement data is an essential input, an issue which affects these and any potential future freight movement projections.

Model calibration and validation

Model calibration and validation is one aspect of this projection methodology where further work is desirable. For these and the previous (BTRE 2006*a*) projections, BITRE has not been to undertake extensive validation and calibration because it does not have access to sufficient road traffic volume data to validate and calibrate the models. Advice from state and territory road authorities suggest that measured road traffic volumes may include sampling error. BITRE is unable to evaluate the impact of sampling error on the projections due to insufficient data. BITRE has previously undertaken some limited validation of the projections, comparing the BTRE (2006*a*) traffic projections for the Bruce Highway with actual traffic growth, between 1996 and 2004. That comparison implies that the models perform reasonably well for that corridor.

4.2 Future projections and freight data

Any future updates of these projections will require updated interregional passenger and freight movement data. TRA's annual NVS and IVS collections, ensure that up-to-date interregional long-distance passenger travel data is generally available. However, there is no equivalent regular and reliable interregional freight data survey in Australia. Of necessity, these projections have had to use FDF Pty Ltd's FreightInfo 1988–99 national database of Australian freight movements, augmented by data from the ABS 2000–01 FMS (ABS 2002) and BITRE's 1998–99 ASF statistics (BTE 2000). This should not affect the projected growth in traffic for different commodities, but it may influence corridor average heavy vehicle traffic growth to the extent that the base year freight movements do not accurately reflect the actual distribution. For any future projections, it would be most desirable to use more current interregional, commodity-level freight movement data.

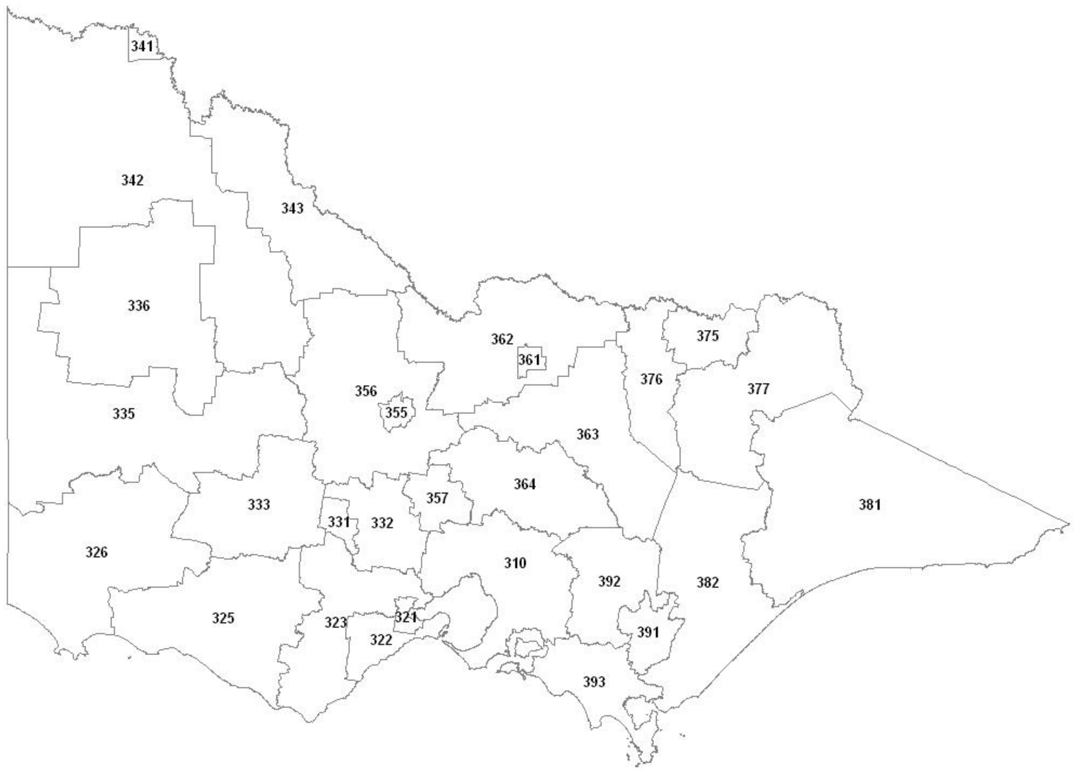
Appendix A FreightInfo 1999 regional classification

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

Figure A.1 FreightInfo 1999 regions, New South Wales

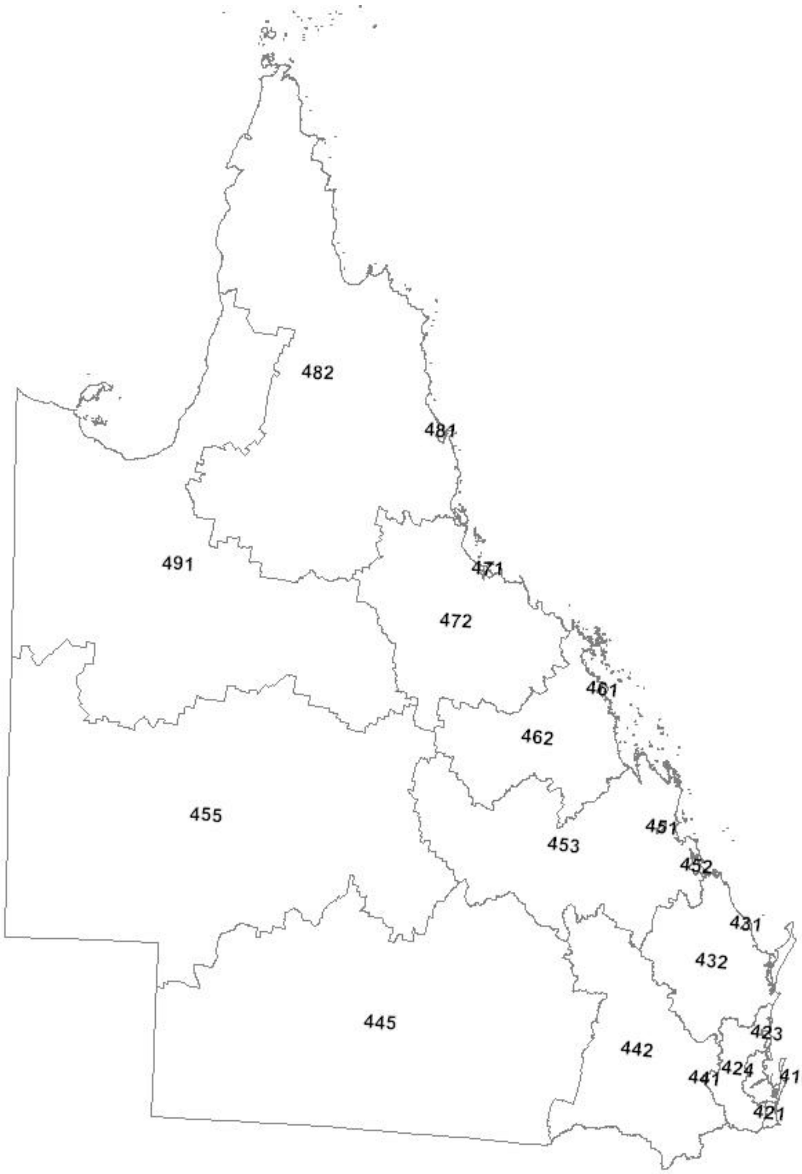
Source: FDF (2001).

Figure A.2 FreightInfo 1999 regions, Victoria



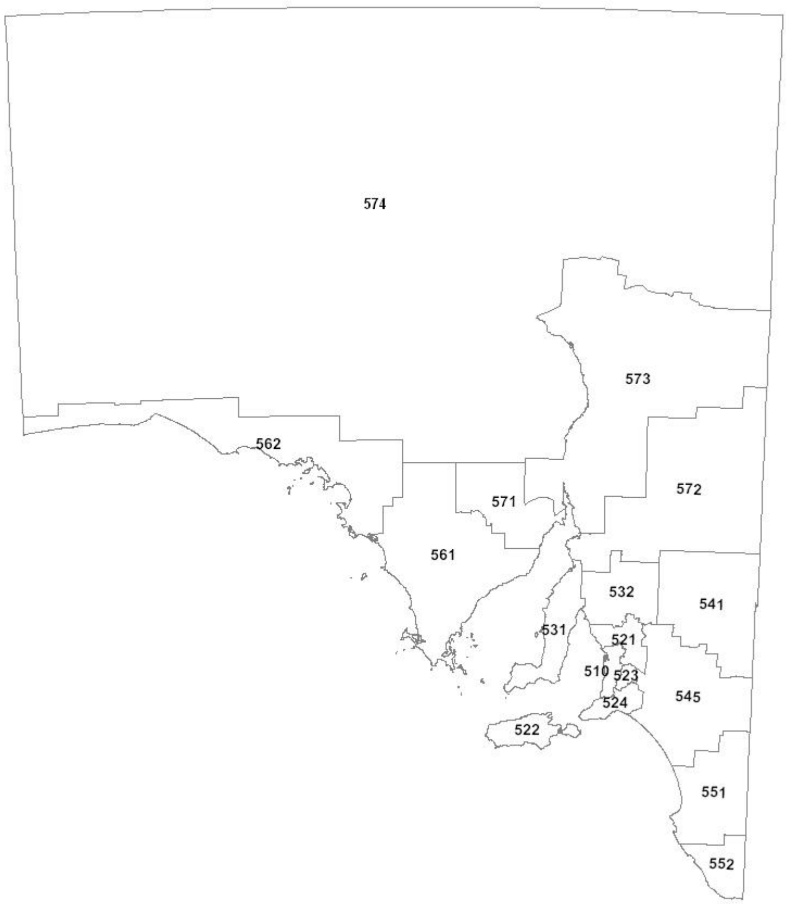
Source: FDF (2001).

Figure A.3 FreightInfo 1999 regions, Queensland



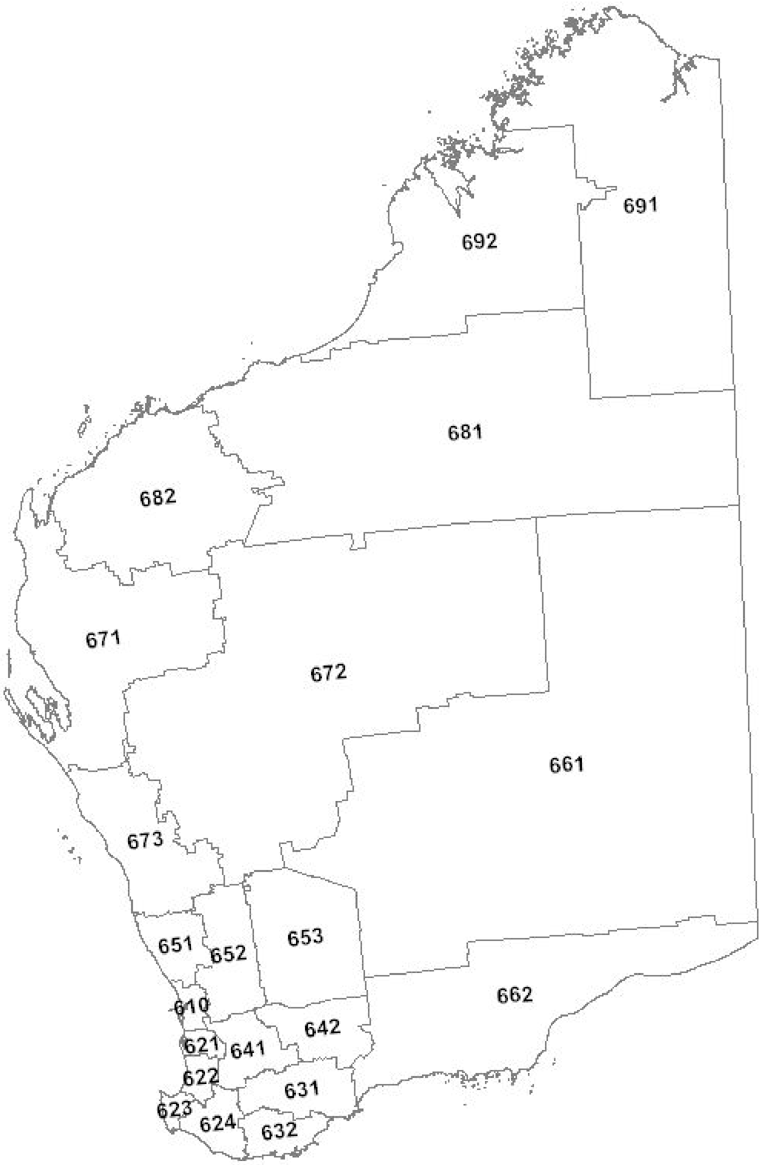
Source: FDF (2001).

Figure A.4 FreightInfo 1999 regions, South Australia



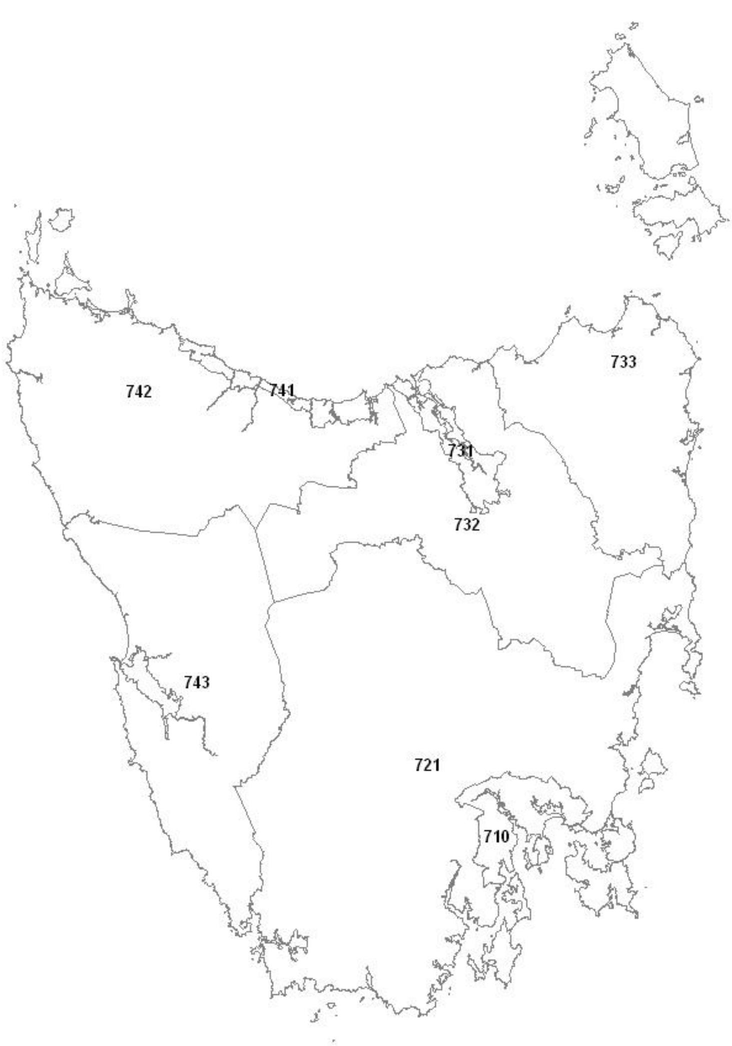
Source: FDF (2001).

Figure A.5 FreightInfo 1999 regions, Western Australia



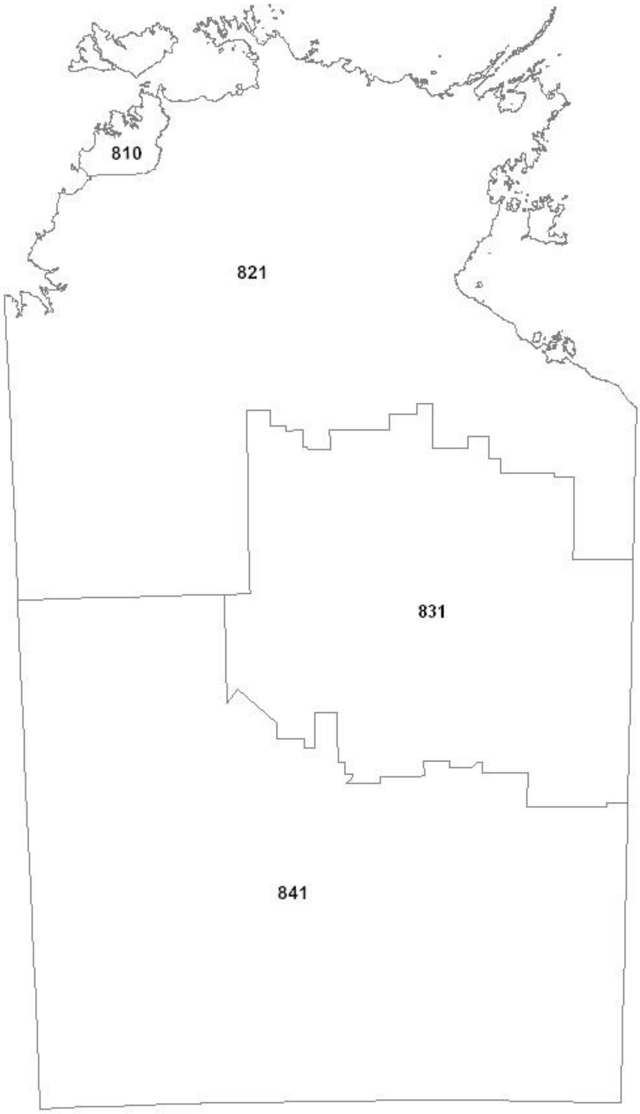
Source: FDF (2001).

Figure A.6 FreightInfo 1999 regions, Tasmania



Source: FDF (2001).

Figure A.7 FreightInfo 1999 regions, Northern Territory



Source: FDF (2001).

Table A.1 FreightInfo 1999 regions

Code	*Region*	*Code*	*Region*
210	Sydney	322	East Barwon
215	Gosford-Wyong	323	West Barwon
221	Newcastle	325	Hopkins
225	Hunter (Balance)	326	Glenelg
231	Wollongong	331	Ballarat
235	Illawarra (Balance)	332	East Central Highlands
241	Tweed Heads	333	West Central Highlands
243	Richmond-Tweed (Balance)	335	South Wimmera
245	Clarence	336	North Wimmera
248	Hastings	341	Mildura
251	Northern Slopes	342	West Mallee
252	Northern Tablelands	343	East Mallee
253	North Central Plain	355	Bendigo
255	Central Macquarie	356	Northern Loddon-Campaspe
256	Macquarie-Barwon	357	South Loddon-Campaspe
257	Upper Darling	361	Shepparton-Mooroopna
261	Bathurst-Orange	362	North Goulburn
262	Central Tablelands	363	South Goulburn
263	Lachlan	364	South West Goulburn
265	Queanbeyan	375	Wodonga
266	Southern Tablelands	376	North Ovens-Murray
267	Lower South Coast	377	East Ovens-Murray
268	Snowy	381	East Gippsland Shire
271	Central Murrumbidgee	382	Wellington-Snowy
272	Lower Murrumbidgee	391	Latrobe Valley
275	Albury	392	West Gippsland
276	Upper Murray	393	South Gippsland
277	Central Murray		
278	Murray-Darling	410	Brisbane
281	Far West	421	Gold Coast City and Albert Shire Part B
295	Lord Howe Island	423	Sunshine Coast
		424	Moreton (Balance)
310	Melbourne	431	Bundaberg
321	Geelong	432	Wide Bay-Burnett (Balance)

Table A.1 FreightInfo 1999 regions (continued)

Code	*Region*	*Code*	*Region*
441	Darling Downs	623	Vasse
442	Darling Downs (Balance)	624	Blackwood
445	South West	631	Pallinup
451	Rockhampton	632	King
452	Gladstone	641	Hotham
453	Fitzroy (Balance)	642	Lakes
455	Central West	651	Moore
461	Mackay	652	Avon
462	Mackay (Balance)	653	Campion
471	Townsville City and Thuringowa City Part A	661	Lefroy
472	Northern (Balance)	662	Johnston
481	Cairns	671	Gascoyne
482	Far North (Balance)	672	Carnegie
491	North West	673	Greenough River
		681	De Grey
510	Adelaide	682	Fortescue
521	Barossa	691	Ord
522	Kangaroo Island	692	Fitzroy
523	Onkaparinga		
524	Fleurieu	710	Hobart
531	Yorke	721	Southern
532	Lower North	731	Greater Launceston
541	Riverland	732	Central North
545	Murray Mallee	733	North Eastern
551	Upper South East	741	Burnie-Devonport
552	Lower South East	742	North Western Rural
561	Lincoln	743	Lyell
562	West Coast		
571	Whyalla	810	Darwin
572	Pirie	821	Northern Territory Balance (Balance)
573	Flinders Ranges	831	Barkly
574	Far North	841	Central NT
610	Perth	110	ACT
621	Dale		
622	Preston	999	Overseas

Source: FDF (2001).

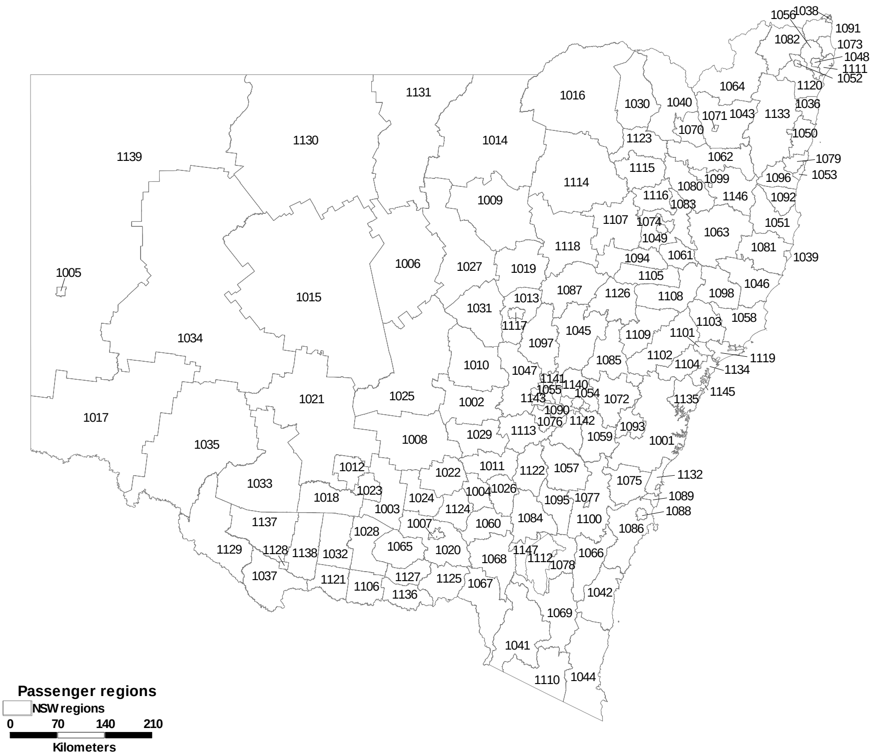
Appendix B NVS/IVS regional classification

The NVS and IVS unit record data includes detailed information about domestic trips down to the SLA level. In order to derive more accurate network traffic flows, BITRE used SLAs as the basis for defining the tourism regions to be used in OZPASS for modelling OD passenger movements. The BITRE-defined tourism regions are based on a mix of Urban Centres and Localities (UCL) and SLAs, based on the following principles:

1. Where several adjacent SLAs are part of a UCL, the tourism region is the relevant UCL. Examples include state and territory capital cities, other large urban areas such as Wollongong, Newcastle, Geelong, Gold Coast, Sunshine Coast, Townsville and Cairns, and other provincial urban areas.
2. Where individual SLAs are not part of a UCL, then the tourism region is the SLA.

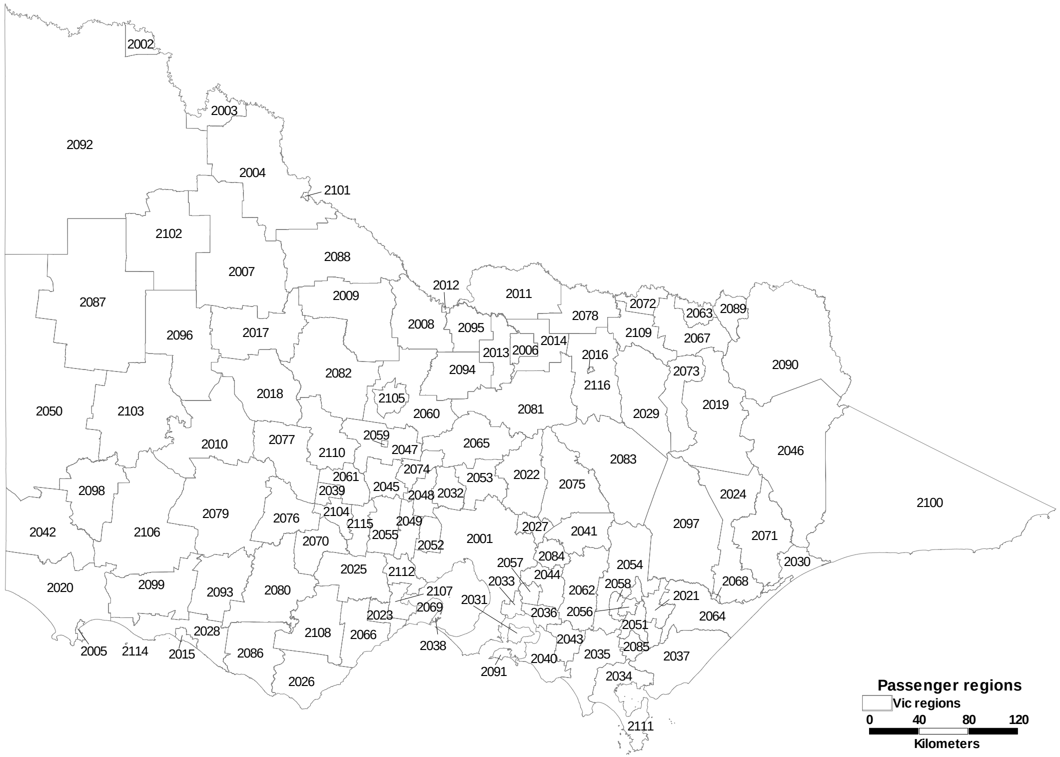
Figures B.1 to B.10 illustrate the BITRE-defined tourism regions for each state and territory. Table B.1 lists the BITRE-defined tourism regions.

Figure B.1 BITRE-defined tourism regions, New South Wales and Australian Capital Territory, 2004



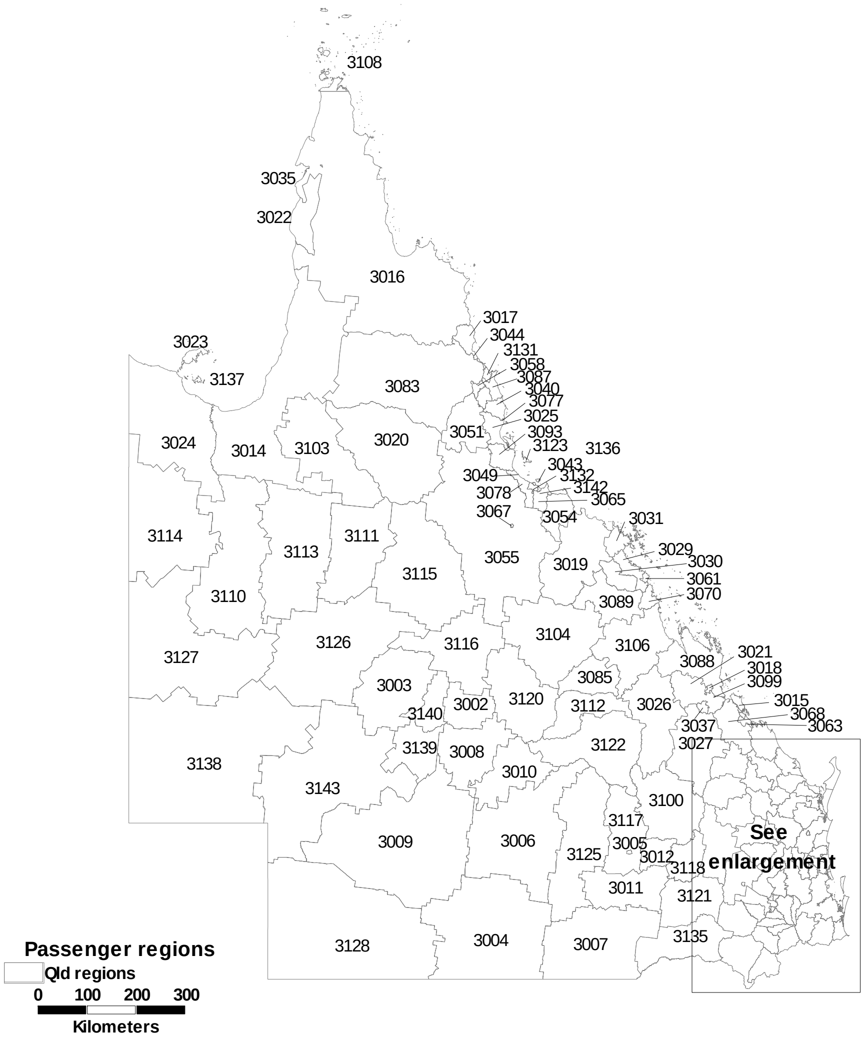
Sources: ABS (2001*b*) and BITRE estimates.

Figure B.2 BITRE-defined tourism regions, Victoria, 2004



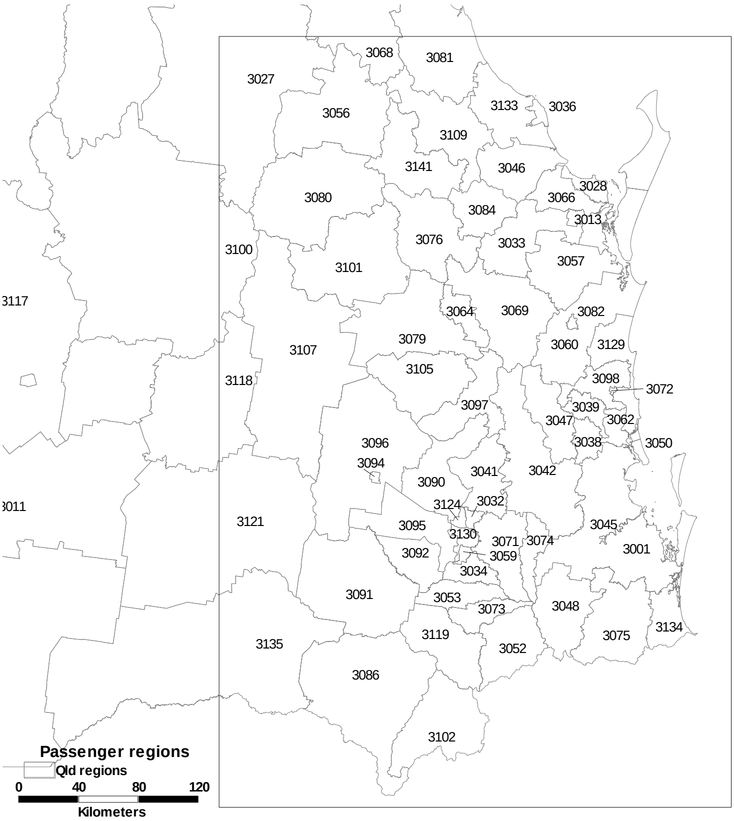
Sources: ABS (2001*b*) and BITRE estimates.

Figure B.3 BITRE-defined tourism regions, Queensland, 2004



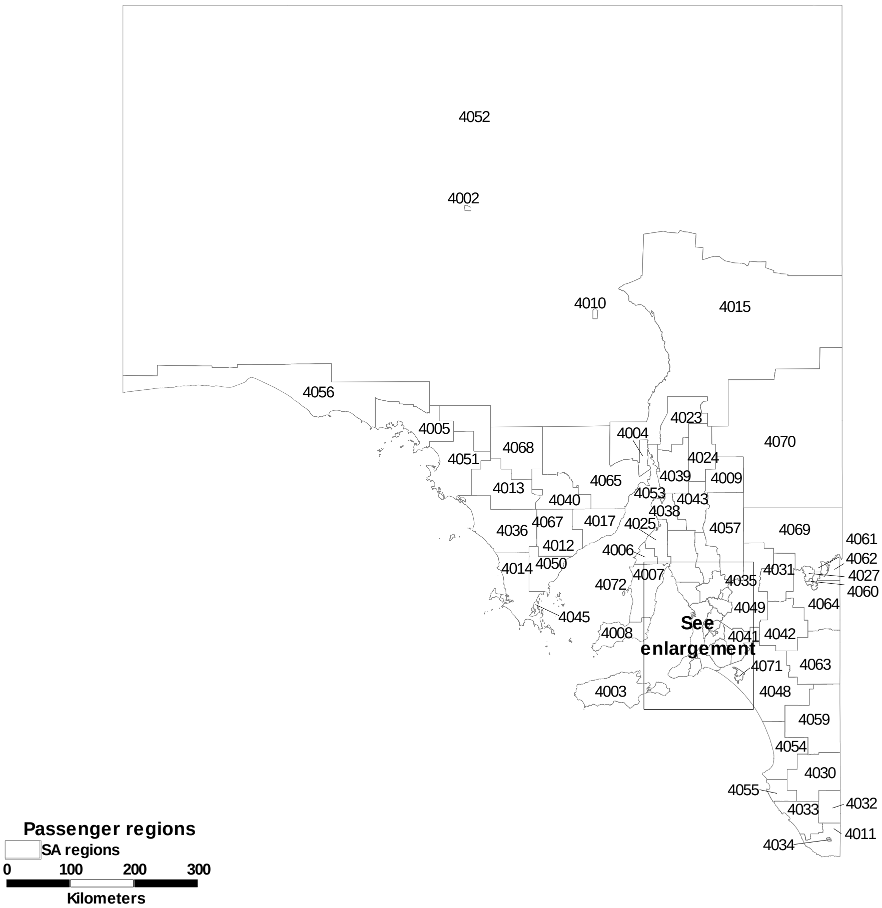
Sources: ABS (2001*b*) and BITRE estimates.

Figure B.4 BITRE-defined tourism regions, Queensland (enlargement), 2004



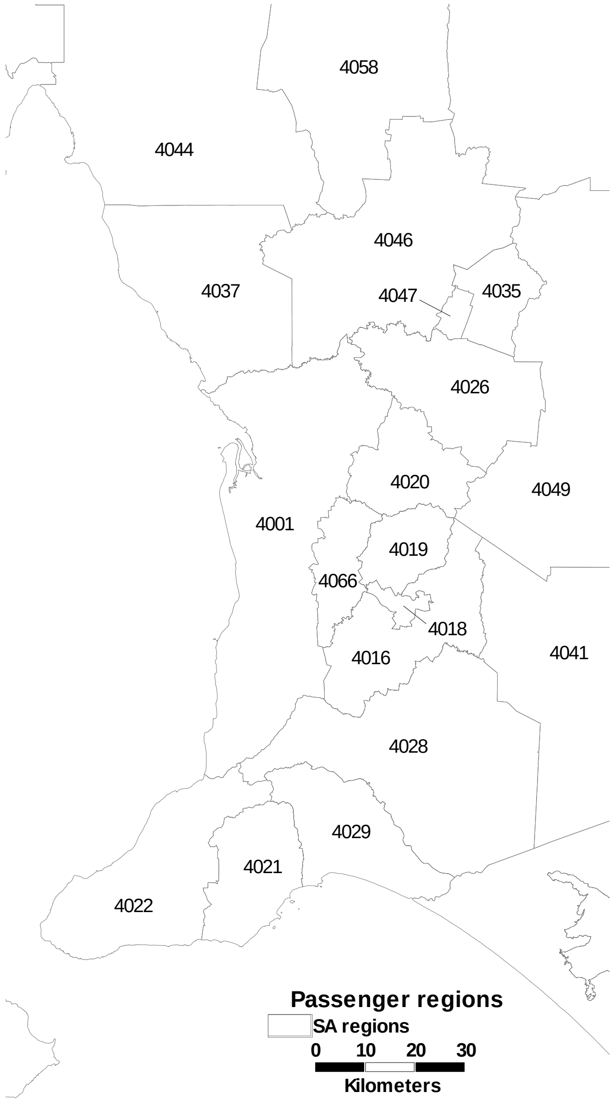
Sources: ABS (2001*b*) and BITRE estimates.

Figure B.5 BITRE-defined tourism regions, South Australia, 2004



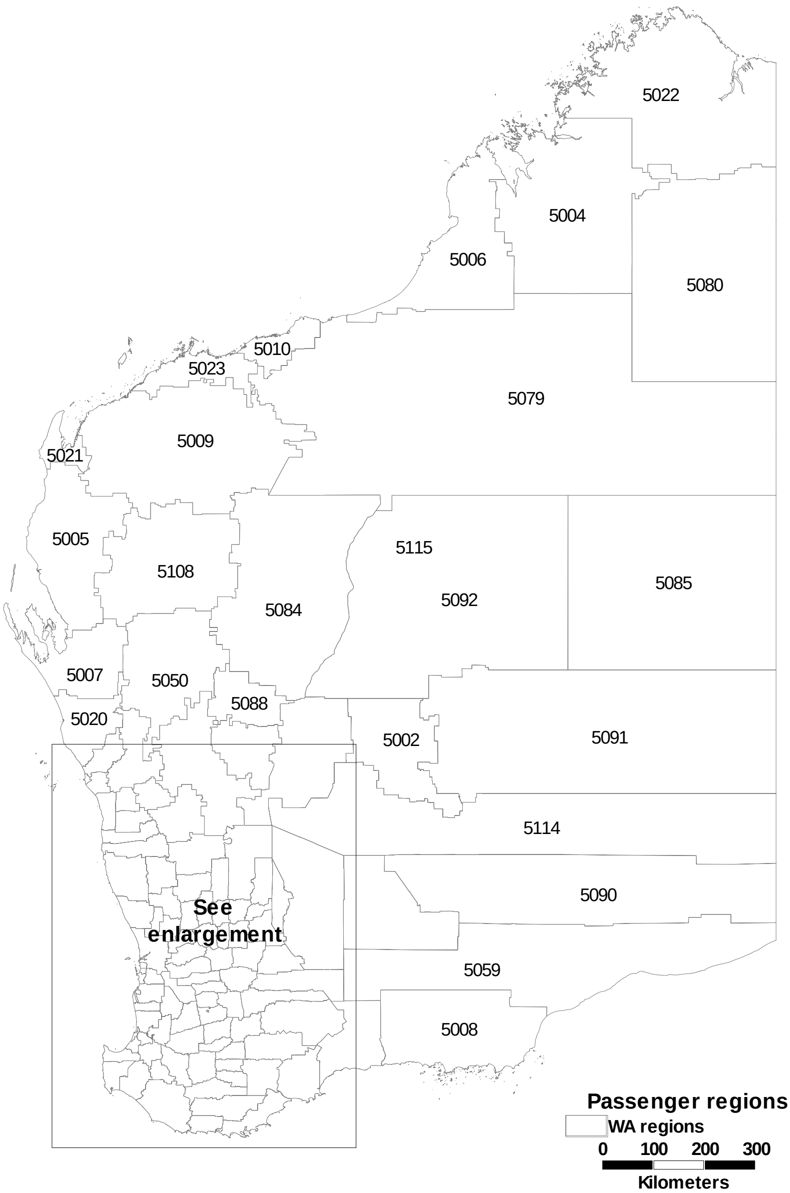
Sources: ABS (2001*b*) and BITRE estimates.

Figure B.6 BITRE-defined tourism regions, South Australia (enlargement), 2004



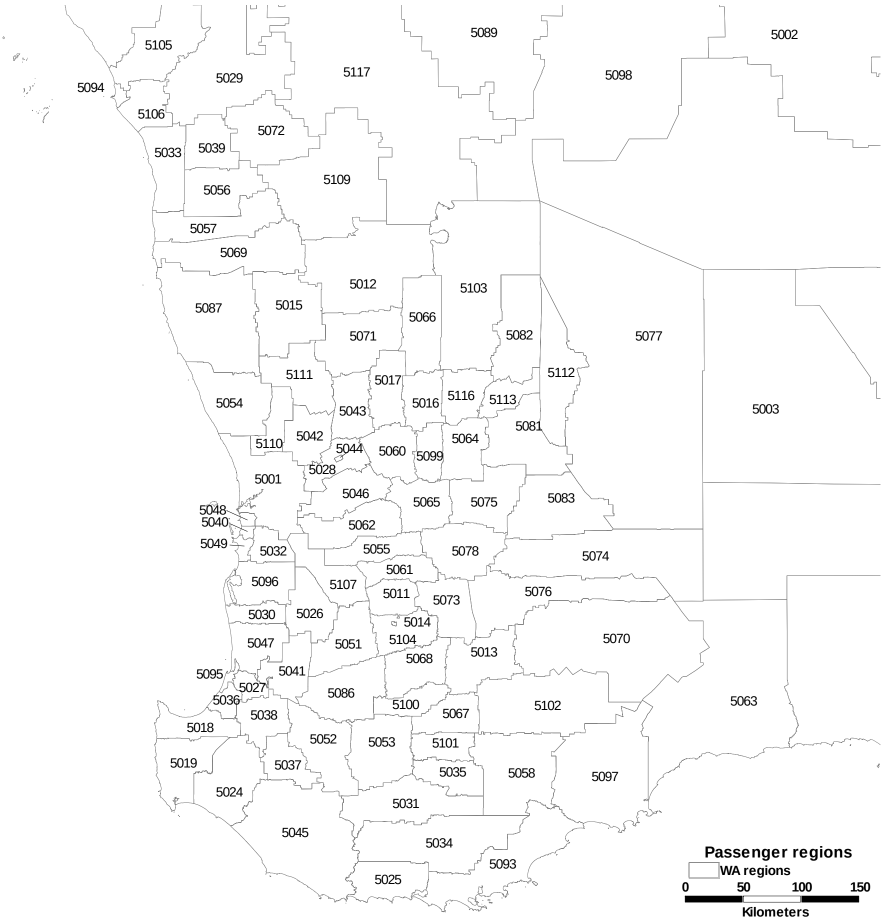
Sources: ABS (2001*b*) and BITRE estimates.

Figure B.7 BITRE-defined tourism regions, Western Australia, 2004



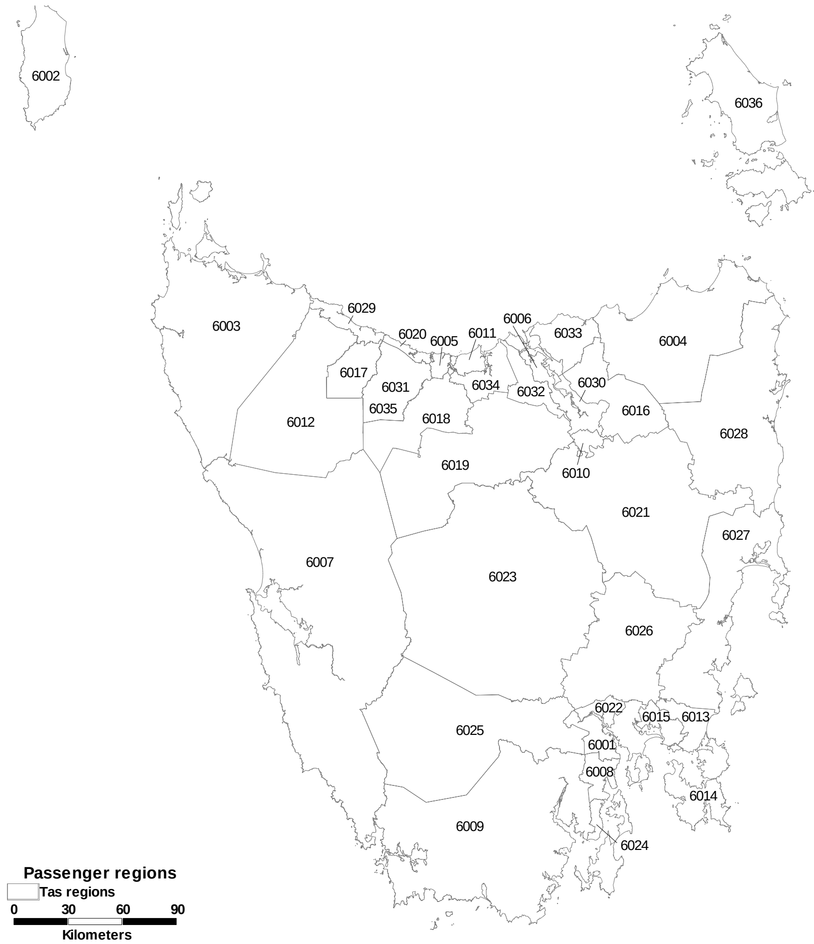
Sources: ABS (2001*b*) and BITRE estimates.

Figure B.8 BITRE-defined tourism regions, Western Australia (enlargement), 2004



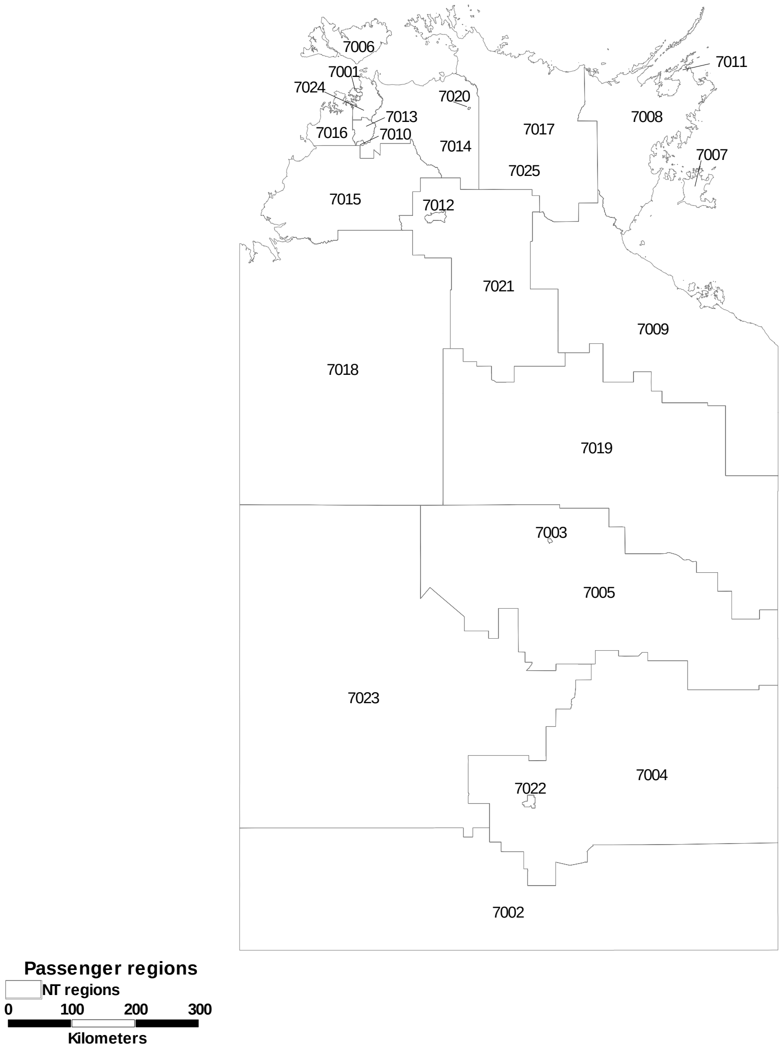
Sources: ABS (2001*b*) and BITRE estimates.

Figure B.9 BITRE-defined tourism regions, Tasmania, 2004



Sources: ABS (2001*b*) and BITRE estimates.

Figure B.10 BITRE-defined tourism regions, Northern Territory, 2004



Sources: ABS (2001*b*) and BITRE estimates.

Table B.1 BITRE-defined tourism regions, 2004

Code	Region	Code	Region
	New South Wales		
1001	Sydney	1043	Severn (A)
1002	Forbes (A)	1044	Bega Valley (A)
1003	Narrandera (A)	1045	Mudgee (A)
1004	Cootamundra (A)	1046	Greater Taree (C)
1005	Broken Hill (C)	1047	Cabonne (A) - Pt C
1006	Bogan (A)	1048	Lismore (C) - Pt A
1007	Wagga Wagga (C) - Pt A	1049	Tamworth (C)
1008	Bland (A)	1050	Pristine Waters (A) - Ulmarra
1009	Coonamble (A)	1051	Kempsey (A)
1010	Parkes (A)	1052	Richmond Valley (A) - Casino
1011	Young (A)	1053	Coffs Harbour (C) - Pt A
1012	Griffith (C)	1054	Bathurst (C)
1013	Dubbo (C) - Pt A	1055	Orange (C)
1014	Walgett (A)	1056	Lismore (C) - Pt B
1015	Cobar (A)	1057	Crookwell (A)
1016	Moree Plains (A)	1058	Great Lakes (A)
1017	Wentworth (A)	1059	Oberon (A)
1018	Murrumbidgee (A)	1060	Gundagai (A)
1019	Gilgandra (A)	1061	Nundle (A)
1020	Wagga Wagga (C) - Pt B	1062	Guyra (A)
1021	Carrathool (A)	1063	Walcha (A)
1022	Temora (A)	1064	Tenterfield (A)
1023	Leeton (A)	1065	Lockhart (A)
1024	Coolamon (A)	1066	Tallaganda (A)
1025	Lachlan (A)	1067	Tumbarumba (A)
1026	Harden (A)	1068	Tumut (A)
1027	Warren (A)	1069	Cooma-Monaro (A)
1028	Urana (A)	1070	Inverell (A) - Pt B
1029	Weddin (A)	1071	Glen Innes (A)
1030	Yallaroi (A)	1072	Greater Lithgow (C)
1031	Narromine (A)	1073	Byron (A)
1032	Jerilderie (A)	1074	Parry (A) - Pt A
1033	Hay (A)	1075	Wingecarribee (A)
1034	Central Darling (A)	1076	Blayney (A) - Pt B
1035	Balranald (A)	1077	Goulburn (C)
1036	Maclean (A)	1078	Yarrowlumla (A) - Pt A
1037	Murray (A)	1079	Coffs Harbour (C) - Pt B
1038	Tweed (A) - Pt A	1080	Uralla (A)
1039	Hastings (A) - Pt A	1081	Hastings (A) - Pt B
1040	Inverell (A) - Pt A	1082	Kyogle (A)
1041	Snowy River (A)	1083	Parry (A) - Pt B
1042	Eurobodalla (A)	1084	Yass (A)

Table B.1 BITRE-defined tourism regions, 2004 (continued)

Code	Region	Code	Region
1085	Rylstone (A)	1117	Dubbo (C) - Pt B
1086	Shoalhaven (C) - Pt B	1118	Coonabarabran (A)
1087	Coolah (A)	1119	Port Stephens (A)
1088	Shoalhaven (C) - Pt A	1120	Richmond Valley (A) Balance
1089	Kiama (A)	1121	Berrigan (A)
1090	Blayney (A) - Pt A	1122	Boorowa (A)
1091	Tweed (A) - Pt B	1123	Bingara (A)
1092	Nambucca (A)	1124	Junee (A)
1093	Blue Mountains (C)	1125	Holbrook (A)
1094	Quirindi (A)	1126	Merriwa (A)
1095	Gunning (A)	1127	Culcairn (A)
1096	Bellingen (A)	1128	Deniliquin (A)
1097	Wellington (A)	1129	Wakool (A)
1098	Gloucester (A)	1130	Bourke (A)
1099	Armidale Dumaresq (A) - City	1131	Brewarrina (A)
1100	Mulwaree (A)	1132	Wollongong
1101	Maitland (C)	1133	Grafton
1102	Singleton (A)	1134	Newcastle
1103	Dungog (A)	1135	Central Coast
1104	Cessnock (C)	1136	Albury
1105	Murrurundi (A)	1137	Windouran (A)
1106	Corowa (A)	1138	Conargo (A)
1107	Gunnedah (A)	1139	Unincorp. Far West
1108	Scone (A)	1140	Evans (A) - Pt B
1109	Muswellbrook (A)	1141	Cabonne (A) - Pt B
1110	Bombala (A)	1142	Evans (A) - Pt A
1111	Ballina (A)	1143	Cabonne (A) - Pt A
1112	Queanbeyan (C)	1144	Lord Howe Island
1113	Cowra (A)	1145	Off-Shore Areas & Migratory
1114	Narrabri (A)	1146	Armidale Dumaresq (A) Balance
1115	Barraba (A)	1147	Yarrowlumla (A) - Pt B
1116	Manilla (A)		
	Victoria		
2001	Melbourne	2011	Moira (S) - West
2002	Mildura (RC) - Pt A	2012	Campaspe (S) - Echuca
2003	Swan Hill (RC) - Robinvale	2013	Gr. Shepparton (C) - Pt B West
2004	Swan Hill (RC) Balance	2014	Gr. Shepparton (C) - Pt B East
2005	Glenelg (S) - Portland	2015	Warrnambool (C)
2006	Gr. Shepparton (C) - Pt A	2016	Delatite (S) - Benalla
2007	Buloke (S) - North	2017	Buloke (S) - South
2008	Campaspe (S) - Rochester	2018	N. Grampians (S) - St Arnaud
2009	Loddon (S) - North	2019	Alpine (S) - East
2010	N. Grampians (S) - Stawell	2020	Glenelg (S) - Heywood

Table B.1 BITRE-defined tourism regions, 2004 (continued)

Code	Region	Code	Region
2021	Latrobe (C) - Traralgon	2064	Wellington (S) - Rosedale
2022	Murrindindi (S) - West	2065	Mitchell (S) - North
2023	Surf Coast (S) - East	2066	Surf Coast (S) - West
2024	Wellington (S) - Avon	2067	Indigo (S) - Pt A
2025	Golden Plains (S) - South-East	2068	Wellington (S) - Sale
2026	Colac-Otway (S) - South	2069	Greater Geelong (C) - Pt B
2027	Yarra Ranges (S) - North	2070	Golden Plains (S) - North-West
2028	Moyne (S) - South	2071	E. Gippsland (S) - South-West
2029	Wangaratta (RC) - South	2072	Indigo (S) - Pt B
2030	E. Gippsland (S) - Bairnsdale	2073	Alpine (S) - West
2031	French Island	2074	Macedon Ranges (S) - Kyneton
2032	Macedon Ranges (S) - Romsey	2075	Murrindindi (S) - East
2033	Casey (C) - South	2076	Pyrenees (S) - South
2034	South Gippsland (S) - East	2077	Pyrenees (S) - North
2035	South Gippsland (S) - Central	2078	Moira (S) - East
2036	Cardinia (S) - South	2079	Ararat (RC)
2037	Wellington (S) - Alberton	2080	Corangamite (S) - North
2038	Queenscliffe (B)	2081	Strathbogie (S)
2039	Ballarat (C) - North	2082	Loddon (S) - South
2040	Bass Coast (S) Balance	2083	Delatite (S) - South
2041	Yarra Ranges (S) - Pt B	2084	Yarra Ranges (S) - Central
2042	Glenelg (S) - North	2085	Latrobe (C) Balance
2043	South Gippsland (S) - West	2086	Corangamite (S) - South
2044	Cardinia (S) - North	2087	Hindmarsh (S)
2045	Hepburn (S) - East	2088	Gannawarra (S)
2046	E. Gippsland (S) Balance	2089	Towong (S) - Pt A
2047	Mount Alexander (S) Balance	2090	Towong (S) - Pt B
2048	Macedon Ranges (S) Balance	2091	Bass Coast (S) - Phillip Is.
2049	Moorabool (S) - Bacchus Marsh	2092	Mildura (RC) - Pt B
2050	West Wimmera (S)	2093	Moyne (S) - North-East
2051	Latrobe (C) - Morwell	2094	Campaspe (S) - South
2052	Melton (S) Balance	2095	Campaspe (S) - Kyabram
2053	Mitchell (S) - South	2096	Yarriambiack (S) - South
2054	Baw Baw (S) - Pt B East	2097	Wellington (S) - Maffra
2055	Moorabool (S) - Ballan	2098	S. Grampians (S) - Wannon
2056	Latrobe (C) - Moe	2099	Moyne (S) - North-West
2057	Cardinia (S) - Pakenham	2100	E. Gippsland (S) - Orbost
2058	Baw Baw (S) - Pt A	2101	Swan Hill (RC) - Central
2059	Mount Alexander (S) - C'Maine	2102	Yarriambiack (S) - North
2060	Gr. Bendigo (C) - Pt B	2103	Horsham
2061	Hepburn (S) - West	2104	Ballarat
2062	Baw Baw (S) - Pt B West	2105	Bendigo
2063	Wodonga (RC)	2106	Hamilton

Table B.1 BITRE-defined tourism regions, 2004 (continued)

Code	Region	Code	Region
2107	Geelong	2112	Greater Geelong (C) - Pt C
2108	Colac	2113	Off-Shore Areas & Migratory
2109	Wangaratta	2114	Lady Julia Percy Island
2110	Maryborough	2115	Moorabool (S) - West
2111	Bass Strait Islands	2116	Delatite (S) - North
	Queensland		
3001	Brisbane	3038	Caboolture (S) - Pt B
3002	Barcaldine (S)	3039	Caloundra (C) - Hinterland
3003	Longreach (S)	3040	Eacham (S)
3004	Paroo (S)	3041	Crow's Nest (S) - Pt B
3005	Roma (T)	3042	Esk (S)
3006	Murweh (S)	3043	Magnetic Island
3007	Balonne (S)	3044	Cairns (C) - Northern Suburbs
3008	Blackall (S)	3045	Bellbowrie
3009	Quilpie (S)	3046	Isis (S)
3010	Tambo (S)	3047	Kilcoy (S)
3011	Warroo (S)	3048	Boonah (S)
3012	Bendemere (S)	3049	Pallarenda-Shelley Beach
3013	Maryborough (C)	3050	Bribie Island
3014	Carpentaria (S)	3051	Herberton (S)
3015	Gladstone (C)	3052	Warwick (S) - East
3016	Cook (S) (Excl. Weipa)	3053	Clifton (S)
3017	Douglas (S)	3054	Burdekin (S)
3018	Fitzroy (S) - Pt B	3055	Dalrymple (S)
3019	Bowen (S)	3056	Monto (S)
3020	Etheridge (S)	3057	Tiaro (S)
3021	Rockhampton (C)	3058	Cairns (C) - Pt B
3022	Aurukun (S)	3059	Cambooya (S) - Pt A
3023	Mornington (S)	3060	Cooloola (S) (Excl. Gympie)
3024	Burke (S)	3061	Mirani (S)
3025	Cardwell (S)	3062	Caloundra (C) - Rail Corridor
3026	Duaringa (S)	3063	Calliope (S) - Pt A
3027	Banana (S)	3064	Murgon (S)
3028	Hervey Bay (C) - Pt A	3065	Townsville (C) - Pt B
3029	Mackay (C) - Pt B	3066	Hervey Bay (C) - Pt B
3030	Mackay (C) - Pt A	3067	Charters Towers (C)
3031	Whitsunday (S)	3068	Calliope (S) - Pt B
3032	Crow'S Nest (S) - Pt A	3069	Kilkivan (S)
3033	Woocoo (S)	3070	Sarina (S)
3034	Cambooya (S) - Pt B	3071	Gatton (S)
3035	Cook (S) - Weipa Only	3072	Maroochy (S) - Nambour
3036	Burnett (S) - Pt A	3073	Warwick (S) - North
3037	Mount Morgan (S)	3074	Laidley (S)

Table B.1 BITRE-defined tourism regions, 2004 (continued)

Code	Region	Code	Region
3075	Beaudesert (S) - Pt B	3110	Cloncurry (S)
3076	Gayndah (S)	3111	Richmond (S)
3077	Johnstone (S)	3112	Emerald (S)
3078	Thuringowa (C) - Pt B	3113	Mckinlay (S)
3079	Wondai (S)	3114	Mount Isa (C)
3080	Eidsvold (S)	3115	Flinders (S)
3081	Miriam Vale (S)	3116	Aramac (S)
3082	Cooloola (S) - Gympie Only	3117	Bungil (S)
3083	Mareeba (S)	3118	Murilla (S)
3084	Biggenden (S)	3119	Warwick
3085	Peak Downs (S)	3120	Jericho (S)
3086	Inglewood (S)	3121	Tara (S)
3087	Atherton (S)	3122	Bauhinia (S)
3088	Livingstone (S)	3123	Hinchinbrook (S) - Palm Island
3089	Nebo (S)	3124	Rosalie (S) - Pt A
3090	Rosalie (S) - Pt B	3125	Booringa (S)
3091	Millmerran (S)	3126	Winton
3092	Pittsworth (S)	3127	Boulia (S)
3093	Hinchinbrook (S) Excl. Palm I.	3128	Bulloo (S)
3094	Dalby (T)	3129	Sunshine Coast
3095	Jondaryan (S) - Pt B	3130	Toowoomba
3096	Wambo (S)	3131	Cairns
3097	Nanango (S)	3132	Townsville-Thuringowa
3098	Maroochy (S) Balance	3133	Bundaberg
3099	Fitzroy (S) - Pt A	3134	Gold Coast
3100	Taroom (S)	3135	Goondiwindi
3101	Mundubbera (S)	3136	Off-Shore Areas & Migratory
3102	Stanthorpe (S)	3137	Unincorp. Islands
3103	Croydon (S)	3138	Diamantina (S)
3104	Belyando (S)	3139	Isisford (S)
3105	Kingaroy (S)	3140	Ilfracombe (S)
3106	Broadsound (S)	3141	Perry (S)
3107	Chinchilla (S)	3142	Stuart-Roseneath
3108	Torres (S)	3143	Barcoo (S)
3109	Kolan (S)		
	South Australia		
4001	Adelaide	4008	Yorke Peninsula (DC) - South
4002	Coober Pedy (DC)	4009	Peterborough (DC)
4003	Kangaroo Island (DC)	4010	Roxby Downs (M)
4004	Port Augusta (C)	4011	Grant (DC)
4005	Ceduna (DC)	4012	Cleve (DC)
4006	Copper Coast (DC)	4013	Le Hunte (DC)
4007	Yorke Peninsula (DC) - North	4014	Lower Eyre Peninsula (DC)

Table B.1 BITRE-defined tourism regions, 2004 (continued)

Code	*Region*	*Code*	*Region*
4015	Unincorp. Flinders Ranges	4044	Wakefield (DC)
4016	Mount Barker (DC) Balance	4045	Port Lincoln (C)
4017	Franklin Harbor (DC)	4046	Light (DC)
4018	Mount Barker (DC) - Central	4047	Barossa (DC) - Tanunda
4019	Adelaide Hills (DC) Balance	4048	The Coorong (DC)
4020	Adelaide Hills (DC) - North	4049	Mid Murray (DC)
4021	Victor Harbor (DC)	4050	Tumby Bay (DC)
4022	Yankalilla (DC)	4051	Streaky Bay (DC)
4023	Flinders Ranges (DC)	4052	Unincorp. Far North
4024	Orroroo/Carrieton (DC)	4053	Port Pirie C, Dists (M) - City
4025	Barunga West (DC)	4054	Lacepede (DC)
4026	Barossa (DC) - Barossa	4055	Robe (DC)
4027	Berri & Barmera (DC) - Barmera	4056	Unincorp. West Coast
4028	Alexandrina (DC) - Strathalbyn	4057	Goyder (DC)
4029	Alexandrina (DC) - Coastal	4058	Clare And Gilbert Valleys (DC)
4030	Naracoorte And Lucindale (DC)	4059	Tatiara (DC)
4031	Loxton Waikerie (DC) - West	4060	Berri & Barmera (DC) - Berri
4032	Wattle Range (DC) - East	4061	Renmark Paringa (DC) - Paringa
4033	Wattle Range (DC) - West	4062	Renmark Paringa (DC) - Renmark
4034	Mount Gambier (C)	4063	Southern Mallee (DC)
4035	Barossa (DC) - Angaston	4064	Loxton Waikerie (DC) - East
4036	Elliston (DC)	4065	Whyalla
4037	Mallala (DC)	4066	Crafers-Bridgewater
4038	Port Pirie C, Dists (M) Balance	4067	Off-Shore Areas & Migratory
4039	Mount Remarkable (DC)	4068	Unincorp. Lincoln
4040	Kimba (DC)	4069	Unincorp. Riverland
4041	Murray Bridge (RC)	4070	Unincorp. Pirie
4042	Karoonda East Murray (DC)	4071	Unincorp. Murray Mallee
4043	Northern Areas (DC)	4072	Unincorp. Yorke
	Western Australia		
5001	Perth	5014	Narrogin (T)
5002	Leonora (S)	5015	Moora (S)
5003	Coolgardie (S)	5016	Wyalkatchem (S)
5004	Derby-West Kimberley (S)	5017	Dowerin (S)
5005	Carnarvon (S)	5018	Busselton (S)
5006	Broome (S)	5019	Augusta-Margaret River (S)
5007	Shark Bay (S)	5020	Northampton (S)
5008	Esperance (S)	5021	Exmouth (S)
5009	Ashburton (S)	5022	Wyndham-East Kimberley (S)
5010	Port Hedland (T)	5023	Roebourne (S)
5011	Cuballing (S)	5024	Nannup (S)
5012	Dalwallinu (S)	5025	Denmark (S)
5013	Dumbleyung (S)	5026	Boddington (S)

Table B.1 BITRE-defined tourism regions, 2004 (continued)

Code	Region	Code	Region
5027	Dardanup (S) - Pt B	5070	Lake Grace (S)
5028	Northam (S)	5071	Wongan-Ballidu (S)
5029	Mullewa (S)	5072	Morawa (S)
5030	Waroona (S)	5073	Wickepin (S)
5031	Cranbrook (S)	5074	Kondinin (S)
5032	Serpentine-Jarrahdale (S)	5075	Bruce Rock (S)
5033	Irwin (S)	5076	Kulin (S)
5034	Plantagenet (S)	5077	Yilgarn (S)
5035	Tambellup (S)	5078	Corrigin (S)
5036	Capel (S) - Pt B	5079	East Pilbara (S)
5037	Bridgetown-Greenbushes (S)	5080	Halls Creek (S)
5038	Donnybrook-Balingup (S)	5081	Merredin (S)
5039	Mingenew (S)	5082	Mukinbudin (S)
5040	Kwinana (T)	5083	Narembeen (S)
5041	Collie (S)	5084	Meekatharra (S)
5042	Toodyay (S)	5085	Ngaanyatjarraku (S)
5043	Goomalling (S)	5086	West Arthur (S)
5044	Northam (T)	5087	Dandaragan (S)
5045	Manjimup (S)	5088	Cue (S)
5046	York (S)	5089	Mount Magnet (S)
5047	Harvey (S) - Pt B	5090	Kalgoorlie–Boulder
5048	Cockburn (C)	5091	Laverton (S)
5049	Rockingham (C)	5092	Wiluna (S)
5050	Murchison (S)	5093	Albany
5051	Williams (S)	5094	Geraldton
5052	Boyup Brook (S)	5095	Bunbury
5053	Kojonup (S)	5096	Mandurah
5054	Gingin (S)	5097	Jerramungup (S)
5055	Brookton (S)	5098	Sandstone (S)
5056	Three Springs (S)	5099	Tammin (S)
5057	Carnamah (S)	5100	Woodanilling (S)
5058	Gnowangerup (S)	5101	Broomehill (S)
5059	Dundas (S)	5102	Kent (S)
5060	Cunderdin (S)	5103	Mount Marshall (S)
5061	Pingelly (S)	5104	Narrogin (S)
5062	Beverley (S)	5105	Chapman Valley (S)
5063	Ravensthorpe (S)	5106	Greenough (S) - Pt B
5064	Kellerberrin (S)	5107	Wandering (S)
5065	Quairading (S)	5108	Upper Gascoyne (S)
5066	Koorda (S)	5109	Perenjori (S)
5067	Katanning (S)	5110	Chittering (S)
5068	Wagin (S)	5111	Victoria Plains (S)
5069	Coorow (S)	5112	Westonia (S)

Table B.1 BITRE-defined tourism regions, 2004 (continued)

Code	*Region*	*Code*	*Region*
5113	Nungarin (S)	5116	Trayning (S)
5114	Menzies (S)	5117	Yalgoo (S)
5115	Off-Shore Areas & Migratory		
	Tasmania		
6001	Hobart	6019	Meander Valley (M) - Pt B
6002	King Island (M)	6020	Central Coast (M) - Pt A
6003	Circular Head (M)	6021	Northern Midlands (M) - Pt B
6004	Dorset (M)	6022	Brighton (M)
6005	Devonport (C)	6023	Central Highlands (M)
6006	George Town (M) - Pt A	6024	Kingborough (M) - Pt B
6007	West Coast (M)	6025	Derwent Valley (M) - Pt B
6008	Kingborough (M) - Pt A	6026	Southern Midlands (M)
6009	Huon Valley (M)	6027	Glamorgan/Spring Bay (M)
6010	Northern Midlands (M) - Pt A	6028	Break O'Day (M)
6011	Latrobe (M) - Pt A	6029	Burnie-Somerset
6012	Waratah/Wynyard (M) - Pt B	6030	Launceston
6013	Sorell (M) - Pt B	6031	Central Coast (M) - Pt B
6014	Tasman (M)	6032	West Tamar (M) - Pt B
6015	Sorell (M) - Pt A	6033	George Town (M) - Pt B
6016	Launceston (C) - Pt C	6034	Latrobe (M) - Pt B
6017	Burnie (C) - Pt B	6035	Off-Shore Areas & Migratory
6018	Kentish (M)	6036	Flinders (M)
	Northern Territory		
7001	Darwin	7014	South Alligator
7002	Petermann	7015	Daly
7003	Tennant Creek (T)	7016	Cox-Finniss
7004	Sandover - Balance	7017	West Arnhem
7005	Tennant Creek - Balance	7018	Victoria
7006	Bathurst-Melville	7019	Tableland
7007	Groote Eylandt	7020	Jabiru (T)
7008	East Arnhem - Balance	7021	Elsey - Balance
7009	Gulf	7022	Alice Springs
7010	Coomalie (CGC)	7023	Tanami
7011	Nhulunbuy	7024	Palmerston
7012	Katherine (T)	7025	Off-Shore Areas & Migratory
7013	Litchfield (S) - Pt B		
	Australian Capital Territory		
8001	Canberra	8002	Hall
	Other Territories		
9002	Jervis Bay Territory	9004	Territory Of Cocos (Keeling) Islands
9003	Territory Of Christmas Island		

Note: Local Government Area / Urban Centre types: A—Area; B—Borough; C—City; CGC—Community Government Council; DC—District Council; M—Municipality; RC—Rural City; S—Shire; T—Town.
Sources: ABS (2001*b*) and BITRE estimates.

Appendix C Population projections

C.1 Overview

As outlined in Chapter 1, this report presents two sets of traffic projections for the NLTN non-urban corridors:

1. One based on the 'latest' ABS long-term population projections, at detailed regional level—'ABS (2006)-based population projections'

2. A second set based on the 'latest' state and territory source population projections, also at detailed regional level—'state-sourced population projections'.

The ABS (2006)-based regional population projections are based on the ABS (2003) SLA-level population projections, which cover the period 2002–2022, adjusted (and extended) to match the total state and territory population projections published in ABS (2006).

The five mainland states—New South Wales, Victoria, Queensland, South Australia and Western Australia—also produce long-term regional population projections, either at the SLA or LGA-level. Tasmania, Northern Territory and Australian Capital Territory do not produce their own regional population projections. OZPASS and FreightSim require SLA-level population projections, and so the LGA-based population projections provided by Queensland and Western Australia had to be converted to SLAs. The latest available Queensland regional population projections covered the period 2001 to 2026 and the latest available South Australian population projections the period 2001 to 2021. For these jurisdictions, BITRE extended the projections to 2030. The other three mainland states produced regional population projections that extend to at least 2030.

The remainder of this appendix provides a brief outline of the key assumptions underpinning the projections and the methods used to construct the ABS and state and territory-sourced regional population projections to 2030. The final section provides a comparison of the two sets of population projections at the state and territory level.

ABS population projections

ABS (2003)

As indicated in section C.1, the latest available ABS-source SLA-level population projections are ABS (2003), which is based on 2002 estimated resident population (ERP) levels derived using the 2001 Census.

Among the key assumptions underpinning ABS (2003) are:

- The fertility rate declines to 1.6 births per female by 2011, and
- Annual net overseas migration of +100 000 persons per annum. (See Box C.1 for a comparison of the key assumptions used in ABS (2003) and ABS (2006).)

BITRE extended the medium-level (Series B) ABS (2003) SLA population projections to 2030 using a second order polynomial relationship between the projected population in each SLA and time. Using this methodology, the total Australian population is projected to be 24.8 million persons by 2030.

ABS (2006)

ABS (2006) provides the latest published ABS population projections, albeit the projections only extend to the level of capital city/rest of state for each state and territory.

The assumptions underpinning ABS (2006) are quite different to those used in ABS (2003). In particular:

- The fertility rate is assumed to decline to 1.8 births per female by 2018, and
- Annual overseas migration of +110 000 persons per annum (see Box C.1 for further details).

Under these assumptions the total Australian population is projected to be 25.6 million persons by 2030 (ABS 2006) (medium-level or Series B projections)—some three per cent higher than implied by the extended ABS (2003) projections.

Table C.1 provides a comparison of the ABS (2003) based and ABS (2006) population projections, by state and territory, and Table C.3 shows the implied population growth rate.

Table C.1 ABS (2003) and ABS (2006) projected population, by state and territory, 2004 to 2030

(thousand persons)

Year	*New South Wales*				*Victoria*				*Queensland*				*South Australia*			
	ABS (2003)	*ABS (2006)*			*ABS (2003)*	*ABS (2006)*			*ABS (2003)*	*ABS (2006)*			*ABS (2003)*	*ABS (2006)*		
		Series A	*Series B*	*Series C*		*Series A*	*Series B*	*Series C*		*Series A*	*Series B*	*Series C*		*Series A*	*Series B*	*Series C*
2002	6 640.4				4 872.5				3 707.2				1 520.2			
2003	6 694.8				4 929.9				3 786.5				1 527.1			
2004	6 752.1	6 720.8	6 720.8	6 720.8	4 981.6	4 963.0	4 963.0	4 963.0	3 861.5	3 888.1	3 888.1	3 888.1	1 533.0	1 532.7	1 532.7	1 532.7
2005	6 812.3	6 783.2	6 775.9	6 773.7	5 027.3	5 021.8	5 016.7	5 015.2	3 930.9	3 975.2	3 966.9	3 961.2	1 538.5	1 539.2	1 539.1	1 539.5
2006	6 869.4	6 848.8	6 834.3	6 827.5	5 071.1	5 077.7	5 068.1	5 064.9	3 999.5	4 064.2	4 043.4	4 026.6	1 543.5	1 545.2	1 545.6	1 546.4
2007	6 925.6	6 917.9	6 896.8	6 884.9	5 114.0	5 129.3	5 117.2	5 113.5	4 067.7	4 155.9	4 117.5	4 084.9	1 548.3	1 551.1	1 552.0	1 553.3
2008	6 980.9	6 987.8	6 958.5	6 939.0	5 156.2	5 181.7	5 166.0	5 160.0	4 135.5	4 249.5	4 192.2	4 142.0	1 552.7	1 557.1	1 558.2	1 559.9
2009	7 035.2	7 058.1	7 019.9	6 992.0	5 197.5	5 234.2	5 214.4	5 205.6	4 203.0	4 343.7	4 266.8	4 198.4	1 556.9	1 563.1	1 564.3	1 566.2
2010	7 088.7	7 128.8	7 081.0	7 043.8	5 238.1	5 286.8	5 262.4	5 250.4	4 270.0	4 438.5	4 341.4	4 254.2	1 560.8	1 569.0	1 570.3	1 572.2
2011	7 141.2	7 200.0	7 141.7	7 094.5	5 278.0	5 339.6	5 310.1	5 294.4	4 336.6	4 534.0	4 416.0	4 309.3	1 564.5	1 574.9	1 576.1	1 578.0
2012	7 192.8	7 271.7	7 201.8	7 143.7	5 317.1	5 392.7	5 357.3	5 337.3	4 402.9	4 630.1	4 490.4	4 363.6	1 567.9	1 580.8	1 581.8	1 583.5
2013	7 244.1	7 344.0	7 261.2	7 191.4	5 356.0	5 446.2	5 404.0	5 379.2	4 469.1	4 726.9	4 564.6	4 417.1	1 571.1	1 586.8	1 587.3	1 588.7
2014	7 295.0	7 416.9	7 320.1	7 237.7	5 394.5	5 500.0	5 450.3	5 420.2	4 535.3	4 824.5	4 638.6	4 469.7	1 574.3	1 592.7	1 592.6	1 593.6
2015	7 345.5	7 490.4	7 378.4	7 282.6	5 432.8	5 554.2	5 496.2	5 460.2	4 601.3	4 922.8	4 712.3	4 521.5	1 577.3	1 598.7	1 597.8	1 598.3
2016	7 395.6	7 564.6	7 436.2	7 326.3	5 470.8	5 608.8	5 541.8	5 499.3	4 667.2	5 021.7	4 785.9	4 572.5	1 580.2	1 604.8	1 602.9	1 602.7
2017	7 445.3	7 639.5	7 493.3	7 368.3	5 508.5	5 663.8	5 586.8	5 537.3	4 733.0	5 121.5	4 859.2	4 622.6	1 582.9	1 610.9	1 607.7	1 606.8
2018	7 494.3	7 715.2	7 549.5	7 408.9	5 545.7	5 719.4	5 631.3	5 574.4	4 798.5	5 222.0	4 932.1	4 671.8	1 585.5	1 617.2	1 612.4	1 610.6
2019	7 542.8	7 791.5	7 605.1	7 448.4	5 582.6	5 775.2	5 675.2	5 610.7	4 863.7	5 323.2	5 004.7	4 720.4	1 587.9	1 623.4	1 616.8	1 614.1
2020	7 590.7	7 868.0	7 660.0	7 487.3	5 618.9	5 831.0	5 718.7	5 646.5	4 928.5	5 424.8	5 077.1	4 768.6	1 590.0	1 629.6	1 621.1	1 617.5
2021	7 637.8	7 944.6	7 714.4	7 525.4	5 654.8	5 886.8	5 761.7	5 681.8	4 993.0	5 526.9	5 149.2	4 816.3	1 592.0	1 635.8	1 625.2	1 620.7
2022	7 684.0	8 021.4	7 767.9	7 562.5	5 690.0	5 942.7	5 804.0	5 716.4	5 057.0	5 629.3	5 220.9	4 863.4	1 593.8	1 641.9	1 629.1	1 623.6
2023	7 728.6	8 098.2	7 820.6	7 598.7	5 719.3	5 998.7	5 845.7	5 750.3	5 117.9	5 732.0	5 292.2	4 910.0	1 594.5	1 647.9	1 632.7	1 626.3
2024	7 773.4	8 174.9	7 872.3	7 633.8	5 751.7	6 054.6	5 886.7	5 783.4	5 180.5	5 835.0	5 362.9	4 955.8	1 595.6	1 653.8	1 636.0	1 628.7
2025	7 817.6	8 251.5	7 923.0	7 667.8	5 783.4	6 110.3	5 927.0	5 815.6	5 242.8	5 938.1	5 433.1	5 000.9	1 596.5	1 659.6	1 639.0	1 630.8
2026	7 861.2	8 327.7	7 972.5	7 700.6	5 814.5	6 165.9	5 966.4	5 847.0	5 304.7	6 041.3	5 502.6	5 045.1	1 597.2	1 665.2	1 641.7	1 632.6
2027	7 904.1	8 403.7	8 020.7	7 731.9	5 844.9	6 221.3	6 004.7	5 877.3	5 366.2	6 144.6	5 571.2	5 088.4	1 597.7	1 670.7	1 644.0	1 634.1
2028	7 946.3	8 479.4	8 067.5	7 761.7	5 874.6	6 276.4	6 042.1	5 906.4	5 427.3	6 247.9	5 638.9	5 130.6	1 598.0	1 675.9	1 645.9	1 635.1
2029	7 988.0	8 554.7	8 112.8	7 789.8	5 903.7	6 331.2	6 078.2	5 934.3	5 488.1	6 351.1	5 705.6	5 171.7	1 598.0	1 681.0	1 647.4	1 635.6
2030	8 028.9	8 629.4	8 156.4	7 816.1	5 932.1	6 385.5	6 113.1	5 960.9	5 548.5	6 454.1	5 771.2	5 211.5	1 597.9	1 685.8	1 648.5	1 635.8

Table C.1 ABS (2003) and ABS (2006) projected population, by state and territory, 2004 to 2030 (continued)

(thousand persons)

Year	Western Australia				Tasmania				Northern Territory				Australian Capital Territory			
	ABS (2003)	ABS (2006)			ABS (2003)	ABS (2006)			ABS (2003)	ABS (2006)			ABS (2003)	ABS (2006)		
		Series A	Series B	Series C		Series A	Series B	Series C		Series A	Series B	Series C		Series A	Series B	Series C
2002	1 927.3				472.7				198.0				321.8			
2003	1 952.5				474.2				198.7				324.6			
2004	1 978.8	1 978.1	1 978.1	1 978.1	475.1	482.2	482.2	482.2	200.2	199.8	199.8	199.8	327.3	324.1	324.1	324.1
2005	2 006.2	2 013.6	2 008.9	2 006.1	475.8	486.6	485.9	484.7	202.7	203.0	202.2	201.5	329.9	326.7	325.5	324.8
2006	2 032.8	2 050.9	2 040.3	2 031.6	476.5	490.5	488.4	486.0	205.2	207.2	205.1	203.1	332.5	330.3	327.3	325.4
2007	2 059.1	2 089.1	2 071.6	2 054.9	477.0	493.9	489.9	485.7	207.6	211.5	208.0	204.2	335.0	334.9	330.0	326.4
2008	2 085.2	2 127.9	2 102.9	2 077.2	477.4	497.3	491.4	485.1	210.0	215.8	210.9	205.2	337.4	339.5	332.8	327.3
2009	2 111.0	2 167.0	2 134.1	2 099.2	477.7	500.7	492.8	484.5	212.3	220.3	213.9	206.2	339.7	344.2	335.5	328.0
2010	2 136.6	2 206.3	2 165.2	2 120.7	478.0	504.2	494.1	483.8	214.7	224.8	216.9	207.2	342.0	348.8	338.1	328.7
2011	2 161.9	2 245.8	2 196.3	2 141.8	478.1	507.6	495.4	482.9	217.0	229.3	219.9	208.1	344.3	353.6	340.7	329.3
2012	2 187.0	2 285.6	2 227.2	2 162.5	478.1	511.1	496.6	481.9	219.3	234.0	222.9	209.0	346.5	358.3	343.3	329.8
2013	2 212.0	2 325.7	2 258.0	2 182.8	478.0	514.6	497.7	480.7	221.6	238.7	226.0	209.8	348.6	363.1	345.8	330.2
2014	2 237.0	2 366.1	2 288.6	2 202.5	477.9	518.2	498.8	479.4	223.9	243.5	229.0	210.6	350.8	367.8	348.3	330.5
2015	2 261.9	2 406.7	2 319.1	2 221.9	477.7	521.8	499.8	478.0	226.3	248.4	232.1	211.4	352.9	372.7	350.8	330.7
2016	2 286.6	2 447.7	2 349.5	2 240.8	477.4	525.4	500.7	476.5	228.6	253.3	235.2	212.1	355.0	377.5	353.2	330.8
2017	2 311.2	2 488.9	2 379.7	2 259.2	477.0	529.1	501.6	474.8	230.9	258.3	238.3	212.8	357.0	382.4	355.5	330.8
2018	2 335.7	2 530.4	2 409.7	2 277.1	476.6	532.8	502.3	473.0	233.3	263.5	241.4	213.5	359.1	387.3	357.8	330.7
2019	2 360.0	2 572.1	2 439.4	2 294.6	476.0	536.4	503.0	471.0	235.6	268.7	244.5	214.1	361.0	392.2	360.1	330.6
2020	2 384.1	2 613.9	2 469.0	2 311.9	475.4	540.1	503.5	468.9	238.0	273.9	247.7	214.7	363.0	397.2	362.3	330.4
2021	2 407.9	2 655.9	2 498.4	2 328.9	474.6	543.7	504.0	466.8	240.4	279.2	250.8	215.3	364.9	402.1	364.5	330.1
2022	2 431.4	2 698.0	2 527.5	2 345.5	473.7	547.2	504.3	464.4	242.8	284.6	254.0	215.9	366.8	407.1	366.7	329.8
2023	2 455.0	2 740.1	2 556.3	2 361.8	472.7	550.7	504.5	462.0	245.4	290.1	257.2	216.5	368.4	412.1	368.8	329.5
2024	2 478.4	2 782.3	2 584.9	2 377.7	471.6	554.2	504.5	459.4	247.8	295.6	260.4	217.1	370.1	417.1	370.8	329.0
2025	2 501.6	2 824.5	2 613.0	2 393.1	470.4	557.6	504.4	456.7	250.3	301.1	263.7	217.7	371.8	422.0	372.8	328.6
2026	2 524.7	2 866.7	2 640.8	2 408.1	469.2	560.9	504.2	453.8	252.8	306.8	266.9	218.2	373.4	427.0	374.8	328.0
2027	2 547.6	2 908.8	2 668.2	2 422.5	467.8	564.1	503.8	450.8	255.3	312.4	270.2	218.8	375.0	432.0	376.6	327.4
2028	2 570.3	2 950.9	2 695.0	2 436.4	466.4	567.2	503.3	447.6	257.8	318.2	273.4	219.3	376.6	436.9	378.4	326.7
2029	2 592.9	2 992.9	2 721.3	2 449.6	464.8	570.3	502.5	444.2	260.4	324.0	276.7	219.8	378.1	441.8	380.2	325.9
2030	2 615.3	3 034.8	2 747.1	2 462.3	463.2	573.3	501.6	440.6	262.9	329.8	279.9	220.2	379.6	446.7	381.8	325.0

Sources: ABS (2003),ABS (2006).

Box C.1 ABS population projections assumptions

ABS (2003)

The ABS (2003) medium scenario (Series B) population projections incorporate the following general assumptions:

Fertility: Total fertility rate (at national level) declining to 1.6 live births per woman by 2011 and then remaining constant.

Mortality: Life expectancy at birth (at national level) of 84.2 and 87.7 years for males and females, respectively, in 2050–51. Under this assumption, life expectancy at birth will increase by 0.30 years for males and 0.25 years for females per year until 2005–06, following which improvement will gradually decline until 2050–51.

Overseas migration: Annual net overseas migration gain (at national level) of 100 000 persons by 2005–06.

Interstate migration: 'Medium' net population gains and losses from states and territories.

The latest available ERP are used for the base year of the projections. For state and territory total population, preliminary 30 June 2002 ERP is the base year population, while within each jurisdiction, the capital city/rest of state final 30 June 2001 ERP is the base population.

ABS (2006)

The ABS (2006) medium scenario population projections incorporate the following general assumptions:

Fertility: Total fertility rate (at national level) declining to 1.7 live births per woman by 2018, and then remaining constant.

Mortality: Life expectancy at birth will reach 84.9 years for males and 88.0 years for females by 2050–51, and remain constant thereafter. Under this assumption life expectancy at birth will increase by 0.40 years per year for males and 0.30 years per year for females until 2005–06, then by 0.30 years per year for males and 0.25 years per year for females until 2010–11, after which mortality improvement will gradually decline until 2050–51.

Overseas migration: Annual net overseas migration gain (at national level) of 110 000 persons throughout the projection period.

Interstate migration: 'Medium' net population gains and losses from states and territories.

The base population for all geographic areas is the revised ERP at 30 June 2004.

Table C.2 ABS (2006)-based and state-sourced population projections, by state and territory, 2004 to 2030

(thousand persons)

Year	NSW		Vic.		Qld		SA		WA		Tas.		NT		ACT	
	State / Territory	ABS	State / Territory	ABS	State / Territory	ABS	State / Territory	ABS	State / Territory	ABS	State / Territory	ABS	State / Territory	ABS	State / Territory	ABS
2004	6 752	6 721	4 971	4 963	3 876	3 888	1 536	1 533	1 985	1 978	482	482	200	200	324	324
2005	6 810	6 776	5 024	5 017	3 959	3 967	1 544	1 539	2 016	2 009	486	486	202	202	326	326
2006	6 869	6 834	5 077	5 068	4 041	4 043	1 553	1 546	2 048	2 040	488	488	205	205	327	327
2007	6 928	6 897	5 129	5 117	4 119	4 118	1 564	1 552	2 080	2 072	490	490	208	208	330	330
2008	6 987	6 958	5 181	5 166	4 196	4 192	1 575	1 558	2 113	2 103	491	491	211	211	333	333
2009	7 046	7 020	5 232	5 214	4 273	4 267	1 586	1 564	2 145	2 134	493	493	214	214	336	336
2010	7 106	7 081	5 282	5 262	4 351	4 341	1 597	1 570	2 178	2 165	494	494	217	217	338	338
2011	7 165	7 142	5 332	5 310	4 428	4 416	1 608	1 576	2 210	2 196	495	495	220	220	341	341
2012	7 222	7 202	5 381	5 357	4 507	4 490	1 616	1 582	2 244	2 227	497	497	223	223	343	343
2013	7 279	7 261	5 430	5 404	4 586	4 565	1 624	1 587	2 277	2 258	498	498	226	226	346	346
2014	7 336	7 320	5 478	5 450	4 665	4 639	1 633	1 593	2 310	2 289	499	499	229	229	348	348
2015	7 393	7 378	5 527	5 496	4 744	4 712	1 641	1 598	2 343	2 319	500	500	232	232	351	351
2016	7 450	7 436	5 575	5 542	4 823	4 786	1 650	1 603	2 376	2 350	501	501	235	235	353	353
2017	7 507	7 493	5 623	5 587	4 901	4 859	1 657	1 608	2 409	2 380	502	502	238	238	356	356
2018	7 564	7 550	5 670	5 631	4 979	4 932	1 665	1 612	2 441	2 410	502	502	241	241	358	358
2019	7 621	7 605	5 718	5 675	5 057	5 005	1 672	1 617	2 473	2 439	503	503	244	244	360	360
2020	7 678	7 660	5 764	5 719	5 134	5 077	1 680	1 621	2 504	2 469	504	504	248	248	362	362
2021	7 735	7 714	5 811	5 762	5 212	5 149	1 688	1 625	2 535	2 498	504	504	251	251	364	364
2022	7 791	7 768	5 856	5 804	5 286	5 221	1 696	1 629	2 565	2 528	504	504	254	254	367	367
2023	7 846	7 821	5 901	5 846	5 361	5 292	1 703	1 633	2 595	2 556	504	504	257	257	369	369
2024	7 902	7 872	5 946	5 887	5 435	5 363	1 710	1 636	2 624	2 585	504	504	260	260	371	371
2025	7 957	7 923	5 989	5 927	5 510	5 433	1 717	1 639	2 652	2 613	504	504	264	264	373	373
2026	8 013	7 972	6 031	5 966	5 584	5 503	1 724	1 642	2 679	2 641	504	504	267	267	375	375
2027	8 065	8 021	6 073	6 005	5 655	5 571	1 730	1 644	2 705	2 668	504	504	270	270	377	377
2028	8 116	8 068	6 113	6 042	5 726	5 639	1 737	1 646	2 730	2 695	503	503	273	273	378	378
2029	8 168	8 113	6 152	6 078	5 797	5 706	1 743	1 647	2 755	2 721	502	502	277	277	380	380
2030	8 220	8 156	6 189	6 113	5 866	5 771	1 748	1 648	2 778	2 747	502	502	280	280	382	382

Notes: NSW data are obtained for the years 2001, 2006, 2011, 2016, 2021, 2026 and 2031. These data were then interpolated to obtain annual projections.

a. The projections for Queensland population are in five year intervals. These data were then interpolated to obtain annual projections.

b. The projections for South Australia population are in five year intervals. These data were then interpolated to obtain annual projections.

c. Tasmania, Northern Territory and the Australian Capital Territory population projections are same as the ABS projections, due to lack of state and territory based projections.

Sources: ABS (2006), DIPNR (NSW) (2004) DSE (Vic) (2004), DLGPSR (Qld) (2006), DOP (SA) (2007), WAPC (2005).

Combined 'latest' ABS population projections

In order to be consistent with the latest ABS population projections, but retain the level of detail required for OZPASS and FreightSim, the extended SLA-level ABS (2003) population projections were weighted by the relative difference between the relevant capital city/rest of state population in ABS (2006) and that for ABS (2003). This method preserves the relative population growth for SLAs within each capital city/rest of state cohort and ensures that the total projected population for each state and territory matches the ABS (2006) projections.

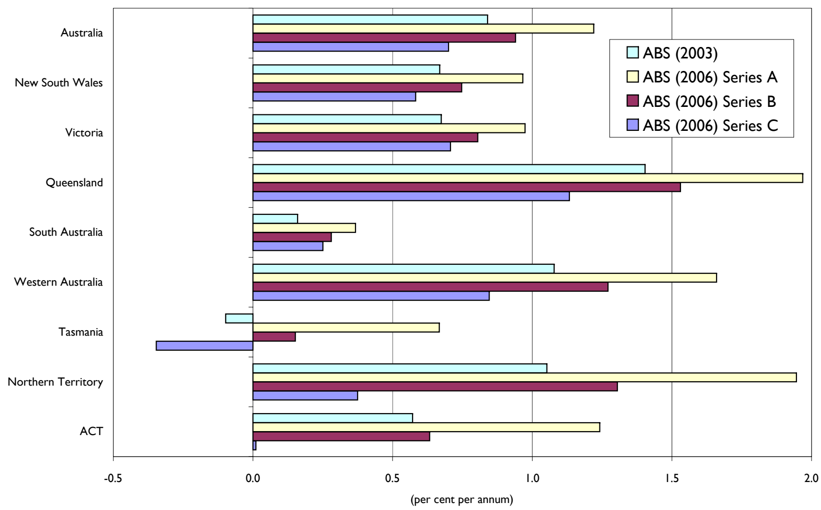
Table C.3 ABS (2003) and ABS (2006) projected population growth by state and territory, 2004 to 2030

(per cent per annum)

State / Territory	*ABS (2003)*	*ABS (2006)*		
		Series A	*Series B*	*Series C*
New South Wales	0.67	0.97	0.75	0.58
Victoria	0.67	0.97	0.80	0.71
Queensland	1.40	1.97	1.53	1.13
South Australia	0.16	0.37	0.28	0.25
Western Australia	1.08	1.66	1.27	0.85
Tasmania	−0.10	0.67	0.15	−0.35
Northern Territory	1.05	1.95	1.30	0.37
Australian Capital Territory	0.57	1.24	0.63	0.01
Australia	0.84	1.22	0.94	0.70

Sources: ABS (2003),ABS (2006).

Figure C.1 ABS (2003) and ABS (2006) projected population growth by state and territory, 2004 to 2030



Sources: ABS (2003),ABS (2006).

C.2 State and territory population projections

BITRE obtained state and territory-sourced population projections (2004–30) for the five mainland states: New South Wales, Victoria, Queensland, South Australia and Western Australia. As mentioned in the introduction, Tasmania, Northern Territory and the Australian Capital Territory do not produce their own, state-based population projections and the ABS (2006) projections were used for these jurisdictions.

New South Wales, Victoria and South Australia projections are published at the SLA-level. Queensland and Western Australia's regional population projections are published at the LGA-level. The LGA-level projections for these jurisdictions were translated to the SLA-level using the ABS (2003) SLA-level projections to apportion the LGA population for those LGAs that span two or more SLAs.

New South Wales, Queensland and South Australia provide five-yearly population projections. BITRE interpolated linearly to derive annual projections.

C.3 Comparison: ABS and state and territory population projections

Table C.2 lists the ABS and state and territory-sourced population projections by jurisdiction between 2004 and 2030. Again, Tasmania, Northern Territory and Australian Capital Territory do not have separate state and territory based population projections, and so the 'ABS' and 'state and territory' source projections are identical for these jurisdictions.

The separate state and territory population projections are all slightly higher than the ABS (2006, Series B) population projections. For New South Wales, Victoria, Queensland and Western Australia, the state-sourced population projections are between 1.0 and 2.0 per cent higher than the ABS projections by 2030. For South Australia, the state-sourced population projections are 6 per cent higher in 2030 than the ABS projections.

At the national level, the state-sourced projections imply a population of 25.97 million persons by 2030, 1.4 per cent higher than the ABS projections.

Table C.4 lists and Figure C.2 illustrates the projected population growth rates for each state and territory under the ABS and state-sourced population projections. It can be observed that, despite the slight differences in the projected population growth rate between the two sources, the overall story is unchanged—population growth is projected to be strongest in Queensland, Northern Territory and Western Australia. Population growth in New South Wales and Victoria is projected to average around 0.8 per cent per annum to

2030. Both South Australia and Tasmania are projected to have the slowest population growth, less than 0.5 per cent per annum to 2030.

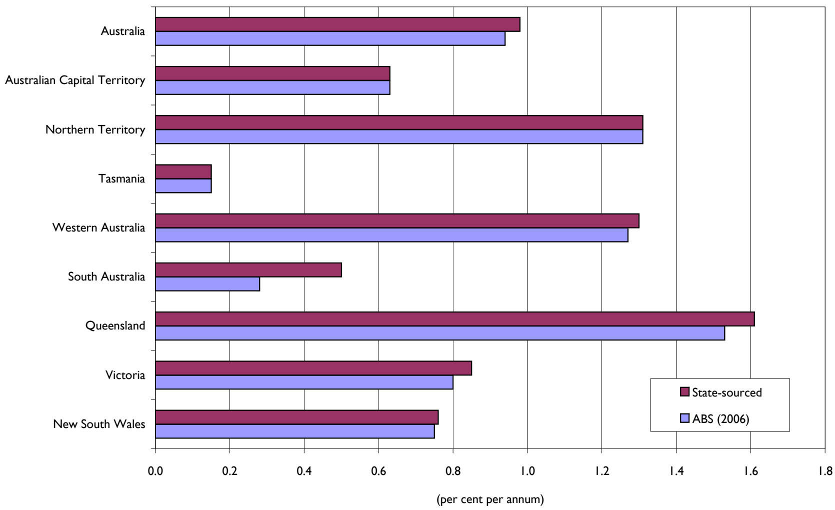
Table C.4 ABS (2006) and state-sourced projected population growth by state and territory, 2004 to 2030

(per cent per annum)

State/Territory	*ABS (2006)*	*State-sourced*
New South Wales	0.75	0.76
Victoria	0.8	0.85
Queensland	1.53	1.61
South Australia	0.28	0.5
Western Australia	1.27	1.3
Tasmania	0.15	0.15
Northern Territory	1.31	1.31
Australian Capital Territory	0.63	0.63
Australia	0.94	0.98

Sources: ABS (2006), DIPNR (NSW) (2004) DSE (Vic) (2004), DLGPSR (Qld) (2006), DOP (SA) (2007), WAPC (2005).

Figure C.2 ABS (2006) and state-sourced projected population growth by state and territory, 2004 to 2030

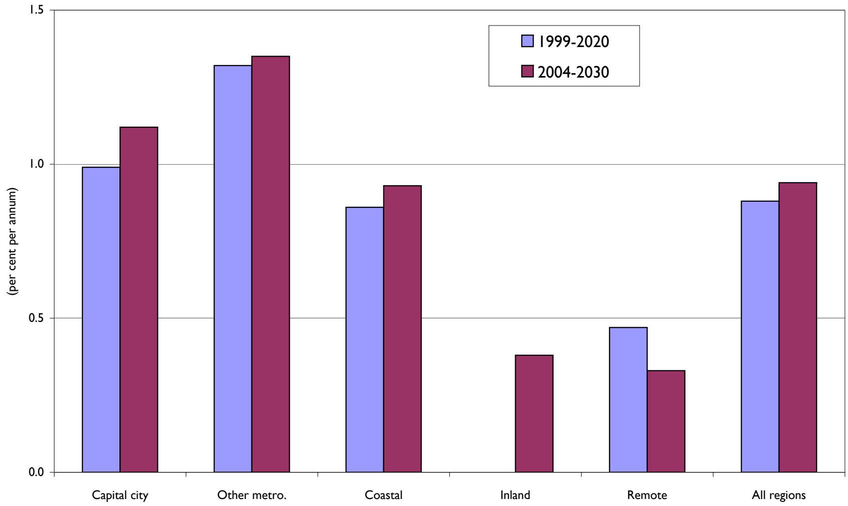


Sources: ABS (2006), DIPNR (NSW) (2004) DSE (Vic) (2004), DLGPSR (Qld) (2006), DOP (SA) (2007), WAPC (2005).

Comparison with population projections used in BTRE (2006*a*)

Comparing the ABS (2006) projected population growth, between 2004 and 2030, with the population projections used in BTRE (2006*a*), between 1999 and 2002, the latest projections imply slightly higher population growth in all re-

Figure C.3 Comparison: population projection assumptions BTRE (2006*a*), 1999 to 2020, and updated projection assumptions, 2004 to 2030



Sources: ABS (2006) and BTRE (2006*a*).

Table C.5 Comparison: population projection assumptions BTRE (2006*a*), 1999 to 2020, and updated projection assumptions, 2004 to 2030

(per cent per annum)

Projection period	*Capital city*	*Other metro.*	*Coastal*	*Inland*	*Remote*	*All regions*
1999–2020 (BTRE 2006*a*)	0.99	1.32	0.86	0.00	0.47	0.88
2004–2030 (ABS 2006)	1.12	1.35	0.93	0.38	0.33	0.94

Sources: ABS (2006) and BTRE (2006*a*).

gional areas, except remote regions (see Figure C.3 and Table C.5). Population growth is projected to be much stronger in inland areas.

Appendix D GDP growth assumptions

Table D.1 lists the projected annual real GDP growth rates, for the period 2003–04 to 2029–30, used in deriving the passenger and freight task projections presented in the report. The long-term projections are broadly based on the real GDP growth projections in the latest Intergenerational Report (Treasury 2007*a*). The IGR projects average annual real GDP growth of 2.4 per cent per annum over the next 40 years to 2040. The real GDP growth projections listed in Table D.1 are based on actual real annual GDP growth up to June 2007, the MYEFO projections (Treasury 2007*b*) for 2007–08 and 2008–09 and annual nominal GDP estimates input to Treasury (2007*a*), subtracting projected annual inflation of 2.5 per cent per annum. The projections imply average real GDP growth of 2.67 per cent per annum between 2005 and 2030. The long-term real GDP growth estimates are based on unpublished nominal GDP growth projections input to Treasury (2007*a*), deflated by 2.5 per cent per annum—the assumed average annual rate of price inflation (Treasury 2007*a*), also the mid-point of the Reserve Bank of Australia's target inflation band and consistent with the inflation assumptions in the original Intergenerational Report (Treasury 2002).

The Treasury (2007*a*) GDP projections imply a higher rate of GDP growth than that assumed in Treasury (2002) due to assumed higher migration rates and higher longer-term fertility rates and changes in demographic, labour force and productivity trends. However, the projections still imply slowing rates of GDP growth due to slowing labour force growth due to an aging population. The projections imply real GDP growth will decline from around 4 per cent per annum in 2003–04 to around 2.2 per cent per annum in 2029–30. Over the 25 years 2004–05 to 2029–30, projected real GDP growth will average 2.67 per cent per annum.

Table D.1 also lists the projected growth in total national population between 2003–04 and 2029–30, based on the ABS (2006) and the state-sourced projected population growth. These estimates are reproduced from Appendix C.

As far as BITRE is aware, there are no other comparable long-term GDP growth projections available for Australia. Access Economics provides five year GDP growth projections. The latest such projections extend to 2011–12 (Access Economics 2008). Access Economics (2008) projects average annual GDP growth of 3.7 per cent per annum between 2006–07 and 2011–12. In comparison, the MYEFO and IGR projections imply average annual GDP growth of 3.4 per cent over the next five years.

Table D.1 Projected GDP and population growth, 2003–04 to 2029–30

(per cent per annum)

Year	Real GDP growth	Population growth	
		ABS (2006)	State-sourced
2003–04	4.05		
2004–05	2.68	1.156	1.196
2005–06	2.91	1.139	1.179
2006–07	3.37	1.122	1.137
2007–08	4.25	1.105	1.121
2008–09	3.50	1.088	1.106
2009–10	3.25	1.072	1.092
2010–11	3.17	1.057	1.077
2011–12	2.99	1.037	1.059
2012–13	2.88	1.019	1.048
2013–14	2.80	1.001	1.035
2014–15	2.71	0.984	1.023
2015–16	2.59	0.969	1.010
2016–17	2.51	0.950	0.987
2017–18	2.43	0.931	0.973
2018–19	2.40	0.913	0.959
2019–20	2.37	0.898	0.945
2020–21	2.34	0.882	0.931
2021–22	2.33	0.864	0.897
2022–23	2.30	0.846	0.883
2023–24	2.25	0.826	0.867
2024–25	2.24	0.806	0.851
2025–26	2.23	0.785	0.835
2026–27	2.22	0.762	0.790
2027–28	2.22	0.738	0.774
2028–29	2.21	0.714	0.754
2029–30	2.22	0.688	0.734

Sources: Treasury (2007*a*),Treasury (2007*b*), Treasury (pers. comm.) Sep. 2005, DIPNR (NSW) (2004) DSE (Vic) (2004), DLGPSR (Qld) (2006), DOP (SA) (2007) and WAPC (2005).

Appendix E Base year road traffic data

The base year road traffic volume data used in the projections is from the combined small road section dataset for the NLTN, compiled by BITRE from data supplied by state and territory road authorities. That data set contains estimates of annual average daily traffic (AADT) volumes and percentage of commercial vehicles, generally for calendar year 2005, for over 18 000 separate sections (including dual carriageways).

The state and territory supplied data also included geographic coordinates for each road section. In order to match the traffic count data with assigned OD light and heavy vehicle traffic, BITRE used the geographic information to match the state and territory road sections to the relevant road section in the GA (2004) road layer.

This appendix provides a summary of the combined NLTN small road section data (Section E.1) and average 2005 traffic volumes across all NLTN corridors (Section E.2). Section E.3 provides a brief discussion of some data quality issues. BTRE (2007*b*) provides a more detailed discussion of the small section data supplied by the states and territories and the methods used to combine the data into a single data set.

E.1 NLTN small section road data set

The combined NLTN small section data set contains 16 750 separate sections for approximately 21 720 kilometres of roads that comprise the network, as well as approximately 1660 kilometres of the Brand and North West Coastal Highways between Perth and Port Hedland. The road traffic count data includes average annual daily traffic count data and estimates of the percentage of commercial vehicles for all road sections. Table E.1 provides some summary statistics for the small section data set.

The section length supplied by each of the states and territories varied from GPS point sample recordings roughly every 10 metres—provided by the Northern Territory and Australian Capital Territory for some road sections—to section lengths of over 100 kilometres in Queensland. Most jurisdictions provided traffic data for sections of between 1 and 6 kilometres in length.

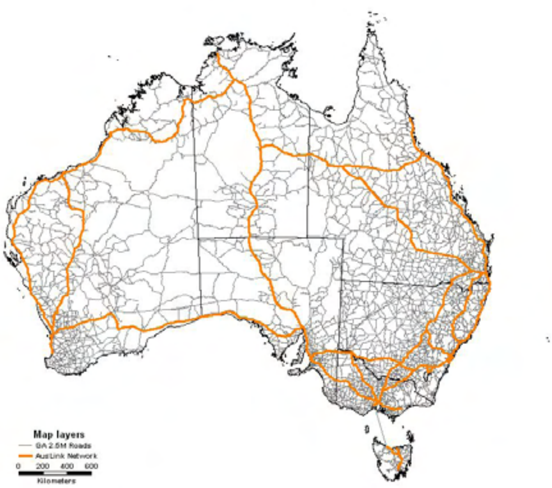
BITRE combined the Northern Territory and Australian Capital Territory sample point data into approximately one kilometre separate sections. The Queensland data is coarsest, with an average section length of approximately 10.6 kilometres and Victorian, Western Australian, Northern Territory and Australian Capital Territory data finest with average section lengths of around one kilometre. Divided roads comprise approximately 2400 kilometres, approximately 10 per cent, of the NLTN.

Table E.1 Summary: NLTN small section road data set

State / territory	*No. sections*	*Length (km)*					
		Total	*Divided roads*	*Undivided roads*	*Average*	*Shortest*	*Longest*
NSW	4 026	4 193.0	1 100.3	3 092.7	1.31	..	6.01
Vic.	2 614	1 822.1	770.9	1 051.2	0.99	0.163	1
Qld	473	5 029.2	..	5 029.2	10.63	0.03	176.94
SA	1 480	2 770.5	260.0	2 510.5	2.05	0.03	5.99
WA[a]	6 963	6 530.6	216.4	6 314.1	0.97	0.01	1
Tas.	121	367.3	..	367.3	3.04	0.04	10.51
NT	2 716	2 680.9	34.1	2 646.8	1.00	0.19	2.57
ACT	52	19.0	19.0	..	0.73	0.175	3.035
Total[a]	18 445	23 413.0	2 400.8	21 012.0	1.27	..	176.94

.. Not applicable.
a. Includes the Brand and North West Coastal Highways (WA) are not part of the NLTN.
Note: The length of divided road sections was computed as the average length of adjacent carriageways.
Sources: State and territory small section road traffic data and BTRE (2007*b*).

Figure E.1 NLTN roads and GA (2004) road layers



Note: The Brand and North West Coastal Highways (WA) are not part of the NLTN.
Sources: State and territory small section road traffic data and BTRE (2007*b*).

E.2 NLTN corridor traffic summary

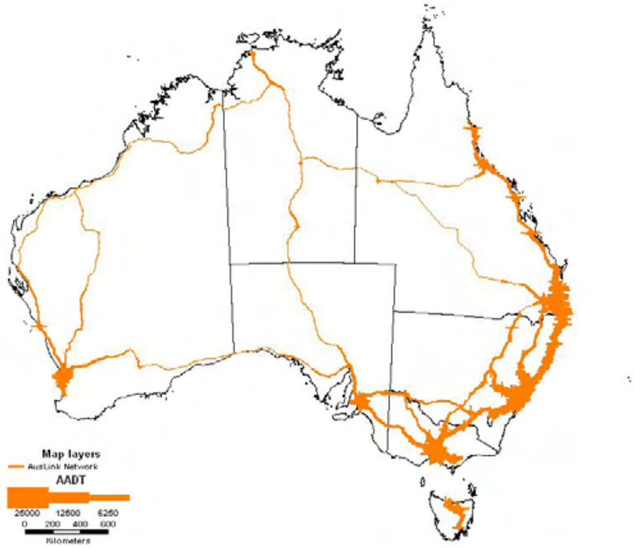
Table E.2 presents average traffic levels by NLTN corridor and Table E.3 the average traffic level by link for each of the NLTN corridors. Figures E.2 and E.3 show base year total AADT and heavy vehicle AADT across the NLTN.

Table E.2 Average traffic levels by NLTN corridor, 2005

Corridor ID	*Corridor*	*Length*	*Total AADT*	*HV AADT*	*HV share*
		(km)	*(AADT)*		*(per cent)*
		Interstate corridors			
1200	Syd–Mel (via Hume Hwy)	814.5	13 688	3 696	27
1300	Syd–Bne (via New England Hwy)	932.6	12 345	1 537	12.5
1310	Syd–Bne (via Pacific Hwy)	765.9	21 471	4 753	22.1
1400	Syd–Adl	984	3 426	646	18.9
1800	Canberra connectors	126.3	11 394	1 285	11.3
2300	Mel–Bne	1 434.9	2 659	836	31.4
2400	Mel–Adl	700.4	7 811	1 577	20.2
3700	Bne–Dar	2 419	1 503	263	17.5
4500	Adl–Per	2 666.9	1 497	348	23.2
4700	Adl–Dar	2 704.8	722	116	16.1
5700	Per–Dar	3 690.9	515	138	26.8
		Intrastate corridors			
1110	Syd–Dbo	369.8	13 770	1 446	10.5
1210	Syd–Wol (via Princes Hwy)	63.4	44 530	3 349	7.5
2200	Mel–Gee	48.5	63 152	6 349	10.1
2210	Mel–Mlq	528.6	6 343	763	12
1210	Mel–Sxe	172.1	17 183	2 351	13.7
3300	Bne–Cns	1 675.2	7 475	1048	14
3310	Tvl–Isa	762.5	688	137	20
5500	Per–Bun	160.3	19 356	1 678	8.7
5510[a]	Per–Phe	1 662.4	1 015	230	22.7
6600	Hob–Dpo	319.8	7 544	844	11.2
6610	Lst–Bell Bay	47.5	5 724	695	12.1
		Urban corridors			
1199	Sydney urban sections	88.4	71 358	5 314	7.4
2299	Melbourne urban sections	88.7	85 219	10 558	12.4
3399	Brisbane urban sections	75.1	57 061	15 857	27.8
4499	Adelaide urban sections	46.3	28 856	2 912	10.1
5599	Perth urban sections	63.8	33 428	3 319	9.9

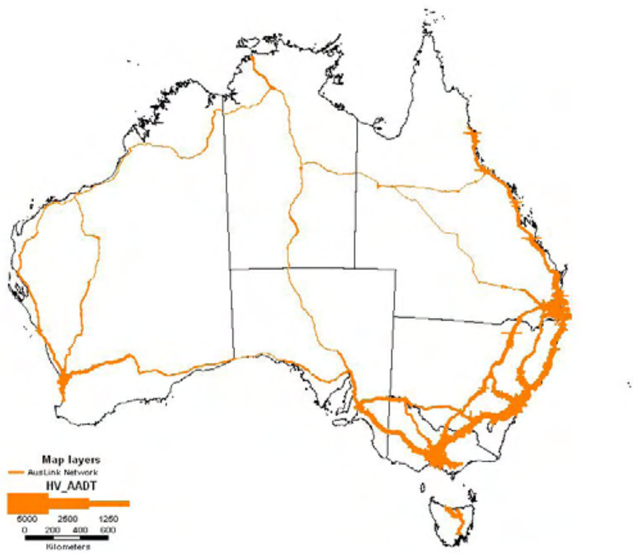
a. The Brand and North West Coastal Highways are not part of the NLTN.
Sources: State and territory road traffic volume data and BTRE (2007*b*).

Figure E.2 NLTN average daily total traffic



Note: The Brand and North West Coastal Highways (WA) are not part of the NLTN.
Sources: State and territory small section road traffic data and BTRE (2007*b*).

Figure E.3 NLTN average daily heavy vehicle traffic



Note: The Brand and North West Coastal Highways (WA) are not part of the NLTN.
Sources: State and territory small section road traffic data and BTRE (2007*b*).

Table E.3 Average traffic levels by NLTN corridor and link, 2005

Corridor ID	*Link ID*	*Link*	*Length (km)*	*AADT*	*HV AADT*	*HV share (per cent)*
		Interstate corridors				
Sydney–Melbourne (via Hume Highway)						
1200	11	Sydney–Federal Hwy	166.8	27 189	5 146	18.9
1200	12	Federal Hwy–Barton Hwy	64.8	7 516	3 014	40.1
1200	13	Barton Hwy–Sturt Hwy	139.2	7 550	2 784	36.9
1200	14	Sturt Hwy–Holbrook	79.4	5 054	1 817	36
1200	15	Holbrook–Vic. border	67.3	9 157	3 034	33.1
1200	21	NSW border–Wangaratta	67.8	12 091	3 688	30.5
1200	22	Wangaratta–Euroa	90.5	9 936	3 401	34.2
1200	23	Euroa–Goulburn Vly Hwy	51	8 902	3 166	35.6
1200	24	Goulburn Valley Hwy–Western Ring Road	87.7	21 496	5 718	26.6
Sydney–Brisbane (via New England Highway)						
1300	11	Sydney–Newcastle	126	52 934	4 857	9.2
1300	12	Newcastle–Maitland	14.7	35 861	2 814	7.8
1300	13	Maitland–Singleton	46.1	18 405	2 386	13
1300	14	Singleton–Muswellbrook	47.2	11 840	2 244	19
1300	15	Muswellbrook–Tamworth	155.8	5 455	1 120	20.5
1300	16	Tamworth–Armidale	112.1	3 870	642	16.6
1300	17	Armidale–Glen Innes	93.9	2 469	466	18.9
1300	18	Glen Innes–Qld border	111.1	2 246	523	23.3
1300	31	NSW border–Warwick	97.1	3 117	546	17.5
1300	32	Warwick–Ipswich	128.6	6 549	1 268	19.4
Sydney–Brisbane (via Pacific Highway)						
1310	11	Sydney–Newcastle Fwy – Bulahdelah	87.7	18 140	2 457	13.5
1310	12	Bulahdelah–Port Macquarie	141.3	12 190	1 853	15.2
1310	13	Port Macquarie–Kempsey	42.4	13 098	2 035	15.5
1310	14	Kempsey–Nambucca Heads	62.9	9 613	1 448	15.1
1310	15	Nambucca Heads–Coffs Harbour	47.1	13 460	1 639	12.2
1310	16	Coffs Harbour–Grafton	84.9	11 378	1 568	13.8
1310	17	Grafton–Ballina	126.7	9 448	1 382	14.6
1310	18	Ballina–Qld border	90.5	18 230	2 041	11.2
1310	31	NSW border–Brisbane	82.5	91 269	29 298	32.1
Sydney–Adelaide						
1400	11	Hume Hwy–Wagga Wagga	45.6	5 021	1 011	20.1
1400	12	Wagga Wagga–Newell Hwy	94.4	2 772	652	23.5
1400	13	Newell Highway (Narrandera)–Hay	169.3	1 066	423	39.7
1400	14	Hay–Balranald	131.7	1 252	503	40.2
1400	15	Balranald–Mildura	156.4	2 032	452	22.2
1400	21	Mildura–SA border	117.4	2 016	777	38.6
1400	41	Vic. border–Renmark	26.3	2 201	562	25.5
1400	42	Renmark–Waikerie turnoff	76.8	3 513	631	18
1400	43	Waikerie turnoff–Truro	87.9	2 557	663	25.9
1400	44	Truro–Adelaide	78.3	18 251	1 370	7.5
Canberra connectors (Federal Highway)						
1800	11	Hume Hwy–ACT Border	65.8	12 112	1 332	11
1800	81	ACT Border–Barton Hwy	7.1	15 165	2 615	17.2
Canberra connectors (Barton Highway)						
1800	12	Hume Hwy–ACT Border	41.4	7 536	678	9
1800	82	ACT Border–Federal Hwy	11.9	18 573	2 340	12.6

Table E.3 Average traffic levels by NLTN corridor and link, 2005 (continued)

Corridor ID	*Link ID*	*Link*	*Length (km)*	*AADT*	*HV AADT*	*HV share (per cent)*
Melbourne–Brisbane						
2300	11	Vic. border–Narrandera	163.2	1 627	535	32.9
2300	12	Narrandera–West Wyalong	138.3	1 443	442	30.7
2300	13	West Wyalong–Parkes	137.5	2 760	951	34.5
2300	14	Parkes–Dubbo	121	3 594	1 016	28.3
2300	15	Dubbo–Coonabarabran	157.2	2 173	725	33.3
2300	16	Coonabarabran–Narrabri	119.4	1 974	781	39.6
2300	17	Narrabri–Moree	100.3	3 568	1 446	40.5
2300	18	Moree–Qld border	122	2 460	984	40
2300	21	Hume Hwy–Shepparton	74.3	6 386	1 456	22.8
2300	22	Shepparton–NSW border	78.6	4 411	908	20.6
2300	31	NSW border–Toowoomba	223	2 151	654	30.4
Melbourne–Adelaide						
2400	21	Melbourne–Ballarat	87.6	25 335	3 408	13.5
2400	22	Ballarat–Ararat	96	5 082	1 581	31.1
2400	23	Ararat–Horsham	95.7	4 262	1 289	30.2
2400	24	Horsham–SA border	137.6	2 371	945	39.9
2400	41	Vic. border–Keith	63.9	2 608	986	37.8
2400	42	Keith–Tailem Bend	126.8	3 620	1 228	33.9
2400	43	Tailem Bend–Adelaide	92.8	15 136	1 963	13
Brisbane–Darwin						
3700	31	Ipswich–Toowoomba	96.6	19 137	2 694	14.1
3700	32	Toowoomba–Miles	211.4	3 755	640	17
3700	33	Miles–Morven	318.3	1 006	222	22.1
3700	34	Morven–Winton	699.4	377	107	28.4
3700	35	Winton–Mount Isa	470.2	491	125	25.6
3700	36	Mount Isa–NT border	189.5	445	116	26
3700	71	Qld. border–Stuart Hwy	433.7	217	33	15
Adelaide–Perth						
4500	41	Adelaide–Port Augusta	294.7	5 304	895	16.9
4500	42	Port Augusta–Kimba	154.3	837	219	26.2
4500	43	Kimba–Ceduna	313.2	594	210	35.4
4500	44	Ceduna–WA border	482.2	402	130	32.2
4500	51	SA border–Norseman	720.7	339	152	44.9
4500	52	Norseman–Coolgardie	164.2	622	235	37.8
4500	53	Coolgardie–Merredin	296.1	1 744	562	32.2
4500	54	Merredin–Northam	162.2	2 396	672	28.1
4500	55	Northam–Perth	79.3	8 432	974	11.5
Adelaide–Darwin						
4700	41	Port Augusta–Pimba	169.6	714	168	23.5
4700	42	Pimba–Coober Pedy	369	372	89	24
4700	43	Coober Pedy–NT border	388.5	420	80	19
4700	71	SA border–Lasseter Hwy	91.7	300	45	15
4700	72	Lasseter Hwy–Alice Springs	199.2	778	117	15
4700	73	Alice Springs–Barkly Hwy	531.2	705	103	14.6
4700	74	Barkly Hwy–Katherine	647.4	538	80	15
4700	75	Katherine–Darwin	301.2	1 990	280	14.1
4700	76	Berrimah Road	6.9	3 876	574	14.8

Table E.3 Average traffic levels by NLTN corridor and link, 2005 (continued)

Corridor ID	*Link ID*	*Link*	*Length (km)*	*AADT*	*HV AADT*	*HV share (per cent)*
Perth–Darwin						
5700	51	Perth–Brand Hwy	33.6	11 171	1 869	16.7
5700	52	Brand Hwy–Mount Magnet	513.1	830	277	33.3
5700	53	Mount Magnet–Meekatharra	194.9	669	245	36.6
5700	54	Meekatharra–Newman	420.3	180	77	42.7
5700	55	Newman–NW Coastal Hwy	409.7	241	81	33.6
5700	56	NW Coastal Hwy–Pt Hedland	33.3	1 249	148	11.8
5700	57	Port Hedland–Broome	565.6	308	96	31.1
5700	58	Broome–Halls Creek	650.9	290	62	21.3
5700	59	Halls Creek–NT border	400.1	629	178	28.4
5700	71	WA border–Katherine	469.4	295	44	15
		Intrastate corridors				
Sydney–Dubbo						
1110	11	Sydney–Katoomba	65.7	46 224	3 675	8
1110	12	Katoomba–Bathurst	97.8	9 766	1 370	14
1110	13	Bathurst–Orange	54	8 422	1 147	13.6
1110	14	Orange–Dubbo	152.3	4 243	640	15.1
Sydney–Wollongong						
1210	11	Sydney–Wollongong	63.4	44 530	3 349	7.5
Melbourne–Geelong						
2200	21	West Gate Fwy–Geelong	48.5	63 152	6 349	10.1
Melbourne–Sale						
1210	24	Sale–Moe	80	11 822	1 451	12.3
1210	25	Moe–Melbourne	92.1	21 841	3 133	14.3
Melbourne–Mildura						
2210	21	Melbourne–Bendigo	131.2	19 964	1 969	9.9
2210	22	Bendigo–Sea Lake	210.1	1 667	367	22
2210	23	Sea Lake–Mildura	187.2	2 044	364	17.8
Brisbane–Cairns						
3300	31	Brisbane–Gympie	146.3	34 737	2 934	8.4
3300	32	Gympie–Gladstone turnoff	343.5	4 975	1 007	20.2
3300	33	Gladstone turnoff–Rockhampton	121.1	4 619	975	21.1
3300	34	Rockhampton–Mackay	333.9	3 936	763	19.4
3300	35	Mackay–Bowen	187.3	4 162	722	17.3
3300	36	Bowen–Townsville	194.3	4 286	603	14.1
3300	37	Townsville–Cairns	349	6 435	1 018	15.8
Townsville–Mount Isa						
3310	31	Townsville–Charters Towers	123.9	2 219	330	14.9
3310	32	Charters Towers–Hughenden	251.3	561	138	24.6
3310	33	Hughenden–Landsborough Hwy	387.3	281	75	26.8
Perth–Bunbury						
5500	51	Perth–Mandurah	54.8	36 982	2 767	7.5
5500	52	Mandurah–Bunbury	105.5	10 208	1 113	10.9
Perth–Port Hedland (via North West Coastal Highway)						
5510	51	Perth–Geraldton	367.6	2 245	436	19.4
5510	52	Geraldton–Overland Roadhouse	280.7	1 537	314	20.4
5510	53	Overland Roadhouse–Carnarvon	193.7	633	233	36.8
5510	54	Carnarvon–Minilya Exmouth Rd	142.2	447	175	39.1
5510	55	Minilya Exmouth Rd–Karratha Rd	487.7	283	96	34
5510	56	Karratha Rd–Great Northern Hwy	190.5	556	91	16.4

Table E.3 Average traffic levels by NLTN corridor and link, 2005 (continued)

Corridor ID	*Link ID*	*Link*	*Length (km)*	*AADT*	*HV AADT*	*HV share (per cent)*
Hobart–Burnie						
6600	61	Hobart–Launceston	178.4	6 320	717	11.3
6600	62	Launceston–Burnie	141.5	9 087	1 003	11
Launceston–Bell Bay						
6610	61	Launceston–Bell Bay	47.5	5 724	695	12.1
		Urban corridors				
Sydney						
1199	11	South-West Motorway	30	91 805	6 885	7.5
1199	12	General Holmes Dr, Foreshore Dr	5.4	81 436	7 909	9.7
1199	13	King Georges Road	17.3	62 541	3 565	5.7
1199	14	Cumberland Highway	35.7	56 932	4 447	7.8
Melbourne						
2299	21	West Gate Freeway	13.6	140 023	18 687	13.3
2299	22	Western Ring Road	29.6	94 538	13 356	14.1
2299	23	Tullamarine Freeway	8.2	57 354	1 952	3.4
2299	24	Monash Freeway	32.6	70 938	7 897	11.1
2299	25	Footscray Road	2.3	22 735	4 555	20
2299	26	Airport Drive	2.4	9 441	1 274	13.5
Brisbane						
3399	31	Gateway Motorway	39.4	63 220	25 936	41
3399	32	Ipswich Motorway, Redland Sub-Arterial Rd, Griffith Arterial Rd	30.1	57 864	4 960	8.6
3399	33	Port of Brisbane Rd (Lytton Rd)	5.7	9 816	3 535	36
Adelaide						
4499	41	Portrush Road	9.9	26 442	1 609	6.1
4499	42	Hampstead Road	3.9	30 451	2 043	6.7
4499	43	Grand Junction Road	4.7	34 974	4 521	12.9
4499	44	South Road	9.6	38 896	5 047	13
4499	45	Burbridge Road	2.8	27 773	868	3.1
4499	46	Salisbury Highway	7.1	35 413	3 898	11
4499	47	Victoria Road	8.4	10 995	1 367	12.4
Perth						
5599	51	Roe Highway	29.6	29 690	3 469	11.7
5599	52	South Street	4.1	49 057	4 072	8.3
5599	53	Tonkin Highway	3.4	42 011	4 075	9.7
5599	54	Leach Highway	22.1	37 122	3 207	8.6
5599	55	Stirling Highway, Tydeman Road and Port Beach Road	3.7	22 483	2 102	9.4
5599	56	Canning Highway, Queen Victoria Road and Beach Street	1.1	11 760	500	4.3

Note: Brand and North West Coastal Highways are not part of the NLTN.
Sources: State and territory road traffic volume data and BTRE (2007*b*).

E.3 Data quality issues

In combining the separate state/territory road network data, BITRE investigated the consistency of the traffic volume data across jurisdictions.

Cross-border consistency

Apart from visual inspection of the traffic volume data, using maps such as those shown in Figures E.2 and E.3, the only other substantive check on the consistency of the road traffic volume data provided by states and territories was to compare the traffic volumes reported on each interstate NLTN corridor for sections either side of a state/territory border. The approach is probably not wholly conclusive where there are significant population centres at the border—for example Albury–Wodonga on the Hume Highway and Coolangatta–Tweed Heads on the Pacific Highway.

Table E.4 lists traffic volumes on each side of each state/territory border on the interstate NLTN corridors. The traffic volumes are listed in the order specified in the Description column—for example, for the Hume Hwy, NSW–Victoria border, total AADT of 45 358 is traffic on the NSW side and AADT of 51 684 is traffic on the Victorian side. Traffic levels within ± 10–15 per cent on each side of the border represent a reasonably close match, given the potential differences in how the traffic is measured. For most corridors, however, total measured traffic levels differ by more than 20 per cent. The match between measured heavy vehicle traffic is a little better, with measured heavy vehicle traffic levels within ± 10–15 per cent on each side of the border for five of the twelve sites. Implied light vehicle traffic levels can vary quite significantly on each side of the border.

Apart from additional traffic generated by population centres located on the border, other possible explanations for the differences in measured traffic levels at state/territory borders could include:

- differences in length and timing of the traffic sampling period
- location of traffic count stations and degree of imputation required to estimate traffic levels at small section level.

A full accounting for these differences was beyond the scope of this analysis. The text below provides a further discussion, by corridor and location, of the similarities and differences in traffic levels.

Hume Highway (NSW–Vic. border) Total AADT is reasonably similar on each side of the border—that is, within ± 10–15 per cent—but the proportion of heavy vehicles quite different—35.3 per cent on New South Wales side and 10 per cent on Victorian side. This may be an issue of sampling accuracy in the New South Wales data, as the total AADT estimates increase from 22 928 vehicles per day to 45 358 vehicles per day along

Table E.4 Comparison: base year traffic volumes at state/territory borders, interstate NLTN corridors

Corridor		Traffic		
ID	Highway (border)	Total AADT	LV AADT	HV AADT
1200	Hume Hwy (NSW–Vic)	45 358 : 51 684	29 347 : 46 516	16 011 : 5 168
1300	New England Hwy (NSW–Qld)	2 513 : 2 213	1 963 : 1 793	550 : 420
1310	Pacific Highway (NSW–Qld)	42 588 : 58 955	38 329 : 55 082	4 259 : 3 873
1400	Sturt Hwy (NSW–Vic)	11 993 : 7 073	10 902 : 6 083	1 091 : 990
1400	Sturt Hwy (Vic–SA)	1 753 : 1 700	982 : 1 156	771 : 544
2300	Goulburn Valley & Newell Hwys (Vic–NSW)	3 531 : 4 051	2 613 : 2 986	918 : 1 065
2300	Newell & Gore Hwys (NSW–Qld)	4 162 : 2 807	3 017 : 1 653	1 145 : 1 154
2400	Western & Dukes Hwys (Vic–SA)	1 798 : 2 600	863 : 1 638	935 : 962
3700	Barkly Hwy (Qld–NT)	187: 231	136 : 196	51 : 35
4500	Eyre Hwy (SA–WA)	320 : 339	224 : 187	96 : 152
4700	Stuart Hwy (SA–NT)	420 : 300	340 : 255	80 : 45
5700	Victoria Hwy (WA–NT)	261 : 195	223 : 166	38 : 29

Sources: State and territory road traffic volume data and BITRE estimates.

the sections approaching the Victorian border, but the estimated heavy vehicle share is unchanged at 35.3 per cent.

New England Highway (NSW–Qld border) Measured total AADT and estimated light vehicle AADT are within ± 10–15 per cent. Estimated heavy vehicle AADT levels are relatively similar in absolute terms.

Pacific Highway (NSW–Qld border) Measured total AADT and estimated light vehicle AADT differ by around 30 per cent. Traffic flows could well differ significantly at this point of the highway because this site is within a heavily populated area.

Sturt Highway (NSW–Vic. border) Estimated heavy vehicle AADT is within ± 10–15 per cent, but total light vehicle traffic differs significantly. This could be due to local traffic patterns around Mildura.

Sturt Highway (Vic.–SA border) Estimated total traffic levels are fairly similar across the border at this site. Estimated heavy vehicle traffic levels differ significantly in proportionate terms.

Goulburn Valley and Newell Highways (Vic.–NSW border) Measured light and heavy vehicle AADT on each side of the border at this site are all within ± 10–15 per cent.

Newell and Cunningham Highways (NSW–Qld border) Measured light vehicle traffic at this point suggests there are over 80 per cent more light vehicles on the New South Wales side of the border than on the Queensland side. It is likely that this difference could be local light vehicle traffic between Goondiwindi (Qld) and Boggabilla (NSW). Six kilometres south of the border, just before Boggabilla, total AADT is around 2200 vehicle per day, rather than 4160 vehicle per day shown in Table E.4. There is practically no difference between measured heavy vehicle traffic levels either side of the border at this location.

Western and Dukes Highways (Vic.–SA border) Estimated heavy vehicle AADT levels are practically identical on both sides of the border at this site. However, estimated light vehicle traffic differs significantly across the border. It is not clear why this is the case as there is no town on the border—Bordertown (SA) is approximately 20 kilometres from the Victorian border.

The remaining border crossing locations:

- Barkly Highway (Qld–NT border)
- Eyre Highway (SA–WA border)
- Stuart Highway (SA–NT border)
- Victoria Highway (WA–NT border)

are all in relatively remote areas, with very low traffic volumes. In absolute terms total, light and heavy vehicle AADT levels are broadly similar, although in proportionate terms they appear significantly different.

Overall then, the estimated traffic levels on each side of the border on interstate NLTN corridors are broadly consistent—that is, of the same order of magnitude and generally same scale—although there are significant differences in estimated light and heavy vehicle traffic levels that could be due to the nature of local traffic flows.

Appendix F Origin–destination freight and weigh-in-motion data

The interregional freight task projections presented in this report are based on FDF Ltd's FreightInfo 1999 national database of interregional freight movements, augmented by non-bulk road freight movement estimates from the ABS 2001 FMS (ABS 2002), for selected region pairs.

Substitution of 2001 FMS road freight estimates for the FDF FreightInfo data was based on a comparison of both the FMS and FreightInfo data against available 'on-road' measures of road freight and freight vehicle movements obtained from CULWAY/WIM site recordings and traffic count data. Where the 2001 FMS data better matched the on-road CULWAY/WIM traffic data than the FreightInfo 1999 data, and this was mainly on highways between capital cities and between capital cities and other major urban centres, the non-bulk road freight estimates from the 2001 FMS were substituted for the non-bulk FreightInfo 1999 estimates.

This appendix describes BITRE's comparison of road freight movement data and on-road measures of road freight and road freight vehicle movements derived from CULWAY/WIM site data and small section traffic data supplied by state and territory road agencies. The on-road freight traffic data presented in this appendix largely relates to calendar year 2005. Consequently, the FreightInfo 1999 and FMS 2001 data have to be projected to 2005 levels for comparison with the CULWAY/WIM site data and small section traffic data.

The structure of this appendix is as follows. Section F.1 describes each of the four main road freight (traffic) data sources used in the comparison:

- State and territory CULWAY/WIM data
- FDF FreightInfo 1999 interregional freight movements database
- ABS 2001 FMS (ABS 2002)
- State and territory commercial vehicle traffic counts for small-sections.

as well as the assumptions necessary to compare across the different sources. Comparison of OD road freight movements with on-road freight estimates requires assignment of the OD freight to the road network, and Section F.1 outlines the OD road freight assignment the methods. Section F.2 presents the comparison of the assigned OD road freight task estimates with the on-road freight estimates for selected CULWAY/WIM sites and discusses the implications of the results. Section F.3 provides some additional information on recent growth in freight movements for selected highways.

F.1 CULWAY/WIM and origin–destination freight data

State and territory road authorities operate a relatively extensive network of WIM devices across the non-urban highway network. The majority of rural WIM sites in Australia employ CULWAY/WIM technology, which is a combination of an axle sensor and a strain measuring device designed to detect the pattern and degree of pavement flexure caused by a passing vehicle—usually located in culverts (hence 'CULWAY'). Although other technologies are available, most WIM devices generally count the number of axles passing over the WIM device and record the vehicle axle configuration, axle masses and vehicle speeds.

Adjusting for the number of days when the CULWAY/WIM equipment did not record vehicle movements, and with assumptions about the average tare weight of heavy vehicles by vehicle class, the CULWAY/WIM data can be used to provide a measure of the total freight that has passed that point on the highway.

Previous comparisons of origin-destination and CULWAY/WIM data

BTRE (2006*a*, Appendix VII) compared the OD freight flow estimates assigned to the road network against on-road data for only one heavy vehicle checking station, located on the Hume Highway at Marulan, north of Goulburn, in New South Wales (NSW). The Marulan checking station uses WIM technology to dynamically weigh and classify freight vehicles and so provides similar data to that obtained at CULWAY/WIM sites. At Marulan, in contrast to most CULWAY/WIM sites, heavy vehicles temporarily leave the main highway section and traverse a dedicated heavy vehicle lane in which the WIM equipment is embedded.

BTRE (2006*a*) indicated the usefulness of extending this methodology to other CULWAY/WIM sites to validate OD freight movement estimates across a wider selection of the road network.

Description of the state/territory CULWAY/WIM data

For the current update, six state and territory road agencies provided BITRE with data from selected CULWAY/WIM sites covering the following periods:

- New South Wales for 2005
- Victoria for 1995 to 2005[5]
- South Australia for 2002 to 2005
- Western Australia for 2004 to 2007
- Tasmania (one quarter in 2006)
- Northern Territory for 2003 to 2006.

Only the results for 2005 were used in the analysis in Section VI.3. No comparison was undertaken for Western Australia and Tasmania. In the case of Western Australia, the CULWAY/WIM site data was not available at the time this analysis was undertaken. For Tasmania, it was considered that extrapolating from one quarter's observations may not be representative of total annual movements.

The CULWAY/WIM data was generally supplied as summary tables showing total traffic measurements at each site. The data are inclusive of adjustments made by jurisdictions to account for non-recording days and other potential anomalies. The Northern Territory also separately supplied traffic count data for 2005 derived from piezo-electric axle counters, which classify the vehicles.

Table F.1 lists, and Figures F.1 and F.2 show, the location of the CULWAY/WIM sites for which data was analysed. (Figures F.1 and F.2 show the sites by site number, listed in Table F.1. (New South Wales also operates heavy vehicle checking (weighing) stations at Marulan (Hume Highway) and Chinderah and 12 Mile Creek (Pacific Highway), but the BTRE was not supplied with data for these sites.)

New South Wales also provided data for the CULWAY/WIM site near Maitland on the New England Highway. However, the data only covers westbound vehicle movements. Because there was no information on the average vehicle loads for eastbound heavy vehicles at this location it was not analysed further. (At other sites where not all lanes are metered, adjustments for non-metered lanes were made by using the average load of vehicles travelling on a metered lane in the same direction. See discussion of adjustment for non-metered lanes, below.)

Typical CULWAY/WIM site summary data

Table F.2 shows a typical example of the CULWAY/WIM data supplied by each jurisdiction. All jurisdictions supplied, at least, the number days measured,

5. Note that some sites were added and others removed during this period.

Figure F.1 Selected CULWAY/WIM site locations—New South Wales, Victoria and South Australia

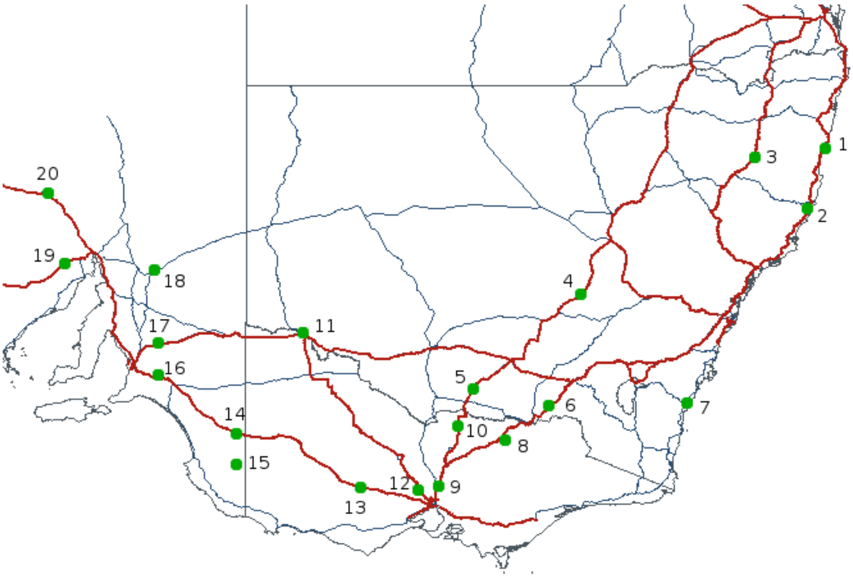


Figure F.2 Selected CULWAY/WIM site locations—Northern Territory

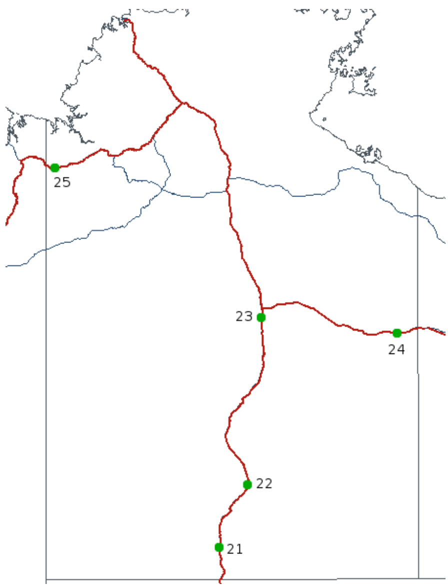


Table F.1 Selected CULWAY/WIM sites

No.	Site	No.	Site
New South Wales		*Victoria*	
1	Pacific Hwy—Walker's Creek	8	Hume Hwy—Milawa
2	Pacific Hwy—Coffs Harbour	9	Hume Hwy—Wallan
3	New England Hwy—Uralla	10	Goulburn Valley Hwy—Wunghnu
4	Newell Hwy—Forbes	11	Sturt Hwy—Mildura
5	Newell Hwy—Jerilderie	12	Calder Hwy—Gisborne
6	Hume Hwy—Holbrook	13	Western Hwy—Beaufort
7	Princes Hwy—Batemans Bay		
South Australia		*Northern Territory*	
14	Dukes Hwy—Bordertown	21	Stuart Hwy—Erldunda
15	Riddoch Hwy—Naracoorte	22	Stuart Hwy—Alice Springs
16	South East Hwy—Monarto	23	Stuart Hwy—Three Ways
17	Sturt Hwy—Truro	24	Barkly Hwy—Avon Downs
18	Barrier Hwy—Oodla Wirra	25	Victoria Hwy—20km E WA Bdr
19	Eyre Hwy—Iron Knob		
20	Stuart Hwy—Pimba		

Sources: ABS (2003),ABS (2006).

the number of lanes measured, and the vehicle count. Depending on the jurisdiction the CULWAY/WIM data also variously included:

- the average gross vehicle mass and/or total gross vehicle mass, by Austroads heavy vehicle class (i.e. Austroads classes 3 to 12)
- the average tare mass and/or total tare mass, by Austroads heavy vehicle class
- the average and/or total net freight mass, by Austroads heavy vehicle class.[6]

Table F.2, extracted from the 2002 Transport SA CULWAY report (Transport SA 2003), provides a summary of CULWAY/WIM data for the median lane of the Sturt Highway at Truro, for the nearly half-year period 03 January 2002 to 30 June 2002. The summary data includes the number of days for which vehicles were recorded (163 days), total vehicles detected (52 387) and the number of vehicles measured (3823). The key data items of interest for the purposes of this analysis are:

- Austroads vehicle class (column 1).
- Weighed vehicle counts (column 4)—which provides the total number of vehicles actually detected by the CULWAY/WIM device. This may be converted to an estimate of the total half-year vehicle movements by multiplying these quantities by the ratio of total days to measured days (182.5 days / 163 days).

6. Any two of these variables is sufficient to determine the third.

Table F.2 CULWAY classified vehicle report—Truro East (median lane) Sturt Highway, January–June 2002

Truro East (median lane) Sturt Highway Data Coverage from 03/01/2002 to 30/06/2002

Total Days:	163
Total Vehicles:	52 387
Vehicles Weighed:	3 823

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Austroads class	ESA			Weighted Vehicle Count		% Overloaded		Vehicle freight	Speed *(km/h)*			Vehicle weight *(tonnes)*		
	ESA / Veh	ESA / Day	Total	Per Day	% of Total	Axle Group	Gross Mass	/Day	Mean	StDev	85%<	Mean	StDev	95%<
3	0.32	1	422	3	0.8	0	0.2	1	91.1	17.6	110	6.2	3.1	12.9
4	3.15	6	318	2	0.6	9.7	17.9	16	76.9	16	99	18.4	6.5	27.3
5	4.63	1	33	0	0.1	24.2	12.1	2	86.7	16.3	103	21.5	7.4	34.7
6	0.50	0	14	0	0	0	0	0	87.1	20.3	103	7.9	5.8	20.2
7	0.43	0	97	1	0.2	1	0	1	91.1	19	108	8.5	6.8	22.7
8	2.14	2	122	1	0.2	4.9	0.8	4	91.3	12.2	102	20.3	9.4	36.8
9	2.83	32	1 848	11	3.5	6.5	6.8	130	89	12.7	102	27.3	10.8	50.3
10	3.19	19	954	6	1.8	7.7	5.9	97	84.6	14.9	99	37.6	16.1	71.0
11	5.00	0	11	0	0	0	0	0	74	13.9	87	51.1	21.0	81.6
12	17.00	0	4	0	0	100	0	1	63.5	10.6	60	107.6	34.8	121.7
Total	2.62	61	3 823	23	7.3	6.4	6.4	251	87.6	15.2	102	25.6	15.5	48.2

Source: Reproduced from Transport SA (2003).

- Mean vehicle weight (column 13)—which provides the mean gross mass of all measured vehicles for each heavy vehicle class. The total gross mass can be estimated by multiplying column 13 by column 4, adjusted to account for missing days.

The average freight carried by each vehicle class, may be estimated by subtracting the (estimated) mean vehicle tare weight (refer to Table F.4 and associated discussion, below) from column 13. The total freight carried by each vehicle class can be estimated by multiplying the average freight carried by the adjusted number of heavy vehicles.

The other columns in Table F.2 describe statistical information relating to vehicle mass and load characteristics, equivalent standard axles (ESAs)—standardised measures of total axle loads—vehicles overloaded and vehicle speeds, which were not of direct interest for this analysis. The South Australian CULWAY/WIM summary data includes an estimate of the average freight carried (Vehicle freight / Day, column 9) in its CULWAY reports, but this measure was not generally provided by other jurisdictions.

Supplementary Northern Territory data

The Northern Territory provided two related sets of data for 2005. The first set comprised vehicle count and gross mass estimates from the CULWAY/WIM unit data. The second contained the separate piezo-electric axle count based commercial vehicle counts, combined with the measured vehicle gross mass estimates. The Northern Territory CULWAY/WIM devices use piezo-electric axle counters located immediately before the culvert and over the centreline of the culvert to count and classify vehicles. Both detectors must record the same axle count for a vehicle to be classified and weighed (DIPE (NT) 2003). Comparison of the CULWAY/WIM measured vehicle counts and the piezo-electric counts provide quite different estimates of the number of heavy vehicle. The Northern Territory data is discussed in further detail below. The CULWAY/WIM based freight estimates for the Northern Territory presented in Section VI.3 are based on the average vehicle mass estimates recorded for vehicles measured by the CULWAY/WIM device multiplied by the piezo-electric commercial vehicle counts.

CULWAY/WIM data reliability

Austroads (2000, p. 4) notes there are numerous factors that affect the ability of WIM systems to reliably and accurately determine (static) vehicle mass. It identifies the three key elements that affect the accuracy of WIM equipment as:

- WIM location characteristics—principally the topology and topography of the WIM installation site and its approach

- vehicle characteristics—speed, acceleration/deceleration, body and suspension type, tyre condition and aerodynamic affects can all affect the performance of WIM equipment
- environmental characteristics—temperature, wind and ice can all significantly affect the performance of WIM equipment.

Accurate mass measurement using WIM equipment requires that the mass sensor(s) be properly calibrated and, to ensure that mass measurement accuracy does not deteriorate significantly, the devices should be re-calibrated at regular intervals Austroads (2000, p. i).

Indicators of CULWAY/WIM site accuracy

Published indicators of in-situ CULWAY/WIM device accuracy and reliability are limited. Austroads (2000) identifies three main types of WIM system errors:

- actual error—that is, an error in determining the true mass of the vehicle
- systematic error—e.g. flawed calibration or drift in calibration
- random error—that is, WIM system errors or vehicle characteristics.

Austroads (2000) notes that there is no Australian standard method of determining and presenting WIM site accuracy results. Generally, the accuracy is specified in terms of the 95 per cent tolerance of vehicles being weighed. DIPE (NT) (2003, p. 3), for example, states that the variation between static axle mass and CULWAY recorded values for axle group and gross vehicle mass is typically within $\pm$ 10 per cent for 95 per cent of observations.

Unpublished information obtained from the New South Wales Road Traffic Authority (RTA) in April 2007 claims WIM device accuracy of:

- 99 per cent for vehicle counts;
- $\pm$ 10 to 15 per cent for individual gross vehicle mass; and
- $\pm$ 20 per cent for axle group mass readings.

This information appears to be the standard tolerances provided by CULWAY/WIM equipment manufacturers, and is similar to the tolerances given in the published DIPE (NT) (2003) and Transport SA (2003) CULWAY/WIM reports.

Accuracy of Northern Territory vehicle counts

The Northern Territory data may provide insights into the possible limitations of the CULWAY/WIM technology. For 2005, the Northern Territory adjusted its CULWAY/WIM vehicle count and freight estimates using the raw vehicle counts derived from the piezo-electric axle counters, rather than the CULWAY/WIM device vehicle counts, which, as explained above, requires that the number of axles counted by both pre-device counter and the centreline counter be identical for the vehicle to be classified and recorded. BITRE's comparison of the Northern Territory supplied CULWAY/WIM and separate piezo-electric vehicle counts for 2005 suggests that the Northern Territory CULWAY/WIM device underestimated the total number of commercial vehicles, relative to the piezo-electric counts, by between 12 and 40 per cent, depending on the site. Averaged across all Northern Territory sites, the CULWAY/WIM results underestimated the number of vehicles by 28 per cent. In addition, the two data sets provide different estimates of the proportion of vehicles by heavy vehicle class.

The Northern Territory authorities (DIPE, unpublished data, 2005) attribute the under-enumeration of heavy vehicles by the CULWAY/WIM equipment to two primary factors:

- non-recording of vehicles due to CULWAY failure or malfunction
- non-recording of vehicles because their characteristics fall outside the rejection parameter settings.

The Northern Territory has a far higher proportion of double and triple road trains (Austroads class 11 and 12 vehicles) operating on its roads, than in other jurisdictions, and this could contribute to the relatively high occurrence of non-recorded heavy vehicles.

Summary

This section has highlighted some of the issues associated with the accuracy of CULWAY/WIM site data, and hence the potential limitations such data might have as an indicator of road freight activity. The typical manufacturer rated tolerances imply for 95 per cent of vehicles, the measured gross vehicle mass is within ± 10 to 15 per cent of the actual static mass. However, because the CULWAY/WIM data is effectively a very large sample of the heavy vehicle population passing the site, the confidence interval for the average load or the total gross mass measured across all vehicles traversing the site should be much smaller than ± 10–15 per cent, and hence the CULWAY/WIM measures of total vehicle mass relatively accurate. This assumes that the CULWAY/WIM devices are accurately and regularly calibrated, but there is little evidence available on how significant calibration drift is for CULWAY/WIM devices in operation in Australia. The Northern Territory evidence suggests also that the number of heavy vehicles measured by CULWAY/WIM devices should be compared with independent classified count data to ensure the reliability of the total count of heavy vehicles.

For the comparison of CULWAY/WIM data and OD freight movements data presented below, BITRE has assumed that the CULWAY/WIM estimates provide accurate measures of the average gross mass for vehicle recorded and used that and estimated total vehicle counts to derive estimates of the total (net) road freight task passing each CULWAY/WIM site.

Inferring road freight task estimates from CULWAY/WIM data

Three further adjustments to the CULWAY/WIM data may be necessary in order to compare it with OD-based road freight task estimates. These are:

- adjusting for non-recorded days
- adjusting for non-metered lanes
- subtracting average vehicle tare weight, by vehicle class, to derive average (net) freight load.

Accounting for non-recorded days

Where the CULWAY/WIM equipment did not record heavy vehicle movements on every day of the survey period, it is necessary to adjust the estimate to account for non-recorded days. Most jurisdictions provide both the number of vehicles counted and the average gross vehicle mass, and either an adjusted estimate of the total gross mass, taking account of missing days, or an indicator of the proportion of count days in the measurement period. In the latter case, this was used to adjust vehicle and mass estimates to derive an annual estimate by scaling by the ratio of period days to recorded days.

Adjustments for non-metered lanes

Several CULWAY/WIM sites do not include measurements of heavy vehicles across all road lanes, either because the CULWAY/WIM unit was not fully operational for part of the measurement period or because one or more lanes are not metered. In order to compare the CULWAY/WIM data measures with the assigned OD road freight estimates, BITRE adjusted the raw estimates to account for heavy vehicles in the non-metered lane(s). The discussion below describes the methods used to adjust the estimates at each CULWAY/WIM site where there are non-metered lanes.

Hume Highway—Wallan (Mitchell Shire, Victoria)

The Hume Highway near Wallan (Victoria) comprises four lanes—two northbound and two southbound. The CULWAY/WIM equipment at this site measures commercial vehicles on both northbound lanes, but only vehicles in the outer lane southbound. Estimates of heavy vehicles movements, and gross freight, travelling in the southbound median lane were derived by, firstly estimating the share of total northbound freight tonnes in the median lane, and then using this share to estimate southbound median lane freight tonnes—in other words, assuming that the share of road freight traffic in the median lane is identical for both north and south bound freight.

Approximately 5 per cent of total northbound freight uses the median lane, so this adjustment adds approximately 2.5 per cent to total freight measured at this site.

Hume Highway (Springhurst, Victoria), Goulburn Valley Highway (Wunghnu), Princes Freeway (East Yarragon/East Longwarry, Victoria) and Calder Highway (Gisborne/Kyneton)

The CULWAY/WIM sites on the Princes, Goulburn Valley and Calder Highways are all located at points where the road has two lanes in each direction, however, the CULWAY/WIM equipment only records commercial vehicles in the outer lane. For the Hume Highway CULWAY/WIM site near Springhurst, commercial vehicle movements are recorded only for the northbound median lane and the southbound kerb-side lane. Consequently, the estimation method used for the Hume Highway site at Wallan could not be employed for these sites.

Instead, estimates of the number of commercial vehicles in the median lanes at each of these sites were derived by subtracting the CULWAY/WIM sites estimates of total heavy vehicle movements in the outer lane from total commercial vehicle movements implied by the small section traffic count data used for the corridor traffic projections. BITRE has assumed that the small section traffic counts are measured independently of the CULWAY/WIM site counts.

Non-metered lane adjusted total road freight estimates for these sites were derived by multiplying the average load of heavy vehicles in the metered lane and the estimated number of vehicles in the non-metered lanes—with the implicit assumptions that the vehicle mix and average load of vehicles travelling in the non-metered lanes is identical to that of vehicles in the metered lane(s)—and adding the result to the estimated freight in the metered lanes. Table F.3 shows the estimated net freight per vehicle (across all heavy vehicle classes) used to estimate net freight for the non-metered lanes at each of these CULWAY/WIM sites. The non-metered lane freight task estimates were added to the metered lane estimates to derive the total freight task.

The accuracy of the road freight estimates derived using this approach depend critically on the assumption that the average load and vehicle mix are identical across the metered and non-metered lanes. To the extent that this is not the case, the adjusted estimates will over- or under-state the actual on-road freight. One indicator of the potential reliability of the adjusted estimates is

Table F.3 Estimated average net load per vehicle, selected Victorian CULWAY/WIM sites

CULWAY/WIM site	*Average load*
Western Highway—Pyrenees	16.20
Goulburn Valley Highway—Murchison	15.27
Princes Highway—Baw Baw	8.21
Hume Highway—Wallan	16.40
Hume Highway—Milawa	16.49
Calder Highway—Macedon	9.70

Sources: VicRoads and BITRE estimates.

the proportion of freight imputed in the non-metered lane(s). For the Western, Goulburn Valley, Princes and Calder Highway CULWAY/WIM sites, the adjustment method implies that between 40 and 80 per cent of commercial vehicle movements are in the non-metered lane—generally the median lane at these sites. This is quite a high share of total traffic—for example, inner-lane heavy vehicle traffic is around 6 per cent of the total heavy vehicle traffic on the Hume Highway at Milawa—and suggests that the adjusted estimates for these sites should be treated with caution. If, for example, much of the non-metered lane commercial vehicle traffic comprised mainly a larger proportion of smaller commercial vehicle types, then the adjusted estimates may overstate total road freight.

Derived estimates of net freight

The (net) road freight task is calculated by subtracting the average vehicle tare weight from the total gross vehicle mass, for each vehicle class, and summing over all vehicle classes. Average vehicle tare weights, by vehicle class, can be computed from the CULWAY/WIM site data by averaging the measured axle weights of all vehicles classified as unladen by the CULWAY/WIM device.[7]

The CULWAY/WIM data provided by South Australia and the Northern Territory included estimates of the net freight task. The New South Wales data, however, included only the total gross vehicle weights. For New South Wales CULWAY/WIM sites, the (net) freight task was estimated by multiplying the difference between the average gross vehicle weight and the estimated average tare weight, for each Austroads vehicle class, by the total number of vehicles in each class, and summing over all vehicles classes.

Victoria provided estimates of the gross, tare and net freight task, by Austroads vehicle class, for each CULWAY/WIM site. The Victorian-supplied average tare weights, however, appeared to be relatively high compared to other tare weight estimates. BITRE recalculated the net freight task estimates for the Victorian sites using estimated tare weights, by vehicle class, obtained from across a sample rural highway CULWAY/WIM sites in Victoria, Queensland and South Australia using data collected in 1999 and 2000.

Table F.4 lists the Victorian-supplied and BTRE-estimated average tare weights by vehicle class, and includes the total tare weight derived by summing the standard CULWAY/WIM axle-based tare weight parameters for the typical axle configuration for each vehicle class. Table F.4 also shows the typical CULWAY/WIM parameter-based tare estimates for each vehicle class and the threshold tare weights, allowing the 20 per cent tare mass tolerance generally used in CULWAY/WIM devices in Australia. The threshold tare weight represents the upper limit, above which a vehicle will be classified as

7. Vehicles within 20 per cent of the prescribed tare mass for each axle group are classified as unladen.

Table F.4 Comparison of estimated average tare weight, by Austroads vehicle class

(tonnes)

Austroads vehicle class		CULWAY/WIM parameter-based total tare weight		Victorian-supplied CULWAY tare weight	BITRE-estimated unit record-based tare weight
Class	Brief description	Parameter-based	Threshold weight		
3	Two axle truck or bus	8.5	10.2	6.93	5.28
4	Three axle truck or bus	10	12	10.85	8.61
5	Four axle truck	13.2	15.84	13.96	10.81
6	Three axle articulated	11	13.2	9.73	6.94
7	Four axle articulated truck	13.2	15.84	13.19	9.48
8	Five axle articulated truck	14.7	17.64	16.83	13.4
9	Six axle articulated truck	15.7	18.84	18.6	16.43
10	B-double or heavy truck/trailer	20.4	24.48	24.87	21.22
11	Double road train	26.1	31.32	26.79	23.52
12	Triple road train	30.8	36.96	31.53	27.15

Sources: VicRoads (unpublished CULWAY/WIM data) and BITRE estimates.

laden by the CULWAY/WIM equipment.[8]

A quick comparison of the Victorian-supplied tare weights to the BTRE-derived estimates and the CULWAY/WIM parameter-based total tare weights shown in table F.4, suggests that the Victorian-supplied estimates are too high, especially for the larger heavy vehicles: classes 9 to 12. For example, the Victorian-supplied tare weight for class 9 vehicles—six axle articulated trucks—is 18.6 tonnes, well above the unit record implied 16.4 tonnes and approaches the CULWAY/WIM parameter-based implied threshold tare weight, 18.84 tonnes. The same holds for class 10 vehicles. As indicated above, BITRE has used the unit record based tare weights by vehicle class in calculating the total net freight carried over Victorian CULWAY/WIM sites.

FreightInfo origin–destination road freight estimates

The FreightInfo 1999 database contains estimates of interregional freight movements between 132 regions—comprising 123 Australian Statistical Subdivisions outside of the major capital cities, 8 capital city Statistical Divisions and one region for the rest of the world—for the four principal transport modes—road, rail, sea and air. The database is constructed from regional production and consumption information for major commodities and about the transport patterns. The FreightInfo 1999 is the latest reliable available database that provides reasonably comprehensive measures of interregional freight movements in Australia. The FreightInfo 1999 data has to be assigned

8. The axle group based tare weight parameters mean that some laden vehicles, classed as such because at least one of the axle groups exceeds the relevant axle group tare mass threshold, may have a total gross vehicle mass below the total tare mass threshold values listed in Table F.3.

to the road network in order to compare with the CULWAY/WIM site data. This process is described in Section F.3, below.

2001 Freight Movements Survey

The 2001 FMS (ABS 2002) provides estimates of Australian interregional OD freight movements by road, rail, sea and air for the period 1 April 2000 to 31 March 2001. The road component of the 2001 FMS comprised a vehicle-based survey of articulated trucks only. Articulated trucks carry most of the heavy vehicle freight moved on interurban highways, and so the FMS should, in theory, be reasonably comparable to the CULWAY/WIM site measurements.

The 2001 FMS results, however, need to be scaled up by approximately 10 per cent to adjust for systematic under-enumeration of heavy vehicle trips. For comparison with 2005 CULWAY/WIM site data, the 2001 FMS results also need to be scaled to account for growth in freight road freight between 2001 and 2005. For this exercise, the 2001 FMS freight estimates were scaled by 5 per cent per annum to 2005. This rate of growth was based an analysis of overall annual growth rates in net freight for non-urban highways for selected sites in Victoria and South Australia (see Section F.4, Tables F.7 and F.8). The OD flows were then assigned to the NLTN road network in a similar way to the FreightSim OD estimates (see Section F.3).

Small section traffic count data

The small section traffic count data, provided by the states and territories for the NLTN, provides another, independent data source for checking the CULWAY/WIM and OD freight movement estimates. The NLTN small section traffic data includes average daily total traffic count and estimates of the share of commercial vehicles for each section. The CULWAY/WIM site source heavy vehicle estimates may be compared with the traffic count data for the adjacent road section. As previously described, the small section data was also used to estimate the total heavy vehicle movements for those CULWAY/WIM sites which do not cover all traffic lanes.

F.2 OD freight assignment

FreightInfo and the 2001 FMS provide point-to-point freight movement estimates while the CULWAY/WIM data and small section data measures are flows past a particular point or over a link on the highway of freight moving between multiple OD pairs. In order to compare across datasets, the OD freight movement estimates were assigned to the road network to derive OD-based link flows.

As with BTRE (2006*a*), the adjusted FreightSim and 2001 FMS freight movement estimates were assigned to the AUSLIG (1992) TOPO-10M vector topographic

Figure F.3 AUSLIG (1992) TOPO–10M vector topographic road layer

Source: AUSLIG (1992).

road layer (illustrated in Figure F.3) using the SUE assignment algorithm in TransCAD (Caliper Corporation 2004). Unlike BTRE (2006*a*), the assignment was done on the basis of total freight tonnages and not on the implied number of heavy vehicles. (Refer to Chapter 3 and Appendix J for further details about the traffic assignment algorithm used for assigning traffic to the non-urban road network.)

The assignment procedure produced inconsistent results in assigning road freight movements between Sydney and Brisbane—assigning essentially all of the northbound freight to one highway but splitting the southbound freight almost equally across the highways. The assignment procedure was run with unconstrained road capacity, and it was not clear why these results occurred. In place of the traffic assignment algorithm, the BITRE exogenously assumed that freight vehicle traffic between Sydney (and surrounds) and Brisbane (and surround) is split 70 per cent via the Pacific Highway and 30 per cent via the New England Highway, in both directions. The results listed in Tables VI.5 and VI.6, and described in section VI.6, are based on this assumed traffic split. For all other sites, the assigned freight traffic is as per the TransCAD traffic assignment.

F.3 CULWAY/WIM and OD road freight data comparison

Table F.5 provides, for each of the analysed sites, a comparison of the estimated total net freight measured by the CULWAY/WIM device with the (adjusted) assigned FreightInfo and 2001 FMS freight estimates. The table includes estimates of the freight task and the relative disparity of the assigned OD-based freight estimates relative to the CULWAY/WIM measures. Table F.6 provides a comparison of the estimated number of heavy vehicles obtained from the CULWAY/WIM data (including allowances for non-recorded days and non-metered lanes) with the adjacent small section heavy vehicle traffic count data.

The following discussion provides a summary of the results presented in Tables F.5 and F.6.

Comparison of CULWAY/WIM and OD freight task estimates

Inspection of the relative disparity between the assigned FMS and the CULWAY/WIM data, in Table F.5, suggests that across most sites analysed, the FMS data matches the CULWAY/WIM data fairly well. Indeed, across 18 of the 26 sites analysed, the assigned FMS estimates are within ± 15 per cent of the CULWAY/WIM system estimates. The major exceptions are:

- New England Highway, Armidale (NSW)
- Calder Highway, Macedon (S) (Vic.)
- Eyre Highway, Iron Knob (SA)
- Barrier Highway, Oodla Wirra (SA)
- Riddoch Highway, Naracoorte (SA)
- Stuart Highway, Erldunda (NT)

There also appears to be a significant discrepancy between the FMS estimates and the CULWAY/WIM data at Mildura on the Sturt Highway, but this appears to be because the CULWAY/WIM data includes only half the total heavy vehicle traffic in comparison with the small section traffic count information.

The adjusted FreightInfo estimates do not match the CULWAY/WIM site data near as well as the FMS data—for only 11 of the 26 sites are the assigned FreightInfo estimates within ± 15 per cent of the CULWAY/WIM estimates.

The following discussion highlights some of the discrepancies between CULWAY/WIM and OD data on a jurisdictional basis.

New South Wales

For sites in New South Wales, the assigned FreightInfo road freight estimates are within ± 15 per cent of the CULWAY/WIM estimate for five of seven

Table F.5 Comparative 2005 road freight task estimates at selected CULWAY/WIM sites

	Freight task estimates			Disparity with CULWAY/WIM	
Highway/Site	*CULWAY / WIM (kt)*	*Freight-Info (kt)*	*FMS (kt)*	*Freight-Info (%)*	*FMS (%)*
New South Wales					
New England Highway—Uralla	1 932	4 433	4 576	129	137
Princes Highway—Batemans Bay	877	3 429	774	291	–12
Pacific Highway—Coffs Harbour	7 321	7 985	7 227	9	–1
Newell Highway—Forbes	6 044	5 099	6 254	–16	3
Newell Highway—Jerilderie	4 336	4 052	4 767	–7	10
Hume Highway—Holbrook	12 828	13 440	14 456	5	13
Pacific Highway—Walkers Creek	8 523	9 603	9 019	13	6
Victoria					
Western Highway—Pyrenees	7 787	8 342	8 267	7	6
Goulburn Valley Highway—Murchison[a]	8 998	7 254	7 904	–19	–12
Sturt Highway—Mildura	2 435	4 446	5 797	83	138
Princes Highway—Baw Baw[a]	8 418	10 848	7 085	29	–16
Hume Highway—Wallan	24 175	23 623	27 362	–2	13
Hume Highway—Milawa[a]	22 975	15 692	19 948	–32	–13
Calder Highway—Macedon[a]	6 135	4 016	3 756	–35	–39
South Australia					
South East Highway—Monarto	9 447	11 386	8 489	21	–10
Sturt Highway—Truro	4 948	4 881	5 548	–1	12
Dukes Highway—Bordertown	6 945	6 586	6 727	–5	–3
Eyre Highway—Iron Knob	1 445	3 730	2 053	158	42
Barrier Highway—Oodla Wirra	1 544	1 791	1 076	16	–30
Riddoch Highway—Naracoorte	1 275	605	395	–53	–69
Stuart Highway—Pimba	1 518	773	1 579	–49	4
Northern Territory					
Barkly Highway—Avon Downs	561	245	428	–56	–24
Stuart Highway—Erldunda	524	662	835	26	59
Stuart Highway—Alice Springs	1 061	710	1 069	–33	1
Stuart Highway—Tennant Creek	690	550	892	–20	29
Victoria Highway—20km E WA bdr	235	20	276	–91	17

a. CULWAY/WIM site estimates adjusted to account for non-metered lanes using small section traffic data.
Sources: Freight Info, VicRoads, Transport SA, NSW RTA, Northern Territory Transport and BITRE estimates.

sites. The FMS OD road freight estimates are within ± 15 per cent of the CULWAY/WIM estimate for six of the seven sites.

For the site on the New England Highway south of Uralla, the assignment results (and BITRE assumed Sydney–Brisbane road freight vehicle split) for the FreightInfo and FMS data imply total road freight on this link is over 100 per cent higher than measured by the CULWAY/WIM equipment. Sydney–Brisbane OD road freight comprises a significant share of the freight moving on this corridor. Unpublished advice from the New South Wales Roads and Traffic Authority suggests that heavy vehicle traffic volumes on the New

Table F.6 Comparison—CULWAY/WIM and small section traffic counts, 2005

Highway/Site	CULWAY/WIM (AADT)	Small section data (AADT)	Proportional disparity (%)
New South Wales			
New England Highway—Armidale	537	525	2.2
Princes Highway—Batemans Bay	529	na	na
Pacific Highway—Coffs Harbour	2 055	1 603	28.2
Newell Highway—Forbes	905	840	7.7
Newell Highway—Jerilderie	630	498	26.4
Hume Highway—Holbrook	1 896	1 759	7.8
Pacific Highway—Walkers Creek	1 938	1 909	1.5
Victoria			
Western Highway—Pyrenees	1 183	1 322	–10.5
Goulburn Valley Highway—Murchison[a]	1 613	1 613	..
Sturt Highway—Mildura	388	771	–49.6
Princes Highway—Baw Baw[a]	2 806	2 806	..
Hume Highway—Mitchell	3 786	5 716	–33.8
Hume Highway—Milawa[a]	3 815	3 815	..
Calder Highway—Macedon[a]	1 731	1 731	..
South Australia			
South East Highway—Monarto	1 630	1 828	–10.8
Sturt Highway—Truro	590	734	–19.7
Dukes Highway—Bordertown	883	961	–8.2
Eyre Highway —Iron Knob	174	187	–6.8
Barrier Highway—Oodla Wirra	168	230	–27.0
Riddoch Highway—Naracoorte	295	340	–13.0
Stuart Highway—Pimba	159	168	–5.2
Northern Territory			
Barkly Highway—Avon Downs	60	33	85.7
Stuart Highway—Erldunda	65	45	43.8
Stuart Highway—Alice Springs	169	143	18.0
Stuart Highway—Tennant Creek	98	55	77.4
Victoria Highway—20km E WA border	39	29	33.0

.. Not applicable.
na Not available.
a. CULWAY/WIM site estimates adjusted to account for non-metered lanes using small section traffic data. Consequently, CULWAY/WIM and small section estimates are identical.
Sources: Freight Info, VicRoads, Transport SA, NSW RTA, Northern Territory Transport and BITRE estimates.

England Highway have remained virtually unchanged since 1995, with most of the freight vehicle traffic growth over this period appearing to be on the Pacific Highway. In view of this, if only 5 per cent of total Sydney–Brisbane road freight travelled via the New England Highway, then the assigned FMS road freight on the New England Highway would be 2706 kilotonnes, 40 per cent above the CULWAY/WIM site estimate. This would increase heavy vehicle freight on the Pacific Highway to 9097 kilotonnes at Coffs Harbour—24 per cent above the relevant CULWAY/WIM site estimate—and 10 889 kilotonnes at Walkers Creek—28 per cent above the relevant CULWAY/WIM site estimate.

For the Princes Highway site north of Batemans Bay, the FMS estimate is reasonably close to the CULWAY/WIM estimate. However, the assigned FreightInfo estimate grossly overstates total road freight on this highway. The most likely explanation for this result is that the FreightInfo base year estimates for freight to and from south east New South Wales are too high.

Victoria

For sites in Victoria, the assigned FMS data matched the CULWAY/WIM estimates to within ± 15 per cent for all but two of the sites: Calder Highway and Sturt Highway. As indicated above, the Sturt Highway discrepancy appears to be due to under-estimation of the number of heavy vehicles—the number of heavy vehicles measured by the CULWAY/WIM device (338 vehicles per day, Table F.6) is approximately half the level indicated by the small section data. The Calder Highway discrepancy is less easily explained, and could be partly due to the coarseness of the underlying OD regions.

The FreightInfo-based OD estimates also match poorly the CULWAY/WIM site estimates for the Calder and Sturt Highways, and also match less well the CULWAY/WIM source data for the Princes Highway, Hume Highway (Milawa) and Goulburn Valley Highway.

South Australia

The assigned FMS OD road freight estimates are within plus or minus 15 per cent of the CULWAY/WIM estimate for four of the seven sites analysed. However, the FMS data appears to overestimate freight movements over the Eyre Highway (at Iron Knob), and underestimates freight movements over the Riddoch Highway (Naracoorte) and the Barrier Highway (Oodla Wirra).

The Eyre Highway discrepancy is likely to occur for two reasons—first, the FMS results do appear to overstate road freight movements between Western Australia and the eastern states and, secondly, the growth rate used to project the 2001 FMS road freight estimates to 2005 may well be too high for east–west freight, where rail is likely to capture most of the growth. (However, the recent estimates of freight traffic at this site, listed in Table F.7, imply very strong growth in road freight traffic.)

For the Riddoch and Barrier Highways, which are not part of the NLTN, the discrepancies are less easily explained—the result could be due to the coarseness of the regions and the traffic assignment procedure. For example, there may be significant local timber movements over the Naracoorte Highway which is not well captured in the assigned FMS data.

The results for the assigned FreightInfo data are similar to that of the FMS, albeit that the discrepancy between the CULWAY/WIM and FreightInfo data are larger than those of the assigned FMS data at most sites.

Northern Territory

Road freight volumes to and from the Northern Territory are far smaller than across the rest of the country, and consequently the standard errors of the FMS survey are generally far higher. As a result, one should not expect the FMS data to match the Northern Territory CULWAY/WIM site data anywhere near as well as on more highly trafficked corridors. Predictably then, the assigned FMS estimates generally match the CULWAY/WIM results to within $\pm$ 25 per cent at most sites. The outlier is the Stuart Highway site at Erldunda, where the assigned FMS estimates are 60 per cent above the CULWAY/WIM implied data. This result may be due to over-estimation of freight movements to and from Darwin and that the assumed growth in road freight movements between 2001 and 2005 overstates actual growth.

In contrast with the FMS based-estimates, the FreightInfo-based estimates are significantly below the CULWAY/WIM-based total road freight estimates at most Northern Territory sites. The exception is the Stuart Highway at Erldunda, where the FreightInfo-based estimates are higher than the CULWAY/WIM estimates.

One other thing to note about the Northern Territory data is the large discrepancy between the CULWAY/WIM heavy vehicle traffic estimates and those of the small section data, presented in Table F.6. For all road sections, the CULWAY/WIM heavy vehicle traffic count estimates are much larger than the small section count data. If the small section data is more accurate than the CULWAY/WIM estimates, then this would imply that the difference between actual on-road freight vehicle traffic and the OD freight data is even larger than implied by the results in Table F.5. BITRE has not satisfactorily resolved these discrepancies at this time.

Summary

The above comparison of CULWAY/WIM and assigned OD road freight estimates suggests that that the 2001 FMS OD road freight task estimates, scaled for recent freight growth and sample under-enumeration, compares reasonably favourably with on-road WIM estimates at most sites analysed. The FMS generally approximates more closely the WIM site data than the raw FreightInfo data.

There are, however, several sites where the WIM site data and OD-based data are vastly different and these areas warrant further investigation to determine whether it is the traffic assignment procedure, gaps in the underlying OD data and/or deficiencies in the WIM data that are the cause(s) of the discrepancy.

The reasonable match between the FMS OD-based data and the CULWAY/WIM data suggest that the FMS survey produced reasonably reliable estimates of interregional freight and that a new FMS-type survey would provide useful information on Australian interregional road freight movements.

Finally, the validity and robustness of the conclusions derived in this appendix hinge on the reliability of the CULWAY/WIM readings to provide an objective on-road survey of freight vehicles and freight quantities. Given that the WIM data is subject to random (and possibly systematic) error due to technical failure and, potentially, calibration drift over time, more information/research on the accuracy of individual sites over specified periods would be of some benefit in developing time series of road freight movements from WIM data.

F.4 Historical non-urban highway freight growth

Tables F.7 and F.8 provide some information on recent growth in the road freight and freight vehicle numbers based on WIM data from Victorian and South Australian CULWAY/WIM sites. Historical data availability restricted the analysis to rural WIM sites in these two jurisdictions. Readers should note that the time period to which the reported growth in total tonnages varies by site. The growth in measured freight movements also varies enormously across the various sites. Across many of the sites, the CULWAY/WIM estimates imply very strong growth in total road freight but lower growth rates in heavy vehicle numbers, which would be indicative of substitution to larger freight vehicles. The one year drop in freight for the Sturt Highway (at Mildura) is additional evidence that the latest data used for this site may not measure all freight traffic at this location. On a freight-weighted average basis, growth in total freight movements past these WIM sites average around 5.7 per cent per annum for the Victorian sites and 4.7 per cent per annum for the South Australian sites.

Table F.7 Historical freight growth, selected CULWAY/WIM sites

Highway/Site	*Measurement period*	*Total net freight (period end) (kt)*	*Change in net freight (kt)*	*Avg. growth rate (% pa)*
Victoria				
Western Highway—Pyrenees	1995–2005	1 183	4 695	9.7
Goulburn Valley Highway—Moira	1996–2003	1 613	−529	−8.5
Sturt Highway—Mildura	2004–2005	388	−1 343	−36.0
Princes Highway—Baw Baw	2004–2005	2 806	841	21.7
Hume Highway—Mitchell	1995–2005	3 786	3 943	4.7
Melba Highway—Yarra Ranges	2004–2005	1 308	190	16.8
Calder Highway—Macedon	1995–2005	1 731	663	3.9
Wtd. average growth				5.7
South Australia				
South East Highway—Monarto	2002–2005	1 630	949	3.6
Sturt Highway—Truro	2002–2005	590	235	1.6
Dukes Highway—Bordertown	2002–2005	883	1 871	11
Eyre Highway—Iron Knob	2002–2005	174	233	6
Barrier Highway—Oodla Wirra	2002–2005	168	240	5.8
Riddoch Highway—Naracoorte	2002–2005	295	−19	−0.5
Stuart Highway—Pimba	2002–2005	159	76	1.7
Wtd. average growth				4.7

Sources: VicRoads, Transport SA (2003),Transport SA (2006) and BITRE estimates.

Table F.8 Historical heavy vehicle traffic growth, selected CULWAY/WIM sites

Highway/Site	*Measurement period*	*Total net freight (period end) (kt)*	*Change in net freight (kt)*	*Avg. growth rate (% pa)*
Victoria				
Western Highway—Pyrenees	1995–2005	1 181	502	5.7
Goulburn Valley Highway—Moira	1996–2003	165	−115	−7.2
Sturt Highway—Mildura	2004–2005	401	−76	−16.4
Princes Highway—Baw Baw	2004–2005	1 503	−79	−4.8
Hume Highway—Mitchell	1995–2005	1 787	412	2.7
Melba Highway—Yarra Ranges	2004–2005	351	26	7.6
Calder Highway—Macedon	1995–2005	563	226	5.3
Wtd. average growth				0.4
South Australia				
South East Highway—Monarto	2002–2005	1 257	−175	−4.3
Sturt Highway—Truro	2002–2005	1 009	331	14.2
Dukes Highway—Bordertown	2002–2005	1 321	503	17.3
Eyre Highway—Iron Knob	2002–2005	177	−3	−0.5
Barrier Highway—Oodla Wirra	2002–2005	271	117	20.7
Riddoch Highway—Naracoorte	2002–2005	358	84	9.3
Stuart Highway—Pimba	2002–2005	170	32	7.3
Wtd. average growth				7.1

Sources: VicRoads, Transport SA (2003),Transport SA (2006) and BITRE estimates.

Appendix G Bulk commodity production projections

In FreightSim, future bulk commodity production levels must be supplied as an exogenous input to the model. For key export commodities, such as coal and iron ore, the production projections determine the level of domestic transport of these commodities. For other bulk commodities, that are consumed domestically, the regional pattern of production and consumption jointly influence the domestic transport task. For the NLTN heavy vehicle traffic projections presented in this report, BITRE updated the projected commodity production estimates, at the regional level, for 11 of the 14 bulk commodity classes, including:

- agricultural products (including grains and oilseeds, meat and livestock)
- coal
- metallic minerals
- oil
- gas
- cement
- timber.

The specific bulk commodity production projections used here are based on either:

- Published long-term commodity production projections—for example, the agricultural sector production projections are based on projections by Foran and Poldy (2002), Dunlop, Turner, and Howden (2005),Dunlop, Turner, Foran, and Poldy (2005) and CIE (2001) and the long term timber output are based, in part, on the long-term plantation wood availability projections of Ferguson, Fox, Baker, Stackpole, and Wild (2002).
- Existing production and announced medium term production capacity expansion plan, supplemented by time series regression based forecasts of

production—which is the method used for projecting future regional coal, oil, gas and metallic minerals production.

- Simple econometric model of production with respect to economic activity—the approach used for projecting cement and concrete products output.

This appendix summarises the derivation of the bulk commodity production projections for each bulk commodity group. The information is presented in the FreightSim model order of the commodity groups:

- agricultural products
- coal
- metallic minerals
- oil
- gas
- cement
- timber.

For most of the commodities considered here, the production projections range from 1988–99 to 2029–30. In some cases, the discussion refers to data between 2003–04 and 2029–30. In all cases, the commodity production projections used to project heavy vehicle traffic levels covered the period 1998–99 to 2029–30.

G.1 Agricultural commodity production

Total Australian agricultural commodity production measured approximately 100 to 120 million tonnes in 1999–2000, depending on the data source. Table G.1 provides a comparison of agricultural commodity production estimates from three separate data sources:

- FreightInfo 1999 dataset of national freight flows
- ABS *Agricultural Commodity Survey* (ABS 2001*a*)
- Australian Bureau of Agricultural and Resource Economics' *Australian Commodity Statistics* (ABARE 2001).

Allowing for differences in coverage and scope, the ABS (2001*a*) and ABARE (2001) agricultural production estimates are fairly similar—implying total agricultural sector production of approximately 105 million tonnes in 1999–2000. The FreightInfo 1999 estimates, however, imply significantly higher total agricultural commodity production, around 122 million tonnes in 1999. The source of the difference between the FreightInfo 1999 estimate and the ABS (2001*a*) and ABARE (2001) estimates, around 15 million tonnes, cannot be determined

Table G.1 Comparison: agricultural commodity production estimates

(million tonnes)

Commodity	*FreightInfo*	*ABS (2001a)*	*ABARE (2001)*
Cereal grains	38.6[a]	35.4	34.3
Oilseeds		2.8	2.9
Pulses		3.3	1.7
Cane		38.8	39.7[b]
Horticulture		4.7[c]	2.72[d]
Cotton	83.6[f]	2.7[e]	1.8
Hay and silage		8.2	na
Nuts		0.03	na
Wool		0.6	0.65
Dairy		na	11.4[g]
Meat	6.6	na	3.1
Livestock	6.1	na	na
Total (excluding Meat and Livestock)	122.2	96.3	95.1
Total (including Dairy and production nes)[h]		107.7	107.1

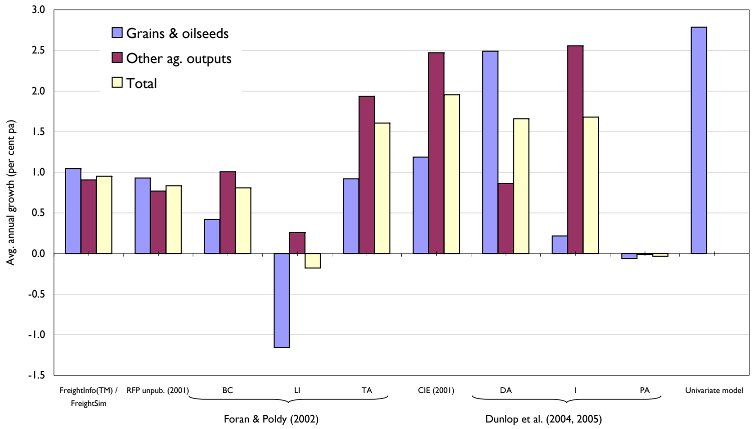
na Not available.
a. Sum of cereal grains and oilseeds.
b. 1999–2000 estimate.
c. Includes all fruit, vegetables, herbs, tobacco and hops.
d. Includes only grapes, dried vine fruit and citrus. Does not include other fruit and vegetables.
e. Includes cottonseed and lint production.
f. Sum of pulses, cane, horticulture, cotton, hay and silage, nuts, wool, and dairy.
g. Assumes an average milk density of 1.03kg/L.
h. The ABS (2001*a*) estimates include dairy produce (11.4Mt). The ABARE (2001) estimates include a 12Mt allowance for horticulture, hay and nut production, not included in ABARE (2001).
Sources: ABS (2001*a*), ABARE (2001), FreightInfo 1999 and BITRE estimates.

due to the aggregated nature of the FreightInfo estimates and unmeasured items in the ABS (2001*a*) and ABARE (2001) data. Part of the difference may be a commodity categorisation issue, with some processed commodity production included as part of agricultural sector output in the FreightInfo dataset but treated differently in the ABS (2001*a*) and ABARE (2001) data collections. In lieu of more detailed evidence to validate the FreightInfo agricultural commodity production estimates, this report assumes that this is the case, and that some degree of over-estimation of total agricultural production is balanced by lower production estimates for other commodities, particularly manufactured products. (Indeed, the FreightInfo dataset appears to understate both the total and the non-bulk (manufactured) commodity transport task, which may be indicative of an under-estimate of total manufacturing output.)

Long-term production projections

Long-term agricultural production trends are extremely difficult to predict with any great degree of confidence. Not only does agricultural production fluctuate significantly from year-to-year, as a result of changes in economic and climatic conditions, over the longer term there are also large uncertainties with regard to the long-run impact on production levels of future world agricultural commodity prices, land integrity preservation (i.e. potential

Figure G.1 Long-term agricultural commodity production projections



Sources: Foran and Poldy (2002), Dunlop, Turner, and Howden (2005),Dunlop, Turner, Foran, and Poldy (2005), CIE and CSIRO (2001), CIE (2001) and BITRE estimates.

soil quality degradation and consequent reduction in crop yields) and the influence of global climate conditions on rainfall patterns across Australia.

The long-term agricultural commodity production projections used in this report assume growth in total agricultural sector output (measure in tonnes), between 2001 and 2030, of approximately 1.05 per cent per annum for grains and oilseeds, 0.8 per cent per annum for meat and 0.91 per cent per annum for all other agricultural products. These projections are an intermediate set of projections from among a range of various published long-term projections, including studies by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) Resource Futures Project and the Centre for International Economics.

Figure G.1 shows the long-term agricultural commodity production growth, for grains and oilseeds and other agricultural outputs used in this report and compares them to long-term projections produced by the CSIRO Resource Futures Project—Foran and Poldy (2002) and Dunlop, Turner, and Howden (2005),Dunlop, Turner, Foran, and Poldy (2005)—the CIE (2001) and long-term grain and oilseed production projections derived using simple univariate time series methods. The discussion below summarises the agricultural commodity projections, and the underlying assumptions, of these published studies.

CSIRO Futures Modelling project estimates

The CSIRO Resource Futures Project has produced several reports that include long-term agricultural output projections as part of a set of future scenarios. These reports include Foran and Poldy (2002) and Dunlop, Turner, and Howden (2005),Dunlop, Turner, Foran, and Poldy (2005).

Foran and Poldy (2002)

Foran and Poldy (2002) present three future agricultural sector production scenarios: a base case scenario and two alternative scenarios labelled 'landscape integrity' and 'technological advance'. The base case scenario (labelled 'BC' in Figure G.1) broadly involves increasing total agricultural output as a result of increasing agricultural land use, water use and improved crop yields. Under the base case scenario, total crop production is projected to increase by 18 per cent (equivalent to 0.65 per cent per annum) between 2001 and 2025.

The landscape integrity scenario (labelled 'LI' in Figure G.1) involves less intensive farming practices and the retirement of 30 per cent of arable crop-land, much of which would be turned over to woody vegetation. Total crop production is projected to fall slightly under this scenario between 2001 and 2025.

The technological advance scenario (labelled 'TA' in Figure G.1) involves new crop technology and farming practices to increase the productivity of farmland. This scenario also involves additional land devoted to cropping. Under this scenario, Foran and Poldy (2002) project total crop production will expand by 38 per cent (1.3 per cent per annum) between 2001 and 2025.

Dunlop, Turner, and Howden (2005) and Dunlop, Turner, Foran, and Poldy (2005)

Dunlop, Turner, and Howden (2005) and Dunlop, Turner, Foran, and Poldy (2005) present three future agricultural production scenarios, labelled: 'dryland agriculture' (DA), 'irrigation' (I) and 'post-agriculture' (PA). They present agricultural sector production levels mainly in terms of the impact to 2051. Table G.2 lists Dunlop, Turner, and Howden (2005) and Dunlop, Turner, Foran, and Poldy (2005) projections of agricultural production in 2051, for selected commodity groups, for each of the three future scenarios. Projected agricultural sector production growth for each of these scenarios is also illustrated in Figure G.1.

Dunlop, Turner, and Howden and Dunlop, Turner, Foran, and Poldy's dryland agriculture scenario involves adaptation of dryland cropping to greater intensity of water use. Under this scenario, marginal land in southern Australia, not capable of supporting more productive crops, is retired from intensive use, and an additional nine million hectares of land in northern Australia is devoted to intensive cropping. The scenario envisages a quadrupling of grain production and almost tenfold increase in horticultural output between 2001 and 2051.

Dunlop, Turner, and Howden and Dunlop, Turner, Foran, and Poldy's irrigation scenario involves the further development of irrigation technology and application to farming to allow continued increase in farming outputs using much less land. This scenario involves a substantial increase in the area irrigated in southern Australia (40 per cent by 2051) and the addition of 1.25 million hectares under irrigation in northern Australia. The scenario involves practi-

Table G.2 Comparison: alternative agricultural commodity production scenarios

Commodity		*Base year production*[a]	*Scenarios (2051)*		
			'DA'	*'I'*	*'PA'*
Crop-land	*(M ha)*	66	62	37	27
Animal numbers					
Sheep	*(million)*	29	23	25	23
Cattle (beef)	*(million)*	24	36	18	18
Cattle (dairy)	*(million)*	3	2.7	4.8	2.4
Crops					
Cereal grains	*(Mt)*	34.3	62.3	34.3	30.7
Rice	*(Mt)*	1.1	0.8	1.0	0.6
Oilseeds	*(Mt)*	2.8	6.2	4.6	4.3
Legumes	*(Mt)*	3.3	7.3	3.9	5.1
Hay and silage	*(Mt)*	8.2	10.8	8.5	8.5
Sugar cane	*(Mt)*	38.8	38.8	77.6	33.6
Cotton lint	*(Mt)*	0.7	0.7	1.6	0.7
Horticulture	*(Mt)*	4.7	14.5	10.6	9.3

a. Base year production levels from ABS (2001*a*).
Sources: ABS (2001*a*), Dunlop, Turner, and Howden (2005), Dunlop, Turner, Foran, and Poldy (2005) and BITRE estimates.

cally no change in cereal grain production, between 2001 and 2051, and significant increases in the level of production of other crops.

In Dunlop, Turner, and Howden (2005) and Dunlop, Turner, Foran, and Poldy (2005)'s post-agriculture scenario, dryland and irrigated agriculture output contracts significantly across most regions, presumably as a result of adverse climatic conditions and degraded land quality. Despite the overall reduction in irrigation, the area of irrigated land used for horticulture is projected to increase significantly, and horticultural output triple, between 2001 and 2051. Dunlop, Turner, and Howden (2005) and Dunlop, Turner, Foran, and Poldy (2005) project cereal grain, cane sugar and cotton production will all decline under this scenario.

CIE and CSIRO (2001) and CIE (2001) estimates

Dunlop, Turner, Foran, and Poldy (2005) also report the results of 20-year agricultural commodity projections developed by the CIE and CSIRO (2001) and CIE (2001). Those projections imply modest increases in production for most agricultural commodities between 2001 and 2020, a doubling of milk production and a tripling in horticultural output over that period. Table G.3 lists the CIE and CSIRO (2001) and CIE (2001) projected increases in production, by commodity group, and the implied production level in 2019–20 for each commodity group, derived from 1999–2000 production levels. The CIE (2001) projected agricultural sector output growth is also illustrated in Figure G.1.

Table G.3 Comparison: CIE and CSIRO agricultural commodity projections

Commodity	*Projected growth 2001–2020*		*Production 1999–2000*	*Implied production 2019–20*
	(%)	*(% p.a.)*	*(Mt)*	*(Mt)*
Wool	5	0.2	0.56	0.59
Beef	43		2.03	2.90
Sheep meat	19	1.6	0.71	0.85
Pork	42		0.36	0.52
Poultry meat	47		0.66	0.96
Milk	121	4	10.56	23.34
Cane sugar	46	1.9	38.8	56.64
Cotton	36	1.5	1.81	2.47
Rice	53	1.2	1.76	2.69
Wheat	28		21.17	27.10
Coarse grains	20		11.39	13.67
Horticulture	215	5.9	4.69	14.71
Total	55	2.2	94.5	146.4

Sources: CIE and CSIRO (2001), CIE (2001) and BITRE estimates.

Univariate time series projections

For comparison, total cereal grains and oilseed production was also projected using simple univariate time series methods based on forty-year historical cereal grains and oilseed production levels (ABARE 2005*a*). Historically, total cereal grains and oilseed production has grown by around 2.5 per cent per annum. Pre-testing suggested that historical cereal grains and oilseed production is stationary with trend. A general-to-specific auto-regressive moving average (ARMA) estimation process implied that adding lagged values of the regressor variable to the model does not improve the statistical fit relative to the simple trend model.

The simple trend model implies that total cereal grains and oilseed production would grow by around 2.7 per cent per annum between 2005 and 2030. This is much higher than all of the other published projections for grains and oilseeds (see Figure G.1), with the exception of the dryland agriculture scenario of Dunlop, Turner, and Howden (2005) and Dunlop, Turner, Foran, and Poldy (2005). Obviously, cereal grains and oilseed production is dependent on a range of factors that are not included in the simple univariate trend model and the simple trend projections based on this model may not best reflect future agricultural production trends.

Regional production projections

Table G.4 summarises the regional agricultural commodity production projections actually used to derive the interregional freight movement projections, separately for grains and oilseeds, livestock and meat and other agricultural products, by state and territory. Total grains and oilseed output (by mass) is projected to grow by just over 1 per cent per annum between 1999–2000 and

Table G.4 Regional agricultural commodity production projections, by broad commodity group and state/territory, 1999–2000 to 2029–30

State/Territory	*1999–2000 (kt)*	*2009–10 (kt)*	*2019–20 (kt)*	*2029–30 (kt)*	*Avg. growth 1999–2000 to 2029–30 (% p.a.)*
Grains and oilseeds					
NSW	13 146.2	15 154.8	16 718.9	17 357.8	1.1
Vic.	3 311.1	3 895.5	4 343.2	4 521.0	1.3
Qld	4 394.2	4 962.9	5 478.4	5 717.5	1.1
SA	6 260.4	7 149.9	8 012.1	8 410.9	1.2
WA	12 085.8	13 852.6	14 521.8	14 530.7	0.7
Tas.	73.7	76.7	77.1	76.3	0.1
NT	12.8	13.9	14.6	12.1	–0.2
ACT	0.1	0.1	0.1	0.1	0.7
Total—Grains and oilseeds	39 284.3	45 106.4	49 166.1	50 626.3	1
Livestock and meat					
NSW	3 929.5	4 303.8	4 542.0	4 612.4	0.6
Vic.	2 658.3	2 963.3	3 149.2	3 198.8	0.7
Qld	3 351.8	3 615.8	3 780.2	3 827.5	0.5
SA	910.5	1 021.8	1 090.8	1 109.9	0.8
WA	1 302.7	1 452.6	1 546.4	1 573.1	0.8
Tas.	366.8	398.7	420.2	427.3	0.6
NT	345.9	368.5	382.4	386.4	0.4
ACT	87.8	99.7	109	112.8	1
Total—Livestock and meat	12 953.2	14 224.2	15 020.2	15 248.1	0.7
Other agricultural output					
NSW	10 922.8	12 348.4	13 466.4	13 928.3	1
Vic.	12 340.4	13 940.9	15 199.7	15 719.6	1
Qld	51 210.1	56 755.9	61 394.6	63 399.2	0.9
SA	3 984.2	4 599.0	5 094.2	5 286.2	1.1
WA	4 142.9	4 720.2	5 098.4	5 229.9	0.9
Tas.	1 885.9	2 018.5	2 095.7	2 114.9	0.5
NT	62.9	61.2	57.3	54.5	–0.6
ACT	3.1	3.4	3.6	3.6	0.6
Total—Other agriculture	84 552.3	94 447.4	102 409.8	105 736.2	0.9

Sources: FreightInfo 1999 and BITRE estimates.

2029–30 in New South Wales, Victoria, Queensland and South Australia and by 0.7 per cent per annum in Western Australia. Livestock and meat output is projected to grow by between 0.5 and 0.8 per cent per annum in each state. And other agricultural output—including cane sugar, legumes, hay and silage and horticultural output—is projected to grow by between 0.9 and 1.1 per cent per annum between 1999–2000 and 2029–30 in each of the mainland states.

G.2 Coal

Total Australian coal production in 2003–04 was 428.9 million tonnes, comprising 362.2 million tonnes of black coal (85 per cent) and 66.3 million tonnes of brown coal (15 per cent). Ninety seven per cent of all Australian black coal

Table G.5 Coal production: actual and projected

Year	*Black coal[a] (Mt)*	*Brown coal (Mt)*	*Total (Mt)*
1998–99	225.0	66.7	291.7
2003–04	285.9	66.3	352.2
2009–10	366.1	68.9	435.0
2019–20	468.8	76.1	544.9
2029–30	555.5	83.8	639.3
Average annual growth 2003–04 to 2029–30 (% *pa*)	2.6	0.9	2.3

a. Net production, which equals raw coal production less rejects removed at coal industry washeries plus/less unexplained stock adjustments at mines only.

Sources: ABARE (2005*b*, p. 246), Akmal and Riwoe (2005) and BITRE estimates.

production is from New South Wales and Queensland mines. Approximately 79 per cent of raw black coal production is saleable. Net black coal production, which equals raw coal production less rejects removed at coal industry washeries, plus/minus unexplained stock adjustments at mines, totalled 285.9 million tonnes in 2003–04. Australian brown coal is produced only in Victoria and used primarily for energy generation.

Long-term production projections

Akmal and Riwoe (2005) provide long-term projections, to 2029–30, of Australian energy production and consumption. Separate estimates are provided for black coal and brown coal. All estimates are in energy equivalent units. For black coal this is equivalent to saleable, or net, production. Akmal and Riwoe (2005) project total black coal energy production will increase by 2.6 per cent per annum between 2003–04 and 2029–30. Applied to the 2003–04 black coal production levels, this implies that total black coal production will grow to 555 million tonnes by 2029–30 (Table G.5). Brown coal energy production is projected to increase by 0.9 per cent per annum, to approximately 84 million tonnes by 2029–30 (Table G.5).

Production capacity expansion plans

Australian Bureau of Agricultural and Resource Economics (ABARE)'s list of major minerals and energy projects (Haine 2006) implies committed and prospective black coal mining projects have the potential to expand current production capacity by an additional 50.8 million tonnes per annum in NSW and 32.1 million tonnes per annum in Queensland by 2010. Beyond 2010, to 2015, announced prospective coal mining projects could potentially expand current production capacity by an additional 38 million tonnes per annum in New South Wales and 61.2 million tonnes per annum in Queensland. Adding these net capacity additions to existing production levels would result in a total production capacity of approximately 400 million tonnes per annum by some time shortly after 2010. This level is consistent with the Akmal and Riwoe (2005) projections.

Regional production projections

Most of the potential additions to black coal mining capacity are in the Hunter Valley, North Central Plains and Central Macquarie regions in New South Wales and the Darling Downs, Fitzroy, Mackay and Northern regions in Queensland. And most of the additional black coal production is destined for export markets, which will add significantly to the domestic transport task to export ports.

The regional black coal production projections used in this report generally reflect the announced capacity expansion plans, with most of the projected growth in coal output projected for the major coal producing regions in New South Wales and Queensland. In most other regions, coal production is projected to grow more slowly, generally in line with growth in projected domestic coal consumption. Table G.6 lists the assumed regional coal production projections used in deriving the freight task projections.

G.3 Metallic minerals

The metallic minerals commodity group includes metallic ores and concentrates of iron, lead, zinc, aluminium, copper, silver, gold, manganese, tin, nickel, titanium, zirconium and uranium, as well as other less significant ores and concentrates. As overall production levels and projected output growth will vary across the different metals, for the traffic projections, projected production information was collected for each of the major metallic minerals, including:

- iron ore
- aluminium
- copper
- zinc
- lead
- silver
- manganese
- nickel
- tin
- titanium
- uranium

and aggregated to derive regional estimates of total metallic mineral output to 2030. The long-term metallic minerals output projections used in the traffic projections are based on information about current production levels and existing resources, announced short to medium term production capacity investment and time series based long-term projected output for each commodity. The following sections briefly outline the projected metallic minerals output for each of the major metals.

Iron ore

Total Australian iron ore production was 234 million tonnes in 2003–04, with over 95 per cent of all output from the Pilbara region in Western Australia and

Table G.6 Projected regional coal production growth, 1999 to 2030

Freight region code	Freight region name	State	Production 1998–99 (Mt)	Projected production 2029–30 (Mt)	Projected growth (% p.a.)
210	Sydney	NSW	6.89	9.82	1.15
215	Gosford-Wyong	NSW	1.55	2.21	1.15
221	Newcastle	NSW	16.42	25.41	1.42
225	Hunter (Balance)	NSW	58.10	99.56	1.75
231	Wollongong	NSW	4.53	6.45	1.15
235	Illawarra (Balance)	NSW	0.20	0.20	0.00
251	Northern Slopes	NSW	0.63	2.13	4.00
253	North Central Plain	NSW	0.00	15.79	47.13
255	Central Macquarie	NSW	4.82	24.81	5.43
261	Bathurst-Orange	NSW	0.71	0.71	0.00
262	Central Tablelands	NSW	5.99	6.99	0.50
263	Lachlan	NSW	1.69	2.41	1.15
265	Queanbeyan	NSW	0.43	0.43	0.00
267	Lower South Coast	NSW	1.46	1.46	0.00
322	East Barwon	Vic.	1.09	1.40	0.81
332	East Central Highlands	Vic.	0.02	0.03	0.78
391	Latrobe Valley	Vic.	64.66	82.37	0.78
410	Brisbane	Qld	0.24	0.24	0.00
424	Moreton (Balance)	Qld	3.36	4.79	1.15
432	Wide Bay-Burnett (Balance)	Qld	5.18	7.37	1.15
442	Darling Downs (Balance)	Qld	0.43	19.23	13.03
453	Fitzroy (Balance)	Qld	48.74	112.96	2.75
461	Mackay	Qld	0.70	0.70	0.00
462	Mackay (Balance)	Qld	40.37	94.68	2.79
472	Northern (Balance)	Qld	10.90	16.18	1.28
491	North West	Qld	2.72	3.87	1.15
573	Flinders Ranges	SA	2.68	4.70	1.83
622	Preston	WA	5.73	9.47	1.63
721	Southern	Tas.	0.00	0.00	2.03
733	North Eastern	Tas.	0.49	0.91	2.03
	All regions		290.70	557.30	2.12

Sources: Akmal and Riwoe (2005), FreightInfo 1999 and BITRE estimates.

the remainder from other areas in Western Australia, South Australia and a small amount from Tasmania. Almost all of the iron ore extracted from the Pilbara region is exported and approximately 88 per cent of Australian iron ore exports go to China, Japan or Korea. In 2002, Australia's economically demonstrated resources totalled 13.0 billion tonnes GA (2006*b*), equivalent to approximately 43 years production at an average production rate of 300 million tonnes per annum.

Long-term production projections

Long-term (20-year plus) projections of Australian iron ore production are not available. Paull and Millsteed (2006), in their article on the outlook for the Indian iron and steel industry, note that ABARE medium-term projections would see Australian iron ore exports increasing from around 210 million tonnes in 2004 to around 429 million tonnes by 2011—that is, more than doubling in around seven years implying growth of around 10 per cent per annum. This would imply total domestic production of over 430 million tonnes in 2011.

Production capacity expansion plans

ABARE's list of major minerals and energy projects (Haine 2006) suggests committed and prospective iron ore mining projects could expand total Australian production capacity by 240 million tonnes per annum by 2010, with a further 20 million tonnes capacity planned to come on stream just after 2010. Most of the additional planned production capacity is in the Pilbara region, spread between the existing mining tenements operated by BHP Billiton and Rio Tinto and planned new mining operations at Hope Downs (Hancock Prospecting and Rio Tinto) and Cloud Break and Christmas Creek (Fortescue Metals Group). Additional production capacity is planned for the Midwest region of Western Australia, exporting iron ore through Geraldton (Oakajee), and the Goldfields region of Western Australia. Total iron ore production will increase by around 3 million tonnes per annum in South Australia after the start up of OneSteel's Iron Magnet mine and conversion of the Whyalla steelworks to process magnetite.

Regional production projections

Based on the announced medium-term iron ore production capacity expansion plans and univariate modelling of long-term iron ore production, the projections used in modelling the future transport task are for total iron ore production to grow from around 155 million tonnes in 1998–99 to around 755 million tonnes in 2029–30. This implies average annual growth in production of 5.2 per cent per annum, which is below the 40-year historical growth of around 9.4 per cent per annum, but similar to growth experienced over the last 15 years (1989–90 to 2003–04) of around 5.5 per cent per annum.

At the regional level, production is projected to grow by around 5 per cent per annum in the Pilbara iron ore producing regions of De Grey and Fortescue. Production in the mid-west region (Greenough River) is projected to grow to around 33 million tonnes per annum by 2014–15 and remain at that level out to 2029–30. Iron ore production in the Kimberley region of Western Australia (Ord and Fitzroy) is projected to commence from 2009–10 and grow to around 7 million tonnes per annum by 2014–15 and remain at that level. Iron ore production in southern Western Australia is projected to grow to around 6.6 million tonnes per annum by 2014–15.

Table G.7 lists the base year actual production of iron ore and projected level of iron ore production in Australia in 2029–30, by freight region, used in the freight transport projections.

Table G.7 Projected regional iron ore production growth, 1999 to 2030

Freight region code	*Freight region name*	*State*	*Production 1998–99 (Mt)*	*Projected production 2029–30 (Mt)*	*Projected growth (% p.a.)*
432	Wide Bay–Burnett (Balance)	Qld	0.03	0.03	0.00
461	Mackay	Qld	0.12	0.12	0.00
571	Whyalla	SA	4.00	7.00	1.82
632	King	WA	0.00	6.60	na
673	Greenough River	WA	0.47	33.00	14.68
681	De Grey	WA	65.50	271.90	4.70
682	Fortescue	WA	83.80	427.30	5.40
691	Ord	WA	0.00	3.00	na
692	Fitzroy	WA	0.00	4.00	na
743	Lyell	Tas.	1.56	1.56	0.00
	Total		155.40	754.50	5.23

Sources: Paull and Millsteed (2006), FreightInfo 1999 and BITRE estimates.

Uranium

In Australia, total production of uranium as uranium oxide (U_3O_8) was 10 964 tonnes in 2004–05, accounting for 22 per cent of world production. Australian production is presently sourced from three mines (UIC 2006):

- Ranger, in the Northern Territory, produced more than half (51 per cent or 5544 tonnes of U_3O_8)
- Olympic Dam, in South Australia) produced 4356 tonnes of U_3O_8
- Beverley, in South Australia, produced 1064 tonnes of U_3O_8.

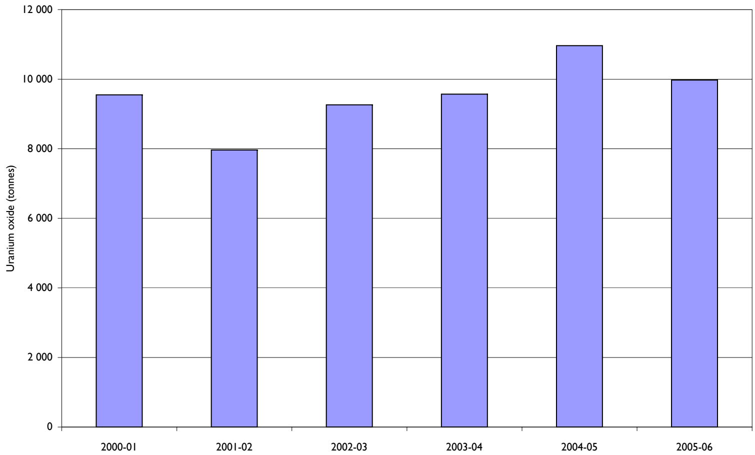
Australian uranium production fell slightly in 2005–06, to 9974 tonnes of U_3O_8, with production at Ranger, Olympic Dam and Beverley mines equal to 5184, 3936 and 854 tonnes, respectively (Mollard, Rumley, Penney, and Curtotti 2006). Recent Australian uranium (as U_3O_8) production is shown in Figure G.2.

Mining at Ranger is currently expected to end in 2008, but processing of mined ore will continue until 2014. This follows an announced drop in the cut-off grade in October 2005, which extended the life of the mine from 2011 to 2014.

Uranium production at Olympic Dam declined in 2002 and 2003, because of a fire in the solvent extraction plant in 2001. However, the uranium production has recovered in subsequent years. Uranium production at Olympic Dam will increase significantly from 2014 following planned expansion of the mine.

At Beverley, which is licensed to 1180 tonnes per year U_3O_8 equivalent, uranium production has been around 1000 tonnes U_3O_8 in recent years. Production in 2004 was 1084 tonnes U_3O_8 but dropped to 977 tonnes in 2005 and 824.6 tonnes in 2006 (UIC 2007). From 2009 production is projected to increase to 1500 tonnes per year.

Figure G.2 Australian uranium ore production (U_3O_8), 2000–01 to 2005–06



Sources: Australian Mineral Statistics (various years).

Long-term production projections

Mollard, Rumley, Penney, and Curtotti (2006) report that over the period to 2015, Australia's uranium production and exports would be influenced by a number of significant factors, including whether or not Commonwealth, state and territory government policy regarding the development of new uranium mines changes, the size and timing of the proposed expansion of Olympic Dam, and whether mining commences at Jabiluka, Koongarra and Kintyre uranium deposits in the Northern Territory. Given the current degree of uncertainty regarding these factors, Mollard, Rumley, Penney, and Curtotti (2006) examined two scenarios for Australian uranium production over the period to 2015—a 'no new mines' scenario and a 'new mines' scenario.

'No new mines' scenario

Under the no new mines scenario, Australia's uranium production will remain relatively steady at just over 10 000 tonnes U_3O_8 per annum over the period to 2012. However, Australia's uranium mine production is projected to grow to 14 329 tonnes of U_3O_8 by 2014–15. This increase will be in large part due to the proposed expansion of Olympic Dam (GA 2006*h*).

In the 'no new mines' scenario, as reported by Mollard, Rumley, Penney, and Curtotti (2006), uranium production capacity at Olympic Dam is assumed to increase to around 15 000 tonnes of U_3O_8 per annum by 2013, production at Beverley mine is assumed to continue at between 1000 and 1500 tonnes of U_3O_8 per annum from 2009; while production at Ranger is assumed to remain around 5000 tonnes U_3O_8 per year.

The no new mines scenario also assumes that the initial production from the Honeymoon project would commence in 2008. The Honeymoon mine is located in South Australia, around 400 kilometres northeast of Adelaide and 75 kilometres northwest of Broken Hill. The uranium resource at this site was estimated at 2460 tonnes of U_3O_8, with an annual production capacity of 400 tonnes U_3O_8 per year and a project life of between six and seven years. In addition, there would be some other relatively small projects which would commence production over the period to 2015.

Under this scenario, a slight decline in production at the Ranger mine is partially offset by the assumed commencement of production at the Honeymoon mine in 2008. And total uranium production is projected to increase over the final three years of the forecast period, due to the Olympic Dam mine expansion.

'New mines' scenario

The new mines scenario (Mollard, Rumley, Penney, and Curtotti 2006) assumes future production at the three existing mines is as in the no new mines scenario and that state government policy regarding the development of new uranium mines in Queensland, South Australia and Western Australia is changed in 2008 and the policy of the current Australian Government remains in place. Under this scenario, total uranium production remains steady to 2009–10, but begins to increase from 2011 as several new mines in Queensland, South Australia and Western Australia commence production. Under this scenario, production is projected to increase to around 23 000 tonnes U_3O_8 per annum by 2014–15.

According to GA (2006*h*), under this scenario, the projected annual production of uranium from the new mines is:

- Jabiluka (NT)—4000 tonnes U_3O_8
- Koongarra (NT)—1000 tonnes U_3O_8
- Kintyre (WA)—1200 tonnes U_3O_8
- Yeelirrie (WA)—2560 tonnes U_3O_8
- Lake Way (WA)—570 tonnes U_3O_8
- Ben Lomond (Qld)—590 tonnes U_3O_8
- Valhalla (Qld)—2750 tonnes U_3O_8 .

Regional production projections

For the uranium production projections used in this report, BITRE has assumed uranium production expansion lies somewhere between the no new mines and new mines scenarios. Production of uranium oxide (U_3O_8) is assumed to expand to 14 000 tonnes per annum by 2014–15, slightly below the level of Mollard, Rumley, Penney, and Curtotti (2006) no new mines scenario. After this time, it is assumed that new mines begin to come on stream, with production increasing to around 26 400 tonnes U_3O_8 per annum by 2029–30 (see Table G.8).

Table G.8 Projected uranium production by state and territory, 2004–05 to 2029–30

(tonnes)

Year	NT	SA	Qld	WA	Total	ARIMA-based projections[a]
1999–2000	4 144	4055	0	0	8 199	9 549
2004–05	5 544	5 420	0	0	10 964	11 222
2009–10	4 000	5 254	0	0	9 254	14 264
2014–15	0	14 000	0	0	14 000	17 316
2019–20	0	17 800	1 990	600	20 390	20 368
2024–25	0	16 700	2 990	3 600	23 290	23 420
2029–30	0	16 900	3 490	6 000	26 390	26 472

a. Aggregate ARIMA-based uranium production projections.
Sources: Mollard, Rumley, Penney, and Curtotti (2006), UIC (2006), sxr Uranium One Inc. (2007) and BITRE estimates.

For comparison, Table G.8 also reports auto-regressive integrated moving average (ARIMA)-based long-term uranium production projections, based on past production. The ARIMA-based production estimates imply total U_3O_8 production of approximately 26 500 tonnes in 2029–30.

Copper

Australia is estimated to hold the second largest economically demonstrated resources (EDR) of copper, estimated at 41.4 million tonnes and 8 per cent of global reserves (ABS 2007*a*). As a producer, Australia ranks fifth, with 6 per cent of world output, after Chile (36 per cent), the United States of America (8 per cent) and Indonesia and Peru (both 7 per cent) (ABS 2007*a*).

In 2005, Australia's mined copper output totalled 918 kilotonnes (by copper metal content), up almost 5 per cent on 2004 production levels (875 kilotonnes) (ABARE 2006) due principally to increased copper production at Olympic Dam in South Australia.

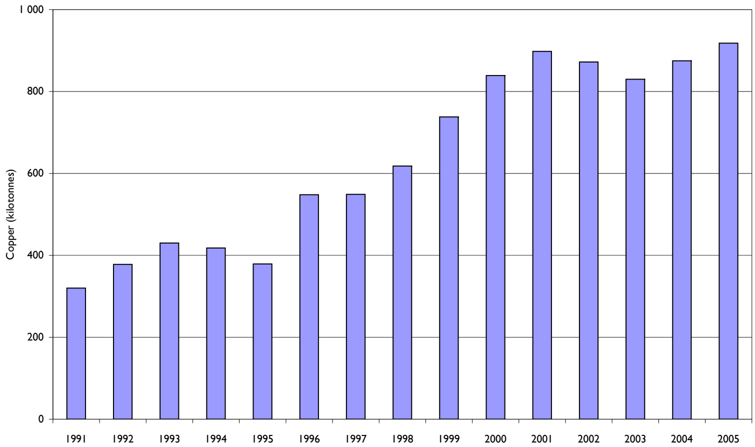
Figure G.3 shows Australian copper mining production between 1991 and 2005. Over this period, copper output has increased by an average 7.8 per cent per annum.

Long-term production projections

GA (2006*f*) estimates that at Australia's 2005 rate of production, accessible economic demonstrated resources (AEDR) of copper are sufficient for 45 years production. However, copper ore reserves, as classified under the Joint Ore Reserves Committee (JORC) Code, are approximately 18 million tonnes Cu, sufficient for 22 years production at 2005 production rates. The difference between the AEDR and copper ore reserves are resources that Geoscience Australian considers will become economic over the longer term (GA 2006*f*).

The likely commencement of several new projects and further expansion of Olympic Dam (South Australia) in 2013, is likely to increase Australian cop-

Figure G.3 Australian copper production, 1991 to 2005



Source: ABARE (2006).

per mine production significantly in the medium to longer-term. Several new projects that are expected to commence production in 2007, include Xstrata's Northern 3500 Ore body at the Enterprise Mine in Queensland (forecast production of 240 kilotonnes copper per year for 11 years), Compass Resources' Browns Oxide mine in the Northern Territory (10 kilotonnes copper per year), Copperco's Lady Annie mine in Queensland (19 kilotonnes copper per year) and Jaguar mine in Western Australia (9.6 kilotonnes copper per year) (Haine 2006). By 2013, it is anticipated that the further expansion of Olympic Dam will be completed, adding up to an additional 267 kilotonnes to total copper production each year. If all the announced new and capacity expanding projects commence as planned, total Australian copper production capacity would increase by around 777 kilotonnes, over current production levels, by 2010.

Table G.15 lists currently planned and announced copper mining capacity expansion projects, the expected commencement data and the addition to production capacity up to 2010.

Regional production projections

The copper production projections used in this report are based on a mix of information about current production at existing mines, estimated ore reserves and mineral resources and announced planned mining capacity expansion. Together, this information provides reasonable estimates of regional copper mining output to about 2014–15, at which time production at some of the smaller to medium sized copper mines will begin to decline. Beyond this point, the level of copper production becomes much less clear. Much will depend on copper prices and the success exploration activity. In the absence of detailed modelling, BITRE estimated a simple univariate model of copper

Table G.9 Planned and announced copper mining capacity expansion projects

Project	*State*	*Expected startup*	*New capacity (kt)*
Mount Watson (stages 1 & 2)	Qld	2007	10 kt Cu cathode
Northern 3500	Qld	2007	21.8 kt Cu concentrates (240 kt Cu over 11 years)
White Range	Qld	2007	15 kt Cu cathode
Lady Annie	Qld	Mid 2007	19 kt Cu cathode initially
Browns Oxide Project	NT	Mid 2007	10 kt Cu cathode
Jaguar base metals	WA	Mid 2007	9.6 kt Cu
Einasleigh Copper	Qld	2008	15–25 kt Cu
Roseby copper	Qld	Late 2008	34 kt Cu
Prominent Hill	SA	Late 2008	104 kt Cu in concentrates
Cloncurry Cu project	Qld	2009	11 kt Cu in concentrates
Kanmantoo	SA	2009	14–19 kt Cu in concentrates
Copper Hill	NSW	2010	32 kt Cu
Olympic Dam expansion	SA	2013	267 kt Cu

Source: Haine (2006).

mining output. Pre-testing of the data suggest that copper mining output is best modelled by a random walk process, which suggests that current production is the best forecast of future copper mining output. In contrast, a simple trend-based model implies that future copper production would continue to increase to 2030. The trend-based estimates, listed in Table G.10, produce similar estimates of production in 2014–15, 1450 kilotonnes Cu as implied by existing production levels and planned production capacity increases. Based on the existing information, BITRE has assumed total copper production would increase to around 1400 kilotonnes in 2014–15. Beyond 2014–15, BITRE has taken a conservative approach and assumed total copper production will increase only slightly above 2014–15 levels. Total production is apportioned across regions in proportion to existing regional production patterns, based on assuming that significant new copper ore bodies are most likely to be discovered near those areas with existing mines. The assumed total copper mining output levels, in five-year intervals to 2029–30 by state and territory, are summarised in Table G.10.

Zinc

Australia has the largest EDR of zinc in the world, at close to 42 million tonnes or 18 per cent of world reserves (ABS 2007*a*,GA 2006*e*). Major deposits include Century, Mt Isa, Cannington, all in Queensland, and McArthur River, Northern Territory. Australia is the third largest zinc producer in the world, behind China and Canada (GA 2006*e*).

In 2005, total Australian zinc mining output was 1367 kilotonnes (zinc metal content), slightly higher than in 2004 (1335 kilotonnes) (ABARE 2006). Figure G.4 shows Australian zinc mining output between 1991 and 2005. Over this period, zinc production has increased by an average of just over 2 per cent per annum.

Table G.10 Projected copper production by state and territory, 2004–05 to 2029–30

(kilotonnes)

Year	*NSW*	*Qld*	*SA*	*WA*	*Tas.*	*NT*	*Total*	*Trend-based regression projections*[a]
2004–05	173	434	213	65	27	0	912	918
2009–10	207	561	333	176	25	10	1 312	1 211
2014–15	187	531	566	151	0	0	1 435	1 449
2019–20	187	449	766	151	0	0	1 553	1 687
2024–25	185	449	766	151	0	0	1 551	1 924
2029–30	185	449	766	151	0	0	1 551	2 162

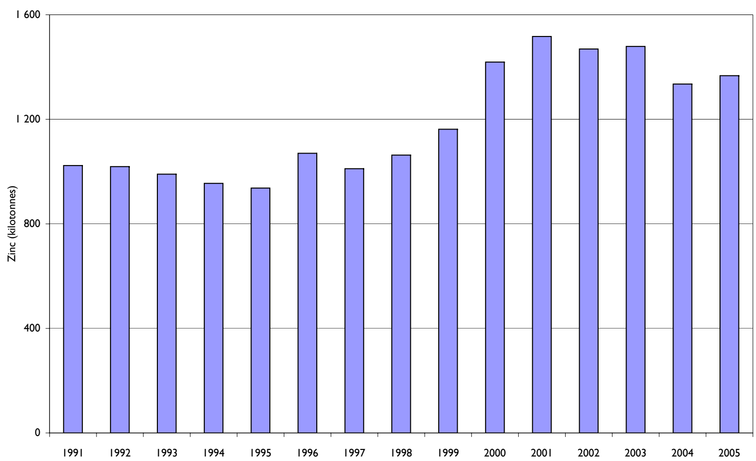
a. Aggregate trend-based time series regression estimates.
Sources: Haine (2006) and BITRE estimates.

The sharp increase in zinc production in 2000, observable in Figure G.4, was due to commencement of production, in early 2000, at the Century mine, north-west of Mt Isa (Queensland) (GA 2001). Figure G.4 also shows that zinc production fell slightly in 2004, due to a drop in output from Endeavour mine (NSW), but increased in 2005, largely due to a major increase in production at Xstrata's Black Star zinc mine in Queensland (KPMG 2006). In 2005, Century mine (near Mount Isa) in Queensland was the largest Australian zinc mine producing 501 kilotonnes (Zn metal content) (ABS 2007*a*).

Long-term production projections

In Australia, zinc mining output is projected to increase over the near to medium term, due to the expected commencement of mining at several new mines and production capacity expansion at some existing mines. In partic-

Figure G.4 Australian zinc production, 1991 to 2005



Source: ABARE (2006).

Table G.11 Planned and announced zinc mining capacity expansion projects

Project	*State*	*Expected startup*	*New capacity (kt)*
Lennard Shelf (restart)	WA	Early 2007	70–80
Jaguar Base Metals	WA	Mid 2007	33.6
Potosi	NSW	Late 2007	35
Angas Zinc	SA	Late 2007	36
Flinders Zinc	SA	Late 2007	50
Rasp	NSW	2008	37.5
Mt Isa zinc-lead expansion	Qld	2008	150
Panorama	WA	2008	39.8
Lady Loretta	Qld	2009	125
Dugald River	Qld	2010	190

Source: Haine (2006).

ular, zinc production from Xstrata's Mount Isa mines is expected to increase with the completion of stage one of the zinc-lead concentrator expansion in 2008. Table G.11 lists committed new projects and capacity expansion plans and announced prospective new resources of zinc production in Australia. Together with existing production, the planned additions to zinc production capacity would see Australian zinc mining output increase to around 2 million tonnes per annum by 2011.

Regional production projections

Like copper, the short to medium term zinc production projections used in this report are based on a mix of information about current production at existing mines, estimated ore reserves and mineral resources and announced mining capacity expansion plans. Based on this information, BITRE assumes total zinc production will increase to around 2100 kilotonnes in 2014–15. Australia's historical zinc mining output exhibits a generally consistent increasing trend. Time series methods imply that zinc output exhibits stationary trend growth. Projections of future zinc production, based on simple trend regressions of historical zinc production, imply that total zinc production would grow to around 2500 kilotonnes per annum, with production predicted to be 1900 kilotonnes per annum in 2014–15. The 2014–15 trend projection is in line with planned production capacity to this time. Beyond 2014–15, BITRE has assumed world demand for zinc continues to grow resulting in increasing Australian zinc production. Between 2014–15 and 2029–30, zinc production is assumed to grow in line with the trend time-series regression estimates. Total zinc production is apportioned across regions in rough proportion to existing regional production patterns, as future zinc production is likely to occur in existing zinc mining provinces. The assumed total zinc mining output levels, in five-year intervals to 2029–30 by state and territory, are summarised in Table G.12.

Table G.12 Projected zinc production by state and territory, 2004–05 to 2029–30

(kilotonnes)

Year	*NSW*	*Qld*	*SA*	*WA*	*Tas.*	*NT*	*Total*	*Trend-based regression projections*[a]
2004–05	202	920	0	70	90	175	1 457	1 513
2009–10	279	1 275	86	284	122	175	2 221	1 676
2014–15	279	1 295	36	180	122	175	2 087	1 880
2019–20	279	1 225	0	150	60	175	1 889	2 083
2024–25	295	1 350	0	150	60	175	2 030	2 286
2029–30	295	1 600	0	150	60	175	2 280	2 490

a. Aggregate trend-based time series regression estimates.
Sources: Haine (2006) and BITRE estimates.

Lead

Australia has the world's largest EDR of lead, with 32 per cent of the world EDR (ABS 2007*a*). Over 55 per cent of Australia's EDR of lead are found in north-western Queensland. Australia is also the world's largest lead producer (GA 2006*f*). At current production rates, Australia's EDR of lead has a production life of around 25 to 30 years.

In 2005, Australia's mined lead production totalled 766 kilotonnes (lead metal content basis), 14 per cent above 2004 production (674 kilotonnes) (ABARE 2006). Cannington mine, in Queensland, is the world's largest and lowest cost lead operation and produced almost 288 kilotonnes of lead in 2005 (ABS 2007*a*).

Figure G.5 shows annual Australian lead production between 1991 and 2005. Over this period, lead mine output has increased on average by approximately 2 per cent per annum.

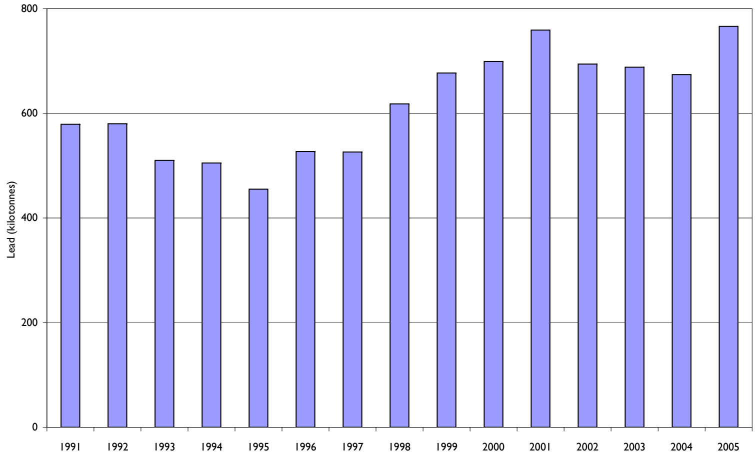
Long-term production projections

Total Australian lead output is projected to increase over the short to medium term as several new mines commence production and production capacity is expanded at some existing mines. In particular, total lead production from Xstrata's Mount Isa mines is expected to increase with the completion of stage 1 of the zinc-lead concentrator expansion in 2008. Table G.13 lists committed new projects and capacity expansion plans and announced prospective new resources of lead production in Australia. Together with existing production, the planned additions to lead production capacity would see total Australian lead mining output increase to around 1100 kilotonnes per annum by 2011.

Regional production projections

The lead production projections used in this report are based on a mix of information about current production, estimated ore reserves and mineral resources at existing mines and announced mining capacity expansion plans.

Figure G.5 Australian lead production, 1991 to 2005



Source: ABARE (2006).

Table G.13 Planned and announced lead mining capacity expansion projects

Project	*State*	*Expected startup*	*New capacity (kt)*
Angas Zinc	SA	Late 2007	12
Rasp mine	NSW	2008	26.5
Mt Isa zinc-lead expansion	Qld	2008	80
Magellan	WA	2008	70
Lady Loretta	Qld	2009	50
Dugald River	Qld	2010	20
Brown's Sulphide	NT	2010	170

Source: Haine (2006).

Based on this information, BITRE has assumed total lead production would increase to around 1090 kilotonnes in 2014–15. Beyond 2014–15, production plans and resources are far less certain. Australia's historical lead mining output exhibits a slight increasing trend. Projections of future lead production, based on simple trend regressions of historical lead production, imply total lead production would grow from around 750 kilotonnes in 2004–05 to around 1121 kilotonnes by 2029–30. Projections of future lead production, based on a trend-based regression of historical lead mining output, implies total lead output would be around 900 kilotonnes by 2014–15, a bit less than the level of production implied by existing mine output and announced capacity expansion. Beyond 2014–15, BITRE has assumed that lead production will remain at around 1100 kilotonnes per annum, similar to 2014–15 production levels. Over two-thirds of lead output is assumed be sourced from the Mt Isa region in north-west Queensland. The assumed total zinc mining output levels, in five-year intervals to 2029–30 by state and territory, are summarised in Table G.14.

Table G.14 Projected lead production by state and territory, 2004–05 to 2029–30

(kilotonnes)

Year	NSW	Qld	SA	WA	Tas.	NT	Total	Trend-based regression projections[a]
2004–05	101	529	0	12	30	76	748	766
2009–10	145	600	12	48	47	246	1 098	828
2014–15	145	610	12	29	47	246	1 089	916
2019–20	145	590	0	25	25	246	1 031	1 004
2024–25	145	690	0	25	25	176	1 061	1 092
2029–30	145	750	0	25	25	176	1 121	1 180

a. Aggregate trend-based time series regression estimates.
Sources: Haine (2006) and BITRE estimates.

Silver

Australian EDR of silver measured 44.0 kilotonnes in 2005, up from 41.4 kilotonnes in 2004. In 2005, Queensland had the largest share at 67.5 per cent, while other reserves occur in South Australia (12.5 per cent), Northern Territory (11.3 per cent), New South Wales (5.0 per cent), and Western Australia (2.5 per cent) with the remainder in Tasmania and Victoria (ABS 2007*a*). Australia has the second largest EDR of silver (16 per cent) in the world. According to GA (2006*f*), silver is mined and produced mainly as a co-product of copper, lead, zinc and, to a lesser extent, gold.

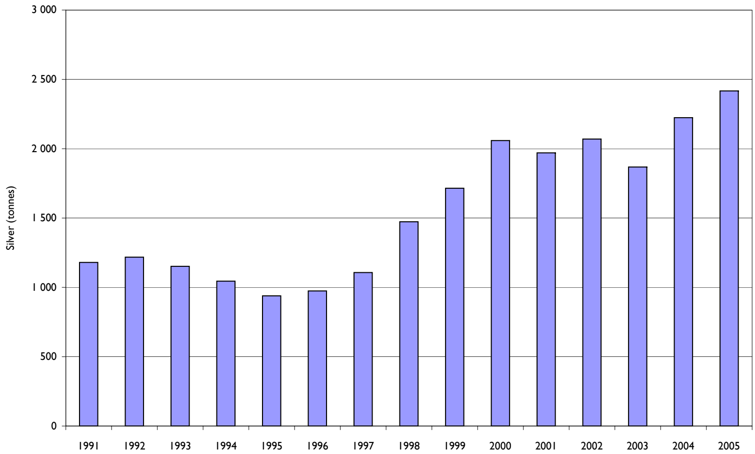
Total Australian mined silver output was 2417 tonnes (Ag metal content) in 2005, up 8.7 per cent on 2004 production levels (2224 tonnes) (ABARE 2006). As a share of total world silver production, Australia ranks fourth behind Peru, Mexico and China. Cannington in Queensland is the world's largest and lowest cost silver operation and produced 43.9 million ounces (1244 tonnes) of silver in 2005 (ABS 2007*a*).

Figure G.6 shows Australian silver production between 1991 and 2005. Over this period, silver mine production has increased on average by 5.25 per cent per annum.

Long-term production projections

In Australia, silver mine output is also projected to increase over the near to medium term due to the planned expansion of existing zinc–lead–silver mines and the commencement as new zinc–lead–silver mines. In particular, silver production from Xstrata's Mount Isa mines is expected to increase with the completion of stage 1 of the zinc-lead concentrator expansion in 2008. Table G.15 lists committed new projects and capacity expansion plans and announced prospective new resources of silver production in Australia.

Figure G.6 Australian silver production, 1991 to 2005



Source: ABARE (2006).

Table G.15 Planned and announced silver mining capacity expansion projects

Project	*State*	*Expected startup*	*New capacity (tonnes)*
Angas Zinc	SA	Late 2007	24
Jaguar Base Metals	WA	Mid 2007	25.1
Rasp mine	NSW	2008	27.9
Mt Isa zinc-lead expansion	Qld	2008	72
Lady Loretta	Qld	2009	23
Dugald River	Qld	2010	33

Source: Haine (2006).

Regional production projections

The silver production projections used in this report, like those of zinc and lead, are based on a mix of information about current production at existing mines, estimated ore reserves and mineral resources and announced mining capacity expansion plans. Based on this information, BITRE assumes total silver production will increase to around 2340 tonnes per annum by 2014–15. Beyond 2014–15, in the absence of significant new silver deposits, silver production would decline to around 800 tonnes per annum as existing mineral resources are depleted. For the projections used in this report, however, BITRE has assumed that continued world demand for zinc, lead and silver will result in new deposits being worked beyond 2014–15, and that overall silver production would grow slightly to around 2800 tonnes per annum by 2029–30. By way of contrast, the long term trend-based regression projections of silver production imply silver production growing to over 4500 tonnes by 2029–30. Again, as in the case of zinc and lead, total projected future silver production was apportioned across regions in rough proportion to existing regional production patterns. The assumed total silver mining output levels, in five-year intervals

Table G.16 Projected silver production by state and territory, 2004–05 to 2029–30

Year	NSW	Qld	SA	WA (tonnes)	Tas.	NT	Total	Trend-based regression projectionsa
2004–05	205	1 804	0	114	90	0	2 213	2 417
2009–10	247	1 834	14	114	129	36	2 374	2 771
2014–15	247	1 834	14	82	129	36	2 342	3 276
2019–20	194	1 950	0	66	51.6	36	2 297	3 780
2024–25	192	2 200	0	66	51.6	36	2 545	4 284
2029–30	192	2 450	0	66	51.6	36	2 795	4 789

a. Aggregate trend-based time series regression estimates.
Sources: Haine (2006) and BITRE estimates.

to 2029–30 by state and territory, are summarised in Table G.16.

Manganese

Australia's EDR of manganese ore measured 143 million tonnes in 2005, and were approximately 12 per cent of world EDR—the fourth largest share in the world (ABS 2007*a*). Australia was the third largest manganese producer in the world in 2005, after South Africa and China, producing 3136 kilotonnes of manganese ore, 14 per cent of the total world manganese output (GA 2006*f*).

In Australia, there are three operating manganese mines:

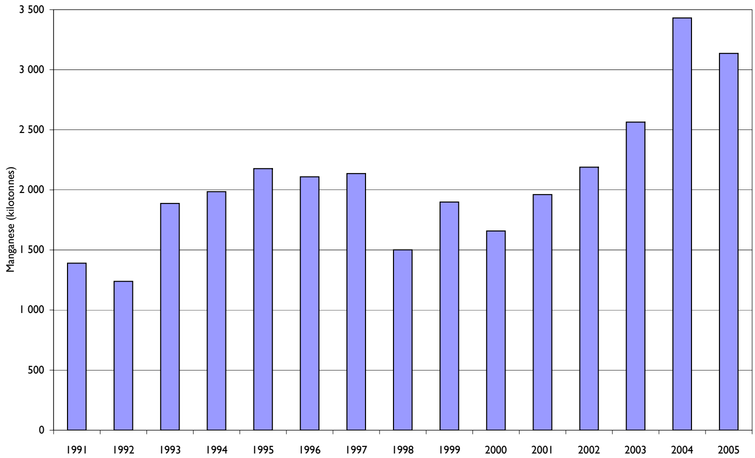
- Groote Eylandt (Northern Territory)—the world's largest manganese mine, producing almost 3 million tonnes per annum, 13 per cent of total world manganese production.
- Woodie Woodie (Western Australia)—current production capacity of 1.0 million tonnes per annum.
- Bootu Creek Resources (near Tennant Creek, Northern Territory)—commenced operations in late 2005 and has a production capacity of 500 kilotonnes and projected mine life of 5 years.

Figure G.7 shows Australian manganese ore production between 1991 and 2005. Over this period, manganese ore output has increased on average by 6 per cent per annum. The dramatic increase in manganese ore production in 2004 (3431 kilotonnes) was due to increased output at Groote Eylandt mine, which produced over 3 million tonnes in that year.

Long-term production projections

Manganese JORC ore reserves were approximately 120 million tonnes (84 per cent of AEDR) in 2005. GA (2006*f*) states that at the current rates of production estimated JORC ore reserves are sufficient for 15 years of beneficiated manganese ore production. However, BITRE estimates that, including both demon-

Figure G.7 Australian manganese ore production, 1991 to 2005



Source: ABARE (2006).

strated and inferred manganese resources, manganese production, especially at Groote Eylandt could continue beyond 2030.

Groote Eylandt

GEMCO, which operates the Groote Eylandt mine, has announced plans to increase manganese ore output, from approximately three to four million tonnes per year by improving the mine's beneficiation process. Current demonstrated and inferred ore reserves are estimated at 169 million dry tonnes at 47.6 per cent wash yield, which implies a resource stock of 80 million washed tonnes of manganese ore, sufficient for 20 years further production. BITRE assumed that Groote Eylandt manganese production would grow to 4 million tonnes per annum from 2010–11 and resources would be sufficient for production to continue at that rate to 2029–30.

Woodie Woodie

Consolidated Minerals Limited (2006) estimate that demonstrated and potential resources at Woodie Woodie are sufficient to sustain production for 15 years. For the projections, BITRE has assumed that manganese ore production at Woodie Woodie continues at a rate of 1.0 million tonnes per annum between 2005–06 and 2019–20, and ceases altogether thereafter.

Bootu Creek

Bootu Creek is assumed to produce 550 kilotonnes of manganese ore per year from 2005–06 to 2011–12.

Table G.17 lists projected manganese ore production, by mine, between 2004–05 and 2029–30.

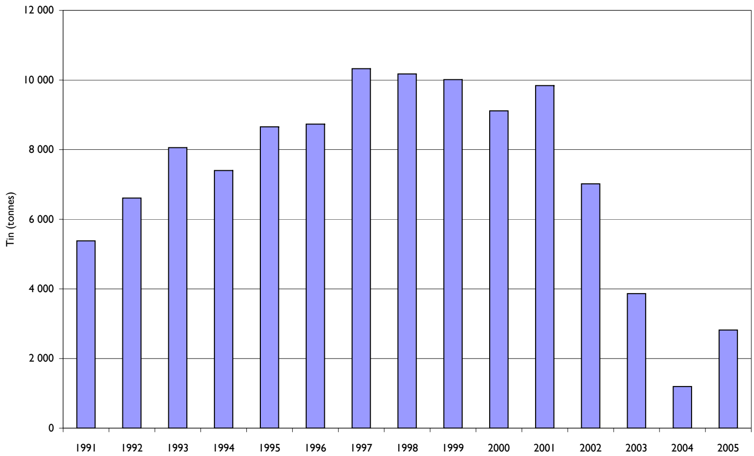
Table G.17 Projected manganese ore production by mine, 2004–05 to 2029–30

(kilotonnes)

Year	Groote Eylandt	Woodie Woodie	Bootu Creek	Total
2004–05	3 150	650	0	3 380
2009–10	3 150	1 000	550	4 700
2014–15	4 000	1 000	0	5 000
2019–20	4 000	1 000	0	5 000
2024–25	4 000	0	0	4 000
2029–30	4 000	0	0	4 000

Sources: ABARE (2006) and BITRE estimates.

Figure G.8 Australian tin production, 1991 to 2005



Source: ABARE (2006).

Tin

Australia's total EDR of tin, at December 2005, was 163 kilotonnes, the tenth largest reserves of tin in the world. Over 85 per cent of Australia's economic tin resources are located at the Renison Bell deposit in Tasmania. The next most important mine is at Greenbushes in Western Australia (GA 2006*d*).

In 2005, total tin (metal content) production in Australia was 2819 tonnes. This is well below average production levels over the ten years to 2002, which has been around 8800 tonnes per year. The decline in tin production between 2001 and 2004 was coincident with a fall in the tin spot price from over US$5000 per tonne to around US$4000 per tonne in 2001. Tin prices began to recover in late 2003, rising to around US$9000 per tonne in 2004. The increase in production in 2005 was due to re-commencement of operations at Renison Bell mine. Tin prices have averaged around US$14 000 per tonne in the first half of 2007. Figure G.8 illustrates Australia tin output between 1991 and 2005.

Table G.18 Projected tin production by state and territory, 2004–05 to 2029–30

(kilotonnes)

Year	*Qld*	*WA*	*Tas.*	*Total*
2004–05	0	0.4	0.7	1.1
2009–10	1	0	16.5	17.5
2014–15	1	0	7.5	8.5
2019–20	1	0	0	1
2024–25	0	0	0	0
2029–30	0	0	0	0

Sources: Haine (2006) and BITRE estimates.

Future projected production

Bluestone Tin Limited has several tin mining projects in development. Production of tin concentrate from Collingwood mine (Queensland) commenced in January 2006. Bluestone Tin is also restarting production at the Renison Bell mine, Mt. Bischoff mine and will mine tailings from past production at Renison—the Rentails project. Collingwood mine is projected to produce 1 kilotonne of tin per annum from 2006–07 to 2021–22. Tin production at Renison is projected to grow increase to 7.5 kilotonnes per annum from 2007–08 and production to continue until 2018–19. The Rentails project is projected to yield 6 kilotonnes of tin metal per annum between 2007–08 and 2013–14 and Mt. Bischoff is projected to produce 3 kilotonnes per annum between 2008–09 and 2013–14.

BITRE has assumed there will be no tin production at Greenbushes (WA) over the projection horizon.

Based on these assumptions, total tin production is assumed to increase to around 17.5 kilotonnes per annum between in 2008–09 and 2014–14, before declining to around 1 kilotonne per annum in 2019–20. Table G.18 lists projected tin metal output, by state, between 2004–05 and 2029–30.

Nickel

Australia's total demonstrated and inferred resources of nickel were 26.7 million tonnes in 2005, of which EDR of nickel comprised 90 per cent, or 23.9 million tonnes. Laterite nickel constituted the largest share of EDR (56.5 per cent, 13.5 million tonnes), while sulphide nickel EDR were 10.4 million tonnes. Over ninety per cent of total Australian EDR of nickel are in Western Australia and Australia holds the largest share of world nickel EDR, with 36.6 per cent (ABS 2007*a*).

In 2005, Australia's mined nickel production totalled 189 kilotonnes (nickel metal output) (ABARE 2006). Australian nickel output has more than tripled since 1992, increasing from around 50 kilotonnes in 1992 to almost 200 kilotonnes in 2001. Since 2001, nickel production has remained around 180–190 kilotonnes per annum. Currently, all of Australia's nickel production is from

Table G.19 Planned and announced nickel mining capacity expansion projects

Project	*State*	*Expected startup*	*New capacity (kt)*
Kalgoorlie	WA	2013	50
Honeymoon Well	WA	2012	40.0–45.0
Jump-up Dam	WA	2009	10
Flying Fox[a]	WA	Early 2007	8.0[c]
Flying Fox[b]	WA	2009	6.0[c]
Ravensthorpe	WA	2008	50
Gladstone nickel-cobalt refinery	Qld	2010	60
North Qld nickel-cobalt project	Qld	2009	10
Avebury	Tas.	Early 2007	8.5[c]

a. Stage 1–T1 deposit (part of Forrestania project).
b. Stage 1–T5 deposit (part of Forrestania project).
c. Nickel in concentrates.
Source: Haine (2006).

Western Australia. Nickel sulphide deposits are mined at Kambalda, Leinster, Mt Keith, Silver Swan, Cosmos, Wannaway, Mittel, RAV8, Radio Hill and Emily Ann by underground and open-cut methods.

Figure G.9 shows Australian nickel production (nickel metal) between 1991 and 2005. Over this period, nickel mine production has increased on average by 7.6 per cent per annum.

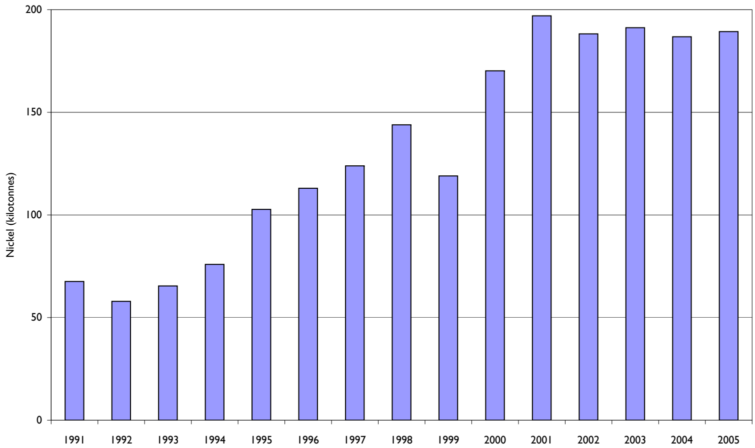
Long-term production projections

According to GA (2006c), at 2005 production rates Australia's AEDR of nickel (including both sulphide and laterite deposits) are sufficient for 120 years production. JORC compliant AEDR comprise approximately 29 per cent of total AEDR and are sufficient for 37 years production at 2005 production rates.

Provided world nickel prices remain favourable, Australian nickel mining output is likely to increase over the medium term as several new projects come on stream. Nickel deposits currently undergoing feasibility studies include lateritic deposits at Ravensthorpe and at Goongarrie in Western Australia, Marlborough deposits in Queensland, and Systerston deposit in New South Wales. Other nickel deposits that are being evaluated include Yakabindie, Honeymoon Well, Sally Malay, Maggie Hays, and Black Swan. The Kalgoorlie, Honeymoon Well and Ravensthorpe deposits together have to potential to nearly double existing nickel output. Table G.19 lists committed new projects and capacity expansion plans and announced prospective new resources of nickel production in Australia.

Besides these new projects and expansion of existing projects, ABARE estimated other prospective nickel sources in Western Australia, where no startup date has been identified could potentially supply an additional 66 kilotonnes of nickel metal per annum (Haine 2006).

Figure G.9 Australian nickel production, 1991 to 2005



Source: ABARE (2006).

Regional production projections

The nickel production projections used in this report are based on a mix of information about current production, estimated ore reserves and mineral resources at existing mines and announced mining capacity expansion plans. Based on this information and assumptions about the timing of new nickel production sources, BITRE has assumed total nickel production would increase up to around 350 kilotonnes (nickel metal content) by 2014–15. Beyond 2014–15, future nickel production levels are far less certain. Univariate time series analysis of historical Australian nickel production suggests nickel output is best explained by a random walk process, which means that current production is the best forecast of future production. Beyond 2014–15, it is assumed that nickel production continues at existing production rates until resources are exhausted. Only one new mine is assumed to commence nickel production beyond 2014–15—the Yakabindie mine is assume to commence production in 2020–21 with annual nickel production of 100 kilotonnes per annum. Under these assumptions total nickel metal output is projected to be 270 kilotonnes in 2029–30. The assumed total nickel production levels, in five-year intervals to 2029–30 by state and territory, are summarised in Table G.20.

Bauxite, alumina and aluminium

Bauxite is mined in Australia to produce alumina and aluminium for domestic consumption and export. In Australia, Bauxite is mined from open cut operations at Weipa (Queensland), Gove (Northern Territory), and the Darling Range (Huntly, Willowdale and Worsley mines, Western Australia). Bauxite deposits at Mitchell Plateau and Cape Bougainville in north Western Australia are currently uneconomic, but are a significant potential future resource

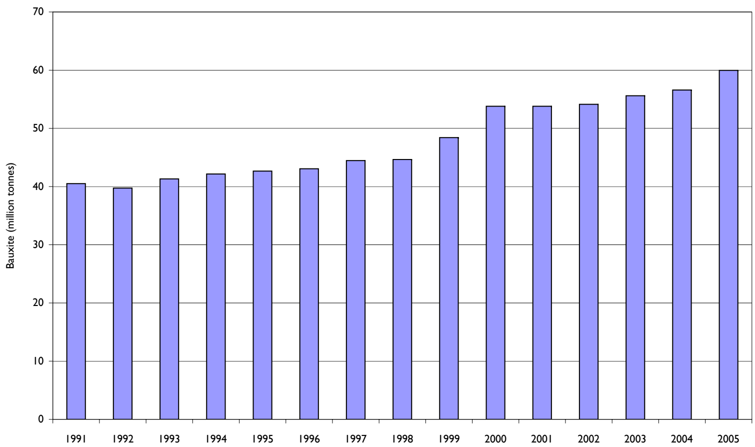
Table G.20 Projected nickel production by state and territory, 2004–05 to 2029–30

(kilotonnes)

Year	*Qld*	*WA*	*Tas.*	*Total*
2004–05	0	188.2	0	188.2
2009–10	10	215.7	8.5	234.2
2014–15	10	347.6	0	357.6
2019–20	10	329.4	0	339.4
2024–25	10	270	0	280
2029–30	0	270	0	270

a. Aggregate trend-based time series regression estimates.
Sources: Haine (2006) and BITRE estimates.

Figure G.10 Australian bauxite production, 1991 to 2005



Source: ABARE (2006).

(GA 2006*a*). Alumina refineries are located in close proximity to current bauxite mines and the alumina shipped to aluminium smelters in New South Wales, Victoria, Queensland and Tasmania.

GA (2006*a*) state that, based on United States Geological Survey data for other countries, Australia's demonstrated bauxite resources of 7.8 billion tonnes, rank second in the world after of Guinea; ahead of Brazil, Jamaica and China.

In 2005, Australia was the world's leading producer of bauxite and alumina, with bauxite production of 60 million tonnes and alumina production equal to 17.7 million tonnes, equal to about 40 per cent of world bauxite and over 30 per cent of world alumina. Australia also produced 1.9 million tonnes of aluminium (ingot metal).

Figure G.10 shows Australian bauxite production between 1991 and 2005. Over this period, bauxite production increased on average by just over 2.8 per cent per annum.

Table G.21 Planned and announced bauxite mining capacity expansion projects

Project	*State*	*Expected startup*	*New capacity (Mt)*
Aurukun	Qld	2011	7.5
Weipa mine expansion	Qld	Late 2007	Not provided
Ely	Qld	2010	Not provided

Source: Haine (2006).

Long-term production projections

GA (2006*f*) report that the ratio of AEDR to current mine production implies the resource life for existing bauxite operations is around 70 to 75 years, and that exploration is likely to extend the resource life well beyond this.

Table G.21 lists announced new bauxite production and capacity expansion projects in Australia. The most notable of these is the Aurukun bauxite deposit, just south of Weipa (Queensland) for which there are plans to mine 7.5 million tonnes of bauxite per annum.

Regional production projections

For the longer term, BITRE used univariate time series methods to project future total national bauxite production and allocated that across the three different production areas based on regional bauxite production trends over the past decade. Long-term bauxite production was found to be trend stationary. Consequently, future bauxite production is trend-based projection of past production. Total Australian bauxite production is assumed to grow from around 60 million tonnes per annum in 2004–05 to approximately 135 million tonnes per annum by 2029–30.

Over the past seven years, bauxite production in Queensland (Weipa) and Western Australia has increased, but remained more or less static in Northern Territory (Gove). Based on the available information/data on total bauxite resources and reserves, and also on mine life, BITRE has assumed that Queensland (Weipa) bauxite production will grow on average by 4.3 per cent per annum between 2005–06 and 2029–2030 and in Western Australia by 3.5 per cent per annum over that period. Bauxite production in the Northern Australia is projected to remain around 5 million tonnes per annum between 2005–06 and 2029–30. BITRE assumed future bauxite production is summarised, by state and territory, in Table G.22.

Mineral Sands

The three main minerals mined from Australian mineral sands deposits are the titanium-bearing minerals—rutile and ilmenite—and the zirconium-bearing mineral—zircon.

Australia is a world leader in production of mineral sands and, according to GA

Table G.22 Projected bauxite production by state and territory, 2004–05 to 2029–30

(kilotonnes)

Year	*Qld*	*NT*	*WA*	*Total*	*Trend-based regression projections*[a]
2004–05	13 770	5 808	38 070	57 648	59 959
2009–10	19 557	5 000	45 079	69 636	71 092
2014–15	23 552	5 000	53 540	82 093	83 809
2019–20	28 133	5 000	63 589	96 722	98 744
2024–25	33 388	5 000	75 524	113 911	116 293
2029–30	39 403	5 000	89 698	134 101	136 906

a. Aggregate trend-based time series regression estimates.
Sources: Haine (2006) and BITRE estimates.

(2006*f*), has the world's largest EDR of rutile and zircon, 40 and 44 per cent, respectively, and the world's second largest EDR of ilmenite (19 per cent). Australia produces approximately 47 per cent of the world's rutile, 40 per cent of the world's zircon, and about 23 per cent of the world's ilmenite.

Australia's EDR of ilmenite is 214.9 million tonnes, of which 59 per cent is in Western Australia, 25 per cent in Queensland and the rest in New South Wales (7 per cent), Victoria (6 per cent) and South Australia (3 per cent). Queensland, New South Wales, Western Australia and Victoria together hold over 97 per cent of Australia's 20.5 million tonnes EDR of rutile. Total zircon EDR is 32.9 million tonnes, of which 68 per cent is found in Western Australia and Queensland (GA 2006*f*).

GA (2006*a*) reports that a significant proportion of Australia's mineral sands deposits are in areas quarantined from mining, mainly national parks. As a consequence, approximately, 17 per cent of ilmenite, 28 per cent of rutile and 25 per cent of zircon EDR is unavailable for mining.

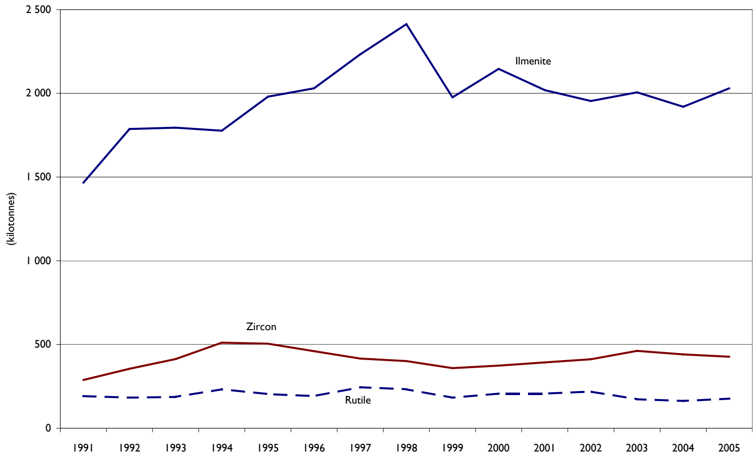
In 2005, Australia produced 2030 kilotonnes of ilmenite, 177 kilotonnes of rutile and 427 kilotonnes of zircon. Figure G.11 illustrates Australian ilmenite, rutile and zircon production between 1991 and 2005. Over this period, ilmenite and zircon production increased by, on average, 2.35 and 2.85 per cent per year, respectively, while zircon production decreased by 0.6 per cent per year.

Long-term production projections

According to GA (2006*f*), AEDR of ilmenite, rutile and zircon are sufficient to enable production for 89, 84 and 57 years, respectively, at 2005 rates of production. However, resources in the JORC Code reserves categories are adequate for only 18 years for ilmenite, 19 years for rutile, and 11 years for zircon.

Australia's mineral sands production is expected to increase quite significantly over the next five years, with several new mines either recently commencing or shortly to commence operations. In particular, BeMax Resources and Illuka

Figure G.11 Australian ilmenite, rutile and zircon production, 1991 to 2005



Source: ABARE (2006).

Table G.23 Planned and announced mineral sands production capacity expansion projects

Project	*State*	*Expected startup*	*New capacity (kt)*
Douglas	Vic.	Late 2006	443
Minderie	SA	Early 2007	101
Waroona	WA	Early 2007	154
Goondicum	Qld	Mid 2007	479
Keysbrook	WA	Mid 2007	93
Coburn	WA	Late 2007	105
Donald	Vic.	Early 2008	265
Cataby	WA	2008	780
Dongara	WA	2008	260
Snapper	NSW	2009	346
Prungle	NSW	2010–2015	195
Jangardup South	WA	na	250
Ouyen	Vic.	na	150
Twelve Mile	NSW	na	250
WIM 150	Vic.	na	140

na – Not available.
Note: Total mineral sands include ilmenite, rutile and zircon (main minerals) and traces of other minerals (including leucoxene, HiTi 71/90, feldspar, apatite, titanomagnetite).
Sources: Haine (2006) and BITRE estimates.

Resources commenced production in the Murray Basin in late 2005. BeMax has plans to commence production at several other mine sites in the Murray Basin. Additionally, there are several new mine sites and mining capacity expansions planned in Western Australia. Table G.23 lists committed new projects and capacity expansion plans and announced prospective new resources of mineral sands production in Australia.

Table G.24 Projected mineral sands (heavy mineral concentrate) production by state and territory, 2004–05 to 2029–30

(kilotonnes)

Year	*NSW*	*Qld*	*Vic.*	*SA*	*WA*	*Total*
2004–05	0	0	285	0	2 495	2 780
2009–10	600	995	765	400	4 173	6 933
2014–15	1 045	995	765	400	4 173	7 378
2019–20	1 045	845	765	400	3 830	6 885
2024–25	1 045	845	480	400	3 050	5 820
2029–30	445	845	480	100	2 130	4 000

Note: Total mineral sands include ilmenite, rutile and zircon (main minerals) and traces of other minerals (including leucoxene, HiTi 71/90, feldspar, apatite, titanomagnetite).
Sources: Haine (2006) and BITRE estimates.

Regional production projections

Planned new mines and capacity enhancements to existing mineral sands mining operations provide a fairly clear picture of the short to medium term mineral sands production trends. Based on this information, BITRE assumes total mineral sands production will increase from around 2800 kilotonnes of heavy mineral concentrates (HMC)—that is, ilmenite, rutile, zircon and other titanium or zirconium bearing minerals—to 7400 kilotonnes HMC by 2014–15. Beyond 2014–15, BITRE has assumed that production will continue at existing rates until resources are exhausted at each site. This assumption implies that production will drop back to around 4000 kilotonnes per year by 2029–30. Table G.24 provides the projected total HMC mining output, for five-year intervals to 2029–30 by state and territory.

Gold and other metals

Gold

Gold mining occurs in all Australian states and the Northern Territory. Western Australia accounts for two-thirds of total Australian gold production. In terms of output, while of great economic significance, gold mine production in Australia is small in quantity terms compared to other metallic minerals.

Australia produced 263 tonnes of gold in 2005 (ABARE 2006), making Australia the third largest producer in the world after South Africa and the United States. At 2005 production rates, Australia's EDR of gold are sufficient for 20 years production. However, JORC class mineral reserves would support only 12 years at 2005 production rates.

Due to its relatively small output in mass terms, and the large number of operating mines, gold production projections were not explicitly undertaken at the regional level.

Other minerals

In addition to gold, other metallic minerals for which future production has not been explicitly covered in these projections include lithium, magnesium, tantalum, tungsten, vanadium and rare earths. The production volumes of these metals were, for all but tantalum, either nil in 2005 or relatively small in comparison to the mass of other metallic minerals. (Australia produced 840 tonnes of tantalum in 2005, with most of that from the Greenbushes and Wodgina mines in Western Australia.) It is not expected that exclusion of these other metallic minerals will have a significant impact on the overall freight traffic projections.

G.4 Non-metallic minerals

Non-metallic mineral production is assumed to grow, on average, by 2 per cent per annum between 2005 and 2030. In the FreightSim model, non-metallic minerals cover a range of different commodities, including:

- limestone
- dolomite
- gypsum
- silica
- clays (kaolinite, bentonite, other)
- construction materials
- dimension stone
- talc
- sulphur
- barite
- diatomite
- magnesite
- magnesia
- feldspar
- garnet
- spudomene
- mica
- perlite
- pyrophylite
- serpentine
- fly ash
- atapulgite
- other (graphite, vermiculite)
- salt

The FreightSim non-metallic minerals classification excludes coal and fertilisers, which are included in separate specific commodity groups.

Reliable time series statistics on non-metallic mineral production are only available for a few non-metallic mineral items—salt, gypsum, limestone, talc, and clay imports and exports. Even for these commodities, the time series data has gaps and changes in definition or survey coverage/completeness. Consequently, it was not possible to produce reliable time series based projections of total production output for non-metallic minerals. The non-metallic minerals production projections used in FreightSim are based on those projections supplied by FDF with the FreightSim/FreightInfo data.

G.5 Oil and Gas

The regional crude oil, condensate and liquified petroleum gas (LPG) production projections, used to derive the freight traffic projections presented in this report, are broadly based on the crude oil and condensate production projections contained in GA (2006*g*), augmented by information from Akmal and Riwoe (2005).

Crude oil, condensate and LPG production

GA (2006*g*) provide forecasts, to 2025, of total crude oil and condensate production in Australia from proved, probable and possible commercially recoverable reserves and estimated undiscovered reserves at the national level. Including undiscovered reserves, the GA (2006*g*) forecasts imply total production of crude oil, condensate and LPG from Australian fields will decline by an average of 5 per cent per annum between 2004–05 and 2024–25, from around 35 billion litres in 2005–06 to around 13 billion litres in 2024–25, due to declining reserves in the major oil producing basins and no significant new reserve discoveries.

Akmal and Riwoe (2005) also provide projections of Australian crude oil, condensate and LPG energy production, to 2029–30. Their projections, which also factor in potential production from undiscovered reserves, present a different outlook for Australian oil production to that of GA (2006*g*)—Akmal and Riwoe project that domestic oil production will remain more or less unchanged in energy equivalent terms between 2004–05 and 2029–30, at around 1200 petajoules per annum. In volumetric terms, total crude oil, condensate and LPG production will increase slightly, due to LPG contributing a slightly higher share of total output. (LPG has approximately 66 per cent the energy per litre of crude oil.)

The projections used in this report are based broadly on the GA (2006*g*) projection estimates. For the projections, BITRE separately estimated annual production of crude oil and condensate for each basin as a function of remaining reserves and a generic relationship between the reserves/production ratio and remaining reserves. Included in the projections are likely future production volumes from the Mutineer/Exeter and Enfield fields, which are expected to produce crude oil for four to five years from 2006–07. Annual production projections of (naturally occurring) LPG for each basin were based on the trend in crude oil and condensate production. These assumptions result in total crude oil production projections that are very close to the GA (2006*g*) production projections at the 50 per cent probability level.

Regional production projections

The main regions where crude oil, condensate and LPG is produced in Australia is the Gippsland Basin (Bass Strait), Cooper Basin and the North

Table G.25 Projected growth in crude oil, condensate and LPG production, by freight region, 1999 to 2030

(kilotonnes)

Freight region code	*Freight region name*	*State*	*1999–2000*	*2009–10*	*2019–20*	*2029–30*
325	Hopkins	Vic	2	2	2	2
381	East Gippsland Shire	Vic	9 311	4 256	2 301	1 244
445	South West	Qld	632	506	123	30
453	Fitzroy (balance)	Qld	42	21	0	0
574	Far North	SA	632	506	123	30
673	Greenough River	WA	6	247	108	47
681	De Grey	WA	0	0	0	0
682	Fortescue	WA	14 334	15 334	7 999	5 012
810	Darwin	NT	4 942	1 372	1 175	1 006
841	Central	NT	73	36	20	11
	Total		29 272	22 280	11 852	7 382

Sources: Akmal and Riwoe (2005), ABARE (2005*b*), ABARE (2005*a*), GA (2006*g*) and BITRE estimates.

West Shelf. For the freight task projections presented here, output in the Gippsland basin is projected to decline by an average of 4.8 per cent per annum between 2003–04 and 2029–30. Output from the North West Shelf is projected to initially increase marginally, but then decline, so that, on average, production will decline by around 3.6 per cent per annum between 2003–04 and 2029–30. Table G.25 shows the assumed growth in crude oil, condensate and LPG production, in thousand tonnes, by freight region.

Natural Gas

The regional natural gas production projections, used in deriving the regional freight transport projections, are mainly based on the projections reported in Akmal and Riwoe (2005).

Akmal and Riwoe (2005) project total Australian natural gas output will increase by an average of 4.8 per cent per annum between 2003–04 and 2029–30. Growth is expected to average over 8.5 per cent per annum to 2009–10 but slow to around 1.8 per cent per annum between 2019–20 and 2029–30. Most of the increase in natural gas output projected by Akmal and Riwoe (2005) is to supply the burgeoning liquified natural gas (LNG) export demand. In contrast, production of natural gas for the domestic market, which is largely sourced from fields in Victoria, Queensland and South Australia, is expected to increase between 2003–04 and 2019–20, to just over 800 petajoules per annum and thereafter decline, as the gas reserves become depleted, to around 720 petajoules in 2029–30.

Table G.26 lists the major gas producing regions (geological basin) and the associated FreightSim freight region.

Table G.26 Australian natural gas producing regions

Geological basin	*State / Territory*	*Freight region code*	*Freight region name*
Amadeus	NT	841	Central NT
Bonaparte	NT	810	Darwin
Bowen-Surat (incl. CSG)	Qld	445	South West
Bowen-Surat (incl. CSG)	Qld	453	Fitzroy (Balance)
Browse	WA	681	De Grey
Carnarvon	WA	682	Fortescue
Cooper–Eromanga (incl. Adavale)	SA / Qld	574	Far North
Gippsland (and Bass)	Vic.	381	East Gippsland Shire
Otway	Vic.	325	Hopkins
Perth	WA	673	Greenough River

Regional production projections

Gippsland basin

Akmal and Riwoe (2005) project that output from the Gippsland basin will peak in 2022–23 and thereafter gas production is projected to decline by 4.4 per cent per annum to around 340 petajoules in 2029–30, implying a peak production level of around 450 petajoules in 2022–23.

Otway basin

Akmal and Riwoe (2005) project that output from the Otway basin will peak in 2010–11 and then fall by around 10 per cent per annum to 16 petajoules in 2029–30. This implies a peak production level of around 118 petajoules in 2010–11.

Cooper–Eromanga basin

Akmal and Riwoe (2005) project future gas production from the Cooper–Eromanga basin will decline from present levels, around 170 petajoules in 2003–04, to negligible levels by 2029–30. Estimated recoverable reserves in the Cooper–Eromanga basin at January 2005 stood at approximately 1750 petajoules (GA 2006*g*). Akmal and Riwoe (2005) allow for a potential 10 per cent of additional reserves to be added through new discoveries. Allowing for additional discoveries would imply approximately 11 years worth of production at current levels. The projections in Akmal and Riwoe (2005), and those used here, assume an increase in the level of production, at half the expected rate of growth in consumption in New South Wales, Queensland and South Australia, over the next eight years before production from this basin declines.

Bowen–Surat basin and coal seam gas output

Akmal and Riwoe (2005) do not provide separate projections of gas output from the Bowen and Surat basins. GA (2006*g*) estimated proved, probable and possible reserves were approximately 269 petajoules in 2003–04. With current annual production around 24.5 petajoules, this implies a remaining production life of between 10 and 11 years. It is assumed here that annual production grows at half the expected rate of growth in consumption in Queensland, implying higher production until 2011–12, after which time production declines.

The ABARE (2005*b*) energy statistics include natural gas produced from coal seams—coal seam gas (CSG). Akmal and Riwoe (2005) estimate there are 4300 petajoules of proved or probable CSG reserves in the Bowen and Surat basins, and potentially 152 000 petajoules in the Bowen basin and 97 000 petajoules in the Gunnedah and Clarence–Moreton basins. Current coal seam gas production was approximately 37 petajoules in 2003–04. Akmal and Riwoe (2005) project CSG output will increase to approximately 140 petajoules in 2009–10 and 258 petajoules by 2029–30.

Amadeus basin

The Amadeus basin, located in central Northern Territory, produced approximately 17 petajoules of natural gas in 2003–04. GA (2006*g*) estimates the Amadeus basin has proved, probable and possible reserves of around 231 petajoules, enough for 12 years supply at current production rates. Akmal and Riwoe (2005) do not provide separate projections for future natural gas production from the Amadeus basin. It is assumed production will grow at around 1.5 per cent per annum until 2013–14, before production begins to decline thereafter.

Perth basin

Akmal and Riwoe (2005) do not provide separate projections of natural gas output from the Perth basin. Total gas production from that basin averaged around 13 to 14 petajoules per annum in the 1990s, but has been around 8.6 petajoules per annum since 1998–99. GA (2006*g*) estimates total proved, probable and possible gas reserves in this basin of around 920 petajoules at January 2005. For this report, it has been assumed that production from the Perth basin will increase by around one per cent per annum over the projection horizon.

LNG export basins—Carnarvon, Browse (Western Australia) and Bonaparte (Northern Territory) basins

Akmal and Riwoe (2005) project growth in natural gas output will be greatest in the major Western Australian export basins—Carnarvon and Browse. Currently, no gas is produced from the Browse basin.

Total LNG exports are projected to increase from around 11.7 million tonnes (equivalent to 16 400 million cubic metres or 720 petajoules) in 2003–04 to 19 million tonnes (equivalent to 26 600 million cubic metres or 1170 petajoules) in 2009–10, an implied growth rate of 8.4 per cent per annum. According to Akmal and Riwoe, the main contributors to this growth will be the North West Shelf's fifth train and the Darwin LNG plant. The other major LNG exporting projects

Table G.27 Projected growth in natural gas output, by freight region, 1999 to 2030

(kilotonnes)

Freight region code	*Freight region name*	*State*	*1999–2000*	*2009–10*	*2019–20*	*2029–30*
325	Hopkins	Vic	146	1 512	833	290
381	East Gippsland Shire	Vic	3 725	6 443	7 734	6 139
445	South West	Qld	498	498	0	0
453	Fitzroy (balance)	Qld	1 223	2 542	3 451	4 684
574	Far North	SA	4 527	3 341	719	0
673	Greenough River	WA	184	246	272	300
681	De Grey	WA	0	0	0	0
682	Fortescue	WA	12 810	23 898	46 133	69 685
810	Darwin	NT	0	1 407	3 914	7 776
841	Central	NT	333	376	0	0
	Total		23 446	40 262	63 056	88 876

Sources: ABARE (2005*b*), ABARE (2005*a*), Akmal and Riwoe (2005) and BITRE estimates.

likely to come on stream include Gorgon LNG, Pluto, Pilbara LNG, Browse and Sunrise Akmal and Riwoe (2005, p. 44).

For this report, BITRE assumed that 90 per cent of all gas produced from these fields will be from the Carnarvon and Browse basins and 10 per cent from the Bonaparte basin.

Table G.27 shows the actual and projected level of natural gas production in Australia between 1999–2000 and 2029–30 by freight region, used in producing the freight transport projections.

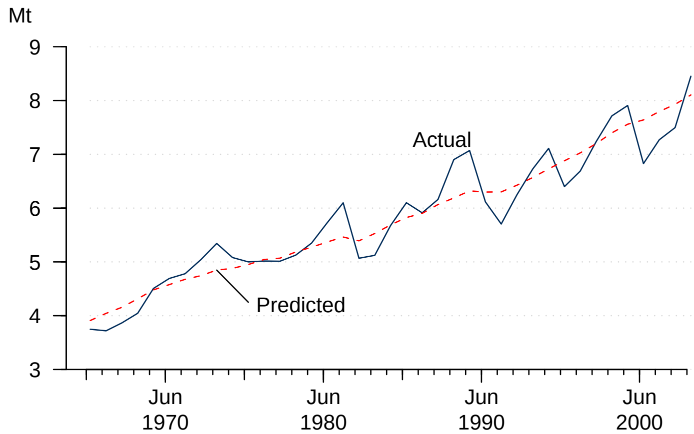
G.6 Cement and concrete products production

Cement and concrete products produced in Australia totalled approximately 8.5 million tonnes in 2003–04 (ABS 2007*a*). Since 1964–65, cement production has grown, on average, by 2.1 per cent per annum, albeit with significant fluctuations over time, most likely reflecting economic conditions in the construction sector. Figure G.12 shows actual and predicted cement production between 1964–65 and 2003–04. The predicted production levels are based on a simple regression of total cement production against real GDP. The simple model predicts the average trend level of cement production. Table G.28 lists the regression model results.

ABS (2007*b*) also includes total production estimates of pre-mixed concrete products—for example, prefabricated structural components for building or civil engineering, concrete bricks, blocks, pavers and roofing tiles, etc. Annual pre-mixed concrete product output is essentially proportional to annual cement production. The trend growth in concrete product output is assumed to be proportional to the projected trend growth in cement production.

Table G.29 shows the 1998–99 actual and 2029–30 projected level of cement

Figure G.12 Actual and predicted cement production in Australia, 1964–65 to 2003–04



Sources: ABS (2007*b*) and BITRE estimates.

Table G.28 Cement production estimation results

Variable	*Estimate*	*t-statistic*
Constant	1.504	4.3
ln GDP	0.548	20.44
Summary statistics		
Dependent variable ln(Cement) (kt)		
$R^2 = 0.9187$, $\hat{\sigma} = 0.0607$		

Source: BITRE estimates.

and concrete product production, derived using the cement production regression results and projected GDP growth, by regional area. Total cement and concrete products production is projected to grow from around 7.3 million tonnes in 1998–99 to 12.1 million tonnes by 2029–30, an average annual growth rate of 1.66 per cent per annum.

G.7 Timber production

Timber and associated industry output

Timber products include raw forest outputs, such as raw logs (roundwood), sawn timber, woodchips, firewood, cork and sawdust, wood waste and scrap, and manufactured timber products—manufactured, processed and fabricated wood products such as plywood and fibreboards, paper and pulp.

Table G.30 shows ABARE estimates of total timber and timber products production in 1998–99 and 1999—2000, measured in cubic metres. ABARE (2005*a*)

Table G.29 Projected growth in cement and concrete products output, by freight region, 1999 to 2030

Region code	*Region name*	*State*	*Production 1998–99 (kt)*	*Projected production 2029–30 (kt)*	*Projected growth (% pa)*
235	Illawarra (Balance)	NSW	1752.5	2923.5	1.66
262	Central Tablelands	NSW	552.4	921.4	1.66
321	Geelong	Vic.	986.0	1644.8	1.66
452	Gladstone	Qld	1870.0	3119.5	1.66
510	Adelaide	SA	434.3	724.5	1.66
521	Barossa	SA	144.4	240.9	1.66
610	Perth	WA	121.5	202.6	1.66
742	North Western Rural	Tas.	1387	2313.6	1.66
810	Darwin	NT	17.4	29.1	1.66
	Total		7265.5	12119.9	1.66

Sources: ABS (2007*a*), FreightInfo 1999 and BITRE estimates.

estimates that over 24.5 million cubic metres of timber were harvested from Australian forests in 1999–2000. Forest timber output is typically differentiated by main source: native, plantation hardwood and plantation softwood. According to BRS (2004), approximately 60 per cent of total roundwood production was from plantations and the remainder from native forests. Sawnwood, fabricated timber products and pulp and paper account for a further 9 million cubic metres of total wood industry production.

The volumetric estimates in Table G.30 have been converted to tonnages using the 'basic densities' reported in NGGIC (2005, Appendix D). The densities for roundwood and half of total sawnwood output are reflective of greenwood densities, since, in the case of roundwood, this is the density of the wood that will typically be transported from forest to timber mill and, for sawnwood, timber is sold as either green or dry wood.[9] These densities imply total production of timber and timber-based manufactured products was around 20.6 million tonnes in 1998–99 and 23.8 million tonnes in 1999–2000 (Table G.30).

FreightSim estimates

In the FreightSim commodity classification, timber and timber products are split across three different commodity groups:

- Roundwood and sawnwood output is included under the FreightSim timber production category
- Fabricated wood products—plywood and fibreboard products—are classified as manufactured items
- Paper is variously classified as other bulk—for paper pulp, newsprint and

9. Basic density = Mass of oven dry wood (kg) / Volume of green wood (m^3).

Table G.30 Comparison: ABARE (2001) and FreightInfo 1998–99 timber production estimates

Production	Volumes 1998–99 ('000 m^3)	Volumes 1999–2000 ('000 m^3)	Density[a] (kg/m^3)	Mass 1998–99 (Mt)	Mass 1999–2000 (Mt)
Roundwood					
Hardwood—Native	8 924	11 299	630	7.31	9.25
Hardwood—Plantation	580	874	630	0.48	0.72
Softwood—Plantation	11 816	12 484	415	6.37	6.74
Total roundwood	21 320	24 657		14.16	16.70
Sawnwood					
Hardwood	1 267	1 364	724.5	0.92	0.99
Softwood	2 338	2 654	529	1.24	1.40
Total sawnwood	3 605	4 018		2.15	2.39
Total round and sawn	24 925	28 657		16.31	19.09
Panel products					
Plywood	169	192	540	0.09	0.10
Particleboard	902	978	520	0.47	0.51
MDF	495	621	600	0.30	0.37
Softboard and other fibreboards	na	na	230	na	na
Paper	2 564	2 836	1 000	2.56	2.84
Pulp	872	884	1 000	0.87	0.88
Total	29 927	34 186		20.60	23.79

na Not available.

a. For roundwood, the density was assumed equal to the basic density—i.e. mass of oven dry wood (kg) / volume of green wood (m^3)—from NGGIC (2005), scaled for the assumed 30 per cent moisture content of green to oven dry wood. For sawnwood, half of total production was assumed to be green and half oven-dry and the density estimate reflects this assumption. For manufactured timber products, NGGIC (2005) the density estimate shown is the basic density of these finished products.

Sources: ABARE (2001), NGGIC (2005, Appendix D) and BITRE estimates.

waste paper—but as manufactured goods for writing paper and household paper goods.

By way of comparison with the ABARE (2005*a*) estimates, the FreightInfo/FreightSim dataset puts total timber industry production at 18.4 million tonnes, between 1998–99 and 1999–2000 ABARE (2005*a*) estimates of total roundwood and sawnwood production when converted to tonnages.

Long-term production projections

For the long-term timber production projections, BITRE used published projections for future plantation–sourced timber production from Ferguson, Fox, Baker, Stackpole, and Wild (2002). For native timber production, BITRE projected total hardwood timber output, using simple univariate time series methods, and subtracted the Ferguson, Fox, Baker, Stackpole, and Wild (2002) projections of plantation hardwood output. Total sawnwood production is roughly proportional to roundwood output. The following three sections describe in more detail each of these sets of projections.

Plantation-based roundwood production projections

Complied as part of the 2001 National Plantation Inventory (NPI), and based on information obtained from growers, Ferguson, Fox, Baker, Stackpole, and Wild (2002) provide long-term projections of wood availability from Australian plantation forests, by NPI region.[10] Two sets of projections, or scenarios, of future plantation timber availability to 2044 are provided:

- a 'no new planting' scenario—under which no new land is used for plantation timber, but there is continued re-planting of existing plantation areas; and
- a 'new planting' scenario—under which the total plantation area increases by approximately 1.1 million hectares between 2000 and 2019, together with continued re-planting of existing plantation areas.

Ferguson, Fox, Baker, Stackpole, and Wild (2002) project growth of just under 1 per cent per annum in annual softwood availability between 2001 and 2030, but very strong growth, of between 6.4 and 8.9 per cent per annum, under the 'no new planting' and 'new planting' scenarios respectively, in plantation hardwood availability. The projections imply equally strong growth in hardwood planted for sawlogs and pulp. Plantations currently provide all of the softwood and around 10 per cent of total hardwood produced in Australia. However, the increasing availability of plantation hardwood in the future is likely to increase significantly the proportion of total hardwood demand met from plantations, and reduce the demand for native hardwood. The NPI regions where hardwood availability is projected to expand most significantly are Western Australia, Tasmania and the Green Triangle region (south-east South Australia and south-west Victoria).

Ferguson, Fox, Baker, Stackpole, and Wild (2002) note that wood availability projections do not necessarily translate directly into harvest production, as there is bound to be slippage in the forecasts and that some of the available wood may not be sold in the market in the period nominated due to a lack of markets and/or processing facilities. They suggest that the two sets of projections provide an 'indicative, somewhat crude set of lower and upper bounds for future levels of production and sale' (Ferguson, Fox, Baker, Stackpole, and Wild 2002, p. 78).

BITRE has assumed regional plantation forest output will grow in proportion to the average of the 'no new planting' and the 'new planting' scenarios in Ferguson, Fox, Baker, Stackpole, and Wild (2002). Native hardwood production is assumed to decline as the availability of plantation hardwood increases, although total native hardwood output is assumed to be not entirely substitutable by plantation-based hardwood.

10. The NPI covers 15 separate wood plantation regions across Australia. See Ferguson, Fox, Baker, Stackpole, and Wild (2002), for example, for a listing and accompanying maps showing each of the NPI regions.

Native hardwood roundwood production projections

Projected total hardwood roundwood production was derived using a simple univariate time series model, which included a time trend term and the lagged value of past hardwood production. The model was estimated using 45-year time series of total hardwood production between 1960–61 and 2004–05. Over this period total hardwood roundwood output grew by an average 0.5 per cent per annum. The projections imply average annual growth of 0.32 per cent per annum in total hardwood roundwood output between 2005–06 and 2029–30.

The average plantation roundwood hardwood production projections from Ferguson, Fox, Baker, Stackpole, and Wild (2002) were subtracted from the time series based total roundwood hardwood production projections to derive projections for native hardwood roundwood production. For some regions, total projected roundwood hardwood production was less than the projected plantation output. In those areas, BITRE generally assumed that not all of the native hardwood production could be substituted by plantation output and that some native production would continue. In the timber production projections used in FreightSim, these differences are all embedded within the single timber and timber products commodity group.

Fabricated timber product production projections

Separate production projections for fabricated timber products were not undertaken, as these products are part of the much broader commodity groups—other bulk and manufactured goods—in the FreightSim model. Historically, fabricated timber products output grew by an average of 2.6 per cent per annum between 1992–93 and 2005–06.

Regional timber production projections

Table G.31 shows the projected growth in timber and timber product production between 1999–2000 and 2029–30, by state and territory, used in this report. The timber production projections were apportioned across FDF freight regions using the FreightInfo 1999 implied regional shares of total timber production. The overall production projections imply average annual growth in timber output of 2.1 per cent per annum, in tonnages terms, between 1999–2000 and 2029–30.

Table G.31 Projected timber and timber product production by state and territory, 1999–2000 to 2029–30

State/Territory	1999–2000 (kt)	2009–10 (kt)	2019–20 (kt)	2029–30 (kt)	Growth 1999–2030 (% pa)
NSW	3 979	3 988	4 550	5 286	0.92
Vic.	4 620	6 528	7 913	9 319	2.29
Qld	1 395	1 510	1 681	2 128	1.37
SA	470	1 642	2 194	2 688	5.79
WA	1 400	5 042	5 830	6 814	5.24
Tas.	5 708	5 665	6 230	7 015	0.67
NT	0	29	72	133	na
ACT	376	381	441	556	1.27
Total	17 948	24 785	28 911	33 939	2.08

Sources: ABARE (2001), Ferguson, Fox, Baker, Stackpole, and Wild (2002), NGGIC (2005, Appendix D) and BITRE estimates.

G.8 Summary—Combined commodity production projections

Table G.32 summaries the bulk commodity production projections used in deriving the projections contained in this report.

- Total agricultural sector output—that is, grains and oilseeds, livestock, meat and other agricultural products—of 0.85 per cent per annum to 175.7 million tonnes in 2030.
- Despite the relatively strong projected growth in coal output between now and 2015, over the period to 2030 coal tonnages are projected to grow by 2.1 per cent per annum, to almost 560 million tonnes in 2030.
- Metallic minerals sector output is projected to grow most strongly, from 186 million tonnes in 1999 to 800 million tonnes by 2030—an average annual growth rate of 4.8 per cent per annum over this period.
- Domestic oil production, by contrast, is expected to contract as reserves are depleted in the Bass Strait and North West Shelf.
- Gas production is projected to growth by almost 4 per cent per annum between 1999 and 2030, from 26.6 million tonnes to approximately 89 million tonnes by 2030.
- Cement industry output is projected to grow from 7.3 million tonnes in 1999 to 12.1 million tonnes by 2030, an implied average annual rate of growth of 1.7 per cent per annum
- And timber industry roundwood and sawnwood output is projected to grow by 2.1 per cent per annum between 1999 and 2030, to around 33.9 million tonnes per annum, with growth in plantation source timber contributing most of the growth.

Table G.32 Commodity production projections, by commodity group, 1999 to 2030

Commodity Code	Description	Year 1999	2015	2030	Growth 1999–2030
		(million tonnes)			(% p.a.)
2	Grains and oilseeds	38.6	47.2	51.7	0.95
3	Sheep live	1.2	1.4	1.5	0.74
4	Cattle live	5	5.5	5.6	0.4
5	Meat	6.6	7.8	8.2	0.7
6	Agricultural products	83.6	98.7	108.6	0.85
7	Coal and coke	290.7	413.6	557.3	2.12
8	Metallic minerals	186	551.7	799.2	4.81
9	Non-metallic minerals	690.8	948.3	1 269.3	1.98
10	Oil and petroleum products	23.3	15.2	7.4	−3.64
11	Gas	26.6	54.4	88.9	3.97
12	Steel and metals	14.7	20.2	27	1.98
13	Fertilisers	1.3	1.8	2.4	1.98
14	Cement	7.3	9.5	12.1	1.66
15	Timber	17.9	26.7	33.9	2.08
16	Other bulk freight	2.9	4	5.3	1.99

Sources: FreightSim and BITRE estimates.

- Finally, output of other bulk freight items is projected to grow by 2 per cent per annum, to 5.3 million tonnes in 2030.

Appendix H State population projection based road traffic projections

H.1 Introduction

Following release of BTRE (2006*a*), several jurisdictions expressed concerns that the ABS (2000) and ABS (2001*c*) population projections used in BTRE (2006*a*) may have understated future regional population growth. As a result, jurisdictions requested that BITRE include a set of traffic projections based on available regional population projections generated by state and territory planning agencies. This appendix provides a summary of the separate NLTN non-urban corridor traffic projections derived using the latest available state-sourced regional population projections.

The five mainland states—that is New South Wales, Victoria, Queensland, South Australia and Western Australia—each produce their own regional population projections. These, together with the ABS (2006)-based population projections, were outlined in Appendix C. The state-sourced population projections for each of the mainland states were combined with the ABS (2006) based regional population projections for Tasmania, Northern Territory and Australian Capital Territory, to produce an Australia-wide 'state-sourced' set of regional population projections, for use in the OZPASS and FreightSim models.

Chapter 2, and Appendix C, outlined the differences between the latest available state-sourced and ABS (2006)-based regional population projections. In short, the state-sourced projections imply slightly higher future population growth than the ABS (2006) projections, resulting in slightly higher projected interregional passenger traffic movements, than those derived using the ABS (2006) population projects. There is less difference in the freight traffic projections. This appendix is structured similarly to Chapter 3, with a summary of the traffic projections provided at state/territory level, followed by corridor level projections and then more detailed projections at link/section level within each corridor.

The methods used to assign the 'state-based' interregional passenger and freight vehicle traffic to the network were identical to the methods described in Chapter 3 and detailed in Appendix J.

The heavy vehicle traffic projections presented in Section H.2 include the impact of the assumed future truck productivity improvement, described in Chapter 3. As there is likely to also be interest in the projected growth in the road freight task on each corridor, Section H.3 presents projections of total heavy vehicle traffic based on the ABS (2006) population projections under the assumption of no change in average heavy vehicle productivity over the projection horizon. Some concluding remarks are made in Section H.4.

H.2 Traffic projections

State and territory summary

Table H.1 shows the projected growth light vehicle and freight traffic for NLTN non-urban roads by state/territory, based on the state-sourced long-term regional population projections. The projections imply that light (passenger) vehicle traffic will grow by, on average, 1.8 per cent per annum between 2005 and 2030. Over the same period, heavy vehicle traffic is projected to grow by approximately 0.7 per cent per annum on average across all NLTN non-urban roads. Traffic growth is projected to be strongest on roads in the Northern Territory, Queensland and Western Australia. Traffic growth, both light and heavy vehicles, 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 all NLTN non-urban roads, and total traffic on NLTN corridor roads in these states are also projected to grow by 1.3 and 1.8 per cent per annum, respectively, between 2005 and 2030.

Interstate and intrastate corridors

Tables H.2 and H.3, and Figures H.1 and H.2, present the road traffic projections for each of the defined NLTN non-urban corridors. Interstate corridors over which future traffic growth is projected to be relatively strong include Sydney–Brisbane (via the Pacific Highway), Brisbane–Darwin, Perth–Darwin and Adelaide–Darwin. Intrastate corridors where overall traffic growth is projected to be particularly strong include the Brisbane–Cairns, Perth–Bunbury, Melbourne–Sale and Melbourne–Geelong.

Heavy vehicle traffic growth is projected to be strongest on the Sydney–Brisbane (via Pacific Highway), Melbourne–Adelaide, Brisbane–Darwin and Adelaide–Darwin interstate corridors. (The heavy vehicle traffic growth rates include the impact of an average 2 per cent per annum increase in average loads.) Heavy vehicle traffic is also projected to grow very strongly on the

Melbourne–Sale, Sydney–Wollongong, Brisbane–Cairns, Townsville–Mount Isa and Launceston–Bell Bay intrastate corridors.

Light vehicle traffic is generally projected to grow more quickly than heavy vehicle traffic volumes across most NLTN non-urban corridors, as a result of the assumed further heavy productivity improvements. Of the interstate NLTN corridors, light vehicle traffic growth is projected to be strongest on the Sydney–Brisbane (via Pacific Highway), Perth–Darwin, Brisbane–Darwin, Adelaide–Darwin and Melbourne–Adelaide corridors.

Light vehicle traffic growth is projected to be even stronger on some of the intrastate links (see Table H.3), particularly for the peri-urban Melbourne–Geelong, Melbourne–Sale, Brisbane–Cairns and Perth–Bunbury corridors—which link fast growing population centres on the periphery of Melbourne, Brisbane and Perth. On these corridors, light vehicle traffic is projected to grow by more than 2.0 per cent per annum between 2005 and 2030.

Table H.1 Projected growth in vehicle traffic, NLTN non-urban corridors, by state/territory, 2005 and 2030

		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*
State	*(km)*	*2005*	*2030*	*2005*	*2030*	*2005*	*2030*			
New South Wales	4 104.6	7 988	11 433	1 531	1 788	9 519	13 221	1.44	0.62	1.32
Victoria	1 733.4	8 432	13 924	1 910	2 234	10 342	16 158	2.03	0.63	1.80
Queensland	4 954.1	4 133	7 887	1 062	1 406	5 195	9 293	2.62	1.13	2.35
South Australia	2 724.2	1 966	2 832	421	452	2 388	3 285	1.47	0.29	1.28
Western Australia[a]	6 466.7	1 056	1 808	254	276	1 310	2 084	2.17	0.34	1.87
Tasmania	365.1	6 515	7 515	825	854	7 340	8 368	0.57	0.14	0.53
Northern Territory	2 674.0	555	964	95	127	650	1 091	2.23	1.17	2.10
Australian Capital Territory	19.0	14 855	23 271	2 443	3 017	17 298	26 288	1.81	0.85	1.69
Australia[a]	23 041.0	3 655	5 872	792	951	4 447	6 823	1.84	0.70	1.66

a. Estimates include the Brand and North West Coastal Highways (1662 kilometres), which are not part of the NLTN.
Source: BITRE estimates.

Table H.2 Projected growth in vehicle traffic, NLTN non-urban interstate corridors, 2005 and 2030

Corridor	*Length (km)*	*Average traffic levels (vehicles per day)* — *Light vehicles* *2005*	*Light vehicles* *2030*	*Heavy vehicles* *2005*	*Heavy vehicles* *2030*	*All vehicles* *2005*	*All vehicles* *2030*	*Average annual traffic growth (per cent per annum)* — *Light vehicles*	*Heavy vehicles*	*All vehicles*
Sydney–Melbourne	814.5	9 992	15 047	3 696	4 274	13 688	19 321	1.7	0.6	1.4
Sydney–Brisbane (via inland)	932.6	10 807	15 805	1 537	1 743	12 345	17 548	1.5	0.5	1.4
Sydney–Brisbane (via coast)	765.9	16 718	29 712	4 753	6 722	21 471	36 434	2.3	1.4	2.1
Sydney–Adelaide	984.0	2 779	3 897	646	702	3 426	4 599	1.4	0.3	1.2
Canberra connectors	126.3	10 109	16 480	1 285	1 429	11 394	17 909	2.0	0.4	1.8
Melbourne–Brisbane	1 434.8	1 823	2 456	836	923	2 659	3 379	1.2	0.4	1.0
Melbourne–Adelaide	700.4	6 234	10 181	1 577	1 928	7 811	12 109	2.0	0.8	1.8
Brisbane–Darwin	2 419.0	1 240	2 267	263	313	1 502	2 579	2.4	0.7	2.2
Adelaide–Perth	2 666.9	1 149	1 734	348	344	1 497	2 079	1.7	0.0	1.3
Adelaide–Darwin	2 697.9	599	1 009	115	134	714	1 143	2.1	0.6	1.9
Perth–Darwin	3 690.9	377	649	138	178	515	826	2.2	1.0	1.9
All interstate corridors	17 233.3	2 964	4 732	787	957	3 752	5 689	1.9	0.8	1.7

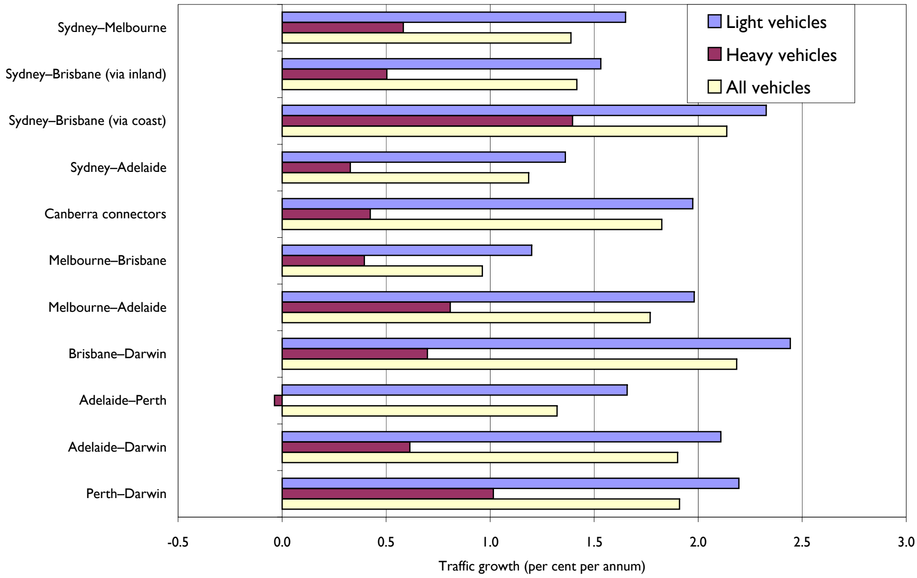
Source: BITRE estimates.

Table H.3 Projected growth in vehicle traffic, NLTN non-urban intrastate corridors, 2005 and 2030

		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)*	*2005*	*2030*	*2005*	*2030*	*2005*	*2030*			
Sydney–Wollongong	63.4	41 181	55 619	3 349	3 678	44 530	59 298	1.2	0.4	1.2
Sydney–Dubbo	369.8	12 324	16 039	1 446	1 457	13 770	17 496	1.1	0.0	1.0
Melbourne-Sale	172.1	14 832	26 463	2 351	2 836	17 183	29 299	2.3	0.8	2.2
Melbourne–Geelong	48.5	56 803	97 724	6 349	7 787	63 152	105 512	2.2	0.8	2.1
Melbourne–Mildura	528.6	5 579	7 974	763	870	6 343	8 844	1.4	0.5	1.3
Brisbane–Cairns	1 675.2	6 427	11 990	1 048	1 319	7 474	13 309	2.5	0.9	2.3
Townsville–Mount Isa	762.5	551	742	137	170	688	913	1.2	0.9	1.1
Perth–Bunbury	160.3	17 678	32 961	1 678	1 965	19 356	34 925	2.5	0.6	2.4
Perth–Port Hedland	1 662.4	785	1 274	230	207	1 015	1 482	2.0	–0.4	1.5
Hobart–Devonport	319.8	6 700	7 847	843	846	7 544	8 693	0.6	0.0	0.6
Launceston–Bell Bay	45.2	5 202	5 166	696	905	5 898	6 070	0.0	1.1	0.1
All intrastate corridors	5 807.8	5 704	9 256	805	931	6 509	10 188	2.0	0.6	1.8

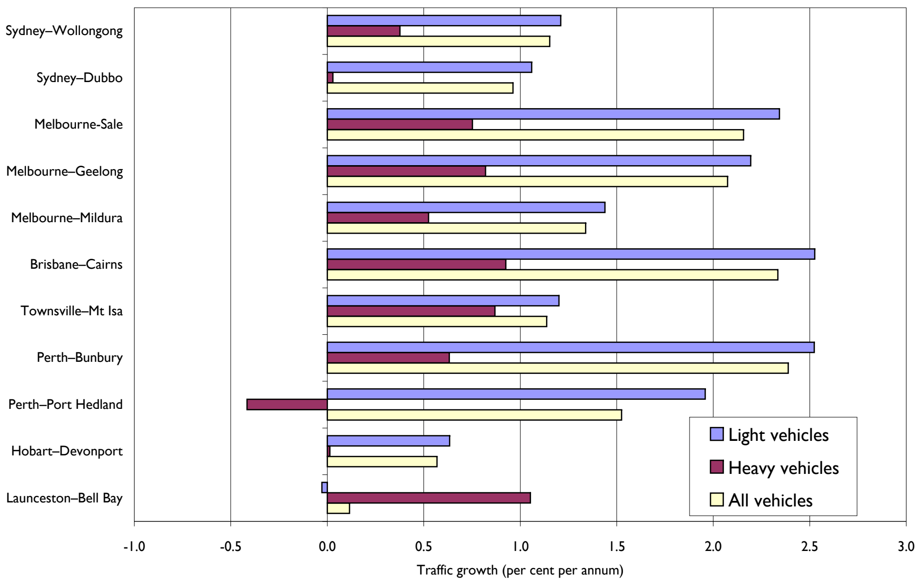
Note: The Brand and North West Coastal Highways are not part of the NLTN.
Source: BITRE estimates.

Figure H.1 Projected traffic growth, NLTN non-urban interstate corridors, 2005 to 2030



Source: BITRE estimates.

Figure H.2 Projected traffic growth, NLTN non-urban intrastate corridors, 2005 to 2030



Source: BITRE estimates.

Corridor specific projections

This section provides more detailed results of projected light and heavy vehicle traffic growth, derived using the latest available state-sourced population projections, for each of the 20 non-urban NLTN corridors and for the Perth–Port Hedland corridor (via the Brand and North West Coastal Highways), which is not part of the NLTN. The results provide estimates of average traffic levels between selected population centres or major junctions on each of the corridors. The base year traffic volumes are the same as for the ABS (2006)-based projections, in Chapter 3; it is the projected 2030 traffic volumes that will differ.

Interstate corridors

Sydney–Melbourne corridor

Table H.4 lists base year 2005 and projected 2030 traffic levels for the Sydney–Melbourne corridor. Total traffic on the Sydney–Melbourne corridor is projected to grow by around 1.4 per cent per annum between 2005 and 2030. Heavy (freight) vehicle traffic is projected to grow by approximately 0.6 per cent per annum and light vehicle traffic by 1.7 per cent per annum. Traffic growth is generally projected to be strongest on Victorian sections, due mainly to stronger projected passenger car traffic growth on those sections. Freight traffic growth is projected to be generally similar across all corridor sections, albeit slightly stronger on those sections between the Sturt Highway turnoff and Wangaratta. The traffic growth projections are almost identical to the projections presented in Table 3.6, derived using the ABS (2006)-based population projections.

Sydney–Brisbane (inland) corridor

Table H.5 lists the base year 2005 and projected 2030 traffic levels for the Sydney–Brisbane (inland) corridor. Total traffic on this corridor is projected to grow by 1.4 per cent per annum between 2005 and 2030, using the state-source population projections. Light vehicle traffic is projected to grow by less than 1.0 per cent per annum on most New South Wales sections north of Newcastle. Light vehicle traffic is projected to grow by approximately 1.6 per cent per annum on the Sydney–Newcastle Freeway and by 2.7 per cent per annum between Warwick and Ipswich in Queensland. Total heavy vehicle traffic is projected to grow by an average of 0.5 per cent per annum across the corridor, however, this is an average of much stronger freight vehicle traffic on the sections between Sydney and Muswellbrook and between the New South Wales border and Ipswich, and lower growth, around 1.6 per cent per annum, on sections between Muswellbrook and Glen Innes. The traffic growth projections are almost identical to the projections derived using the ABS (2006)-based population projections, presented in Table 3.7.

Table H.4 Sydney–Melbourne corridor: base year and projected traffic levels, 2005 and 2030

		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)*	*2005*	*2030*	*2005*	*2030*	*2005*	*2030*			
Sydney–Federal Hwy	166.8	22 043	33 617	5 146	6 177	27 188	39 794	1.70	0.73	1.54
Federal Hwy–Barton Hwy	64.8	4 501	6 063	3 014	3 403	7 515	9 466	1.20	0.49	0.93
Barton Hwy–Sturt Hwy	139.2	4 766	6 497	2 784	3 101	7 550	9 598	1.25	0.43	0.96
Sturt Hwy–Holbrook	79.4	3 237	4 200	1 817	2 135	5 054	6 335	1.05	0.65	0.91
Holbrook–Vic. border	67.3	6 123	7 961	3 034	3 591	9 156	11 552	1.06	0.68	0.93
NSW border–Wangaratta	67.8	8 403	12 628	3 688	4 363	12 091	16 991	1.64	0.67	1.37
Wangaratta–Euroa	90.5	6 535	9 906	3 401	3 871	9 935	13 777	1.68	0.52	1.32
Euroa–Goulburn Valley Hwy	51.0	5 736	9 255	3 166	3 545	8 902	12 800	1.93	0.45	1.46
Goulburn Valley Hwy–Western Ring Road	87.7	15 777	25 730	5 718	6 390	21 495	32 120	1.98	0.45	1.62
Total	814.5	9 992	15 047	3 696	4 274	13 688	19 321	1.65	0.58	1.39

Source: BITRE estimates.

Table H.5 Sydney–Brisbane (inland) corridor: base year and projected traffic levels, 2005 and 2030

		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)*	*2005*	*2030*	*2005*	*2030*	*2005*	*2030*			
Sydney–Newcastle	126.0	48 077	72 073	4 857	5 599	52 934	77 672	1.63	0.57	1.55
Newcastle–Maitland	14.7	33 047	42 390	2 814	3 419	35 860	45 809	1.00	0.78	0.98
Maitland–Singleton	46.1	16 019	20 451	2 386	2 674	18 405	23 125	0.98	0.46	0.92
Singleton–Muswellbrook	47.2	9 596	11 826	2 244	2 354	11 840	14 180	0.84	0.19	0.72
Muswellbrook–Tamworth	155.8	4 334	5 537	1 120	1 181	5 455	6 718	0.98	0.21	0.84
Tamworth–Armidale	112.1	3 229	4 611	642	650	3 870	5 261	1.44	0.05	1.24
Armidale–Glen Innes	93.9	2 003	2 398	466	470	2 469	2 868	0.72	0.03	0.60
Glen Innes–Qld border	111.1	1 722	2 126	523	557	2 246	2 683	0.85	0.25	0.71
NSW border–Warwick	97.1	2 571	3 781	546	623	3 117	4 405	1.55	0.53	1.39
Warwick–Ipswich	128.6	5 281	10 331	1 268	1 647	6 549	11 978	2.72	1.05	2.44
Total	932.6	10 807	15 805	1 537	1 743	12 345	17 548	1.53	0.50	1.42

Source: BITRE estimates.

Sydney–Brisbane (coastal) corridor

Table H.6 lists the base year 2005 and projected 2030 traffic levels for the Sydney–Brisbane (coastal) corridor. Light vehicle traffic along this corridor is projected to grow by approximately 2.3 per cent per annum between 2005 and 2030, with growth strongest near the major population centres of Newcastle and Brisbane, particularly between the New South Wales border and Brisbane. Heavy vehicle traffic is projected to grow by 1.4 per cent per annum, less quickly than light vehicle traffic. The average road freight task across this corridor, in tonne kilometre terms, is projected to grow by approximately 2.8 per cent per annum, between 2005 and 2030, and total interregional road freight by 3.3 per cent per annum. The traffic growth projections in Table H.6 are almost identical to the projections derived using the ABS (2006)-based population projections, presented in Table 3.8.

Sydney–Adelaide corridor

Table H.7 lists the base year 2005 and projected 2030 traffic levels for the Sydney–Adelaide corridor derived using the state-based population projections. Total vehicular traffic along the Sydney–Adelaide corridor is projected to grow by 1.2 per cent per annum between 2005 and 2030. Heavy vehicle traffic is projected to grow by 0.3 per cent per annum, with growth projected to be relatively consistent across most of the corridor. Light vehicle traffic is projected to grow by 1.4 per cent per annum between 2005 and 2030, with growth projected to be higher on most sections of the corridor. By way of comparison with the ABS (2006)-based traffic projections, the state-source population projection based traffic projections differ most significantly in the projected rate of light vehicle traffic growth on the Adelaide–Truro section. The ABS (2006)-based traffic projections imply future light vehicle traffic growth of 0.7 per cent per annum (see Table 3.9), and the state-based projections imply future light vehicle traffic growth of 1.7 per cent per annum for this section (Table H.7). The Adelaide–Truro section is the most heavily trafficked section of this corridor.

Table H.6 Sydney–Brisbane (coastal) corridor: base year and projected traffic levels, 2005 and 2030

		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*
state	*(km)*	*2005*	*2030*	*2005*	*2030*	*2005*	*2030*			
Sydney–Newcastle Fwy–Bulahdelah	87.7	15 683	25 475	2 457	3 222	18 140	28 697	1.96	1.09	1.85
Bulahdelah–Port Macquarie	141.3	10 337	16 455	1 853	2 453	12 190	18 908	1.88	1.13	1.77
Port Macquarie–Kempsey	42.4	11 063	16 280	2 035	2 877	13 097	19 158	1.56	1.40	1.53
Kempsey–Nambucca Heads	62.9	8 165	12 107	1 448	2 074	9 613	14 182	1.59	1.45	1.57
Nambucca Heads–Coffs Harbour	47.1	11 820	17 653	1 639	2 312	13 460	19 965	1.62	1.39	1.59
Coffs Harbour–Grafton	84.9	9 810	14 340	1 568	2 208	11 378	16 548	1.53	1.38	1.51
Grafton–Ballina	126.7	8 066	11 480	1 382	2 018	9 448	13 497	1.42	1.53	1.44
Ballina–Qld border	90.5	16 189	25 794	2 041	2 752	18 230	28 546	1.88	1.20	1.81
NSW border–Brisbane	82.5	61 972	132 298	29 298	42 037	91 269	174 335	3.08	1.45	2.62
Total	765.9	16 718	29 712	4 753	6 722	21 471	36 434	2.33	1.40	2.14

Source: BITRE estimates.

Table H.7 Sydney–Adelaide corridor: base year and projected traffic levels, 2005 and 2030

		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
state	*(km)*	*2005*	*2030*	*2005*	*2030*	*2005*	*2030*			
Hume Highway–Wagga Wagga	45.5	4 010	5 112	1 011	1 025	5 021	6 137	0.98	0.05	0.81
Wagga Wagga–Newell Highway (Narrandera)	94.4	2 120	2 546	652	691	2 772	3 236	0.74	0.23	0.62
Newell Highway (Narrandera)–Hay	169.3	643	811	423	464	1 065	1 275	0.93	0.37	0.72
Hay–Balranald	131.7	749	1 008	503	542	1 252	1 550	1.20	0.30	0.86
Balranald–Mildura	156.4	1 580	1 987	452	488	2 032	2 476	0.92	0.31	0.79
Mildura–SA border	117.4	1 239	1 833	777	842	2 016	2 675	1.58	0.32	1.14
Vic. border–Renmark	26.3	1 640	2 043	562	599	2 201	2 642	0.88	0.26	0.73
Renmark–Waikerie turnoff	76.8	2 882	3 493	631	661	3 513	4 154	0.77	0.19	0.67
Waikerie turnoff–Truro	87.9	1 894	2 591	663	698	2 557	3 289	1.26	0.21	1.01
Truro–Adelaide	78.3	16 881	25 761	1 370	1 604	18 251	27 365	1.71	0.63	1.63
Total	984.0	2 779	3 897	646	702	3 426	4 599	1.36	0.33	1.18

Source: BITRE estimates.

Canberra connectors

Table H.8 lists the base year 2005 and projected 2030 traffic levels for the Canberra connectors—the Barton Highway and Federal Highways—which link Canberra to the Hume Highway. Traffic levels on the Barton Highway are projected to grow by 1.5 per cent per annum in New South Wales and by 1.7 per cent per annum on the Australian Capital Territory sections. The slightly higher traffic growth in the Australian Capital Territory is partly attributable to the settlement of new residential suburbs to the north of Canberra. Traffic on the Federal Highway is projected to grow by around 2.0 per cent per annum on New South Wales sections and 1.6 per cent per annum on the sections within the Australian Capital Territory. The difference in traffic growth on each side of the border is likely to reflect reasonably strong growth in long-distance trips, via the Federal Highway, and slower growing commuter traffic on the Australian Capital Territory sections. Heavy vehicle traffic is projected to grow less quickly than light vehicle traffic, due to the assumed increase in average heavy vehicle loads. The traffic growth projections in Table H.8 are almost identical to the projections derived using the ABS (2006)-based population projections, presented in Table 3.10.

Melbourne–Brisbane corridor

Table H.9 lists the base year and projected traffic levels in 2030 for the Melbourne–Brisbane corridor. Total traffic along the Melbourne–Brisbane corridor is projected to grow by 1.0 per cent per annum between 2005 and 2030, using the state-based population projections. Light vehicle traffic is projected to grow by approximately 1.2 per cent per annum between 2005 and 2030, with growth less than 1.0 per cent per annum on most New South Wales sections, but higher in Victoria and Queensland. Heavy vehicle traffic volumes are projected to grow by 0.4 per cent per annum, on average, across the corridor, with reasonably consistent growth across most of the corridor. Again, the heavy vehicle traffic growth rates reflect the assumed 2 per cent annual productivity improvement for interregional road freight movements. The traffic growth projections in Table H.9 are slightly higher than the ABS (2006)-based population projections, presented in Table 3.11.

Table H.8 Canberra connectors: base year and projected traffic levels, 2005 and 2030

state	Length (km)	Average traffic levels (vehicles per day) Light vehicles 2005	Light vehicles 2030	Heavy vehicles 2005	Heavy vehicles 2030	All vehicles 2005	All vehicles 2030	Average annual traffic growth (per cent per annum) Light vehicles	Heavy vehicles	All vehicles
Hume Hwy–ACT Border	65.8	10 779	18 585	1 332	1 373	12 111	19 958	2.20	0.12	2.02
ACT Border–Barton Hwy	7.1	12 549	19 608	2 615	3 001	15 165	22 609	1.80	0.55	1.61
Hume Hwy–ACT Border	41.4	6 858	10 005	678	787	7 536	10 792	1.52	0.60	1.45
ACT Border–Federal Hwy	11.9	16 233	25 459	2 340	3 026	18 573	28 485	1.82	1.03	1.73
Total	126.3	10 109	16 480	1 285	1 429	11 394	17 909	1.97	0.43	1.83

Source: BITRE estimates.

Table H.9 Melbourne–Brisbane corridor: base year and projected traffic levels, 2005 and 2030

state	Length (km)	Average traffic levels (vehicles per day) Light vehicles 2005	Light vehicles 2030	Heavy vehicles 2005	Heavy vehicles 2030	All vehicles 2005	All vehicles 2030	Average annual traffic growth (per cent per annum) Light vehicles	Heavy vehicles	All vehicles
Hume Highway–Shepparton	74.3	4 930	7 672	1 456	1 525	6 386	9 197	1.78	0.19	1.47
Shepparton–NSW border	78.6	3 502	4 838	908	937	4 411	5 775	1.30	0.12	1.08
Vic. border–Narrandera	163.2	1 092	1 462	535	589	1 627	2 050	1.17	0.39	0.93
Narrandera–West Wyalong	138.3	1 000	1 261	442	509	1 443	1 770	0.93	0.56	0.82
West Wyalong–Parkes	137.5	1 809	2 207	951	1 057	2 760	3 264	0.80	0.42	0.67
Parkes–Dubbo	121.0	2 578	3 268	1 016	1 126	3 594	4 394	0.95	0.41	0.81
Dubbo–Coonabarabran	157.2	1 449	1 819	725	808	2 173	2 627	0.91	0.44	0.76
Coonabarabran–Narrabri	119.4	1 193	1 624	781	904	1 974	2 527	1.24	0.59	0.99
Narrabri–Moree	100.3	2 122	2 659	1 446	1 571	3 567	4 230	0.91	0.33	0.68
Moree–Qld border	122.0	1 476	2 077	984	1 109	2 460	3 185	1.37	0.48	1.04
NSW border–Toowoomba	222.9	1 497	2 072	654	724	2 151	2 796	1.31	0.41	1.05
Total	1 434.9	1 823	2 456	836	923	2 659	3 379	1.20	0.40	0.96

Source: BITRE estimates.

Melbourne–Adelaide corridor

Table H.10 lists base year 2005 and projected 2030 traffic levels for the Melbourne–Adelaide corridor. Total traffic along the Melbourne–Adelaide corridor is projected to grow by 1.8 per cent per annum between 2005 and 2030, using the state-based population projections. Light vehicle traffic is projected to grow by 2.0 per cent per annum, with growth projected to be strongest, around 2.7 per cent per annum, on the Melbourne–Ballarat section. West of Ballarat, light vehicle traffic growth is projected to be at most 1.5 per cent per annum and average 1.25 per cent per annum. Heavy vehicle traffic is projected to grow by 0.8 per cent per annum over the whole corridor. Again, these projections assume increasing heavy vehicle productivity over time. The traffic growth projections in Table H.10 are quite similar to the projections derived using the ABS (2006)-based population projections, presented in Table 3.12. The light vehicle traffic projections differ slightly due to the differences in projected regional population growth, particularly around the ends of the corridor.

Brisbane–Darwin corridor

Table H.11 lists the base year 2005 and projected 2030 traffic levels for the Brisbane–Darwin corridor. Total traffic on the Brisbane-Darwin corridor is projected to grow by approximately 2.2 per cent per annum between 2005 and 2030. Averaged across the corridor, light vehicle traffic is projected to grow by 2.4 per cent per annum, with growth is projected to be strongest, around 3.0 per cent per annum, on the very heavily trafficked Ipswich–Toowoomba section. On the remoter sections, light vehicle traffic is projected to grow by between 1.4 and 2.0 per cent per annum. Heavy vehicle traffic is projected to grow by approximately 0.7 per cent per annum—a mix of relatively low traffic growth on those sections between Brisbane and Cloncurry, and very strong growth between Cloncurry/Mount Isa and the Barkly Highway turnoff. In Chapter 3, it was noted that this was due to projected strong growth in road freight between Townsville and Darwin, albeit from a small base. The traffic growth projections in Table H.11 are broadly similar to the projections derived using the ABS (2006)-based population projections, presented in Table 3.13. The main difference is in the projected rate of light vehicle traffic growth between Ipswich and Toowoomba—the ABS (2006)-based projections imply light vehicle traffic growth of 1.5 per cent per annum between 2005 and 2030 on this section (Table 3.13) whereas the state-source population projections imply light vehicle traffic growth of 3.1 per cent per annum on this section (Table H.11).

Table H.10 Melbourne–Adelaide corridor: base year and projected traffic levels, 2005 and 2030

		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
state	(km)	2005	2030	2005	2030	2005	2030			
Melbourne–Ballarat	87.6	21 927	43 133	3 407	4 189	25 335	47 322	2.74	0.83	2.53
Ballarat–Ararat	96.0	3 501	5 402	1 581	1 904	5 082	7 306	1.75	0.75	1.46
Ararat–Horsham	95.7	2 974	4 291	1 289	1 581	4 262	5 872	1.48	0.82	1.29
Horsham–SA border	137.6	1 425	2 016	945	1 256	2 370	3 271	1.40	1.14	1.30
Vic. border–Keith	63.9	1 622	2 481	986	1 287	2 608	3 769	1.72	1.07	1.48
Keith–Tailem Bend	126.8	2 392	3 677	1 228	1 466	3 620	5 143	1.74	0.71	1.42
Tailem Bend–Adelaide	92.8	13 173	16 398	1 963	2 249	15 136	18 646	0.88	0.55	0.84
Total	700.4	6 234	10 181	1 577	1 928	7 811	12 109	1.98	0.81	1.77

Source: BITRE estimates.

Table H.11 Brisbane–Darwin corridor: base year and projected traffic levels, 2005 and 2030

		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
state	(km)	2005	2030	2005	2030	2005	2030			
Ipswich–Toowoomba	96.6	16 443	35 202	2 694	2 958	19 137	38 160	3.09	0.38	2.80
Toowoomba–Miles	211.4	3 115	4 549	640	721	3 755	5 271	1.53	0.48	1.37
Miles–Morven	318.3	784	1 145	222	235	1 006	1 380	1.53	0.23	1.27
Morven–Winton	699.4	270	424	107	125	377	549	1.82	0.63	1.52
Winton–Mount Isa	470.2	365	517	125	184	491	701	1.40	1.54	1.44
Mount Isa–NT border	189.5	329	459	116	207	445	666	1.34	2.36	1.63
Qld. border–Stuart Highway	433.7	184	300	33	71	217	371	1.97	3.17	2.17
Total	2 419.0	1 240	2 267	263	313	1 502	2 579	2.44	0.70	2.19

Source: BITRE estimates.

Adelaide–Perth corridor

Table H.12 lists the base year 2005 and projected 2030 traffic levels for the Adelaide–Perth corridor derived using the state-sourced regional population projections. Total traffic on the Adelaide–Perth corridor is projected to grow by 1.3 per cent per annum between 2005 and 2030, largely due to projected growth in light vehicle traffic—projected to grow by around 1.7 per cent per annum across the corridor. Light vehicle traffic growth is projected to be slightly higher than this on the Adelaide–Port Augusta section. Heavy vehicle traffic is projected to essentially remain at current levels due to the assumed improvement in future heavy vehicle productivity. Additionally, most of the projected growth in east–west non-bulk freight is expected to be carried by rail. The traffic growth projections in Table H.12 are slightly higher than the ABS (2006)-based population projections, presented in Table 3.14, principally because the state-based population projections imply stronger future population growth around Perth and Adelaide.

Adelaide–Darwin corridor

Table H.13 lists the base year 2005 and projected 2030 traffic levels for the Adelaide–Darwin corridor. Using the state-sourced population projections, total traffic on the Stuart Highway is projected to grow by approximately 1.9 per cent per annum between 2005 and 2030. Light vehicle traffic is projected to grow on average by 2.1 per cent per annum, with growth projected to be strongest on the Katherine–Darwin section. Heavy vehicle traffic is projected to grow by 0.6 per cent per annum across the corridor, with most of the growth projected to be on the Northern Territory corridor sections. The traffic growth projections in Table H.13 are very similar to the ABS (2006) population based traffic projections, presented in Table 3.15.

Table H.12 Adelaide–Perth corridor: base year and projected traffic levels, 2005 and 2030

		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*
state	*(km)*	*2005*	*2030*	*2005*	*2030*	*2005*	*2030*			
Adelaide–Port Augusta	294.7	4 409	6 993	895	873	5 304	7 866	1.86	−0.10	1.59
Port Augusta–Kimba	154.2	618	833	219	204	837	1 037	1.20	−0.29	0.86
Kimba–Ceduna	313.2	384	535	210	198	594	733	1.34	−0.23	0.85
Ceduna–WA border	482.2	273	384	130	123	402	507	1.38	−0.20	0.93
SA border–Norseman	720.7	187	265	152	145	339	410	1.41	−0.20	0.76
Norseman–Coolgardie	164.2	387	547	235	223	622	770	1.39	−0.20	0.86
Coolgardie–Merredin	296.1	1 182	1 714	562	601	1 744	2 314	1.50	0.26	1.14
Merredin–Northam	162.2	1 723	2 474	672	669	2 396	3 143	1.46	−0.02	1.09
Northam–Perth	79.3	7 458	11 265	974	1 021	8 431	12 286	1.66	0.19	1.52
Total	2 666.9	1 149	1 734	348	344	1 497	2 079	1.66	−0.05	1.32

Source: BITRE estimates.

Table H.13 Adelaide–Darwin corridor: base year and projected traffic levels, 2005 and 2030

		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
state	(km)	2005	2030	2005	2030	2005	2030			
Port Augusta–Pimba	169.6	547	685	168	164	714	850	0.91	–0.08	0.70
Pimba–Coober Pedy	369.0	283	440	89	90	372	530	1.79	0.04	1.43
Coober Pedy–NT border	388.5	340	471	80	80	420	551	1.31	0.03	1.09
SA border–Lasseter Highway	91.7	255	404	45	45	300	449	1.85	0.04	1.63
Lasseter Highway–Alice Springs	199.2	661	1 124	117	126	778	1 250	2.15	0.32	1.92
Alice Springs–Barkly Highway	531.2	602	812	103	117	705	929	1.20	0.52	1.11
Barkly Highway–Katherine	647.4	457	622	80	110	538	732	1.24	1.26	1.24
Katherine–Darwin	301.2	1 710	3 870	280	355	1 990	4 225	3.32	0.96	3.06
Total	2 697.9	599	1 009	115	134	714	1 143	2.11	0.61	1.90

Source: BITRE estimates.

Perth–Darwin corridor

Table H.14 lists the base year 2005 and projected 2030 traffic levels on the Perth–Darwin corridor. Total traffic along this corridor is projected to grow by 1.9 per cent per annum between 2005 and 2030. Light vehicle traffic is projected to grow by approximately 2.2 per cent per annum, with average growth influenced heavily by strong projected light vehicle traffic growth on the Great Northern Highway between Perth and the Brand Highway turnoff and Port Hedland and the Northern Territory border. Heavy vehicle traffic is projected to grow by around 1.0 per cent per annum, reflecting average annual road freight growth of 3.0 per cent per annum and an annual average increase in heavy vehicle loads of approximately 2 per cent per annum. Heavy vehicle traffic is projected to grow most strongly on those sections between Broome and Katherine, fuelled by mining activity. The traffic growth projections in Table H.14 are very similar to the ABS (2006) population projection based traffic projections, presented in Table 3.16.

Table H.14 Perth–Darwin corridor: base year and projected traffic levels, 2005 and 2030

		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*
state	*(km)*	*2005*	*2030*	*2005*	*2030*	*2005*	*2030*			
Perth–Brand Highway turnoff	33.6	9 302	17 509	1 869	2 591	11 171	20 100	2.56	1.32	2.38
Brand Highway turnoff–Mount Magnet	513.1	553	803	277	284	830	1 087	1.51	0.11	1.09
Mount Magnet–Meekatharra	194.9	424	576	245	263	668	839	1.24	0.28	0.91
Meekatharra–Newman	420.2	103	154	77	83	180	237	1.61	0.30	1.10
Newman–North West Coastal Highway junction	409.7	160	252	81	83	241	335	1.82	0.09	1.32
North West Coastal Highway junction–Port Hedland	33.3	1 101	1 589	147	173	1 249	1 762	1.48	0.64	1.39
Port Hedland–Broome	565.6	212	394	96	122	308	517	2.51	0.98	2.09
Broome–Halls Creek	650.9	228	488	62	95	290	582	3.08	1.72	2.83
Halls Creek–NT border	400.1	450	832	178	319	629	1 152	2.49	2.36	2.45
WA border–Katherine	469.4	251	399	44	82	295	482	1.88	2.51	1.98
Total	3 690.9	377	649	138	178	515	826	2.20	1.02	1.91

Source: BITRE estimates.

Intrastate corridors

Sydney–Wollongong corridor

Table H.15 lists the base year 2005 and projected 2030 traffic levels for the Sydney–Wollongong corridor derived using the state-sourced population projections. Total traffic is projected to grow by 1.2 per cent per annum. Heavy vehicle traffic is projected to grow by 0.4 per cent per annum (assuming increasing average vehicle loads) and light vehicle traffic by 1.2 per cent per annum. Again, as is the case for most other corridors, the traffic growth projections in Table H.15 are very similar to the ABS (2006) population projection based traffic projections, presented in Table 3.17.

Sydney–Dubbo corridor

Table H.16 lists the base year 2005 and projected 2030 traffic levels along the Sydney–Dubbo corridor, derived using the state-sourced population projections. Total traffic along the corridor is projected to grow by approximately 1.0 per cent per annum between 2005 and 2030. Light vehicle traffic, which comprises, on average, approximately 90 per cent of all vehicles on this corridor, is projected to grow by around 1.1 per cent per annum. In contrast, heavy vehicle traffic is projected to remain more or less at current levels—with growth on the Sydney–Katoomba section offset by projected declines in heavy vehicle numbers west of Katoomba. The traffic growth projections in Table H.16 are very similar to the ABS (2006) population projection based traffic projections, presented in Table 3.18.

Table H.15 Sydney–Wollongong corridor: base year and projected traffic levels, 2005 and 2030

		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)	2005	2030	2005	2030	2005	2030			
Sydney–Wollongong	63.4	41 181	55 619	3 349	3 678	44 530	59 298	1.21	0.38	1.15

Source: BITRE estimates.

Table H.16 Sydney–Dubbo corridor: base year and projected traffic levels, 2005 and 2030

		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)	2005	2030	2005	2030	2005	2030			
Sydney–Katoomba	65.7	42 549	53 021	3 675	4 220	46 224	57 241	0.88	0.55	0.86
Katoomba–Bathurst	97.8	8 396	11 793	1 370	1 232	9 766	13 025	1.37	−0.42	1.16
Bathurst–Orange	54.0	7 274	10 386	1 147	993	8 422	11 379	1.43	−0.58	1.21
Orange–Dubbo	152.3	3 604	4 823	640	574	4 243	5 397	1.17	−0.43	0.97
Total	369.8	12 324	16 039	1 446	1 457	13 770	17 496	1.06	0.03	0.96

Source: BITRE estimates.

Melbourne–Sale corridor

Table H.17 lists the base year 2005 and projected 2030 traffic levels for the Melbourne–Sale corridor derived using the state-based population projections. The traffic growth summary estimates are in two sections: Berwick–Moe and Moe–Sale. Total traffic on this corridor is projected to grow by 2.2 per cent per annum between 2005 and 2030. Light vehicle traffic is projected to grow by 2.3 per cent per annum, with substantially stronger growth projected for the Berwick–Moe section of the corridor, as a result of strong projected future population growth in outer southeast Melbourne. Heavy vehicle traffic is projected to grow by 0.75 per cent per annum (including the impact of heavy vehicle productivity growth). The traffic growth projections in Table H.17 are very similar to the ABS (2006) population projection based traffic projections, presented in Table 3.19.

Melbourne–Geelong corridor

Table H.18 lists the base year 2005 and projected 2030 traffic levels on the Melbourne–Geelong corridor. Total traffic along the Princes Freeway is projected to grow by approximately 2.1 per cent per annum between 2005 and 2030. Light vehicle traffic is projected to grow by 2.2 per cent per annum and heavy vehicle traffic by 0.8 per cent per annum (including the impact of heavy vehicle productivity growth). The traffic growth projections in Table H.18 imply slightly slower light vehicle traffic growth (2.2 per cent per annum), in comparison with the ABS (2006) population projection based traffic projections (2.7 per cent per annum), presented in Table 3.20.

Melbourne–Mildura corridor

Table H.19 lists the base year 2005 and projected 2030 traffic levels for the Melbourne–Mildura corridor. Total traffic on this corridor is projected to increase by 1.3 per cent per annum between 2005 and 2030. Light vehicle traffic is projected to grow by 1.4 per cent per annum over the same period and heavy vehicle traffic by 0.5 per cent per annum. Traffic growth is projected to be relatively stronger on the section between Melbourne and Bendigo. The traffic growth projections in Table H.19 are very similar to the ABS (2006) population projection based traffic projections, presented in Table 3.21.

Table H.17 Melbourne–Sale corridor: base year and projected traffic levels, 2005 and 2030

		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)*	*2005*	*2030*	*2005*	*2030*	*2005*	*2030*			
Sale–Moe	80.0	10 372	13 796	1 451	1 704	11 822	15 499	1.15	0.65	1.09
Moe–Melbourne	92.1	18 707	37 467	3 133	3 819	21 841	41 286	2.82	0.79	2.58
Total	172.1	14 832	26 463	2 351	2 836	17 183	29 299	2.34	0.75	2.16

Source: BITRE estimates.

Table H.18 Melbourne–Geelong corridor: base year and projected traffic levels, 2005 and 2030

		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)*	*2005*	*2030*	*2005*	*2030*	*2005*	*2030*			
West Gate Freeway–Geelong	48.5	56 803	97 724	6 349	7 787	63 152	105 512	2.19	0.82	2.07

Source: BITRE estimates.

Table H.19 Melbourne–Mildura corridor: base year and projected traffic levels, 2005 and 2030

Section	*Length (km)*	*Average traffic levels (vehicles per day)* *Light vehicles 2005*	*Light vehicles 2030*	*Heavy vehicles 2005*	*Heavy vehicles 2030*	*All vehicles 2005*	*All vehicles 2030*	*Average annual traffic growth (per cent per annum)* *Light vehicles*	*Heavy vehicles*	*All vehicles*
Melbourne–Bendigo	131.2	17 996	26 021	1 969	2 311	19 964	28 332	1.49	0.64	1.41
Bendigo–Sea Lake	210.1	1 300	1 743	367	403	1 666	2 145	1.18	0.37	1.02
Sea Lake–Mildura	187.2	1 680	2 319	364	385	2 044	2 704	1.30	0.23	1.13
Total	528.6	5 579	7 974	763	870	6 343	8 844	1.44	0.53	1.34

Source: BITRE estimates.

Brisbane–Cairns corridor

Table H.20 lists the base year 2005 and projected 2030 traffic levels for the Brisbane–Cairns corridor. Total traffic along the Brisbane–Cairns corridor is projected to grow by approximately 2.3 per cent per annum between 2005 and 2030, fuelled predominantly by light vehicle traffic growth. Light vehicle traffic is projected to grow by 2.5 per cent per annum, with very strong growth projected for those sections between Brisbane and Gladstone. Heavy vehicle traffic is projected to grow by an average of 0.9 per cent per annum between 2005 and 2030, reflecting average road freight growth of 2.8 per cent per annum and average annual improvement in heavy vehicle productivity of approximately 2 per cent per annum. The traffic growth projections in Table H.20 are very similar to the ABS (2006) population projection based traffic projections, presented in Table 3.22.

Townsville–Mount Isa corridor

Table H.21 lists the base year 2005 and projected 2030 traffic levels for the Townsville–Mount Isa corridor, derived using the state-sourced population projections. Total traffic is projected to grow by 1.1 per cent per annum between 2005 and 2030. Light vehicle traffic is projected to grow by 1.2 per cent per annum and heavy vehicle traffic by 0.9 per cent per annum. Heavy vehicle traffic growth is projected to be 1.7 per cent per annum on those sections west of Hughenden. The traffic growth projections in Table H.21 are very similar to the ABS (2006) population projection based traffic projections, presented in Table 3.23.

Table H.20 Brisbane–Cairns corridor: base year and projected traffic levels, 2005 and 2030

		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)	2005	2030	2005	2030	2005	2030			
Brisbane–Gympie	146.3	31 803	65 957	2 934	3 768	34 737	69 725	2.96	1.01	2.83
Gympie–Gladstone turnoff	343.5	3 968	7 607	1 007	1 246	4 975	8 852	2.64	0.86	2.33
Gladstone turnoff–Rockhampton	121.0	3 643	6 121	975	1 221	4 618	7 342	2.10	0.90	1.87
Rockhampton–Mackay	333.9	3 173	5 090	763	999	3 936	6 089	1.91	1.08	1.76
Mackay–Bowen	187.2	3 441	6 198	722	901	4 162	7 099	2.38	0.89	2.16
Bowen–Townsville	194.3	3 683	5 583	603	741	4 286	6 325	1.68	0.83	1.57
Townsville–Cairns	349.0	5 417	8 994	1 018	1 252	6 435	10 245	2.05	0.83	1.88
Total	1 675.2	6 427	11 990	1 048	1 319	7 474	13 309	2.53	0.92	2.33

Source: BITRE estimates.

Table H.21 Townsville–Mount Isa corridor: base year and projected traffic levels, 2005 and 2030

		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)	2005	2030	2005	2030	2005	2030			
Townsville–Charters Towers	123.9	1 888	2 605	330	334	2 218	2 939	1.30	0.05	1.13
Charters Towers–Hughenden	251.3	423	535	138	174	561	710	0.94	0.95	0.94
Hughenden–Landsborough Highway	387.3	206	281	75	116	281	397	1.25	1.73	1.39
Total	762.5	551	742	137	170	688	913	1.20	0.87	1.14

Source: BITRE estimates.

Perth–Bunbury corridor

Table H.22 lists the base year 2005 and projected 2030 traffic levels on the Perth–Bunbury corridor. Total traffic is projected to grow by 2.4 per cent per annum between 2005 and 2030, fuelled predominantly by growth in light vehicle traffic (projected growth of 2.5 per cent per annum). Heavy vehicle traffic between Perth and Mandurah is projected to grow by 1.0 per cent per annum (including the impact of heavy vehicle productivity growth). South of Mandurah, heavy vehicle traffic is projected to grow by 0.1 per cent per annum. The traffic growth projections in Table H.22 are very similar to the ABS (2006) population projection based traffic projections, presented in Table 3.24.

Perth–Port Hedland (via Brand and North West Coastal Highways) corridor

Table H.23 lists the base year 2005 and projected 2030 traffic levels for the Perth–Port Hedland corridor derived using the state-sourced regional population projections. The Perth–Port Hedland road corridor is not formally part of the NLTN. Total traffic is projected to grow by approximately 1.5 per cent per annum between 2005 and 2030. Light vehicle traffic is projected to grow by approximately 2.0 per cent per annum, with growth projected to be strongest on the Perth–Geraldton section. Heavy vehicle traffic levels are projected to decline across most of the corridor—with fewer larger vehicles required to undertake the growing freight task. Total road freight is projected to increase by around 1.2 per cent per annum across the corridor. The traffic growth projections in Table H.23 are very similar to the ABS (2006) population projection based traffic projections, presented in Table 3.25.

Tasmanian corridors

Table H.24 lists the base year 2005 and projected 2030 traffic levels for the Hobart–Burnie corridor and Table H.25 the same for the Launceston–Bell Bay corridor, derived using the state-based population projections. As the Tasmanian state-based population projections are based the ABS (2006) projections, there is little difference between these projections and those listed in Tables 3.26 and 3.27.

Table H.22 Perth–Bunbury corridor: base year and projected traffic levels, 2005 and 2030

		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)*	*2005*	*2030*	*2005*	*2030*	*2005*	*2030*			
Perth–Mandurah	54.8	34 215	62 326	2 767	3 551	36 982	65 877	2.43	1.00	2.34
Mandurah–Bunbury	105.5	9 095	17 721	1 113	1 141	10 208	18 862	2.70	0.10	2.49
Total	160.3	17 678	32 961	1 678	1 965	19 356	34 925	2.52	0.63	2.39

Source: BITRE estimates.

Table H.23 Perth–Port Hedland corridor: base year and projected traffic levels, 2005 and 2030

		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)*	*2005*	*2030*	*2005*	*2030*	*2005*	*2030*			
Perth–Geraldton	367.6	1 809	3 189	436	409	2 245	3 599	2.30	−0.25	1.91
Geraldton–Overland Roadhouse	280.7	1 223	1 677	314	246	1 537	1 923	1.27	−0.97	0.90
Overland Roadhouse–Carnarvon	193.7	400	642	233	273	633	915	1.91	0.64	1.48
Carnarvon–Minilya Exmouth Road	142.2	272	443	175	173	447	616	1.97	−0.05	1.29
Minilya Exmouth Road–Karratha Road	487.7	187	293	96	75	283	368	1.82	−1.00	1.06
Karratha Road–Great Northern Highway	190.5	465	759	91	60	556	819	1.98	−1.65	1.56
Total	1 662.4	785	1 274	230	207	1 015	1 482	1.96	−0.42	1.53

Source: BITRE estimates.

Table H.24 Hobart – Burnie–Devonport corridor: base year and projected traffic levels, 2005 and 2030

		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)*	*2005*	*2030*	*2005*	*2030*	*2005*	*2030*			
Hobart–Launceston	178.3	5 603	7 023	717	723	6 320	7 746	0.91	0.03	0.82
Launceston–Burnie	141.5	8 083	8 886	1 003	1 002	9 086	9 888	0.38	0.00	0.34
Total	319.8	6 700	7 847	843	846	7 544	8 693	0.63	0.01	0.57

Source: BITRE estimates.

Table H.25 Launceston–Bell Bay corridor: base year and projected traffic levels, 2005 and 2030

		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)*	*2005*	*2030*	*2005*	*2030*	*2005*	*2030*			
Launceston–Bell Bay	45.2	5 202	6 768	696	905	5 898	7 672	1.06	1.05	1.06

Source: BITRE estimates.

H.3 Road freight traffic projections assuming no heavy vehicle productivity improvement

State and territory summary

Table H.26 presents the projected average number of heavy vehicles in 2030, assuming there is no change in the average load carried by heavy vehicles between 2005 and 2030. Averaged across all non-urban NLTN corridors, total heavy vehicle traffic would grow by 2.3 per cent per annum under this assumption. This is approximately 1.6 per cent per annum faster than for the case of where heavy vehicle productivity is assumed to improve by 2 per cent per annum for interregional road freight and by 1 per cent per annum for intra-regional road freight.

Interstate and intrastate corridors

Tables H.27 and H.28 show projected corridor average heavy vehicle traffic growth, between 2005 and 2030, for interstate and intrastate NLTN non-urban corridors, assuming no change in the future average productivity of heavy vehicles. Across all interstate corridors heavy vehicle traffic volumes would grow by 2.3 per cent per annum in the absence of any heavy vehicle productivity improvement. The effect of the heavy vehicle productivity assumptions is to reduce total heavy vehicle movements by around 1.6 per cent per annum. Across all intrastate corridors, heavy vehicle traffic volumes would increase by an average of 2.0 per cent per annum in the absence of any heavy vehicle productivity improvement, or by 1.4 per cent per annum more than under the projections listed in table 3.3.

Table H.26 Projected growth in heavy vehicle traffic assuming no change in heavy vehicle productivity, NLTN non-urban corridors, by state/territory, 2005 and 2030

		Average heavy vehicle traffic levels		*Average annual traffic growth*
State	*Length (km)*	*2005 (vehicles per day)*	*2030*	*(% pa)*
New South Wales	4 104.6	1 531	2 818	2.47
Victoria	1 733.4	1 910	3 386	2.32
Queensland	4 954.1	1 062	2 017	2.60
South Australia	2 724.2	421	725	2.20
Western Australia[a]	6 466.7	254	410	1.94
Tasmania	365.1	825	1 256	1.69
Northern Territory	2 674.0	95	188	2.78
Australian Capital Territory	19.0	2 443	4 181	2.17
Australia[a]	23 041.0	792	1 437	2.33

a. Estimates include the Brand and North West Coastal Highways (1662 kilometres), which are not part of the NLTN.
Source: BITRE estimates.

Table H.27 Projected growth in heavy vehicle traffic assuming no change in heavy vehicle productivity, NLTN non-urban interstate corridors, 2005 and 2030

Corridor	Length (km)	Average heavy vehicle traffic levels 2005 (vehicles per day)	Average heavy vehicle traffic levels 2030 (vehicles per day)	Average annual traffic growth (% pa)
Sydney–Melbourne	814.5	3 696	6 828	2.49
Sydney–Brisbane (via NE Hwy)	932.6	1 537	2 638	2.18
Sydney–Brisbane (via Pacific Hwy)	765.9	4 753	9 533	2.82
Sydney–Adelaide	984.0	646	1 134	2.27
Canberra connectors	126.3	1 285	2 183	2.14
Melbourne–Brisbane	1 434.8	836	1 421	2.14
Melbourne–Adelaide	700.4	1 577	3 040	2.66
Brisbane–Darwin	2 419.0	263	482	2.46
Adelaide–Perth	2 666.9	348	544	1.81
Adelaide–Darwin	2 697.9	115	206	2.36
Perth–Darwin	3 690.9	138	253	2.45
All interstate corridors	17 233.3	787	1 450	2.31

Source: BITRE estimates.

Table H.28 Projected growth in heavy vehicle traffic assuming no change in heavy vehicle productivity, NLTN non-urban intrastate corridors, 2005 and 2030

Corridor	Length (km)	Average heavy vehicle traffic levels 2005 (vehicles per day)	Average heavy vehicle traffic levels 2030 (vehicles per day)	Average annual traffic growth (% pa)
Sydney–Wollongong	63.4	3 349	5 587	2.07
Sydney–Dubbo	369.8	1 446	2 208	1.71
Melbourne–Sale	172.1	2 351	3 924	2.07
Melbourne–Geelong	48.5	6 349	10 825	2.16
Melbourne–Mildura	528.6	763	1 236	1.95
Brisbane–Cairns	1 675.2	1 048	2 070	2.76
Townsville–Mount Isa	762.5	137	248	2.40
Perth–Bunbury	160.3	1 678	2 844	2.13
Perth–Port Hedland[a]	1 662.4	230	310	1.20
Hobart–Devonport	319.8	843	1 269	1.65
Launceston–Bell Bay	45.2	696	1 163	2.07
All intrastate corridors	5 807.8	805	1 397	2.01

a. The Brand and North West Coastal Highways are not part of the NLTN.
Source: BITRE estimates.

Corridor specific projections

Tables H.29 to H.50 list the projected heavy vehicle traffic volumes, and implied heavy vehicle traffic growth rates, by non-urban NLTN corridor in the absence of any improvement in heavy vehicle productivity. These results may be compared to those presented in Tables 3.6 to 3.27.

Interstate corridors

Table H.29 Sydney–Melbourne corridor: base year 2005 and projected 2030 heavy vehicle traffic levels, assuming no change in heavy vehicle productivity

Section	*Length (km)*	*Average heavy vehicle traffic levels* 2005 (vehicles per day)	*Average heavy vehicle traffic levels* 2030 (vehicles per day)	*Average annual traffic growth (% pa)*
Sydney–Federal Hwy	166.8	5 146	9 529	2.50
Federal Hwy–Barton Hwy	64.8	3 014	5 693	2.58
Barton Hwy–Sturt Hwy	139.2	2 784	5 223	2.55
Sturt Hwy–Holbrook	79.4	1 817	3 596	2.77
Holbrook–Vic. border	67.3	3 034	5 665	2.53
NSW border–Wangaratta	67.8	3 688	6 815	2.49
Wangaratta–Euroa	90.5	3 401	6 222	2.45
Euroa–Goulburn Valley Hwy	51.0	3 166	5 851	2.49
Goulburn Valley Hwy–Western Ring Road	87.7	5 718	10 095	2.30
Total	814.5	3 696	6 828	2.49

Source: BITRE estimates.

Table H.30 Sydney–Brisbane (inland) corridor: base year 2005 and projected 2030 heavy vehicle traffic levels, assuming no change in heavy vehicle productivity

Section	Length (km)	Average heavy vehicle traffic levels 2005 (vehicles per day)	2030	Average annual traffic growth (% pa)
Sydney–Newcastle	126.0	4 857	9 347	2.65
Newcastle–Maitland	14.7	2 814	4 641	2.02
Maitland–Singleton	46.1	2 386	3 810	1.89
Singleton–Muswellbrook	47.2	2 244	3 492	1.79
Muswellbrook–Tamworth	155.8	1 120	1 684	1.64
Tamworth–Armidale	112.1	642	928	1.49
Armidale–Glen Innes	93.9	466	676	1.49
Glen Innes–Qld border	111.1	523	774	1.58
NSW border–Warwick	97.1	546	839	1.73
Warwick–Ipswich	128.6	1 268	2 149	2.13
Total	932.6	1 537	2 638	2.18

Source: BITRE estimates.

Table H.31 Sydney–Brisbane (coastal) corridor: base year 2005 and projected 2030 heavy vehicle traffic levels, assuming no change in heavy vehicle productivity

Section	Length (km)	Average heavy vehicle traffic levels 2005 (vehicles per day)	2030	Average annual traffic growth (% pa)
Sydney–Newcastle Fwy–Bulahdelah	87.7	2 457	5 207	3.05
Bulahdelah–Port Macquarie	141.3	1 853	4 016	3.14
Port Macquarie–Kempsey	42.4	2 035	4 587	3.31
Kempsey–Nambucca Heads	62.9	1 448	3 351	3.41
Nambucca Heads–Coffs Harbour	47.1	1 639	3 682	3.29
Coffs Harbour–Grafton	84.9	1 568	3 525	3.29
Grafton–Ballina	126.7	1 382	3 255	3.49
Ballina–Qld border	90.5	2 041	4 358	3.08
NSW border–Brisbane	82.5	29 298	55 699	2.60
Total	765.9	4 753	9 533	2.82

Source: BITRE estimates.

Table H.32 Sydney–Adelaide corridor: base year 2005 and projected 2030 heavy vehicle traffic levels, assuming no change in heavy vehicle productivity

Section	Length (km)	Average heavy vehicle traffic levels 2005 (vehicles per day)	2030	Average annual traffic growth (% pa)
Hume Highway–Wagga Wagga	45.5	1 011	1 649	1.98
Wagga Wagga–Newell Highway (Narrandera)	94.4	652	1 125	2.20
Newell Highway (Narrandera)–Hay	169.3	423	760	2.37
Hay–Balranald	131.7	503	908	2.39
Balranald–Mildura	156.4	452	818	2.40
Mildura–SA border	117.4	777	1 368	2.29
Vic. border–Renmark	26.3	562	998	2.33
Renmark–Waikerie turnoff	76.8	631	1 103	2.26
Waikerie turnoff–Truro	87.9	663	1 162	2.27
Truro–Adelaide	78.3	1 370	2 365	2.21
Total	984.0	646	1 134	2.28

Source: BITRE estimates.

Table H.33 Canberra connectors: base year 2005 and projected 2030 heavy vehicle traffic levels, assuming no change in heavy vehicle productivity

Section	Length (km)	Average heavy vehicle traffic levels 2005 (vehicles per day)	2030	Average annual traffic growth (% pa)
Hume Hwy–ACT Border	65.8	1 332	2 273	2.16
Hume Hwy–ACT Border	7.1	2 615	4 481	2.18
ACT Border–Barton Hwy	41.4	678	1 121	2.03
ACT Border–Federal Hwy	11.9	2 340	4 001	2.17
Total	126.3	1 285	2 183	2.14

Source: BITRE estimates.

Table H.34 Melbourne–Brisbane corridor: base year 2005 and projected 2030 heavy vehicle traffic levels, assuming no change in heavy vehicle productivity

Section	Length (km)	Average heavy vehicle traffic levels 2005 (vehicles per day)	2030	Average annual traffic growth (% pa)
Hume Highway–Shepparton	74.3	1 456	2 395	2.01
Shepparton–NSW border	78.6	908	1 502	2.03
Vic. border–Narrandera	163.2	535	916	2.17
Narrandera–West Wyalong	138.3	442	758	2.18
West Wyalong–Parkes	137.5	951	1 594	2.09
Parkes–Dubbo	121.0	1 016	1 679	2.03
Dubbo–Coonabarabran	157.2	725	1 234	2.15
Coonabarabran–Narrabri	119.4	781	1 373	2.28
Narrabri–Moree	100.3	1 446	2 373	2.00
Moree–Qld border	122.0	984	1 699	2.21
NSW border–Toowoomba	222.9	654	1 177	2.38
Total	1 434.9	836	1 421	2.14

Source: BITRE estimates.

Table H.35 Melbourne–Adelaide corridor: base year 2005 and projected 2030 heavy vehicle traffic levels, assuming no change in heavy vehicle productivity

Section	Length (km)	Average heavy vehicle traffic levels 2005 (vehicles per day)	2030	Average annual traffic growth (% pa)
Melbourne–Ballarat	87.6	3 407	6 095	2.35
Ballarat–Ararat	96.0	1 581	3 004	2.60
Ararat–Horsham	95.7	1 289	2 549	2.77
Horsham–SA border	137.6	945	2 066	3.18
Vic. border–Keith	63.9	986	2 127	3.12
Keith–Tailem Bend	126.8	1 228	2 415	2.74
Tailem Bend–Adelaide	92.8	1 963	3 625	2.48
Total	700.4	1 577	3 040	2.66

Source: BITRE estimates.

Table H.36 Brisbane–Darwin corridor: base year 2005 and projected 2030 heavy vehicle traffic levels, assuming no change in heavy vehicle productivity

		Average heavy vehicle traffic levels		*Average annual traffic growth*
	Length	*2005*	*2030*	
Section	*(km)*	*(vehicles per day)*		*(% pa)*
Ipswich–Toowoomba	96.6	2 694	4 545	2.11
Toowoomba–Miles	211.4	640	1 038	1.95
Miles–Morven	318.3	222	385	2.23
Morven–Winton	699.4	107	216	2.86
Winton–Mount Isa	470.2	125	279	3.26
Mount Isa–NT border	189.5	116	304	3.94
Qld. border–Stuart Highway	433.7	33	104	4.77
Total	2 419.0	263	482	2.45

Source: BITRE estimates.

Table H.37 Adelaide–Perth corridor: base year 2005 and projected 2030 heavy vehicle traffic levels, assuming no change in heavy vehicle productivity

		Average heavy vehicle traffic levels		*Average annual traffic growth*
	Length	*2005*	*2030*	
Section	*(km)*	*(vehicles per day)*		*(% pa)*
Adelaide–Port Augusta	294.7	895	1 355	1.67
Port Augusta–Kimba	154.2	219	338	1.75
Kimba–Ceduna	313.2	210	328	1.80
Ceduna–WA border	482.2	130	204	1.83
SA border–Norseman	720.7	152	240	1.83
Norseman–Coolgardie	164.2	235	367	1.80
Coolgardie–Merredin	296.1	562	927	2.02
Merredin–Northam	162.2	672	1 043	1.77
Northam–Perth	79.3	974	1 531	1.83
Total	2 666.9	348	544	1.80

Source: BITRE estimates.

Table H.38 Adelaide–Darwin corridor: base year 2005 and projected 2030 heavy vehicle traffic levels, assuming no change in heavy vehicle productivity

Section	Length (km)	Average heavy vehicle traffic levels 2005 (vehicles per day)	2030	Average annual traffic growth (% pa)
Port Augusta–Pimba	169.6	168	265	1.85
Pimba–Coober Pedy	369.0	89	142	1.88
Coober Pedy–NT border	388.5	80	127	1.87
SA border–Lasseter Highway	91.7	45	72	1.87
Lasseter Highway–Alice Springs	199.2	117	187	1.90
Alice Springs–Barkly Highway	531.2	103	178	2.22
Barkly Highway–Katherine	647.4	80	168	2.99
Katherine–Darwin	301.2	280	541	2.67
Total	2 697.9	115	206	2.36

Source: BITRE estimates.

Table H.39 Perth–Darwin corridor: base year 2005 and projected 2030 heavy vehicle traffic levels, assuming no change in heavy vehicle productivity

Section	Length (km)	Average heavy vehicle traffic levels 2005 (vehicles per day)	2030	Average annual traffic growth (% pa)
Perth–Brand Highway turnoff	33.6	1 869	3 431	2.46
Brand Highway turnoff–Mount Magnet	513.1	277	408	1.56
Mount Magnet–Meekatharra	194.9	245	380	1.77
Meekatharra–Newman	420.2	77	127	2.01
Newman–North West Coastal Highway junction	409.7	81	132	1.96
North West Coastal Highway junction–Port Hedland	33.3	147	245	2.06
Port Hedland–Broome	565.6	96	194	2.86
Broome–Halls Creek	650.9	62	139	3.29
Halls Creek–NT border	400.1	178	427	3.55
WA border–Katherine	469.4	44	101	3.38
Total	3 690.9	138	253	2.45

Source: BITRE estimates.

Table H.40 Sydney–Wollongong corridor: base year 2005 and projected 2030 heavy vehicle traffic levels, assuming no change in heavy vehicle productivity

Section	Length (km)	Average heavy vehicle traffic levels 2005 (vehicles per day)	2030	Average annual traffic growth (% pa)
Sydney–Wollongong	63.4	3 349	5 587	2.07

Source: BITRE estimates.

Table H.41 Sydney–Dubbo corridor: base year 2005 and projected 2030 heavy vehicle traffic levels, assuming no change in heavy vehicle productivity

Section	Length (km)	Average heavy vehicle traffic levels 2005 (vehicles per day)	2030	Average annual traffic growth (% pa)
Sydney–Katoomba	65.7	3 675	5 968	1.96
Katoomba–Bathurst	97.8	1 370	2 018	1.56
Bathurst–Orange	54.0	1 147	1 660	1.49
Orange–Dubbo	152.3	640	904	1.39
Total	369.8	1 446	2 208	1.71

Source: BITRE estimates.

Intrastate corridors

Table H.42 Melbourne–Sale corridor: base year 2005 and projected 2030 heavy vehicle traffic levels, assuming no change in heavy vehicle productivity

Section	Length (km)	Average heavy vehicle traffic levels 2005 (vehicles per day)	2030	Average annual traffic growth (% pa)
Sale–Moe	80.0	1 451	2 390	2.02
Moe–Melbourne	92.1	3 133	5 256	2.09
Total	172.1	2 351	3 924	2.07

Source: BITRE estimates.

Table H.43 Melbourne–Geelong corridor: base year 2005 and projected 2030 heavy vehicle traffic levels, assuming no change in heavy vehicle productivity

Section	Length (km)	Average heavy vehicle traffic levels 2005 (vehicles per day)	2030	Average annual traffic growth (% pa)
West Gate Freeway–Geelong	48.5	6 349	10 825	2.16

Source: BITRE estimates.

Table H.44 Melbourne–Mildura corridor: base year 2005 and projected 2030 heavy vehicle traffic levels, assuming no change in heavy vehicle productivity

Section	Length (km)	Average heavy vehicle traffic levels 2005 (vehicles per day)	2030	Average annual traffic growth (% pa)
Melbourne–Bendigo	131.2	1 969	3 250	2.03
Bendigo–Sea Lake	210.1	367	584	1.88
Sea Lake–Mildura	187.2	364	555	1.71
Total	528.6	763	1 236	1.95

Source: BITRE estimates.

Table H.45 Brisbane–Cairns corridor: base year 2005 and projected 2030 heavy vehicle traffic levels, assuming no change in heavy vehicle productivity

Section	Length (km)	Average heavy vehicle traffic levels 2005 (vehicles per day)	2030	Average annual traffic growth (% pa)
Brisbane–Gympie	146.3	2 934	5 825	2.78
Gympie–Gladstone turnoff	343.5	1 007	2 012	2.81
Gladstone turnoff–Rockhampton	121.0	975	1 953	2.82
Rockhampton–Mackay	333.9	763	1 541	2.85
Mackay–Bowen	187.2	722	1 484	2.93
Bowen–Townsville	194.3	603	1 234	2.91
Townsville–Cairns	349.0	1 018	1 882	2.49
Total	1 675.2	1 048	2 070	2.76

Source: BITRE estimates.

Table H.46 Townsville–Mount Isa corridor: base year 2005 and projected 2030 heavy vehicle traffic levels, assuming no change in heavy vehicle productivity

Section	Length (km)	Average heavy vehicle traffic levels 2005 (vehicles per day)	2030	Average annual traffic growth (% pa)
Townsville–Charters Towers	123.9	330	548	2.04
Charters Towers–Hughenden	251.3	138	249	2.40
Hughenden–Landsborough Highway	387.3	75	152	2.86
Total	762.5	137	248	2.40

Source: BITRE estimates.

Table H.47 Perth–Bunbury corridor: base year 2005 and projected 2030 heavy vehicle traffic levels, assuming no change in heavy vehicle productivity

Section	Length (km)	Average heavy vehicle traffic levels 2005 (vehicles per day)	2030	Average annual traffic growth (% pa)
Perth–Mandurah	54.8	2 767	4 948	2.35
Mandurah–Bunbury	105.5	1 113	1 752	1.83
Total	160.3	1 678	2 844	2.13

Source: BITRE estimates.

Table H.48 Perth–Port Hedland corridor: base year 2005 and projected 2030 heavy vehicle traffic levels, assuming no change in heavy vehicle productivity

Section	Length (km)	Average heavy vehicle traffic levels 2005 (vehicles per day)	2030	Average annual traffic growth (% pa)
Perth–Geraldton	367.6	436	631	1.48
Geraldton–Overland Roadhouse	280.7	314	378	0.74
Overland Roadhouse–Carnarvon	193.7	233	407	2.25
Carnarvon–Minilya Exmouth Road	142.2	175	229	1.08
Minilya Exmouth Road–Karratha Road	487.7	96	105	0.35
Karratha Road–Great Northern Highway	190.5	91	78	–0.61
Total	1 662.4	230	310	1.20

Source: BITRE estimates.

Table H.49 Hobart–Burnie corridor: base year 2005 and projected 2030 heavy vehicle traffic levels, assuming no change in heavy vehicle productivity

Section	Length (km)	Average heavy vehicle traffic levels 2005 (vehicles per day)	Average heavy vehicle traffic levels 2030 (vehicles per day)	Average annual traffic growth (% pa)
Hobart–Launceston	178.3	717	1 110	1.76
Launceston–Burnie	141.5	1 003	1 470	1.54
Total	319.8	843	1 269	1.65

Source: BITRE estimates.

Table H.50 Launceston–Bell Bay corridor: base year 2005 and projected 2030 heavy vehicle traffic levels, assuming no change in heavy vehicle productivity

Section	Length (km)	Average heavy vehicle traffic levels 2005 (vehicles per day)	Average heavy vehicle traffic levels 2030 (vehicles per day)	Average annual traffic growth (% pa)
Launceston–Bell Bay	45.2	696	1 163	2.07

Source: BITRE estimates.

H.4 Concluding remarks

To recap, the traffic projections summarised in this appendix (Section H.2) are based on the state-sourced regional population projections. As the aggregate state-sourced population projections imply slightly stronger population growth between 2005 and 2030, the light and heavy vehicle traffic projections are generally slightly higher than those based on the ABS (2006) population projections (summarised in Chapter 3). Chapter 3 also contains a short outline of corridors where there are significant differences between the two sets of projections.

Appendix I OZPASS and FreightSim settings

This appendix presents the OZPASS and FreightSim model settings used to derive the OD passenger and freight movements that underpin the NLTN non-urban corridor traffic projections (Sections I.1 and I.2). The gravity model used to project interregional passenger travel is described in Section I.3. Section I.3 also outlines the assumptions used to differentiate growth by travel direction in OZPASS.

I.1 OZPASS settings

Table I.1 lists the OZPASS model settings used to generate the projections. Two sets of simulations were undertaken; one using the ABS (2006) based regional population projections and the other using the state-sourced regional population projections. Apart from the population projections, the other OZPASS settings were identical for each simulation.

I.2 FreightSim settings

The FreightSim model may be run either through the graphical user interface dialog screens or in batch mode. For the FreightSim results used in the NLTN non-urban corridor projections presented in this report, FreightSim was run in batch mode. Table I.2 lists the key FreightSim settings. Again, as in the case of OZPASS, two simulations were undertaken, one using the ABS (2006) based regional population projections and the other using the state-sourced regional population projections. Apart from the population projections, all other FreightSim settings were identical for each simulation. The elasticity settings relate the rate of growth in consumption, imports and, in the case of manufactured goods, production relative to GDP growth. The bulk commodity production projections, which were presented in Appendix H, and coal and coke consumption projections, which are based on Akmal and Riwoe (2005) domestic coal consumption projections, were exogenous inputs to the model.

Table I.1 OZPASS model settings

Parameter	Travel type: Overnight trips	Day trips	International visitor trips	Rural local travel
First year	2004	2004	2004	2004
Last year	2030	2030	2030	2030
Frequency (years)	1	1	1	1
Gravity model parameters				
α	0.524	0.524	..	..
β	0.565	0.565	..	..
Trip factor settings				
Include children	Yes	Yes	Yes	..
Return journey	No	No	No	..
Children share (per cent)				
Car	31	31	3	..
Air	3	3	3	..
Coach	8	8	3	..
Rail	5	5	3	..
Ferry	5	5	3	..
Other	5	5	3	..

.. not applicable.
Sources: BITRE estimates.

I.3 OZPASS gravity model formulation

As part of the work undertaken for the revised projections, the OZPASS gravity model formulation has been revised, and now includes per capita GDP in place of household income. This section outlines the revised gravity model specification and discusses the method used in the model to differentiate trip growth by trip direction for travel between each OD pair.

The gravity model used in the revised OZPASS model has the general form:

$$T_{ijt} = \frac{A_{ij}\left(P_{it} \times P_{jt} \times \bar{Y}_t^2\right)^{\alpha}}{C_{ijt}^{\beta}} \tag{I.1}$$

where

T_{ijt} is the total trips between regions i and j at time t

P_{it}, P_{jt} denote the populations in region i and region j at time t

$\bar{Y}_t$ is per capita gross domestic product at time t

C_{ijt} is the real generalised travel cost between regions i and j at time t

A_{ij} is an OD specific constant

α,β are model parameters.

Growth in total trips between regions i and j is given by:

$$\hat{T}_{ijt} = \alpha\left(\hat{P}_{it} + \hat{P}_{jt} + \hat{\bar{Y}}_t^2\right) - \beta\hat{C}_{ijt} \tag{I.2}$$

Table I.2 FreightSim model settings

Parameter	*Setting*		
Run parameters			
First year	1999		
Last year	2030		
Frequency (years)	5		
Elasticity settings			
Commodity group	*Consumption*	*Imports*	*Production*
Manufactured products	1.25	1.25	1.25
Grains & oilseeds	0.25	0.25	..[a]
Sheep live	0.25	0.25	..[a]
Cattle live	0.15	0.25	..[a]
Meat	0.2	0.25	..[a]
Agricultural products	0.2	0.2	..[a]
Coal & coke	..[a]	0.5	..[a]
Metallic minerals	0.5	0.5	..[a]
Non-metallic minerals	..[a]	..[a]	..[a]
Oil & petroleum products	0.5	0.75	..[a]
Gas	0.5	0.5	..[a]
Steel & metals	0.5	0.5	..[a]
Fertilisers	0.5	0.5	..[a]
Cement	0.5	0.5	..[a]
Timber & timber products	0.5	0.5	..[a]
Other bulk	0.375	0.375	..[a]

.. not applicable.
a. Exogenous input to FreightSim.
Sources: BITRE estimates.

where

$\hat{T}_{ijt}$ denotes the percentage growth in total trips between regions i and j and between periods $t-1$ and t

$\hat{P}_{it}, \hat{P}_{jt}$ denote proportionate population growth in regions i and j, between periods $t-1$ and t

$\hat{\hat{Y}}_t$ is the percentage growth in per capita gross domestic product between periods $t-1$ and t

$\hat{C}_{ijt}$ is the percentage growth in the real generalised travel cost between regions i and j and between periods $t-1$ and t

Growth in trips by trip direction

The gravity model implies the growth in trips between any single OD pair is identical for travel in both directions. That is, total trips between any two regions i and j is purely a function of the total 'attractive force' between the two regions. In a simple gravity model, it is immaterial how much of the growth in travel between regions i and j is due to growth in trips from region i to region j and how much is due to growth in trips from region j to region i.

This assumption, that the rate of growth in travel from region i to region j and region j to region i does not appear to be realistic, especially in cases where one region has experienced an absolute reduction in total population and another has experienced very strong population growth, which is the example of say Tasmania and Melbourne in the late 1990s.

Population weighted direction specific trip growth

In the gravity model formulation in equation (I.2), the only 'regional differences' present in the function are the growth in regional populations. In the current version of OZPASS, the regional population growth rates are weighted by the directional OD trip shares to differentiate the growth in trips by direction. The method used to differentiate the rate of growth in travel by direction is outlined below.

First, note that total trips between regions i and j at time t is equal to the sum of trips from region i to region j and trips from region j to region i:

$$T_{ijt} = T_{i\rightarrow j,t} + T_{j\rightarrow i,t} \tag{I.3}$$

and that the total growth in trips is the weighted sum of trips from region i to region j and vice versa:

$$\hat{T}_{ijt} = s_{i\rightarrow j,t}\hat{T}_{i\rightarrow j} + s_{j\rightarrow i,t}\hat{T}_{j\rightarrow i,t} \tag{I.4}$$

As motivation for differentiating the rate of travel growth from region i to region j and from region j to region i, suppose that total trips by direction were proportional to the population in each region. That is:

$$T_{i\rightarrow j,t} = \frac{P_{it}}{(P_{it} + P_{jt})} T_{ijt} = s_{it} T_{ijt} \tag{I.5}$$

where s_{it} is the population in region i as a share of the total population in regions i and j.

Then the rate of growth in total travel from region i to region j would be:

$$\hat{T}_{i\rightarrow j,t} = \hat{T}_{ij} + \hat{P}_i - \left(s_i\hat{P}_i + s_j\hat{P}_j\right) \tag{I.6}$$

Replacing the population weighted shares, s_{it} and s_{it}, in equation (I.7) with the trip direction shares, $s_{i\rightarrow j,t}$ and $s_{j\rightarrow i,t}$, provides a rule for apportioning the growth in trips from region i to region j, and vice versa:

$$\hat{T}_{i\rightarrow j,t} = \hat{T}_{ij} + \hat{P}_{it} - \left(s_{i\rightarrow j,t}\hat{P}_{it} + s_{j\rightarrow i,t}\hat{P}_{jt}\right) \tag{I.7}$$

This formulation preserves the total growth in travel between any two regions.

A numerical example

Suppose $\hat{T}_{ij} = \mathbf{2.5}$ (per cent), $\hat{P}_i = -\mathbf{0.5}$, $\hat{P}_j = \mathbf{1.25}$ and $s_{i \to j,t} = \mathbf{0.15}$, which implies $s_{i \to j,t} = \mathbf{0.85}$, then growth in trips from region i to region j will be 1.01 per cent per annum ($\hat{T}_{i \to j} = \mathbf{2.5} - \mathbf{0.5} - (\mathbf{0.15} \times -\mathbf{0.5} + \mathbf{0.85} \times \mathbf{1.25} = \mathbf{1.01})$) and growth in trips from region j to region i will be 2.76 per cent per annum ($\hat{T}_{j \to i} = \mathbf{2.5} + \mathbf{1.25} - (\mathbf{0.15} \times -\mathbf{0.5} + \mathbf{0.85} \times \mathbf{1.25} = \mathbf{2.76})$).

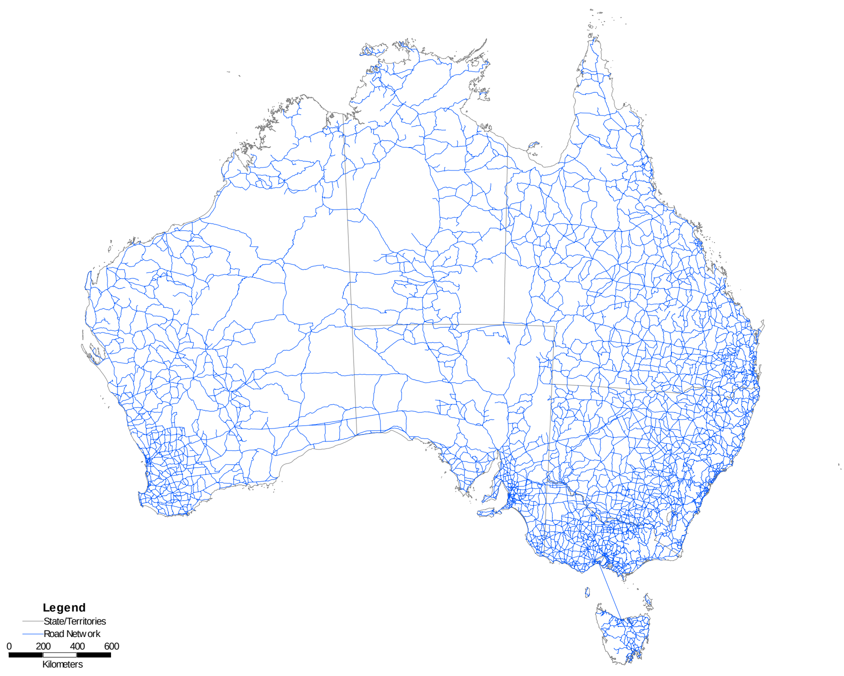
Appendix J TransCAD traffic assignment settings

J.1 Network specification

Traffic assignment in TransCAD requires specification of a road network. For the traffic assignments presented in this report, the whole of the GA (2004) TOPO 2.5M road layer, including an added link between Melbourne and Devonport to handle car-accompanied trips to/from Tasmania by ferry trips. The full road network is illustrated in Figure J.1.

The output from FreightSim and FreightTrucks provides freight flow estimates

Figure J.1 GA (2004) TOPO 2.5M vector topographic road layer



Source: GA (2004) and BITRE estimates.

in specified in terms of OD pairs. For the (road) traffic projections, it is necessary to convert the OD estimates into traffic along each road section. BITRE uses the traffic assignment algorithms included in the TransCAD Transportation GIS Software package together with the road and rail layers included in the GA (2004) TOPO-2.5M vector topographic data set.

Some adjustments to the geographic data were necessary prior to traffic assignment. This appendix describes the adjustments undertaken by BITRE and the assignment procedures.

J.2 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 GA (2004) TOPO 2.5M road layer data does not include this information, and so it is necessary to manually add these data items.

Network settings

Additional links

For the purposes of assigning the traffic to the road network, BITRE 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.

Capacity

Capacity may be handled by adding a new field to the road layer data set. The value of this variable was left unspecified for the traffic assignments undertaken for this report—equivalent to unconstrained road capacity.

Travel cost – Adjusted length rules for traffic assignment

The GA (2004) TOPO 2.5M road layer contains two road classification variables, by road class and surface type. There are five road classes:

- Dual Carriageway
- Principal Road
- Secondary Road
- Minor Road
- Track.

And four road surface types:

- Sealed

Table J.1 Assumed light vehicle average travel speed and implied length weight by road class and road formation

Road class	*Road formation*	*Assumed average speed (km/h)*	*Implied weight*
1	1	100	1.00
2	1	100	1.00
2	2	80	1.25
2	4	100	1.00
3	1	90	1.10
3	2	80	1.25
4	1	80	1.25
4	2	60	1.67
5	2	50	2.00
–	–	–	1.00

.. Not applicable.
Sources: GA (2004) and BITRE estimates.

- Unsealed
- Unknown
- Under construction.

When assigning traffic to the road network, BITRE has assumed that the average travel speed will vary across roads of different classes and surface types and used the difference in the assumed average speeds, relative to the assumed average speed for dual carriageway roads, to derive a weighted length-based index of travel costs across the different road classes. Separate sets of weights were used for assigning light and heavy vehicle traffic to the road network

Light (passenger) traffic assignment weights

The assumed travel speeds and implied network distance weights for light vehicles are listed in Table J.1. The additional road segments added to the GA (2004) road layer—linking the mainland with Tasmania and Kangaroo Island—have no class or formation code and a unit weight.

The code used to create the network weights in TransCAD was:

```
IF (CLASS = "1" and FORMATION = "1") THEN Length
ELSE IF (CLASS = "2" and FORMATION = "1") THEN Length
ELSE IF (CLASS = "2" and FORMATION = "2") THEN 1.25 * Length
ELSE IF (CLASS = "2" and FORMATION = "4") THEN Length
ELSE IF (CLASS = "3" and FORMATION = "1") THEN 1.10 * Length
ELSE IF (CLASS = "3" and FORMATION = "2") THEN 1.25 * Length
ELSE IF (CLASS = "4" and FORMATION = "1") THEN 1.25 * Length
ELSE IF (CLASS = "4" and FORMATION = "2") THEN 1.67 * Length
ELSE IF (CLASS = "5") THEN 2.00 * Length
ELSE Length
```

Table J.2 Assumed heavy vehicle average travel speed and implied distance weighting, by road class and road formation type

Road class	*Road formation*	*Assumed average speed (km/h)*	*Implied weight*	*NLTN factor*	*NRN factor*
1	1	100	1.00	0.5	0.8
2	1	90	1.10	0.5	0.8
2	2	80	1.25	0.5	0.8
2	4	90	1.10	0.5	0.8
3	1	80	1.25	0.5	0.8
3	2	60	1.67	0.5	0.8
4	1	60	1.67	0.5	0.8
4	2	50	2.00	0.5	0.8
5	2	40	2.50	0.5	0.8
–	–	–	1.00	0.5	0.8

.. Not applicable.
Sources: GA (2004) and BITRE estimates.

Heavy (freight) traffic assignment weights

For heavy vehicles, the network length weights are broadly similar to the weights used for light vehicles, except that a discount factor is applied to the weights for NLTN road sections and non-NLTN sections with a National Route Number (NRN). The assumed travel speeds and implied network distance weights for heavy vehicles and NRN road discount factors are listed in Table J.2.

The code used to create the traffic assignment weights in TransCAD was:

```
IF (CLASS = "1" and FORMATION = "1" and AUSLINK = 1) THEN 0.5 * Length
ELSE IF (CLASS = "1" and FORMATION = "1" and AUSLINK = 0 and NRN <> NULL) THEN 0.8 * Length
ELSE IF (CLASS = "1" and FORMATION = "1" and AUSLINK = 0 and NRN = NULL) THEN Length
ELSE IF (CLASS = "2" and FORMATION = "1" and AUSLINK = 1) THEN 0.5 * 1.10 * Length
ELSE IF (CLASS = "2" and FORMATION = "1" and AUSLINK = 0 and NRN <> NULL) THEN 0.8 * 1.10 * Length
ELSE IF (CLASS = "2" and FORMATION = "1" and AUSLINK = 0 and NRN = NULL) THEN 1.10 * Length
ELSE IF (CLASS = "2" and FORMATION = "2" and AUSLINK = 1) THEN 0.5 * 1.25 * Length
ELSE IF (CLASS = "2" and FORMATION = "2" and AUSLINK = 0 and NRN <> NULL) THEN 0.8 * 1.25 * Length
ELSE IF (CLASS = "2" and FORMATION = "2" and AUSLINK = 0 and NRN = NULL) THEN 1.25 * Length
ELSE IF (CLASS = "2" and FORMATION = "4" and AUSLINK = 1) THEN 0.5 * 1.10 * Length
ELSE IF (CLASS = "2" and FORMATION = "4" and AUSLINK = 0 and NRN <> NULL) THEN 0.8 * 1.10 * Length
ELSE IF (CLASS = "2" and FORMATION = "4" and AUSLINK = 0 and NRN = NULL) THEN 1.10 * Length
ELSE IF (CLASS = "3" and FORMATION = "1" and AUSLINK = 1) THEN 0.5 * 1.25 * Length
ELSE IF (CLASS = "3" and FORMATION = "1" and AUSLINK = 0 and NRN <> NULL) THEN 0.8 * 1.25 * Length
ELSE IF (CLASS = "3" and FORMATION = "1" and AUSLINK = 0 and NRN = NULL) THEN 1.25 * Length
ELSE IF (CLASS = "3" and FORMATION = "2" and AUSLINK = 1) THEN 0.5 * 1.667 * Length
ELSE IF (CLASS = "3" and FORMATION = "2" and AUSLINK = 0 and NRN <> NULL) THEN 0.8 * 1.667 * Length
ELSE IF (CLASS = "3" and FORMATION = "2" and AUSLINK = 0 and NRN = NULL) THEN 1.667 * Length
ELSE IF (CLASS = "4" and FORMATION = "1" and AUSLINK = 1) THEN 0.5*1.667*Length
ELSE IF (CLASS = "4" and FORMATION = "1" and AUSLINK = 0 and NRN <> NULL) THEN 0.8 * 1.667 * Length
ELSE IF (CLASS = "4" and FORMATION = "1" and AUSLINK = 0 and NRN = NULL) THEN 1.667 * Length
ELSE IF (CLASS = "4" and FORMATION = "2" and AUSLINK = 1) THEN 0.5 * 2.00 * Length
ELSE IF (CLASS = "4" and FORMATION = "2" and AUSLINK = 0 and NRN <> NULL) THEN 0.8 * 2.00 * Length
ELSE IF (CLASS = "4" and FORMATION = "2" and AUSLINK = 0 and NRN = NULL) THEN 2.00 * Length
ELSE IF (CLASS = "5" and AUSLINK = 1) THEN 0.5 * 2.50 * Length
ELSE IF (CLASS = "5" and AUSLINK = 0 and NRN <> NULL) THEN 0.8 * 2.50 * Length
ELSE IF (CLASS = "5" and AUSLINK = 0 and NRN = NULL) THEN 2.50 * Length
ELSE IF (Adj_Length = NULL) THEN Length
```

J.3 Traffic assignment settings

Traffic assignment in TransCAD requires specification of the assignment method, length and capacity variables and convergence conditions. The settings used for the road freight and passenger vehicle simulations are listed in Table J.3.

The passenger and freight vehicle traffic assignment results derived using the ABS population projections are summarised in Table J.4 and those derived using the state-sourced population projections in Table J.5.

Table J.3 TransCAD traffic assignment settings

Parameter	*Setting*
Assignment method	Stochastic User Equilibrium (SUE)
Time	Adj_Length_LV and Adj_Length_HV
Capacity	Capacity
Maximum iterations	50
Convergence criteria	0.001
SUE assignment settings	
Function	Gumbel
α	0.15
β	4
ε	10

Note: The α, β and ε terms are the parameters in the US Bureau of Public Roads (BPR) link performance function. The BPR function relates link travel times to volume to capacity ratios. With capacity left unconstrained for non-urban road links, these values have no influence on route choice. The term is the parameter that controls the relative perception error, or in other words the degree to which travel diverges from the least cost route.
Source: BITRE assumptions.

Table J.4 Traffic assignment results: ABS (2006)-based population projections

Parameter	*2005*	*2010*	*2015*	*2020*	*2025*	*2030*
			Freight vehicle assignment			
No. iterations	50	50	50	50	50	50
Demand ('000 daily HV trips)	323.5	327.7	331	332.8	333.8	333.2
RMSE (%)	1.42	1.42	1.44	1.46	1.47	1.47
Assigned daily VKT (10^6 km)	19.13	20.04	20.42	20.26	20.32	20.65
Assigned annual VKT (10^9 km)	6.99	7.32	7.46	7.4	7.42	7.54
			Passenger vehicle assignment			
No. iterations	50	50	50	50	50	50
Demand (Daily LV trips)	308.8	348.9	405.4	460.6	518.8	581.5
RMSE (%)	1.93	1.98	2.03	2.08	2.13	2.18
Assigned daily VKT (10^6 km)	62.25	68.83	78.37	87.41	96.74	106.66
Assigned annual VKT (10^9 km)	22.7	25.14	28.62	32.93	35.33	38.96

Source: BITRE estimates.

Table J.5 Traffic assignment results: state-based population projections

Parameter	*2005*	*2010*	*2015*	*2020*	*2025*	*2030*
			Freight vehicle assignment			
No. iterations	50	50	50	50	50	50
Demand ('000 daily HV trips)	323.3	327.5	330.7	332.4	333.3	332.7
RMSE (%)	1.42	1.42	1.44	1.45	1.46	1.45
Assigned daily VKT (10^6 km)	19.12	20.04	20.43	20.32	20.44	20.9
Assigned annual VKT (10^9 km)	6.98	7.32	7.46	7.42	7.47	7.63
			Passenger vehicle assignment			
No. iterations	50	50	50	50	50	50
Demand (Daily LV trips)	308.8	349.5	407.3	464.9	526.4	593.1
RMSE (%)	1.93	1.98	2.03	2.08	2.12	2.16
Assigned daily VKT (10^6 km)	62.24	68.86	78.54	87.87	97.75	108.52
Assigned annual VKT (10^9 km)	22.7	25.15	28.69	32.09	35.7	39.64

Source: BITRE estimates.

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Abbreviations

AADT	average annual daily traffic
ABARE	Australian Bureau of Agricultural and Resource Economics
ABS	Australian Bureau of Statistics
ACT	Australian Capital Territory
AEDR	accessible economic demonstrated resources
ARIMA	auto-regressive integrated moving average
ARMA	auto-regressive moving average
ARTC	Australian Rail Track Corporation
ASF	Australian Sea Freight
ATC	Australian Transport Council
BITRE	Bureau of Infrastructure, Transport and Regional Economics
BPR	US Bureau of Public Roads
BTRE	Bureau of Transport and Regional Economics
BTR	Bureau of Tourism Research
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DIRN	Defined Interstate Rail Network
EDR	economically demonstrated resources
ERP	estimated resident population
FMM	Freight Movements Model
FMS	Freight Movements Survey
GA	Geoscience Australia
GDP	gross domestic product
GIS	geographic information system
HMC	heavy mineral concentrates
IAFC	Independent Air Fares Committee
IGR	Intergenerational Report
IVS	International Visitor Survey
JORC	Joint Ore Reserves Committee

LGA	Local Government Area
LNG	liquified natural gas
LPG	liquified petroleum gas
MYEFO	Mid-Year Economic and Fiscal Outlook
NPI	National Plantation Inventory
NLTN	National Land Transport Network
NRN	National Route Number
NSW	New South Wales
NT	Northern Territory
NTDF	National Transport Data Framework
NVS	National Visitor Survey
OD	origin–destination
PBS	Performance Based Standards
Qld	Queensland
RMSE	root mean squared error
SA	South Australia
SCOT	Standing Committee on Transport
SLA	Statistical Local Area
SMVU	Survey of Motor Vehicle Use
SUE	stochastic user equilibrium
TRA	Tourism Research Australia
Tas.	Tasmania
UCL	Urban Centres and Localities
Vic.	Victoria
WA	Western Australia
WIM	weigh-in-motion