

# linear infrastructure: freight and urban movement

## background and context

Industry is a key demand driver on the transport system. Depending on the nature and scale of the activity, industrial uses can generate high volumes of light commercial and heavy freight vehicle movements; require access for higher productivity vehicles; utilise rail for part or all of the movement of goods; and use air or sea transport for the interstate movement of goods. Industrial activities can also generate additional infrastructure, community and environmental impacts, including water supply, noise and waste disposal.

A strategic approach that examines the demand and supply parameters of industrial activity will contribute to improved transport efficiencies for industry, better matching of the freight task to the transport network and minimisation of community and environmental impacts.

- In terms of demand, there is a need to understand the nature of industry-generated transport movements and their relationship to the strategic transport network
- In terms of supply, the location of industrial areas needs to be strategically planned to optimise linkages with existing transport and infrastructure networks, and to minimise any social and environmental impacts.

The relationship between industry and the transport system is examined in two Information Papers, divided into three sections:

### 1. Industrial sectors overview

The information presented in Section 1 of this Paper provides an overview of key industry sectors, their location and transport task. It forms the foundation for both Information Papers.

### 2. Industrial areas and transport

Examines industrial activity from a land use planning perspective, focusing on industrial land supply and its location in relation to the strategic transport and infrastructure network. The Paper includes an update of a 2003 Southern Region industrial land supply report.

### 3. Linear infrastructure and freight

This Paper focuses on Tasmania's freight task, its nature, source and relationship to the key linear transport modes of road and rail.

## key issues

1. Developing strategies to maintain and optimise freight efficiency in the context of a growing freight task.
2. Provision of sustainable maintenance to an extensive regional and local road network, serving a widely dispersed urban and industrial settlement.
3. Delivery of significant, justified and system-wide improvements with only small scale, dispersed expenditure available.
4. Better matching land-use strategies and development to strategic infrastructure location and function.
5. Recognition of the need to increase urban traffic modelling capabilities to better understand peak demand for fixed infrastructure.
6. Better understanding the role and projected use of the Brooker Highway at both an inter- and intra-regional level.

## additional issues

In addition to the above strategic issues, the following more specific issues were identified by local government during the consultation phase:

### Derwent Valley

- Upgrade of Lyell Highway, including intersection with the Midland Highway.
- Appropriate funding to ensure the Bridgewater Bridge is built to cater for traffic flows for the next 80-100 years.
- Development of a railhead in Derwent Valley to cater for the transport of timber products.

- Brighton**
- Maintaining an extensive regional and local road network serving dispersed urban/industrial settlements.
  - Ensuring land use strategies and development are matched to strategic infrastructure location and function.
  - Midland Highway bypass of Brighton and Pontville.
  - Need for agreed uniform road hierarchy for local roads.
- Glamorgan/ Spring Bay**
- The majority of traffic – including private, freight and tourist vehicles – is focused on the Tasman Highway, making the highway critical for local communities and businesses.
  - No separation or opportunity to separate freight and tourist vehicles on the Tasman Highway.
- Hobart City Council**
- Need to integrate management of certain local roads that have an arterial function, with State roads of similar classification.
- Central Highlands**
- Maintaining an extensive road network with a limited budget.
  - Wear and tear from log trucks - network-wide impacts as well as concerns related to individual roads.
- Tasman**
- Maintaining regional and local road networks.
  - Road funding.
- Southern Midlands**
- Construction of Bagdad-Mangalore-Pontville-Brighton bypass.
- Huon Valley**
- Poor access from Kingston/Channel area to the Huon Highway.
  - Access/egress to and from Hobart via Macquarie Street/ Davey Street.
  - Congestion on the Southern Outlet, including at the roundabout at Kingston on Channel Highway – impedes access and egress to and from the Huon Valley.
  - Heavy vehicles and commuter traffic.
  - Quality of the Huon Highway, Huonville to Dover.
  - Impact of high productivity vehicles on the Huon Highway south of Huonville and on Glen Huon Road (Southwood).

## context

Tasmania's private and commercial transport task is heavily focused on the State's extensive road network, including that of the Southern Region, and a range of options must be considered in optimising the use of this existing network.

In terms of freight, Tasmania has a predominantly intrastate, road-based commercial freight task. The rail network is essentially a bulk goods carrier, and faces some significant infrastructure and financial constraints in its attempts to compete with the road network as a viable freight transport mode.

A predicted increase in the freight task over the medium term is a significant driver in the planning and management of linear transport infrastructure, including strategic transport corridors such as the Brooker Highway, into the future. The relative modal split between road and rail in catering for Tasmania's growing freight task is both a current and future issue.

The Southern Region is highly reliant on the northern ports for the movement of goods to and from the Region. The Brooker Highway is a significant route for the movement of this freight. The Glenorchy municipality, including Derwent Park, is a major centre for warehousing and freight distribution, with freight broken down and re-distributed within the Greater Hobart area. The relationship of the Brooker Highway to regional freight movements and distribution, in terms of linkages to the north of the state and to adjacent industrial areas and local road networks, is key.

## linear infrastructure: overview Tasmania's road network

Roads and road transport are the major conduits through which urban and rural communities in the Region deliver products to market, receive goods and services and access community and commercial services.

Whilst road infrastructure is only one component of a multi-modal transport system - including air, sea and rail - these other modes typically require roads to complete the journey. Consequently, the road network is critical to the economic and social functioning of the community.

Tasmania has approximately 23,000km of improved roads, divided between the following surface types:

- bitumen/concrete: 10,113km;
- gravel/crushed rock: 12,565km; and
- formed only: 200km.

A range of organisations own, plan, maintain or construct roads in Tasmania, including:

- Local government: 14,600km;
- DIER: 3,600km;
- Forestry Tasmania: 3,900km;
- DPIWE: 455km; and
- Hydro: 366km.

As in other jurisdictions, local government owns the majority of the road network, however the highest freight and passenger traffic volumes occur on the State Road network. Nationally, in 2003:

- 83% of roads (672,000 km) were local roads but these roads carried only 24% of total traffic volumes; and
- 87% of all local roads (582,000 km) were rural local roads but these roads carried only 30% of total traffic volumes on local roads.

Specific volumes were not available for Tasmania.

The primary role of the local government network is to facilitate local access needs; for example, to shopping centres, industrial areas and to residential houses. Local roads also include arterial links, which provide connections to strategic transport networks. Examples in the Southern Region include Macquarie and Davey Streets, which provide critical links between the north and south of the Region, and facilitate local access to the central business district of Hobart, and Derwent Park and Lampton Avenues, important access roads for the movement of freight from adjacent industrial areas to the Brooker Highway.

The State Road Network encompasses Tasmania's major state and regional arterial roads and provides key inter-regional connections to major population centres, air and sea ports, and to major industry locations.

The Network includes the 324km AusLink National Network (formerly the National Highway), linking Burnie, Launceston and Hobart via the Bass and Midland Highways; and Launceston to Bell Bay (Port of Launceston and Bell Bay Industrial Estate) via the East Tamar Highway.

## AusLink National Network

In June 2004, the Australian Government released the AusLink White Paper, outlining the final arrangements for development of the AusLink National Land Transport Plan. The Plan centres on a defined AusLink National Land Transport Network of important road and rail infrastructure links and their intermodal connections.

Under AusLink, Tasmania has an expanded national transport network, which includes both road and rail:

- the previous National Highway, i.e. Midland Highway from Hobart (Granton) to Launceston and the Bass Highway from Launceston to Burnie;
- the East Tamar Highway from Launceston to Bell Bay; and
- rail corridors from Hobart to Burnie and Western Junction to Bell Bay (see Map 1).

Two important transport links remain outside the Network:

- Brooker Highway, a major intra- and inter-regional network link for both freight and passengers. The Highway is a major metropolitan arterial road within Greater Hobart, carrying significant passenger and freight traffic. It is a critical link for the transport of freight between Hobart and the northern ports, and links major freight distribution centres in the Glenorchy local government area, with industrial and commercial locations in the Greater Hobart area.

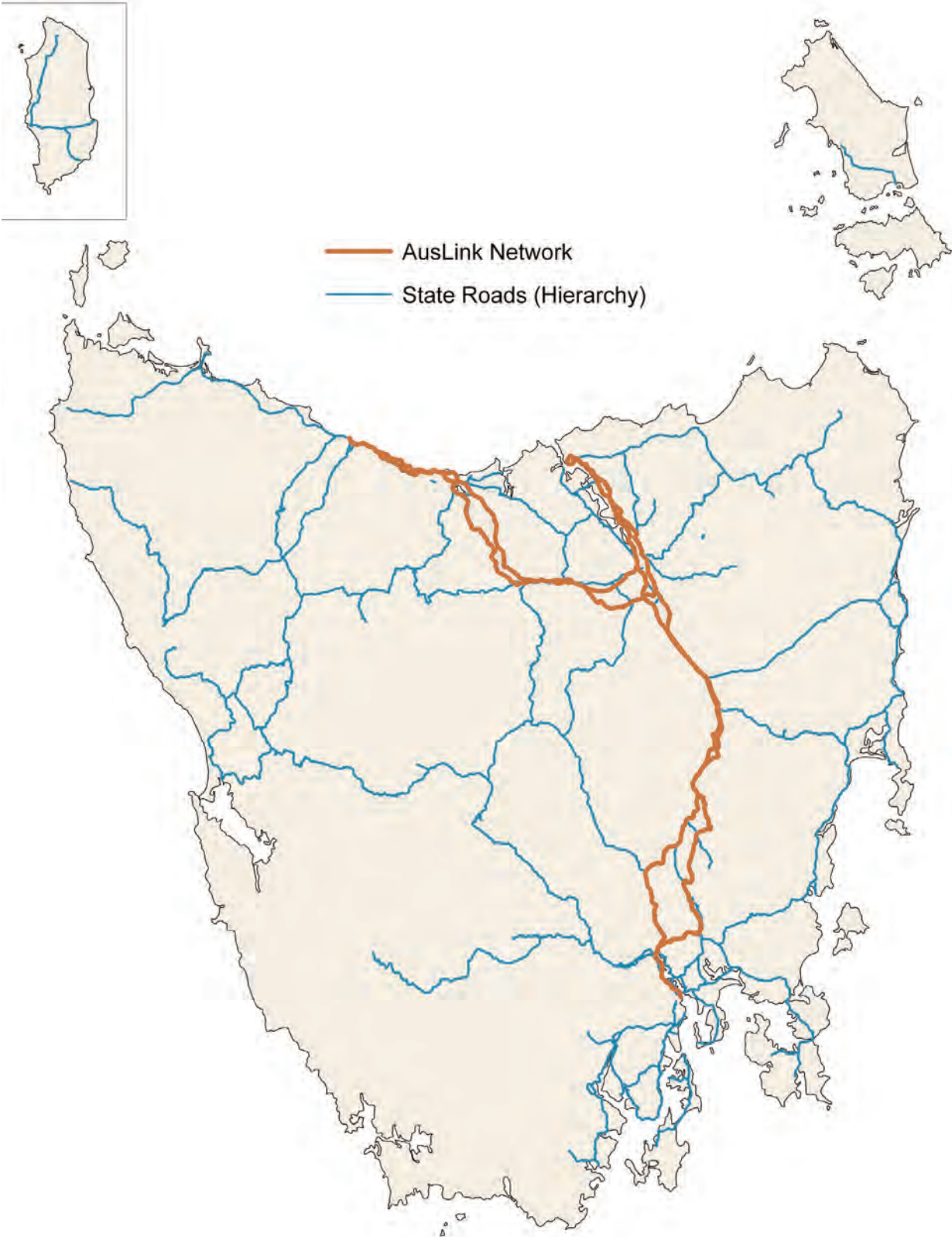
- Tasman Highway, extending from urban Hobart to the Hobart International Airport, Tasmania's major passenger and freight airport. This situation is in contrast to many other Australian centres, which have transport connections to major airports included within the AusLink Network.

## Southern Region road and rail network

The key characteristics of the Region's linear infrastructure network are:

- the AusLink National Network, extending from the Bridgewater Bridge north through the Midlands connecting the Southern Region to major northern cities and towns and to the three major export ports at Launceston, Burnie and Devonport;
- the Brooker Highway, providing critical freight connections between the Southern Region and the National Network, also acting as an important urban arterial and local commuter road;
- Davey and Macquarie Streets, providing the major east-west connections through Hobart;
- three major arterial outlet roads – the Southern Outlet, Tasman Highway (Eastern Outlet), and Brooker Highway - providing transport links through and between the CBD area and major outer urban population centres;
- other significant arterial roads in metropolitan Hobart including the East Derwent Highway (Lindisfarne to Bridgewater) and South Arm Highway (Mornington to South Arm);
- a network of locally significant roads providing inter- and intra-suburb access for residential, commercial and industrial uses, including Main Road and Derwent Park Roads (Glenorchy), Argyle Street (Hobart), Clarence Street (Clarence), and Lewisham and Old Forcett Roads (Sorell);
- a network of High Productivity Vehicle routes, connecting major industrial areas and infrastructure assets, including Tea Tree and Fingerpost Roads;
- State Roads extending in a generally linear fashion along the East Coast from Port Arthur to Bicheno (Tasman and Arthur Highways), Hobart to Cockle Creek (Huon Highway) and in a loop from Hobart to Cygnet (Channel Highway) connecting major towns and providing access to key tourist attractions;
- major inland connectors including the Lake Highway to the Central Highlands; and the Lyell Highway, connecting the Region to the West Coast;
- a series of bridges, including important intra-urban crossings in the Tasman, Bridgewater and Bowen Bridges, and the Sorell Causeway to the south-east. Important sub-regional linkages include the Huonville, Dunalley and New Norfolk bridges.
- the rail network, connecting Hobart Port and Boyer with the north of the State.

map 1. AusLink National Network



## inter-regional connections: AusLink National Network

There are marked differences in the strategic function, linkages and volumes of the National Network in the north and north-west of the State between Launceston and Burnie, compared to the Launceston to Hobart route.

The Launceston to Burnie section:

- connects Tasmania's three major ports;
- connects major cities and towns, including the north-west urban strip, and in this sense performs a local and regional road function; and
- supports significant forestry, light industrial, manufacturing and agriculture sectors, all of which generate high traffic volumes.

As a result, road volumes are significantly higher than on the Midland Highway (**Map 2**):

- Average traffic, Launceston to Burnie, is 8,980 vehicles per day - 60% higher than Hobart to Launceston (5,600 vpd).
- Total travel, Launceston to Burnie, is 1.281 million vehicle-kilometres per day - 31% higher than Hobart to Launceston, which is 0.980 million vehicle km/day (The Hobart-to-Launceston section is 23% longer).
- Growth in traffic volume is currently slightly higher between Launceston and Burnie;
- Average truck traffic, Launceston to Burnie, is 980 trucks per day - 53% higher than Hobart to Launceston (640 trucks/day).
- Total truck travel, Launceston to Burnie, is 0.140 million truck-kilometres per day - 25% higher than Hobart to Launceston which is 0.112 million truck-kilometres per day. (The Hobart to Launceston section is also 23% longer).

## road length

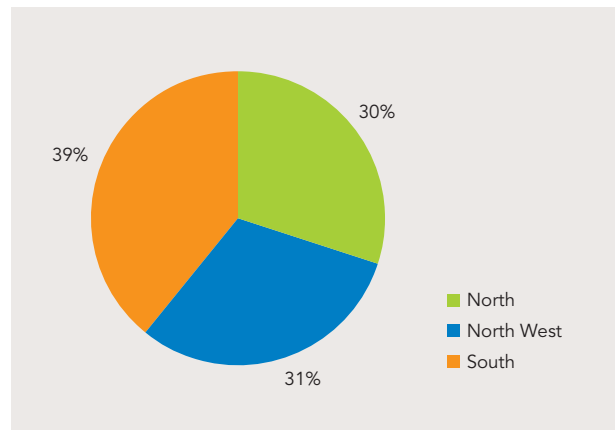
The Region contains 39% of Tasmania's State Road Network by length and 37% of the State's local road network (see **Figure 1**).

The majority of State Roads in the Region are Category 3 (e.g. Goodwood Main Road) or Category 5 (e.g. Nubeena Secondary Road) (see **Figure 2**).

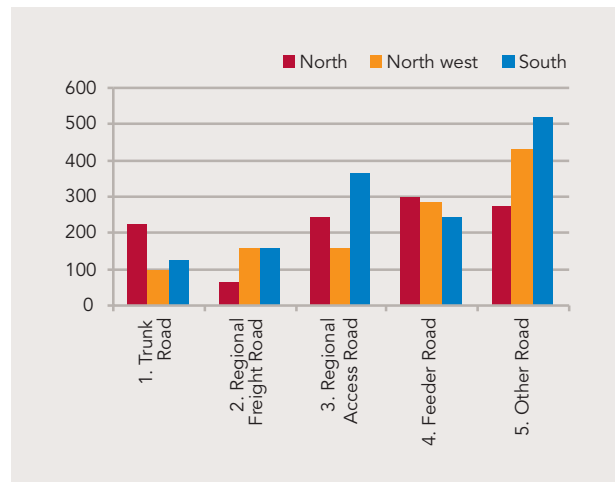
Major State Roads in the Region include the:

- Midland Highway
- Tasman Highway (Eastern Outlet) to Hobart International Airport
- Arthur Highway
- Huon Highway
- Channel Highway
- Lyell Highway
- Lake Highway
- Colebrook Main Road
- Tea Tree and Fingerpost Roads

**figure 1. Tasmanian State Road Network by kilometre by Region**



**figure 2. State Road hierarchy by Region, Tasmania**



**Tables 1 and 2** show state and local road length, by local government area, for the Southern Region. The Region contains:

- 57% of the State's total rural unsealed road network; and
- 22% of the State's total urban sealed road network.

Key observations for individual local government areas are:

- Central Highlands contains the longest State Road Network segment at around 320km, and also has a significant local road network (752km).
- Southern Midlands has the longest local government network at 803km, followed by Huon Valley (757km) and Central Highlands (752km).
- Generally, a high proportion of the local road network within rural LGAs is unsealed. For example:
  - 87% of roads in Central Highlands
  - 78% of roads in Southern Midlands
  - 71% of roads in Tasman.



## map 2. National Network traffic, northern and western versus southern links

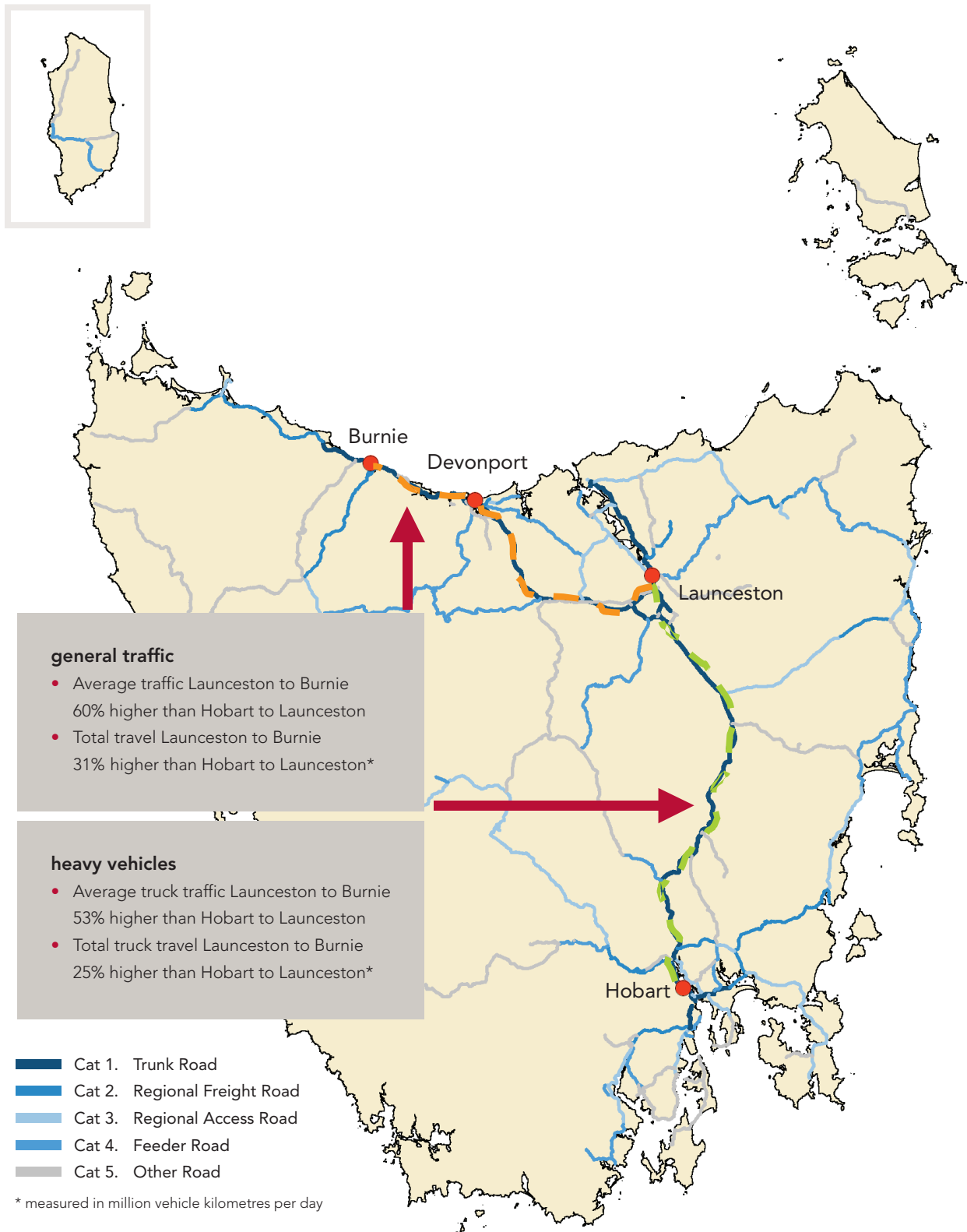


table 1. State Road Network by length, Southern Region LGAs

LGA	1 Trunk Road	2 Regional Freight Road	3 Regional Access Road	4 Feeder Road	5 Other Road	TOTAL
Brighton	8	9.96	9.68	0	10.68	38.32
Central Highlands	0	0	141.47	48.95	127.84	318.26
Clarence	13.1	4.55	33.81	20.95	29.79	102.21
Derwent Valley	1.25	37.74	1.06	22.73	114.55	177.33
Glamorgan/Spring Bay	0	41.66	46.22	80.92	21.89	190.69
Glenorchy	14.26	0	2.74	0	0	17.00
Hobart	10.45	0	1.51	0	0	11.96
Huon Valley	0	10.74	40.67	57.74	52.83	161.98
Kingborough	4.36	14.86	20.56	11.28	87.87	138.93
Sorell	0	18.39	33.06			51.45
Southern Midlands	75.9	18.13	0	3.95	60.72	158.70
Tasman	0	0	36.05	0	12.16	48.21
<b>TOTAL</b>	<b>127.32</b>	<b>156.03</b>	<b>366.83</b>	<b>246.52</b>	<b>518.33</b>	<b>1415.04</b>

table 2. Local Road Network by length, Southern Region LGAs

LGA	urban sealed km	urban unsealed km	rural sealed km	rural unsealed km	total roads km
Brighton	60		58	35	153
Central Highlands	16	2	79	655	752
Clarence	243	4	124	60	430
Derwent Valley	32	4	65	229	330
Glamorgan/Spring Bay	71	16	76	182	345
Glenorchy	240		38	15	293
Hobart	288	9			297
Huon Valley	24	10	134	589	757
Kingborough	111		130	272	513
Sorell	31	41	86	177	335
Southern Midlands	30	13	132	628	803
Tasman	6	2	50	145	203
<b>Total</b>	<b>1,152</b>	<b>101</b>	<b>972</b>	<b>2,987</b>	<b>5,211</b>
<b>% of total roads South</b>	<b>22%</b>	<b>2%</b>	<b>19%</b>	<b>57%</b>	<b>100</b>
<b>Tasmania</b>	<b>2,620</b>	<b>178</b>	<b>4,152</b>	<b>7,071</b>	<b>14,021</b>

## road funding and expenditure

### Australian Government

Under the AusLink National Land Transport Plan, the Australian Government shares financial responsibility for the construction and maintenance of the AusLink National Network with State governments. It also provides funding for State and local roads through programmes such as 'Black Spot.'

#### AusLink

In June 2004, the Australian Government released the AusLink White Paper, outlining the final arrangements for development of the AusLink National Land Transport Plan.

In relation to funding, the White Paper identifies the major components of AusLink as:

- a defined AusLink National Land Transport Network encompassing important road and rail infrastructure links and their intermodal connections;
- the AusLink Investment Programme, outlining the Australian Government's investment priorities for national land transport infrastructure over the next five years;
- new partnership arrangements with the States and Territories, including cost-sharing for some projects;
- Roads to Recovery and Strategic Regional funding programmes to assist local and regional transport improvements; and
- the continuation of the Black Spot Programme.

AusLink channels funding into three core streams: the AusLink National Land Transport Network; Roads to Recovery (including a one-third strategic component) and the Black Spot Programme.

Under the Plan, the Tasmanian Government now shares responsibility for construction and maintenance of the National Network.

Funding is for a five-year rolling programme, renewed annually. In its May 2006 budget, the Australian Government increased its initial national funding commitment of \$12.7 billion to \$15 billion over the first five years - 2004/05 to 2008/09.

Tasmania will receive \$441.7 million under the first five year phase, of which \$194.3 million is directed to major land transport construction projects and the remainder to maintenance, local road upgrades, elimination of crash 'black spots', and research and development.

Despite the inclusion of rail within the Network, no new funds have been allocated for the rail network over the first five-year funding phase.

The Commonwealth Government has made an offer of \$78 million for rail upgrades over the National Network, and will consider a \$3.75 million contribution to the intermodal terminal at the Port of Launceston and up to \$5 million for a

proposed intermodal terminal at Brighton. The offer is conditional on the Tasmanian Government and Pacific National meeting identified undertakings.

In 2006-07, \$77.3 million will be spent in Tasmania, including:

- **Infrastructure projects:** \$26.6 million, including:
  - \$2 million, currently allocated towards building a new Bridgewater Bridge downstream from the existing structure. However, these funds may be re-allocated to the construction and upgrading of the northern approaches to Hobart.
  - \$18 million towards duplication of the last 5.5 km of the Bass Highway between Penguin and Ulverstone.
  - \$5.9 million to maintain the Midland, Bass and East Tamar Highways in good condition.
  - \$60 million to upgrade the East Tamar Highway between Launceston and Bell Bay.
- **AusLink Strategic Regional Programme:** \$12.3 million
- **Roads to Recovery.** \$10 million
- **Black Spot Programme.** \$1.1 million
- **Untied Financial Assistance Grants for local roads.** \$27.3 million

#### AusLink Strategic Regional Programme

The AusLink Strategic Regional Programme targets strategic roads joining individual local government areas. The Programme is designed to assist local governments to develop intra- and inter-regional land transport infrastructure that supports industry, tourism and economic development.

A range of activities is eligible under the Programme:

- construction and maintenance on roads and bridges (excluding AusLink Network);
- construction on rail projects and inter-modal facilities (excluding projects sited directly on the AusLink Network); and
- the application of technology towards improving land transport networks.

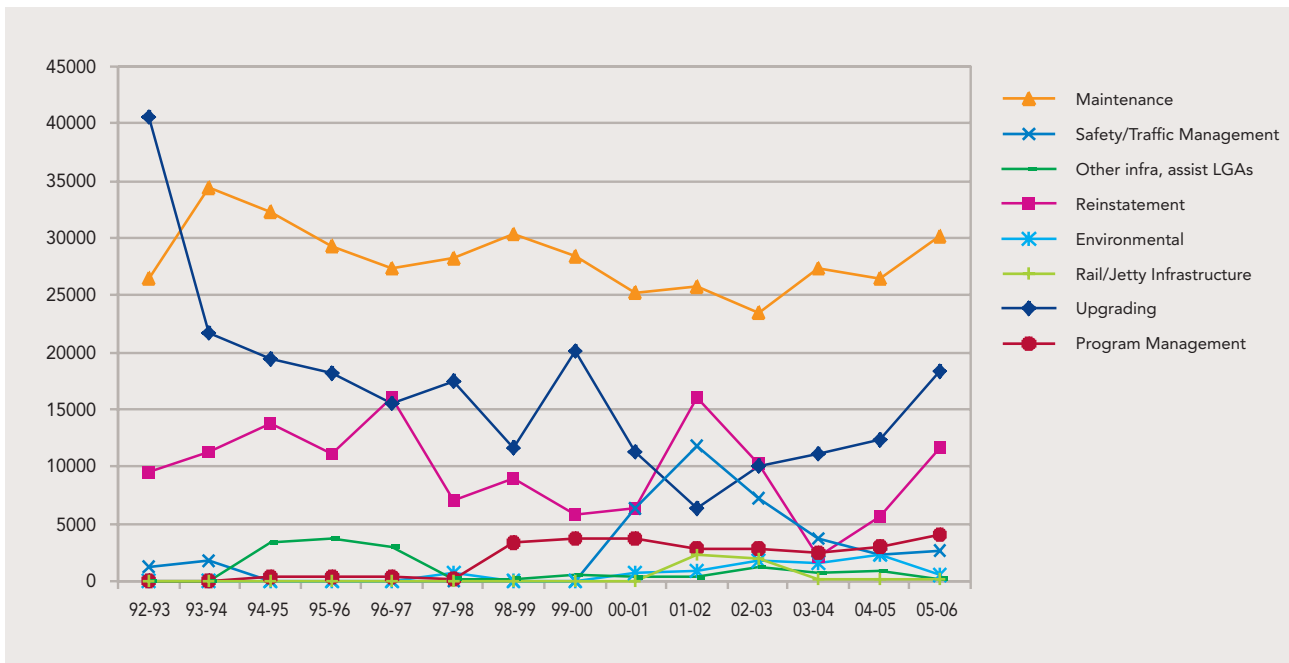
Under the current mix of road ownership in Tasmania, roads fitting the broad Programme criteria are largely owned by the Tasmanian Government, creating a situation where local government is seeking or advocating the expenditure of Programme funds on State-owned assets.

In addition, the total funding pool is small, at around \$127 million nationally.

At the close of applications in May 2006, over 480 applications had been submitted from 274 local governments across Australia, totalling over \$1.9 billion.



figure 3: State road expenditure, 1992/3 - 2005/06



## Tasmanian Government

The Tasmanian Government funds State-classified roads from normal revenues sources. Over the past fifteen years, the State road agency has been largely transformed from a builder of new roads to asset manager of a substantially mature network. Maintenance of an extensive road network now accounts for 62% of the State road budget. Maintenance expenditure has remained consistently above reinstatement and upgrading works for the past decade.

**Figure 3** shows expenditure on State roads and bridges for the year to June 2006.

The Tasmanian Government maintains a five-year forward works programme for the State Road network. The current State Roads Infrastructure Investment Strategy details the main projects to be undertaken in the 2005/06 financial year and projects planned for the five-year forward works programme (i.e. to 2009/10). The Strategy is guided by broad objectives and takes into account key demand drivers, including an increasing freight task.

In its recent budget announcements, the Tasmanian Government indicated infrastructure funding of \$332 million for the development and maintenance of Tasmania's road network over the next 4 years. Strategic projects in the Southern Region over 2006/07 include:

- \$2 million to support planning for improvements to the northern approaches to Hobart.
- \$3.7 million to replace Maclaines Bridge, Triabunna.
- \$500 000 to protect the corridor for the future Kingston Bypass project together with essential planning activities.

- \$500 000 for planning for improvements to the Brooker Highway.
- \$500 000 for planning for an upgrade, including a number of junctions, along the South Arm Road from the Shoreline Roundabout to the Police Academy.
- \$200 000 for planning for traffic management solutions to traffic flow from the Southern Outlet and along Macquarie Street.
- \$200 000 for planning for traffic management in Sorell and junctions along the Tasman and Arthur Highways.
- \$200 000 for planning for the installation of traffic lights at the Mornington Roundabout.
- \$1 million to commence a programme of shoulder widening and sealing, installation of overtaking lanes and re-alignment on the Lyell Highway from Granton to New Norfolk (total project cost of \$14 million over 4 years).

## Local government

Local government funds road works from a variety of sources, including:

- its own rates, fees, fines and charges;
- Commonwealth tied and untied grants (including AusLink);
- State Government grants (including a share of heavy vehicle registration fees); and
- borrowings.

## strategic planning

### AusLink National Network Corridor Strategy

The State's role in AusLink is subject to the terms of a joint Commonwealth-State Bilateral Agreement, signed in October 2005. Under this Agreement, the Tasmanian Government is required to undertake a Corridor Strategy, which is intended to set strategic directions and priorities for the AusLink National Network over the next two decades.

A total of twenty five corridors have been identified nationally as part of the AusLink National Network, and each jurisdiction, in cooperation with the Commonwealth, is responsible for undertaking a similar Strategy for each corridor.

Under the Strategy, the Tasmanian Corridor is specified as Hobart to Melbourne via the three northern ports.

The objectives of the Strategy will be to examine:

- Transport projections, the condition and capacity of infrastructure, and land use plans along the corridor;
- The relationship between the National Network and its connections to the broader transport system; and
- A broad range of options for future transport needs, including those that might defer or limit the need to expand the physical capacity of the network.

Among other issues, the Strategy will consider:

- Current and likely future role of the corridor;
- Demand drivers and trends affecting the corridor, including movement of passengers and freight;
- Existing configuration, condition and capacity of the corridor, including an analysis of any deficiencies;
- Freight movement through intermodal hubs, and upstream/downstream relationships;
- Future scenarios for development of the corridor;
- Likely impact of changes in future demand;
- Existing plans, policies and strategies that affect the corridor;
- Key local, regional and national issues;
- Stakeholder concerns; and
- Options for improving the performance of the corridor.

Although sea transport is not specifically incorporated in the AusLink framework, intermodal freight movements are a key focus. As such, the importance of sea freight to Tasmania and the connections of road and rail routes to port infrastructure will be addressed in the Strategy.

Development of the Strategy will commence in August 2006, and is due for completion by January 2007. The Strategy will be submitted to both the Tasmanian and Commonwealth Governments for approval.

The Strategy will provide a means of benchmarking the performance of transport infrastructure in the State, which will play a role in the assessment of future funding proposals.

### Tasmanian State Road hierarchy

Tasmania's State Road network is strategically planned via a road hierarchy system. The road hierarchy applies to State Roads only and consists of five categories, in decreasing order of priority from Category 1 (Trunk Roads) to Category 5 (Other Roads) (**map 3**).

The Tasmanian State Road Hierarchy reflects the function of individual roads within the network. It provides direction for future planning and assists with ongoing transport system management by ensuring that the planned function and use of roads is clarified across the whole of the network. Specific benefits of this approach include:

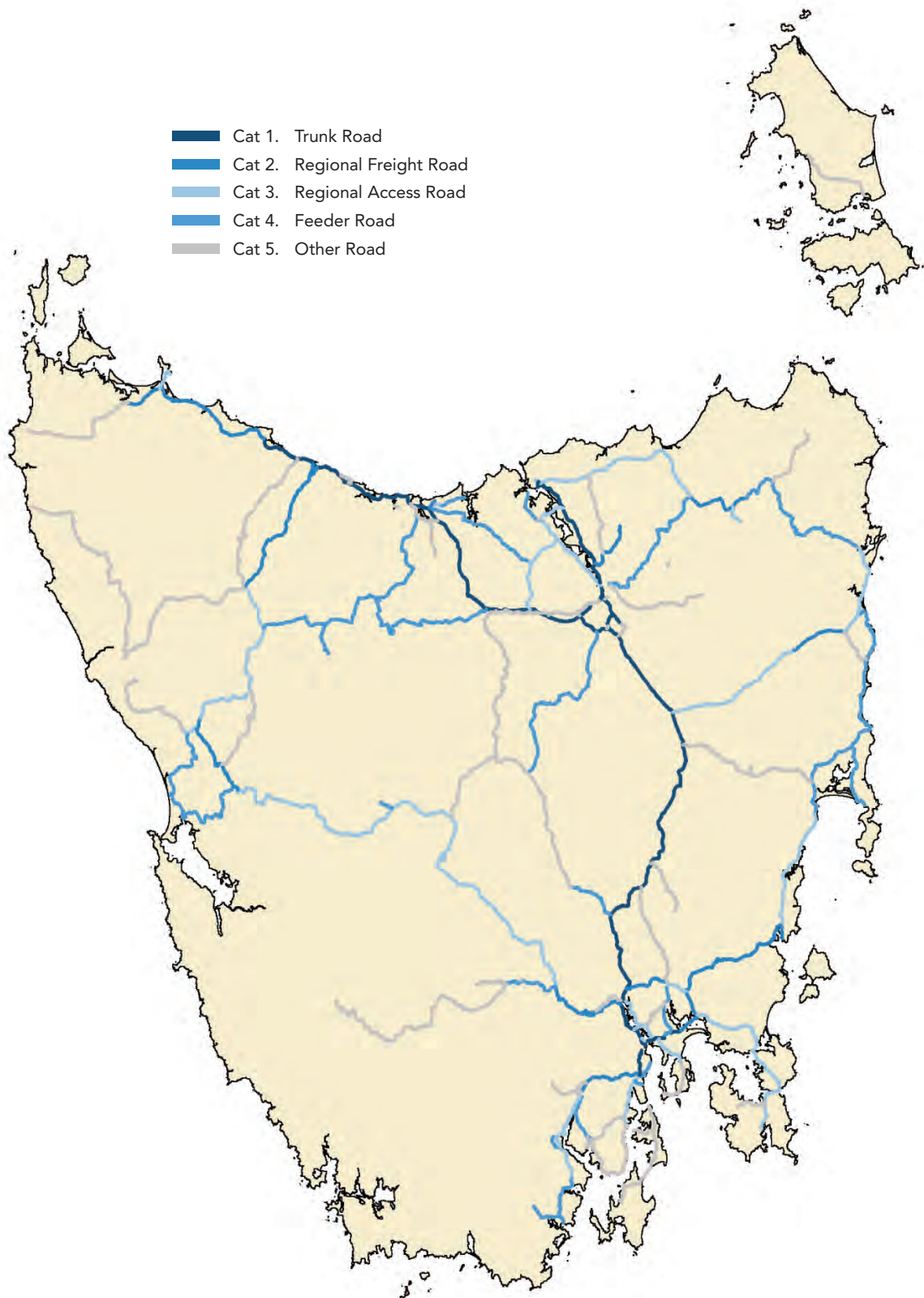
- **Through traffic:** decreasing through traffic in residential streets;
- **Road safety:** reducing the risk of crashes on major routes by minimising the number of access points and therefore potential usage conflicts
- **Right activity in right location:** locating commercial activities in areas where street networks cater for pedestrian and vehicular access
- **Strategic investment:** increasing the rate of return from investment by concentrating on corridors that provide the greatest community benefit
- **Road design:** ensuring road design is directly related to planned use and function.

The State Road Hierarchy is based on:

- Measured use, for example, road count data and data gathered by surveys;
- Current and planned function, for example, the role in connecting towns, cities, ports and airports;
- Trends, for example, projected growth of population centres and changes in road counts over time; and
- Strategy, for example, choosing the preferred route between roads that duplicate each other.

Road categories reflect their usage by passenger vehicles, road freight transport and value in supporting cities, towns, business and tourism.

### map 3. Tasmania's State Road hierarchy



### Category 1 Trunk Roads

Trunk Roads encompass Tasmania's major highways, linking the largest population centres; major sea and air ports; and major industrial locations. The roads carry large numbers of heavy freight and passenger vehicles, and perform a critical role in supporting existing and future economic development.

Trunk Roads facilitate:

- Inter-regional freight movement
- Inter-regional passenger vehicle movement; and
- Business interaction.

### Category 2 Regional Freight Roads

Regional Freight Roads link major production catchments to Trunk Roads; for example, the Huon and Derwent Valleys to the Midland Highway. They carry a large number of both heavy freight and passenger vehicles and, together with Regional Access Roads, provide safe and efficient access to Tasmania's regions.

Regional Freight Roads facilitate:

- Heavy inter-regional and sub-regional heavy freight movement;
- Passenger vehicle movement;
- Commercial interaction; and
- Tourist movement.

Where alternative routes of a lower classification exist, Regional Freight Roads are the Tasmanian Government's preferred heavy vehicle routes.

### Category 3 Regional Access Roads

Regional Access Roads are of strategic importance to regional and local communities and economies, linking important towns to Category 1 and 2 roads. While heavy freight vehicles use these roads, the level of use is less than that of Regional Freight Roads. Together with Regional Freight Roads, Regional Access Roads provide safe and efficient access to Tasmania's regions.

Regional Access Roads facilitate:

- Connecting smaller regional resource bases with trunk and regional freight roads;
- Local commercial interaction;
- Sub-regional freight movement and inter-regional freight movement by connecting with trunk and regional freight roads;
- Sub-regional passenger vehicle movement and connection to trunk and regional freight roads; and
- Sub-regional tourist movement and connection to trunk and regional freight.

### Category 4 Feeder Roads

Feeder Roads provide safe passenger and tourist vehicle movements within the regions of Tasmania. Where the main road servicing the town is a State Road, Feeder Roads connect towns of 1,000 or more people to Trunk, Regional Freight and Regional Access Roads.

While some of these roads currently carry heavy freight traffic, they duplicate existing trunk, regional freight or regional access roads and are not the Tasmanian Government's strategically preferred heavy vehicle routes.

Feeder Roads facilitate connection to Trunk, Regional Freight and Regional Access roads for:

- Local commercial interaction;
- Local freight movement
- Smaller regional resource bases;
- Local passenger vehicle movement;
- Tourists and major tourist destinations.

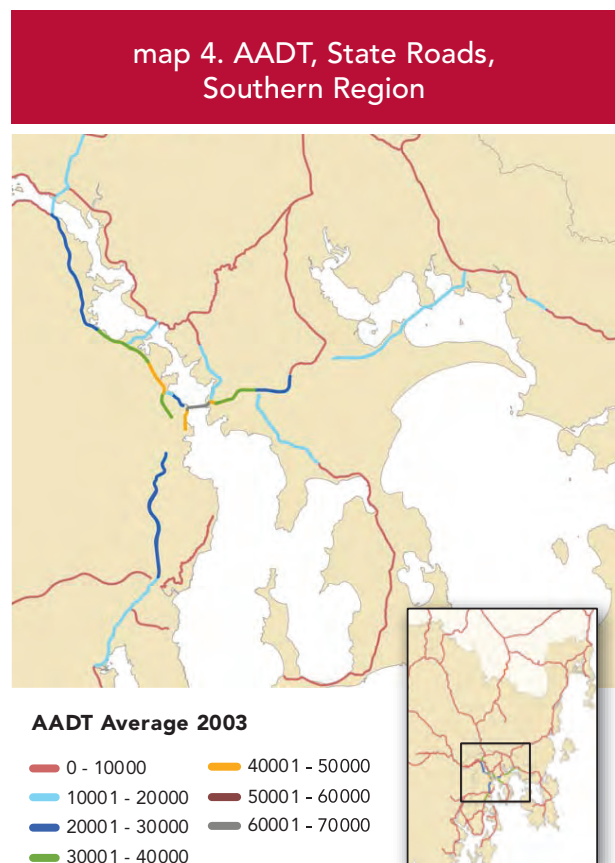
### Other Roads

Other Roads primarily provide access to individual properties. Some may be used for comparatively low frequency, heavy freight vehicle transport, for example:

- log transport but are not the most important log transport roads, and usage levels fluctuate; and
- farm property access purposes such as deliveries of fuel and supplies, for stock transport, for crop delivery and milk pick-up.

While a few of these roads may currently carry larger numbers of heavy freight vehicles, they may duplicate existing Trunk, Regional Freight or Regional Access Roads and are not the Tasmanian Government's strategically preferred heavy freight vehicle routes.

**Map 4.** Shows estimated Annual Average Daily Traffic (AADT) for the Southern Region and Greater Hobart.



## access management

There is a fundamental relationship between the classification of roads within the State Road Hierarchy and levels of property access. It is important to:

- ensure that arterial roads are able to serve their purpose as transport corridors and do not have their strategic role undermined by inappropriate access or development;
- ensure that development and access do not compromise the movement and free flow of traffic or the safe use of roads by others; and
- minimise amenity conflicts between road use and the use of adjoining land.

Vehicles turning into and out of accesses and junctions add to the traffic on an arterial road; can reduce speeds and add to the number of turning movements within otherwise free-flowing traffic.

The proper and safe location of accesses, including an overall reduction in their number, assists road users and landowners by reducing conflict points, traffic congestion and delays and supports safer and more efficient flow of traffic along major roads.

Access management aims to reduce vehicle conflict by controlling the number of accesses onto a road. It focuses on:

- the number of access points;
- ensures adequate visibility to and from accesses and junctions;
- limit the number of accesses and effect proper spacing between junctions;
- maintains major road safety and efficiency; and
- protects the community's investment in the arterial road network.

Approaches to access management include:

- **Planning schemes:** May impose controls, exercised leniently or stringently. There is doubt, however, whether without specific legislation this property right can be extinguished, although control over developments requiring access to a major road is legitimate.
- **Statutory provisions:** Under the Roads and Jetties Act 1935, State Roads can be proclaimed 'limited access roads.' Financial compensation may be given, or existing accesses can be licensed and continue to be used as before – the only change is that the State controls the location and use of any future access.
- **Engineering solutions:** Construction of a central median or a parallel service road.
- **Traffic management:** Turn bans, one-way streets, etc.
- **Title deeds:** can include covenants restricting access along major roads.

## road and rail asset schedule

DIER has developed a Road and Rail Asset Schedule to guide land use and development in relation to the road and rail corridor. The Schedule is designed for inclusion in, and to integrate with, local government planning schemes. It has a number of objectives:

- **Protect the integrity of road infrastructure.** New accesses, road junctions and intensified traffic movements to and from adjoining land reduce the function of major roads and diminishes the value of community investment. Ribbon development along arterial roads may lead to changes in speed limits, reduced travel times and less safe driving conditions, altering the nature of the highway from a high-speed arterial road to an access street. The Schedule aims to maintain the role of Category I-III roads by encouraging access to roads in towns and low speed areas; and restricting access along rural arterial road networks.
- **Road safety.** The number, location, design and layout of driveway accesses and road junctions along arterial roads can produce unexpected driving events that may increase the incidence of accidents. Generally, studies show that each additional house access along an arterial road adds 1-1.5% to the accident rate and each commercial access per kilometre can add 5-10% to the accident rate. The Schedule aims to optimise safety in a variety of ways, by:
  - incorporating visibility standards and the location of junctions and accesses;
  - limiting direct access to rural arterial roads;
  - recognising that some existing junctions to roads are deficient; and
  - requiring a Traffic Impact Assessment so that safety issues are professionally analysed.
- **Reducing amenity conflicts.** A key objective of the Schedule is to ensure that buildings adjoining major roads and rail lines are located, sited and designed to minimise the potential for environmental harm to be received from traffic.
- **Ensuring consistency between planning schemes.** It is important that major arterial road and rail lines are dealt with in a consistent manner in local government planning schemes. The Road Schedule includes provision for the preparation of Traffic Impact Assessments for development applications affecting the State Road network.



## freight movement

### high productivity vehicles

A transport system that supports safe, reliable, efficient and cost-effective freight connections between major transport assets, industrial and intermodal areas, requires a road network with a strong movement function, minimal property access and consistent and high operating speeds. High Productivity Vehicles (HPVs) are designed for specific tasks and are capable of carrying higher payloads. Examples include B-Doubles and truck and trailer combinations.

The use of HPVs can generate significant economic and safety benefits:

- a 25m B-Double can carry half as much again as a 19m semi-trailer, providing a more efficient form of transport and enabling the number of freight vehicles on Tasmanian roads to be reduced;
- a potential reduction in the number of freight vehicles on Tasmanian roads can reduce the chances of accidents involving heavy vehicles; and
- more efficient freight journeys have the potential to reduce the transport costs of Tasmanian industries and producers, contributing to improved competitiveness in the marketplace.

In addition, the evolution of heavy vehicle technology creates further benefits:

- the newer technology of B-Doubles, including safety features such as ABS braking, spray suppression to reduce wheel spray in wet weather and more powerful prime movers, means vehicles are better able to maintain their place in traffic;
- where air suspension and/or central tyre inflation systems are fitted, HPVs may cause less road damage; and
- new tracking and cornering technology may make HPVs equivalent to or better than standard semi-trailers.

Consistent with national transport policy, Tasmania has adopted the HPV network concept within State legislation to make the most efficient use of the existing road network infrastructure. Tasmania's HPV network is shown in **Map 5**.

Other sections of Tasmania's road network are not built to a standard that can accommodate larger vehicles, others are not designed to cater for HPVs. HPVs can also be detrimental to bridges in the span range 10-15m. Consequently, there is a need to regulate the access of HPVs to Tasmanian roads in order to:

- ensure a reasonable level of safety for all road users;
- promote the free flow of traffic;
- prevent undue wear to the road infrastructure and associated assets;
- prevent the creation of multiple parallel routes; and
- ensure minimum impact on the amenity and environment of areas adjacent to the routes.

### map 5. Tasmania's HPV network



### performance-based standards (PBS)

While prescriptive regulations currently govern what a vehicle should look like, PBS will prescribe a dynamic performance outcome, subject to meeting predetermined safety and environmental conditions.

PBS governs several factors regarding the vehicle's capabilities: how the truck performs on the road, including vehicle stability and the risk of rollover; the ability to turn in traffic within a safe 'envelope' and manage 'tail swing'; and measures to protect roads and bridges from excessive 'wear and tear'. Four levels of performance standard (L1-4) will ensure the vehicle is matched to the right road network.

The National Transport Commission (NTC) has proposed the use of PBS in accordance with established criteria that improve vehicle productivity whilst ensuring heavy vehicle compatibility, safe road operations and appropriate maintenance of road infrastructure.

PBS consists of three main sections:

- Standards and Measures for the performance of vehicles;
- a regulatory framework that will provide for legal application of PBS on a national basis; and
- Technical Guidelines to ensure the consistent assessment of vehicles and route networks.

The NTC has approved interim Standards and Measures for the dynamic performance of vehicles. Interim Road Classification Guidelines have also been produced for use by road authorities for the development and assessment of the PBS Route Classification Networks.



## heavy vehicle road pricing

Heavy vehicles are charged for road use, with these charges set at a national level through the National Transport Commission, a forum of Commonwealth and State heads of government. The charges apply to all vehicles over 4.5 tonnes and comprise two parts:

- motor tax attached to payment of registration fees to the states; and
- diesel fuel surcharge payable to the Commonwealth.

Heavy vehicle charges are calculated by assessing the annual level of government road construction and maintenance expenditure relevant to heavy vehicles and their use. This allocated cost is charged to individual heavy vehicle types by combination of a fuel charge in cents per litre (via the fuel excise) and by annual registration charges. The process is intended to recover, in retrospect, the appropriate share of funds already expended.

Pricing is reviewed periodically through 'Road Pricing Determinations.' There have been two Determinations made to date.

Since the Second Heavy Vehicle Road Pricing Determination in 2000, there have been significant changes in the pattern and amount of road expenditure, and changes in the use of roads by Australia's heavy vehicles.

Future options for charging heavy vehicles for their road use are under consideration.

## local roads and heavy vehicles

The State Road network carries the most freight by mass, however the use of local roads by heavy vehicles is an issue for many Tasmanian local governments. Major industries such as forestry, source and move products from rural and remote areas over local government roads not necessarily designed to cater for heavy vehicles.

Heavy vehicles with a high volume freight task have a greater impact on road condition than smaller passenger or light commercial vehicles. This impact has implications for current and future sustainable road maintenance funding. The issue is compounded by Tasmania's:

- Extensive road network, which facilitates route choice over a variety of roads, many inappropriately constructed to withstand the impacts of heavy vehicles.
- Ageing road and rail network, which is at a point in its lifecycle where major intervention is required.
- Increased use of high efficiency (higher mass) vehicles across a large part of the State's road network.

## rail

The Tasmanian rail network consists of 629km of operational track, connecting major ports, cities and processing industries. Tasmania's rail network carries freight only. Regular passenger services ceased in 1978.

While all levels of government have invested heavily in Tasmania's road network, particularly the AusLink National Network, rail has received limited attention and has been largely viewed as a private sector concern. While under Commonwealth ownership, rail modal share was guaranteed under regulation. This resulted in a disincentive to invest in a productive and efficient infrastructure network. As a result of this historic under-investment, Tasmania's rail network faces significant infrastructure and rolling stock constraints.

Nevertheless, while rail accounts for around six percent of Tasmania's 60 million tonne freight task, it carries around 44 per cent of the State's freight task in net tonne kilometres, and an estimated one third of total contestable freight. It is an essential mode for the movement of bulk commodities, including mineral products from the west coast; in intra-port connectivity; and as an alternative transport mode supporting competitive transport options for industry.

Tasmania's rail network faces some significant constraints:

- **Configuration.** Reflecting topographical constraints and previous construction techniques, the current rail alignment includes steep gradients and tight curves, which limit train speeds and axle loads. Low speeds are of particular concern given comparative speeds on the road network may be as high as 110 km/h.
- **Short distance.** The average haul distance for freight on Tasmania's rail network is 167 km.
- **Slow turnaround time.** Trains are currently unable to achieve a 12-hour turnaround between Hobart and the northern ports (particularly Burnie).
- **Narrow rail gauge.** Restricts rolling stock capabilities, speed and load height, and limits available markets from which second-hand equipment can be obtained.
- **Duplication by road.** The Tasmanian rail network is almost entirely duplicated by the road network, meaning it has no unique markets or geographic advantage in serving its markets.

The rail network has not been the responsibility of the Tasmanian Government since 1978, when ownership of the network was transferred to the Commonwealth Government. In 1997, the Commonwealth Government privatised Tasmania's rail system with ownership of the network transferred to the private company, Australian Transport Network (ATN), and to Pacific National (PN) in 2004, after it acquired ATN.

In September 2005, PNT advised the Tasmanian Government that it would close down the intermodal service between Hobart and Launceston unless government financial support was forthcoming. Under a Memorandum of Understanding between PN and the Tasmanian Government signed in August 2006, the Tasmanian Government is set to become the owner of the rail track network, excluding the West Coast line.

Under the proposed Rail Rescue package, the Australian and Tasmanian Governments have offered \$118 million over ten years for capital investment and infrastructure maintenance, including \$78 million for capital investment over ten years from the Australian Government and \$4 million annually for routine track maintenance from the Tasmanian Government. These commitments are subject to PNT investing at least \$38 million over eight years on improved rolling stock.

The Commonwealth Government has indicated it is also prepared to consider a \$3.75 million contribution toward expansion of the intermodal terminal at Bell Bay, and up to \$5 million toward a possible intermodal terminal at Brighton.

Despite the inclusion of rail within the AusLink Network, no new funds have been allocated for the rail network over the first five-year funding phase.

### **competitive neutrality: road and rail**

The primary objective of government investment in freight transport infrastructure is to establish a framework that provides for productivity and efficiency improvements and enables Tasmanian industry to be more competitive by reducing the cost of transport. Its role is not to increase the profitability or market share of any particular transport business.

Over the past five decades, all governments have tended to focus on the development of new road infrastructure, with the level of road investment significantly outweighing investment in rail across all States.

In Tasmania, rail competes primarily with road - and to a lesser extent, coastal shipping - for a share of the freight transport market.

The State's rail system, currently in private ownership, has not been the responsibility of the Tasmanian Government for over 25 years. Rail infrastructure has not attracted any significant investment, is generally in poor condition and has been eclipsed in operational efficiency and innovation by the road freight industry. Throughout Australia, efficiency improvements in the road freight industry have outstripped those in the rail industry, and have included increased mass limits, innovative vehicle configurations and liberal access regimes. Given its dual role in supporting private passenger transport, investment in road infrastructure has attracted significant funds from all levels of government.

As the primary transport modes for the movement of interstate freight in Australia, there is much discussion at a national level concerning the relative function of road and rail transport in the commercial freight task; including whether each has a 'competitive advantage' in terms of regulation, planning or funding.

At a broad level, there are inherent differences between the two modes:

- rail is essentially a point-to-point goods carrier;
- road infrastructure is more extensive - reflecting its dual role in meeting private travel needs;
- road transport tends to be more flexible and dynamic in terms of technology and design, allowing heavy vehicles to capture efficiency gains over shorter time periods compared to rail; and
- road infrastructure has remained in public ownership and is public funded.

Many issues surrounding competitive neutrality in Tasmania are the result of Commonwealth Government programmes; principally the focus on investment in the old National Highway (now the AusLink National Network) to improve the productivity and efficiency of road freight. The incorporation of the strategic rail network in the new AusLink National Network should improve strategic planning approaches and facilitate enhanced consideration of the function of the rail network in moving the freight task.

The Tasmanian Government is committed to the principles of competitive neutrality and is seeking to clearly understand how this should practically apply to rail and road funding. Consistent pricing of and investments between road and rail infrastructure has the potential to optimise system-wide transport efficiencies. As noted elsewhere, the Productivity Commission is inquiring into these matters and is due to report in December 2006.

### **road versus rail: costs**

In comparing the relative positions of road and rail, there is an increasing focus on the external costs of each mode and how these costs are borne. The externalities of transport include noise, air pollution and safety. These costs are real and are borne directly or indirectly by third parties, but have generally not been considered in pricing regimes to date.

Whilst external costs are more difficult to assess than direct operational costs, well-established Australian and international methodologies and data exist to assist in the estimation process.

Generally, Australian studies examining the relative external costs of road and rail have tended to find significantly lower external costs associated with rail transport compared to road.

## increasing freight task<sup>1</sup>

The freight transport task consists of the principal movement of goods, together with associated movements including packaging, return of empty vehicles and wagons, relocation of empty containers, movement of equipment for maintenance and repair, and transport related to recycling and waste disposal.

Improved transport capabilities and efficiency levels are both a driver and facilitator of economic growth. Historically, transport activity has grown about 30% faster than overall economic growth.

Freight transport is forecast to increase significantly in Australia over the next 15 years, with an expected doubling in the national freight task by 2020. Factors supporting this growth include population growth and a general increase in economic activity (in Australia and internationally), as well as changes in the nature of manufacturing and distribution:

- The scale economies of goods processing, manufacture and transport continue to favour smaller numbers of larger production and processing plants, with distribution from these plants to wider markets. The result of this concentration of production and wider dispersal of output is more transport activity.
- At the demand/consumption end of the transport chain, demand is becoming increasingly diverse and individualised, with many manufactures and producers subdividing and targeting increasingly smaller market segments. Achieving economies of manufacturing scale relies on efficient transportation to move finely targeted production to specific consumers of interest. Increased product diversification servicing the same basic markets highlights this trend. Twenty years ago, supermarkets typically contained two or three styles of milk, across two or three package sizes. Most supermarkets now contain upwards of 40 brand or milk formulation combinations, with pack sizes ranging from 250 ml to 4 litres. This principle applies across the range, with a large supermarket now stocking 50,000 – 60,000 lines, compared to less than a quarter of that number only ten years ago.

Freight transport forecasts for Tasmania indicate even higher growth and reflect the following trends:

- Higher economic and industrial growth.
- Increasing dispersion of forestry activity associated with plantation timber.
- A continued shift in activity toward the northern ports.
- Changing nature of freight movements throughout the State.
- Trends by larger companies away from long-term, onsite warehousing and storage to more frequent, 'just in time' deliveries.

Tasmania's total and average vehicle freight loads and average tonne kilometres are increasing. Between 1998 and 2003, the following key trends were evident:

- Tasmania's **total freight load** increased by 33%.
- **Average tonne kilometres** increased at about 6.3% per year, with a 69% and 105% increase in light commercial and rigid vehicle tonne kilometres respectively.
- **Average load carried** per trip increased markedly, with a 6.4% per annum increase for light commercial vehicles to 0.35 tonnes (Australian average 0.40 tonnes); 5.6% per annum increase for rigid trucks to 7.2 tonnes (Australian average 5.7 tonnes); and 1.3% increase for articulated vehicles to 23.9 tonnes (Australian average 24.7 tonnes).

### what does an increasing freight task mean?

Road and rail infrastructure is fixed, expensive to provide and maintain and tends to be long lived. Tasmania has an extensive road network, which supports the movement and distribution of rural and urban goods to local and regional markets, and to export locations. Whilst there are opportunities for further improvements in relation to intermodal linkages and the upgrade of some specific network components, generally, maintaining efficiency in the context of an increasing freight task will focus less on the provision of new infrastructure than mechanisms that maximise the use of existing infrastructure.

In its review of Australia's increasing freight task, SKM and Meyrick and Associates identified a range of key areas and measures to generate improvements in freight efficiency (see Table 3). The measures apply to a range of situations and jurisdictions, from urban freight distribution in highly congested cities such as Sydney and Melbourne to the long-distance movement of freight by road and rail along the Perth-Melbourne corridor. Not all will apply or be relevant to Tasmania, but there may be measures with the potential to generate freight efficiency gains in Tasmania.

<sup>1</sup>This section is based substantially on information and analysis contained in SKM and Meyrick and Associates, 2006, *Twice the Task: A review of Australia's freight transport task*

### table 3. approaches and measures to improve freight efficiency

Summarised from *Twice the Task: A review of Australia's freight transport task.*

<b>Improve transport safety</b>	<ul style="list-style-type: none"> <li>Define and assess measures that could improve transport industry occupational health and safety performance for drivers. This includes measures to reduce fatigue and, in turn, improve driver retention within the industry.</li> </ul>
<b>Optimise use of transport modes</b>	<p><i>Rail encouragement</i></p> <ul style="list-style-type: none"> <li>Align rail regulations across all track jurisdictions and owners, aiming for a single regulator. Standards for communication and signalling may have significant opportunities.</li> <li>Assess whether we want a robust rail system. If so, review rail track conditions nationwide in light of clearly stated concerns about major deterioration in WA, SA, Vic and NSW interstate networks. Assess need and justification for government investment in track.</li> </ul> <hr/> <p><i>Road and rail intermodal</i></p> <ul style="list-style-type: none"> <li>Research circumstances in which intermodal terminals are successful.</li> </ul>
<b>Enhance vehicle capacity and productivity</b>	<p><i>Performance based standards for vehicles</i></p> <ul style="list-style-type: none"> <li>Actively progress implementation of enhanced PBS and innovative vehicle design approaches. Aim for a single point for approval, with mutual recognition if necessary. We suggest that to improve accessibility to a PBS scheme there be consideration of a research fund to support such industry development. Such a scheme would need to consider intellectual property issues given the desire for replication and should include both the technical issues relating to assessment of vehicle design, but also the social issues of ensuring broad community support for the initiative.</li> </ul> <hr/> <p><i>Time and location specific permits with IAP</i></p> <ul style="list-style-type: none"> <li>Promote specific permit conditions to improve system capacity and/or increase vehicle utilisation, such as specific time of day / day of week and specific routes. The Intelligent Access Project could be a vehicle to monitor operations.</li> </ul> <hr/> <p><i>Truck mass limits and infrastructure design</i></p> <ul style="list-style-type: none"> <li>Work towards consistent higher mass limits for trucks throughout Australia, particularly on interstate highways, major urban freeways and arterials with connections to freight hubs and distribution terminal areas. The provision of improved road capacity and new infrastructure links is one of the consequential costs of such measure.</li> <li>Improve road design and management to better suit trucks and road capacity. (This could include pavement and bridge strength, signal sequencing and speed camera placement).</li> </ul>
<b>Improved use of existing infrastructure</b>	<p><i>Infrastructure pricing mechanisms</i></p> <ul style="list-style-type: none"> <li>Implement direct user charging by infrastructure provider, including optional charging for higher limits where infrastructure can support. Aim to remove standard mass limits.</li> </ul> <hr/> <p><i>Passengers, light vehicles and freight</i></p> <ul style="list-style-type: none"> <li>Assess the real contribution of freight to congestion with the aim of adopting improved prioritisation for freight and passenger needs. This will assist awareness about use of road systems by private cars and in assessing the extent of congestion caused by light vehicles. This in turn will address opportunities for improved public transport, car pooling and other car travel minimisation strategies.</li> </ul>
<b>Enhance use of market structures</b>	<ul style="list-style-type: none"> <li>Review the applicability of national competition / ACCC policies to supply chain collaboration processes.</li> <li>Review opportunities from competition, market regulatory or other relevant policies to achieve sustainable, economically efficient rail market structure.</li> </ul>
<b>Secure a skilled labour force</b>	<ul style="list-style-type: none"> <li>Encourage the use of existing exemptions for heavy vehicle progressive licensing and minimum age requirements, to reduce licensing difficulties for drivers.</li> </ul>

table 3. approaches and measures to improve freight efficiency

<b>Develop selected new infrastructure</b>	<p><i>Rail</i></p> <ul style="list-style-type: none"> <li>• Invest in urban rail infrastructure to improve existing bottlenecks and noise performance, and thus facilitating better utilisation. This should include assessing benefits from freight-only infrastructure and under-grounding rail lines.</li> <li>• Determine optimal rail design standards to achieve increased productivity, eg increased axle load limits, greater clearance and loading gauges, improved signalling and communication to increase track capacity, etc.</li> </ul> <hr/> <p><i>Road</i></p> <ul style="list-style-type: none"> <li>• Implement road design standards aimed to minimise the generalised transport cost, not simply to minimise cost of road supply. Consider additional capacity for improved truck size, mass and operational practices, including assessment of specific freight use infrastructure, environmental and safety benefits.</li> </ul>
<b>Integrate transport system planning</b>	<p><i>Policy bodies</i></p> <ul style="list-style-type: none"> <li>• Establish an overall national transport planning body, charged with developing a national transport plan, to be agreed at COAG level considering issues pertaining to Federal, State and local government.</li> </ul>
<b>Data</b>	<ul style="list-style-type: none"> <li>• Establish means and resources to collect essential transport and supply chain data, including time series impact analysis. This would include location and commodity specific information, for basic planning requirements at local and regional level. The current security debate may assist the drive for necessary data collection. There is potential for legislation to require collection, provision and publication of data as per the Inter-State Commission Legislation in the United States.</li> </ul>
<b>Freight and passenger</b>	<ul style="list-style-type: none"> <li>• Increase the consideration of freight in transport system planning. For instance, the initial determination of freight routes at the planning stages will lead to more appropriate land use decisions.</li> </ul>
<b>Actively incorporate transport in land use and spatial policies</b>	<ul style="list-style-type: none"> <li>• Preservation of rights of way for transport corridors and terminals, including urban connections and bypasses.</li> <li>• Identify road and rail transport links to comprise the essential national freight network. Aim for self driving system, with funding linked to land use and designed to focus priority. The network should include inter-capital routes through urban centres to major freight hubs, sources, destinations and regional links.</li> </ul>
<b>Decouple freight and economic growth</b>	<ul style="list-style-type: none"> <li>• Undertake broad community issue awareness program on balancing development and amenity.</li> </ul>

Source: SKM and Meyrick & Associates, 2006, Twice the Task: A Review of Australia's freight transport task.

## modal and infrastructure relationships

A higher freight task means Tasmania will need to cater for greater convergence on key modal points, such as major sea and air ports. There is a need to optimise the road and rail linkages to and from these key locations to ensure the efficient and cost-effective movement of freight and passengers.

Inter-modal transport facilities describe the interface between two or more transport modes. Most freight is carried by road for at least part of the journey, before and/or after transferring to rail, sea or air. Inter-modal facilities of varying efficiencies are located at these interchange points and are critical components of a seamless, integrated transport system, that can link road, rail, sea and air. Improvements in inter-modal facilities and arrangements can provide whole of system benefits.

Key inter-modal facilities in the Southern Region include Hobart International Airport and Hobart Port at both Macquarie Point, which has road and rail linkages, and Triabunna.

The development of policies and strategies that maintain and optimise freight efficiency in the context of a growing freight task and potential changes in the composition of this task is a key issue into the future.

### Brighton intermodal hub

The freight forwarder Toll has identified the potential establishment of a new inter-modal road/rail hub at Brighton. The companies currently operate out of Macquarie Wharf, and the project would see the transfer of road and rail operations to Brighton from the Port of Hobart. The project has been under consideration by Toll and Pacific National Tasmania for some time.

The main rationale for the proposed inter-modal hub is its potential to deliver a twenty-four hour turnaround for trains travelling between Burnie and Hobart.

Issues for consideration include:

- Operationally, there are limitations associated with the existing Macquarie Point site for heavy vehicles. The site is located close to the Hobart CBD and has seen increasing, generally incompatible residential and commercial development on adjacent land (i.e. along Evans and Hunter Streets).
- A declining share of freight is moved through the Port of Hobart, and most freight transfers at the site are road-rail rather than marine-based.
- The existing Macquarie Point site developed from an old rail facility and is not a purpose built inter-modal facility.
- Development of a new inter-modal hub will generate considerable sunk investment costs. There are significant costs associated with relocation of the current inter-modal operations to a new inland site.
- The Brighton site will see improvements in rail turnaround times between Burnie and Hobart, and therefore generate transport efficiency gains.

- The Brighton site is located some distance from key warehouse and freight distribution centres at Derwent Park and Glenorchy. Its location would:
  - see an increase in total pick up and delivery time for some road freight users; and
  - generate increased total movements of light trucks between the site and Greater Hobart with the likelihood of increased vehicle movements over that part of the road network.
- The location may also see increased transport costs for some users due to the greater distances/time involved in pick up and delivery times from Brighton.

## Brooker Highway: a major regional and passenger freight route

Under the existing AusLink National Network, the road component of the Network terminates at the southern end of the Midland Highway near the Bridgewater Bridge at Granton. Despite the inclusion of the parallel rail link to the Port of Hobart within the Network and notwithstanding the significant freight and commuter role of the Brooker Highway, the highway has not been included in the National Network.

The Brooker Highway links key freight distribution and warehousing areas in the Glenorchy municipality, including Derwent Park and Glenorchy, and provides the major link between the Southern Region and the three northern ports. In terms of private transport, the highway is a significant commuter route, carrying higher daily volumes than the Southern Outlet, and provides the main north-south linkage through and within the Greater Hobart area.

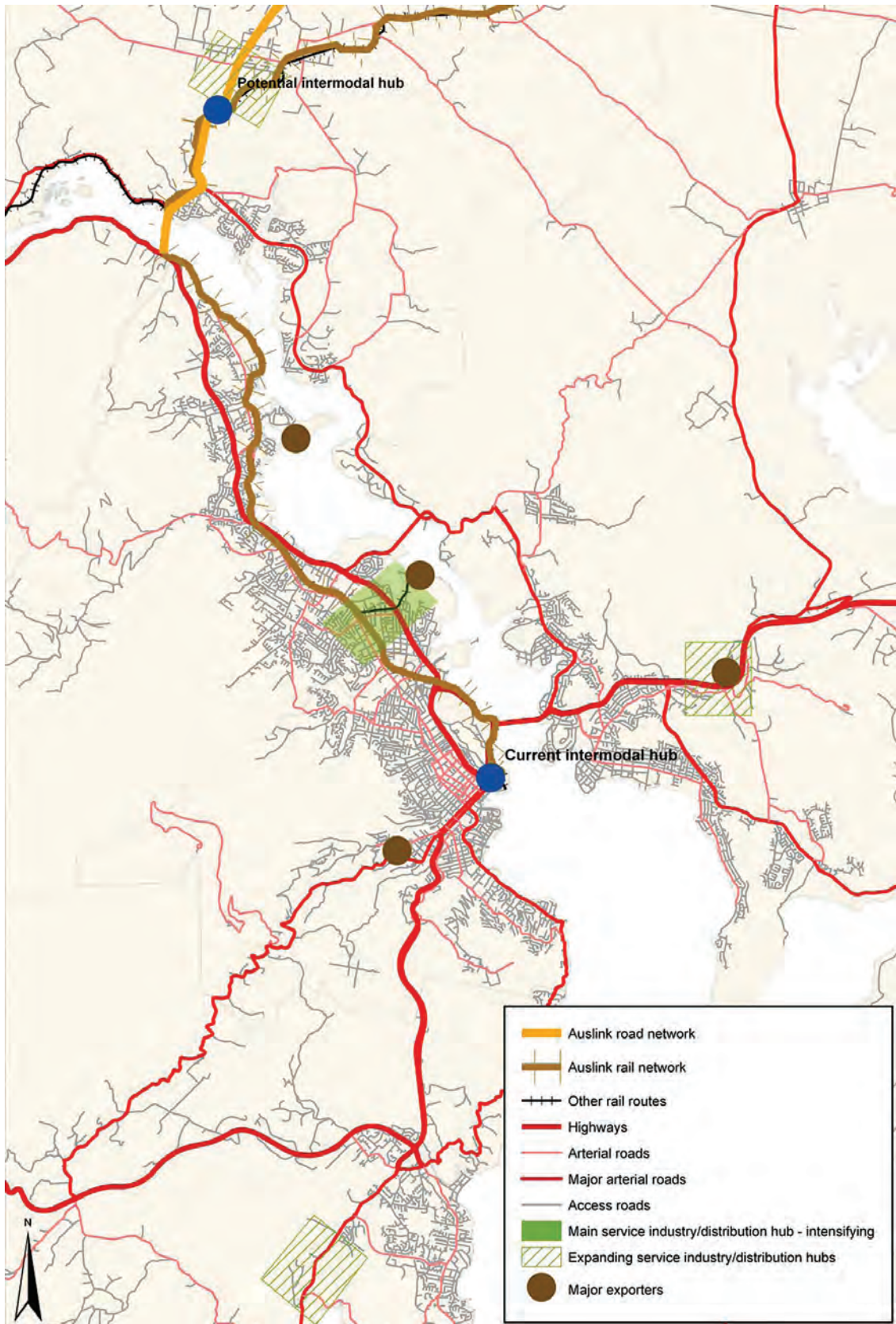
In 2003, approximate AADT for the Brooker Highway was around 48,000 for the section from Risdon Road south, falling to around 31,000 near Rosetta.

The relationship of the highway to surrounding land uses is shown in **Map 6**.

**Map 7** shows freight volumes across the three major outlet roads at the points of highest tonnage and value (values shown are the total for each road, based on two-directional flows). The Brooker Highway carries an average of around 1.6 million tonnes at an average total freight value of 1.5 billion dollars. In terms of value, this is around three times higher than both the Tasman Highway (west of the Mornington Roundabout) and the Southern Outlet (north of Kingston). In terms of tonnage, it is slightly less than double the freight volumes on the Tasman Highway at the measured point, and almost 400 million tonnes higher than the freight task carried on the Southern Outlet.



map 6. Brooker Highway and surrounding land uses



map 7. freight volumes, major outlet roads Hobart

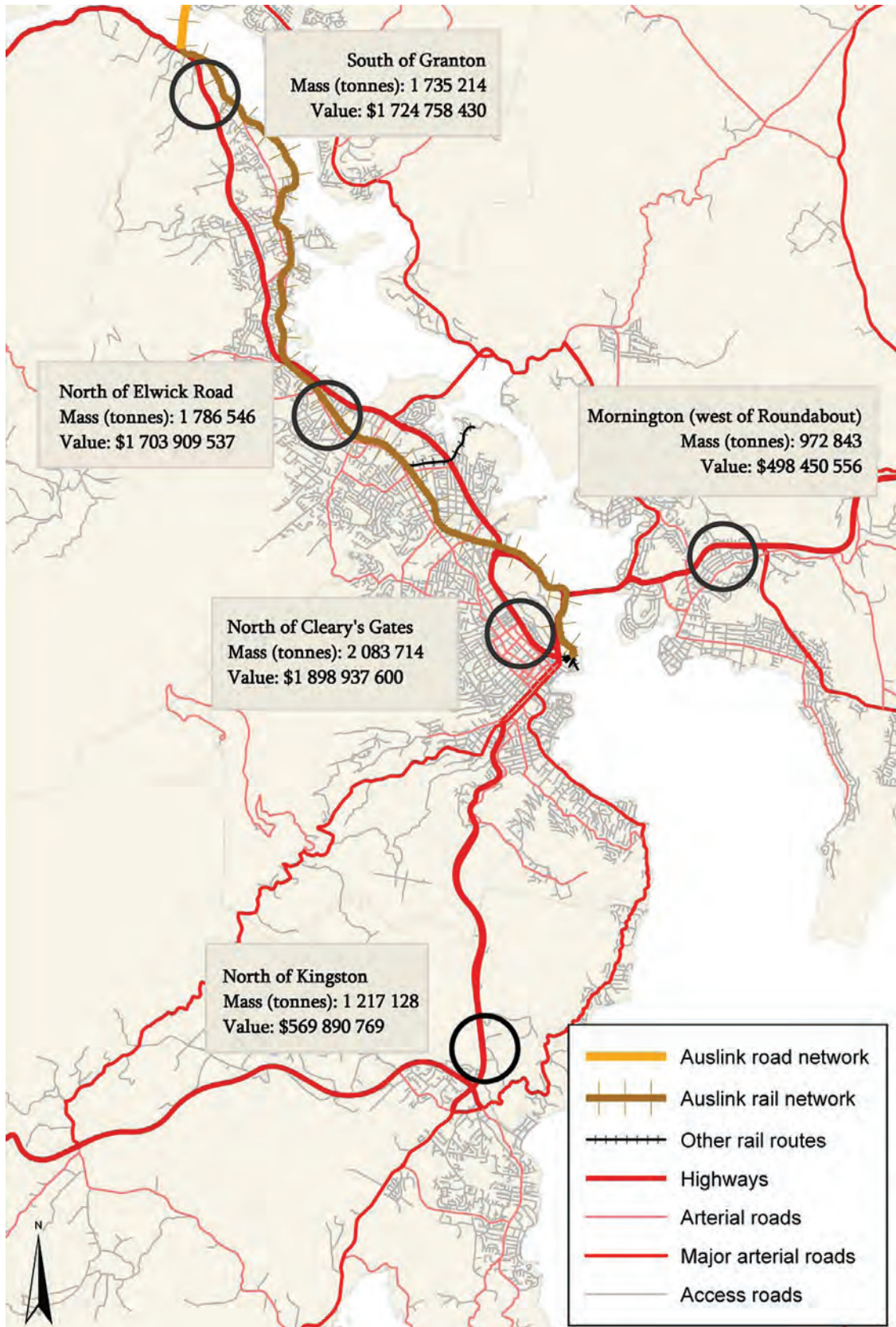
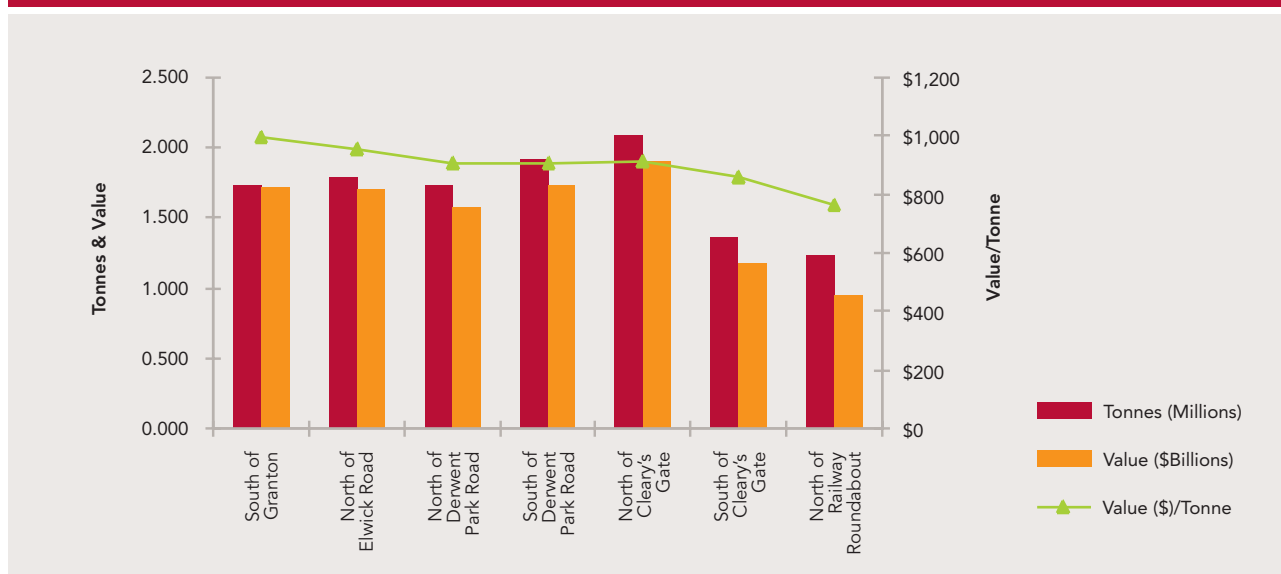




figure 4. freight tonnes and value carried, Brooker Highway



The following freight information is sourced from the 2003 DIER Freight Demanders Survey. While broadscale, the analysis highlights the:

- importance of the highway to the Region in terms of inter- and intra-regional freight movements;
- changing freight task over the length of the highway; and
- linkages to a number of key connecting arterial roads.

At its northern end at Granton, the Brooker Highway carries around 1.75 million tonnes of freight with a value of about \$1.75 billion. This overall freight load and value varies only slightly until around Derwent Park Road, where it jumps to over 2 million tonnes/\$1.9 billion north of Cleary's Gates before declining to around 1.25 million tonnes/\$950 million just north of the Railway Roundabout near the CBD (see figure 4).

The changing value of the freight task across the highway is of interest. The closer to the city, the less valuable the freight becomes in \$/tonne terms. This appears to reflect a large tonnage of lower value bulk freight coming onto the Brooker Highway at and south of Derwent Park Road, at the same time as other more valuable freight is leaving it for various other destinations around the Derwent Park area and the city using other routes.

From Granton south to the city, there are several points at which heavy freight enters or leaves the Brooker Highway. While these multiple entry and exit points do not have a marked effect on the overall tonnage and value of freight carried on the Brooker Highway, until well into Hobart's northern suburbs, the mix of freight and the vehicles used to carry the freight does change (see Figures 5 and 6).

Two heavy vehicle types dominate at both locations, the 6-axle semi-trailer (the largest and heaviest semi-trailer) and B-doubles (the largest and heaviest heavy vehicle). 3-axle rigid trucks and 5-axle semi-trailers play a much smaller role. Other vehicle types are almost non-existent. North of Elwick Road, 6-axle semi-trailers carry nearly 75% of the value and half the mass in over 50% of the trips by heavy vehicles, while B-doubles carry only 15% of the value but over 40% of the mass in about 20% of the trips. 3-axle rigid trucks are performing about 20% of the trips but carry a much smaller share of the value and mass of freight carried.

This is further demonstrated when approaching Cleary's Gates, where B-doubles assume a much greater role, carrying nearly 50% of the total mass on that part of the highway, and about 25% of the value in about 25% of the trips. In this part of the highway, 3-axle rigid trucks also expand their role, carrying around 15% of the total mass and value, but performing about 30% of the trips.

This point data appears to the efficiency of B-doubles when used to carry the heaviest freight, the flexibility of 6-axle semi-trailers for carrying higher value freight to perhaps more widely dispersed locations and the importance of 3-axle rigid trucks in performing the inner-city distribution task.

Figures 7 and 8 confirm the changing nature of the freight task performed by the Brooker Highway at the same two points.

While groceries, consumer goods and motor vehicles and parts constitute nearly \$700 million and over 40% of the total value of freight north of Elwick Road, this falls to around \$580 million and 31% of the value north of Cleary's Gates. This reflects the diversion of some of these goods off the Brooker Highway in Hobart's northern suburbs, for either consumption or for re-distribution elsewhere in Hobart, along with a large amount of zinc products and fuels, in both mass and value terms, coming on to the Highway in this area.

figure 5. freight volumes, north of Elwick Road

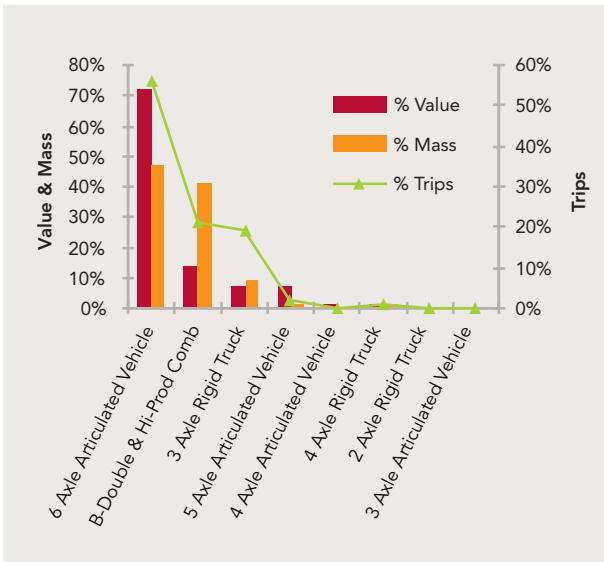


figure 6. freight volumes, north of Cleary's Gates

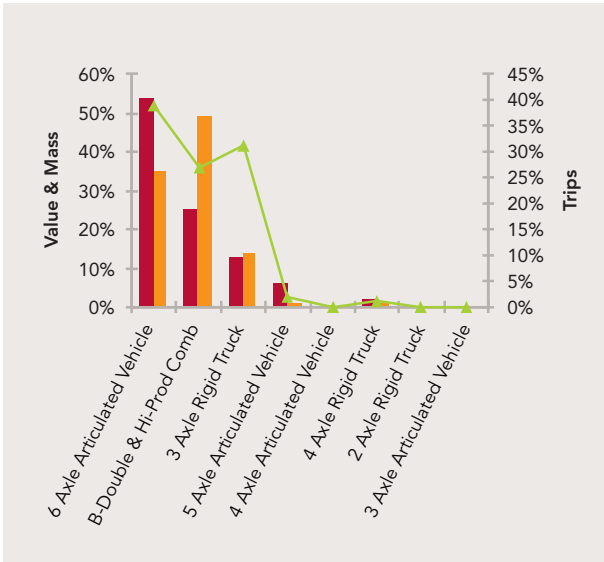


figure 7. Commodity values, north of Cleary's Gates

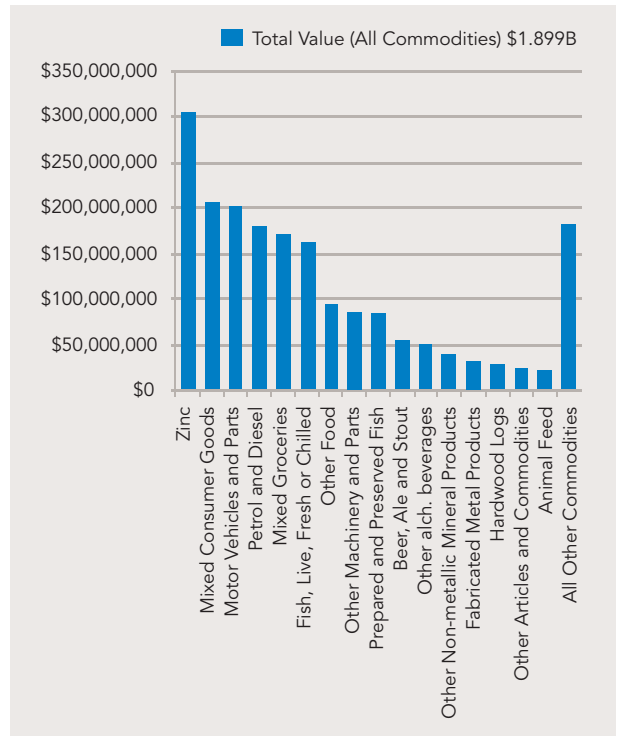
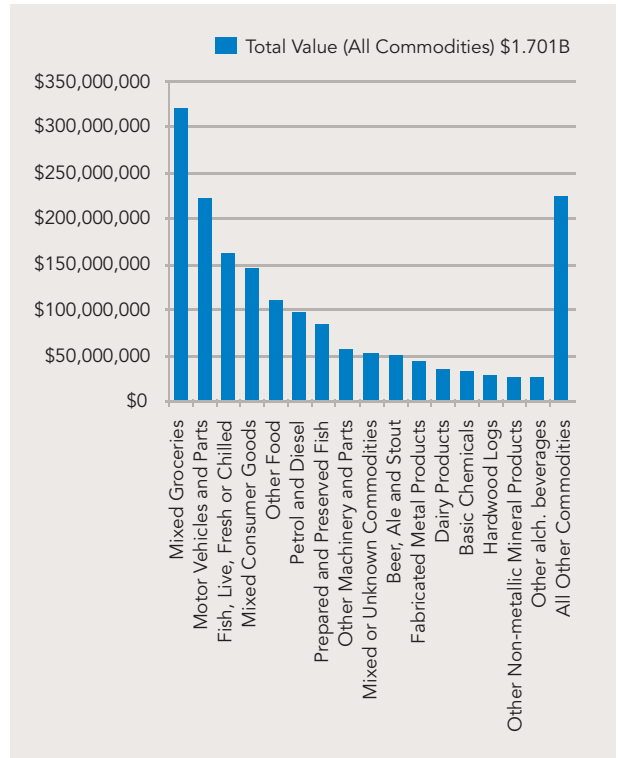


figure 8. Commodity values, north of Elwick Road





map 8. Freight tonnages Southern Region (2002/03 FDS)

**Road freight volumes (mass tonnes)**

- 5 - 50000
- 50001 - 100000
- 100001 - 500000
- 500001 - 1000000
- 1000001 - 10000000

map 9. Freight tonnages Greater Hobart Region (2002/03 FDS)

**Rail freight volumes (mass tonnes)**

- 1000 - 7000
- 7001 - 56000
- 56001 - 106000
- 106001 - 209000
- 209001 - 1096563



## freight demanders survey

In 2002/03, DIER undertook a statewide freight demanders' survey, examining freight movement across the entire network in terms of commodity type, total trips, mass and value. The survey is the only one of its kind in Australia, and provides important information on freight journeys, including movements between and through major infrastructure such as ports and airports. The information can be analysed at various spatial scales; for example, at a regional or local government level, along a road or road segment, or by individual port or airport, and using different values, including mass, commodity value and number of trips.

The data is provided by private companies and carries commercial-in-confidence restrictions. The survey is being replicated during the 2005/06 financial year.

The following information provides inter-regional comparisons for the State and some broad-level analysis by individual LGAs.

Generally, the Southern Region is a net importer of goods, with a significant movement of goods from the northern ports south.

### Southern Region

- In 2002/03, the Southern Region accounted for 25% of the total value of goods moved throughout Tasmania; 23% by mass and 25% of the total number of trips (see figure 9, 10 and 11).
- Major commodities by value included petrol and diesel, zinc and fish products (see figure 12).
- Hardwood logs were the major freight product in terms of trips generated and mass tonnes carried, at 18% and 32% respectively. Stone, sand and clay products recorded the second largest number of trips and mass tonnes carried.

### regional overview

Maps 8 and 9 show freight tonnages over the Region's road and rail network, based on FDS data.

- The highest volumes are carried on the Brooker Highway, Midland Highway, Tea Tree Road and Fingerpost Road.
- The Huon and Lyell Highways also carry comparatively high tonnages.

### local government comparison

#### commodity value (see figure 12)

Glenorchy and Hobart recorded the highest commodity values, followed by the Huon Valley.

#### commodity mass (see figure 13)

The Central Highlands recorded the highest freight tonnages at almost 900,000 mass tonnes. Around 81% of this was attributable to forestry freight.

Glenorchy, Huon Valley, Hobart, Derwent Valley and Clarence also recorded high mass volumes.

figure 9. commodity mass

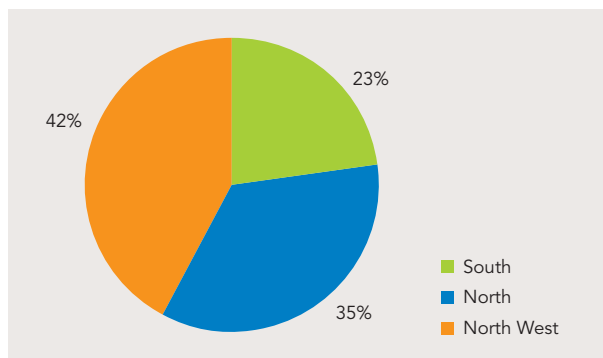


figure 10. commodity value

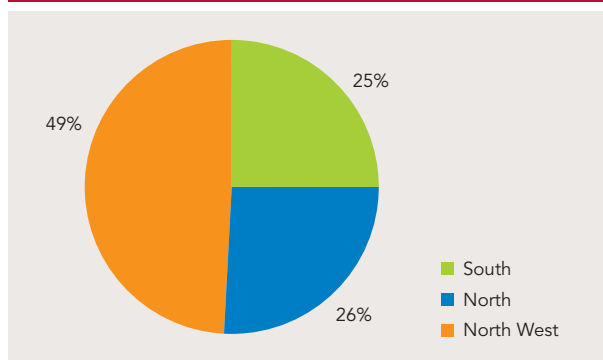
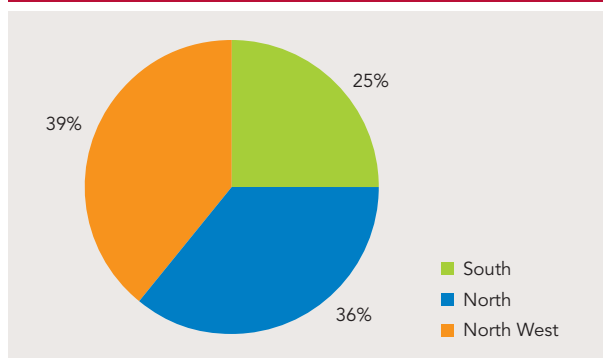


figure 11. number of trips



#### number of trips (see figure 14)

In 2002/03, Glenorchy recorded the highest number of freight-based trips by volume. Hobart and Clarence recorded the second and third highest number of trips respectively.

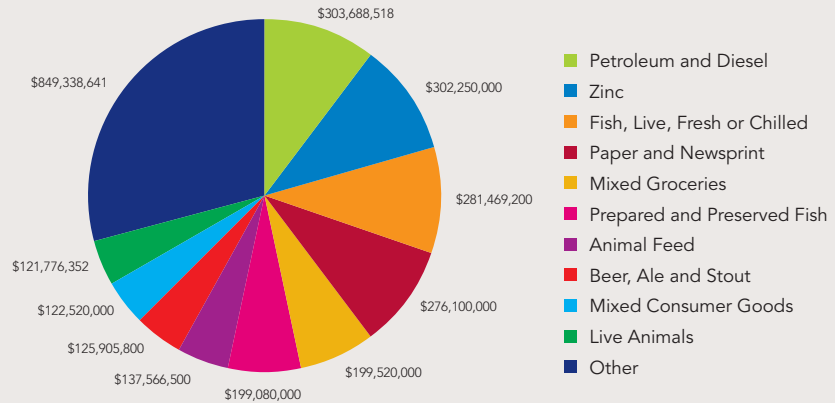
High numbers of trips were also recorded in Huon Valley and Central Highlands; largely attributable to the large forestry freight task within these LGAs.



figure 12. commodity value

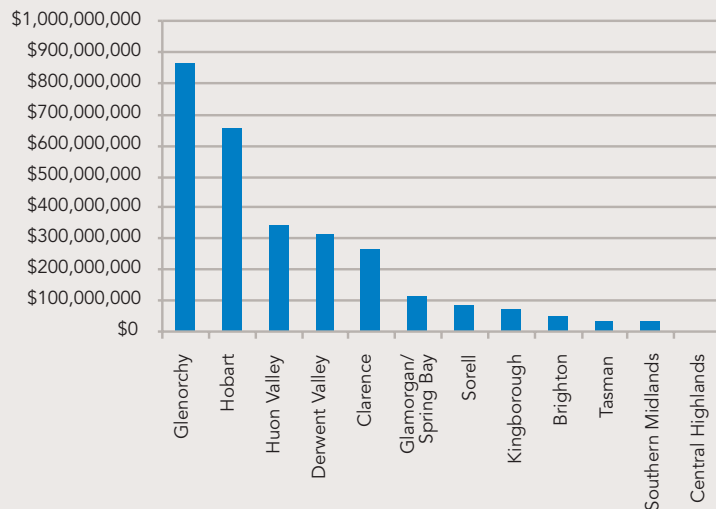
**SUMMARY**

- Total commodity value of \$2.9 billion.
- Major commodities include petrol and diesel, zinc, seafood and paper and newsprint, each at around 14% of the total value of freight moved in the Region.



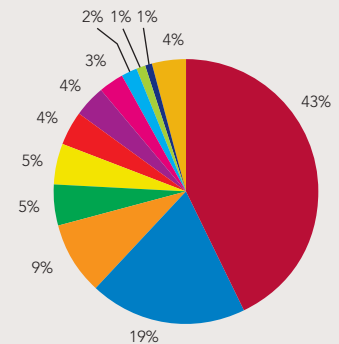
**LGA COMPARISON**

- Glenorchy and Hobart recorded the highest commodity values, followed by the Huon Valley.



**HOBART**

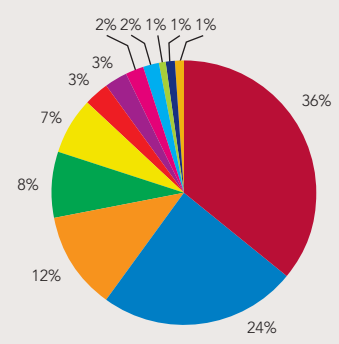
- Petrol and diesel are the highest value commodity (43%) followed by beer, ale and stout (19%).
- Various commodities contribute the remaining value, including



- Petroleum and Diesel
- Beer, Ale and Stout
- Other Non-metallic Mineral Products
- Motor Vehicles and Parts
- Other Machinery and Parts
- Dairy Products
- Other Articles and Commodities
- Empty Containers
- Fish, Live, Fresh or Chilled
- Prepared and Preserved Fish
- Other Minerals
- Other

**GLENORCHY**

- The LGA incorporates a number of high value commodities, including zinc and mixed groceries.

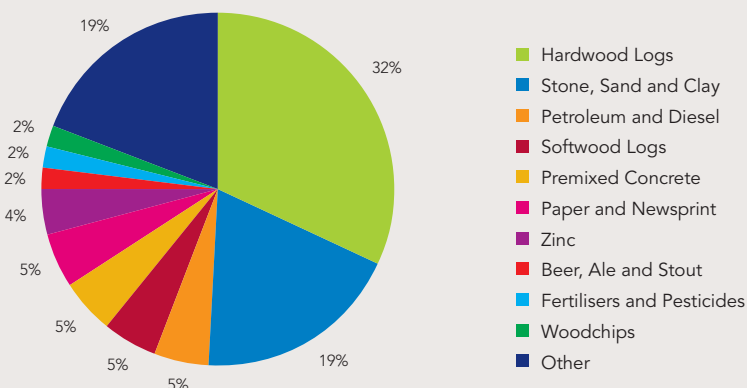


- Zinc
- Mixed Groceries
- Other Food
- Mixed Consumer Goods
- Other Alcoholic Beverages and mixed alcoholic consignments
- Fabricated Metal Products
- Fertilisers and Pesticides
- Basic Chemicals
- Motor Vehicles and Parts
- Premixed Concrete
- Rough Sawn or Dressed Wood
- Other

figure 13. commodity mass

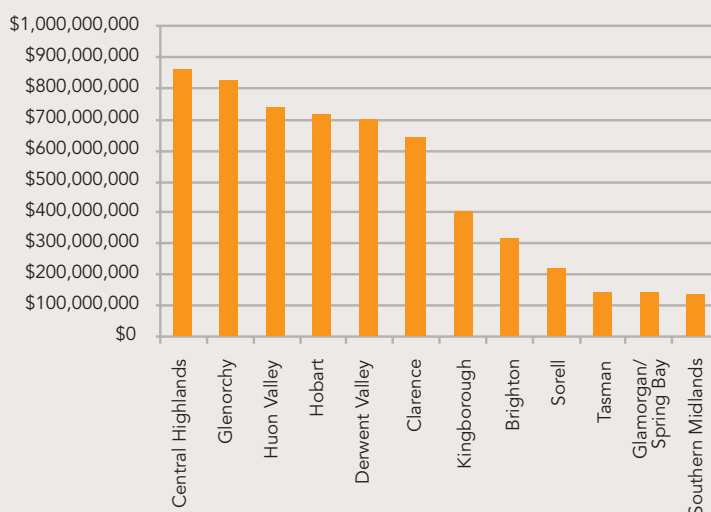
**SUMMARY**

- A total of 6,043,761 million mass tonnes was carried, representing 23% of the State's freight task.
- Major commodities include hardwood logs, stone, sand and clay and petrol and diesel.



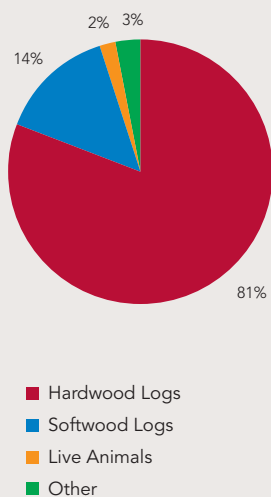
**LGA COMPARISON**

- Central Highlands recorded the highest freight tonnage at almost 900,000 mass tonnes.
- Glenorchy, Huon Valley, Hobart, Derwent Valley and Clarence also recorded high mass volumes.



**CENTRAL HIGHLANDS**

- Around 95% of the LGAs freight task is attributable forestry freight, including 81% hardwood logs and 14% softwood logs.



**GLENORCHY**

- The Region has a high commodity base in terms of mass tonnes.
- Zinc, premixed concrete and fertilisers/pesticides form the top three commodities.

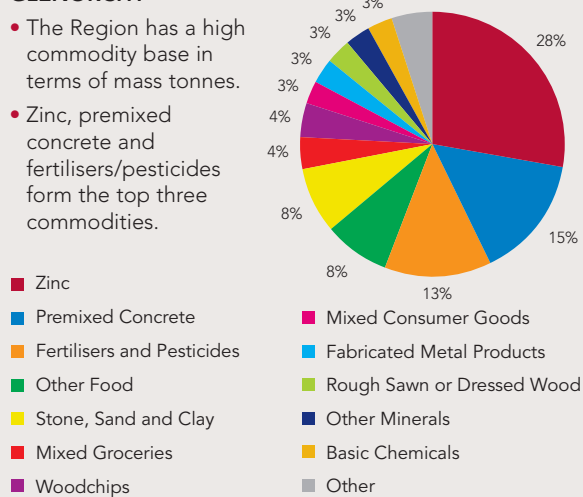
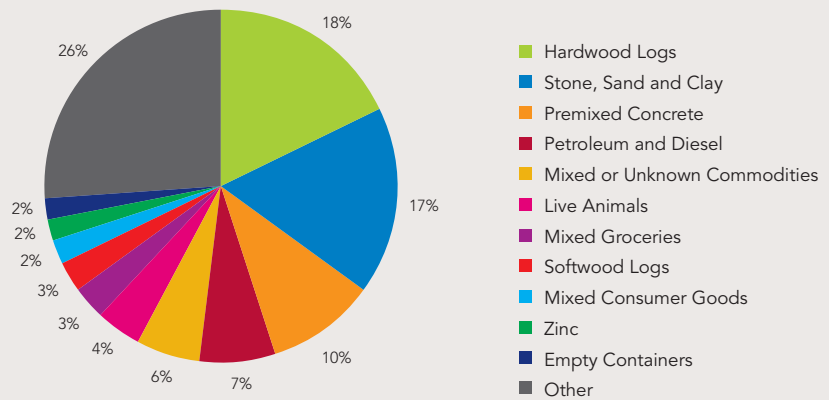


figure 14. commodity number of trips

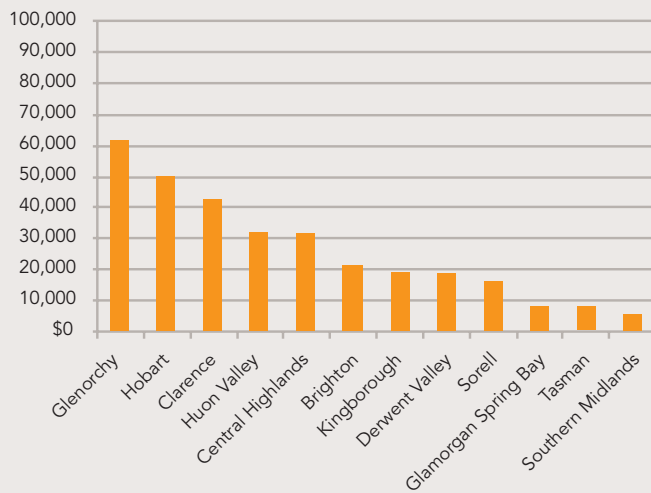
**SUMMARY**

- A total of 317,923 freight related trips were recorded.
- The single largest freight item by number of trips is hardwood logs, followed by stone, sand and clay and premixed concrete.



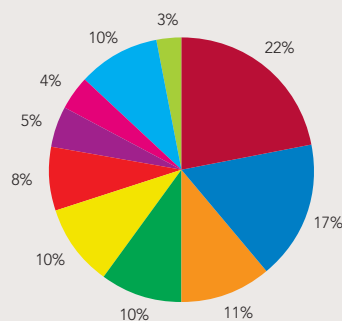
**LGA COMPARISON**

- Glenorchy recorded the highest number of freight related trips, with over 62,000 trips.
- High number of trips were also recorded in Hobart and Clarence.



**GLENORCHY**

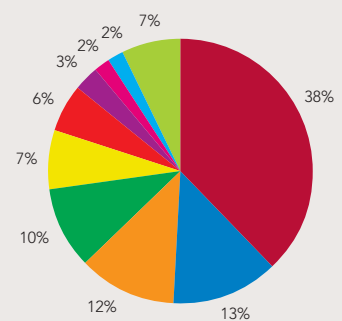
- Premixed concrete and groceries are the major items by number of trips.
- Other major commodities include zinc and chemicals, alcoholic beverages and stone, sand and clay.



- Premixed Concrete
- Mixed Groceries
- Zinc
- Stone, Sand and Clay
- Other Alcoholic Beverages
- Fertilisers and Pesticides
- Other Food
- Mixed Consumer Goods
- Basic Chemicals
- Other

**GLENORCHY**

- Petrol and diesel, which is imported through Self's Point, is the major commodity by trip number..
- Empty containers, premixed concrete and alcoholic beverages also account for a high number of trips.



- Petrol and Diesel
- Empty Containers
- Premixed Concrete
- Beer, Ale and Stout
- Mixed/Unknown Commodities
- Other Non Metallic Mineral Products
- Mixed Consumer Goods
- Dairy Products
- Basic Chemicals
- Other

## Urban movement

Passenger transport in the Region is almost entirely road based. Private cars are the primary passenger transport mode; the public passenger transport system is bus-based; with the exception of the Inter-City Cycleway, cyclists generally use on-road infrastructure.

There is an increasing community perception that traffic congestion is worsening within the Hobart metropolitan area and that response measures are required.

The Tasmanian Government has commenced a number of projects aimed at addressing these concerns, including the collection and analysis of quantitative information on peak traffic flows across major urban arterial routes to indicate whether, how and to what extent traffic flows are affected during peak times or the impact of any delays on industry and business.

Anecdotally, congestion issues are significantly reduced outside school periods and there is benefit in better understanding the contribution of school-based trips to peak traffic flows and volumes.

Improving accessibility, including measuring accessibility and understanding impediments to travel, is a key component of any transport planning framework and congestion needs to be considered within this context. Approximately one third of Tasmanian journey to work each day, mostly in private vehicles. The maintenance of a certain level of travel efficiency for these commuters must be considered alongside the transport needs of both non-commuters and the commercial transport sector.

As in other jurisdictions, new infrastructure has formed the major response to transport issues in Tasmania, and this has often been based on traffic volumes/capacity analysis. This approach has resulted in limited medium or long-term efficiency gains, which reflects the general experience of other Australian states and internationally. A cultural shift is required amongst infrastructure planners, managers and users away from a focus on infrastructure provision to one that considers a broader range of potential responses.

At a policy and planning level, there is a need to better understand the suitability and applicability of travel demand management techniques in Tasmania's major urban areas. Measures that have been successful or beneficial in large metropolitan cities experiencing serious congestion are unlikely to achieve the same gains in Tasmania and may not offset the cost involved in implementation. Generally, in the absence of clear efficiency impacts as a result of congestion, small-scale measures and/or measures that provide a range of triple bottom line benefits that in totality will justify an intervention, are likely to be more applicable in Tasmania.

The statutory and strategic land use planning processes do not adequately identify the transport and infrastructure costs and impacts of land use decisions, including the impacts of incremental, small-scale growth over time.

The Tasmanian Government's State Infrastructure Planning System will provide much needed demand and supply forecasting and modelling at a macro and micro level to better understand the impacts of land use planning decisions to assist strategic transport planning.

The following section reviews the nature of congestion, general policy and response measures, and current planning and analytical projects undertaken in Tasmania.

The discussion below on congestion responses is taken substantially from the Victorian Competition and Efficiency Commission draft report, (2006) *Making the Right Choices: Options for Managing Transport Congestion*.

## congestion: context

Congestion can cause a variety of economic (delays, higher vehicle operating costs), social (accidents and loss of amenity in areas affected by congestion) and environmental costs (emissions of pollutants and noise). Much of the concern about congestion, however, centres on its impact on travel times for both passengers and freight.

Typically, congestion exists when the demand for transport services approaches or exceeds available capacity. Congestion can be measured in different ways, making it difficult to quantify. Some commonly used measures include:

- **Volume-capacity ratio** - the number of vehicles passing a particular point on the transport system relative to capacity. This distinction is important as some studies have estimated that up to 60% of road traffic delays are caused by 'traffic incidents' such as disabled vehicles and accidents.
- **Time delay measures** - the time delays experienced relative to free flow conditions;
- **Journey time reliability** - the variability in travel times.
- Measures of the **performance of transport systems** - such as average traffic speed and the amount of congested roads in a metropolitan road network.

Addressing congestion is equally complex. In terms of physical infrastructure, congestion is a natural consequence of the relationship between fixed road infrastructure and fluid and peak traffic demand. A range of factors contribute, directly and indirectly, to this traffic demand, including:

- Mobility choices, which increasingly favour private, often single occupancy cars.
- Many short trips are car-based, and there is an increasing trend toward the use of cars to take children to and from school.
- Weekday demand for travel within a concentrated period, related to work and educational trips.
- Increased use of 'just-in-time' inventory management, which sees a greater number of trips.
- Various non-recurring events such as accidents, breakdowns and other incidents, which can cause, or intensify, periods of congestion.

- In Hobart:
  - topographical constraints that focus traffic into and through Hobart onto three major arterial roads; and
  - fringe development that has seen increased residential development across a spatially disjointed and dispersed area, leading to higher traffic volumes converging on key intersections and along arterial roads.

In providing efficient, high-speed travel, arterial roads facilitate residential growth, making previously outer urban areas more attractive places to live by reducing initial travel times over high standard infrastructure. Examples in Hobart relate to all three outlet roads, but particularly the Eastern Outlet and the Sorell, Southern Beaches and South Arm communities, and the Southern Outlet and Kingston and Margate. Because these roads link often-dispersed residential locations, they also tend to encourage a reliance on cars. In many jurisdictions:

- Significant investment in urban arterial roads has improved mobility for people with cars, while at the same time has assisted in promoting fragmented, low-density urban settlements that are not conducive to non-car based transport.
- The cross-subsidisation of residential subdivisions in fringe locations has tended to mask the real infrastructure costs of development decisions.

It is now clear that new arterial roads lead to induced demand, with little longer term benefits as the approach tends to increase the:

- use of the road, as users previously travelling over other routes divert to a new and better alternative; and
- long-term traffic volumes, as a greater number of people move to the area 'opened up' by the road.

Ten to twenty years after construction of a new road, peak congestion is generally back to or worse than the initial situation that prompted the infrastructure response.

## congestion responses

Most congestion problems have neither a common cause nor a single response. Reflecting this complexity and inter-relationships, a suite of measures should be considered to address congestion.

Congestion measures include both 'supply' and 'demand' side measures, and these are briefly outlined below.

### supply side approaches

Transport congestion is related to the capacity of transport infrastructure, such as roads, to carry traffic. Supply side measures aim to increase this capacity. For example, through:

- improved traffic management;
- the use of technology to improve driver information;
- better traffic signalling;
- improved incident detection and response; and
- improved coordination of public transport services.

It may also be possible to address congestion in one mode (i.e road) through investment in alternative transport options (such as rail or trams). While supply-side measures increase capacity in the short term, their long-term effectiveness is less clear.

### demand side approaches

Demand side approaches aim to reduce congestion by influencing the demand for particular transport modes, such as road, rail, tram, bus and bicycle travel. Demand side approaches may also aim to make users more aware of the costs of using the transport system and so be able to make more informed travel choices. Options range from campaigns to provide users with better information regarding the availability and cost of transport choices, through to improved pricing for transport services.

### land use planning

Urban settlement patterns - including places of residence, work and recreation - influence transport requirements and travel mode shares. Some cross-city comparisons show that sprawling, low-density cities often have the highest levels of car ownership and use, due to the spatial diversity of travel patterns. Dense cities - with jobs concentrated in urban centres - often have high levels of public transport patronage, as origin-destination patterns are usually close together.

Urban planning may have the potential to influence travel mode shares and thereby help reduce congestion for particular modes of travel, such as roads.

The attractiveness of urban planning approaches depends on the cost of reconfiguring existing transport and other infrastructure. The malleability of individual travel habits and preferences, particularly in societies with high rates of car ownership, is also a factor. For these reasons, urban planning may be viewed as part of a broader set of policy responses to congestion.

A variety of planning-related policies have been applied in Australia and internationally:

- **Integrated land use planning and road design practices** that aim to improve traffic flow and encourage non-motorised forms of transport. This may be achieved through: encouraging clustered developments (activity centres) to shorten travel distances; creating more pedestrian and cycling-oriented street designs; and limiting the number of driveways and intersections on arterial roads and highways to improve traffic flow and reduce accidents.
- **Planning restrictions** that are designed to reduce motor vehicle use and access in specific areas. Restrictions can be applied to certain types of vehicles, such as trucks, and apply only during certain times of the day.
- **Pricing and funding approaches** that aim to signal the costs of developing new transport infrastructure, particularly in major new developments. Examples include developer charges and State and local government levies.

A more detailed review of supply and demand measures is outlined in **Table 4** and **Box 1**.

## Victorian Congestion Inquiry: draft outcomes

Toward the end of 2005, the Victorian Competition and Efficiency Commission (VCEC) commenced an inquiry into managing transport congestion. The aim of the Inquiry was to:

*examine and report on the nature and incidence of transport congestion in Melbourne and major regional cities, the impact on businesses in Victoria, any regulatory barriers to tackling transport congestion and the potential application of approaches used in other major international cities.*

The VCEC was also asked to develop a set of possible policy responses to address the issue of traffic congestion in Melbourne and Victoria's other major regional cities (Geelong, Ballarat and Bendigo).

The draft report – *Making the Right Choices. Inquiry into managing transport congestion* - focuses on Melbourne rather than the other major regional cities, which formed part of the scope of the Inquiry. This focus reflects the higher incidence of congestion and congestion-related impacts in Melbourne. As a high population metropolitan area with a comparatively more extensive public transport system, including a tram network, Melbourne provides a different context in terms of the scale and nature of congestion and related response measures when compared to Tasmania.

Despite this focus, the report provides a relatively comprehensive discussion of the nature and impacts of congestion, and the costs and benefits of implementing a range of different congestion measures. For the most part, this discussion confirms the view that congestion levels need to be sufficiently high to justify the cost of many interventions, and that a well-developed public transport system is required to provide a viable alternative where measures target the cost or flexibility of car transport.

A key conclusion of the report is that measures to improve the efficiency of existing infrastructure should be implemented preferentially over measures that expand capacity. Specific messages are:

- Although congestion reflects some physical characteristics of parts of the road network and constraints on investment in public transport, many of the causes are much broader. These causes include increased economic prosperity; personal mobility choices, including a preference to use cars for short trips and to take children to and from school; and the greater use of just-in-time freight inventory management for many businesses.
- Addressing congestion often involves difficult tradeoffs, and this is reflected in a lack of consensus about the best options for managing congestion.
- A number of options are available to improve transport efficiency. Most of these options produce the greatest benefits when used in combination:
  - Better management of existing road space.
  - Overhauling the bus system, including an expansion of services.

- Efficiency measures relating to freight movements, particularly for rail freight.
- Location-specific use of peak-period pricing to improve congestion.

- In the longer term, there is likely to be a need to consider more comprehensive road pricing. An enhanced public transport system is a pre-condition, ensuring that an acceptable alternative form of transport is available. Significant equity and distributional issues would need to be considered in any decision-making regarding road pricing.
- Major infrastructure projects should be rigorously evaluated to ensure key factors such as induced demand and network benefits are appropriately incorporated in the analysis.
- Institutional changes that would improve management of transport congestion include a stronger role for public transport, a single transport budget, and common project appraisal criteria.

Enhanced integration of transport and land use planning is also important, and may provide an appropriate framework for the targeted application of lower-scale/cost measures such as walking and cycling enhancements, and some aspects of car parking policy.

Specific options to reduce congestion by influencing the demand for travel were identified as:

- parking restraint measures, which effectively increase road travel costs and so discourage road use;
- increasing government information programs on the range of travel choices available; and
- promoting flexible school or working hours.



## Box 1. Examples of congestion responses

### Road area charges: London

In an attempt to reduce inner-city congestion, an area licence scheme covering 22 sq. km. of central London was introduced in February 2003. The area contains 370,000 residents and 1.2 million jobs. A daily charge (around £8) applies to vehicles driving in the zone between 7 am and 6.30 pm on business days. Residents in the charged area receive a 90% discount. The system is enforced via 700 video cameras, which scan the rear licence plate of every vehicle entering the toll zone.

The capital costs of introducing the scheme were around £180 million, of which around half related to traffic management measures extending to areas well outside the charging zone. The high recurrent costs - around £92 million per annum - are largely due to the costly camera-based licence plate recognition technology needed to enforce the scheme. Total revenue is around £190 million each year. The operating costs of the scheme account for over half of the revenue collected.

The charge has been successful in reducing congestion - traffic volumes have reduced by 15-18% within the charging zone, total travel times by around 19% and 'delay' time by between 30 and 33%. Approximately 35% of car trips into the charging zone have changed since its introduction - 55% changed to public transport, 10% to walking or cycling, while the remainder re-routed or re-timed their car travel. Substantial enhancements to bus services were made prior to the scheme's introduction. There has been approximately a 17% increase in the number of bus trips into the charging zone since introduction of the charge.

From February 2007, the scheme charging area is to be extended westwards, to cover a substantial area of inner west London. 'Boundary area' problems have been less of an issue than expected - there has been no significant change in parking demand in areas just outside the zone. Congestion along the main diversionary route, the Inner Ring Road, has not increased since introduction of the charging scheme.

### Staggered school hours (Northern Ireland)

Neighbouring schools stagger their start and finish times to enable sharing of bus services. This has come about historically, as new schools have opened existing bus services have been extended and modified to serve them either before or after 9am. There are significant drawbacks, however, including:

- late sessions are unpopular with teachers
- it is difficult for working parents to co-ordinate with their children
- pupils can be tired and unable to concentrate on lessons in the late afternoon
- schools with the earliest or latest start times are less attractive and face unfair competition for pupils from other neighbouring establishments with more conventional hours

- there are no resources to reimburse those schools with the most unfavourable session times.

Similar proposals have been examined in the UK, where journeys to school contribute significantly to congestion in the morning peak. The British Government is encouraging neighbouring schools to consider staggering their starting and finishing times.

### ABC planning, The Netherlands

The ABC policy aims 'to require businesses and services with a high potential of public transport use by its employees and visitors to be located within easy access to these services.' There are three different types of location under the policy:

- A - locations that are easily accessible to local, regional and national public transport. This effectively means they must be located on a public transport junction. The share of commuting by car should be under 10-20%.
- B - locations that are easily accessible by local and regional public transport. The share of commuting by car should be under 35%.
- C - locations that are easily accessible by car, such as areas along highways. Those locations where the proportion of commuting by car exceeds 35% are classed as C locations.

Planning authorities give all businesses a mobility profile, which depends on the number of employees and visitors and the level of car and freight traffic to the site. Shops are preferably located in A areas; offices are located in A and B areas, while C areas should only be used for transport activities or land intensive activities. Parking standards are incorporated into the ABC system.

The ABC policy has resulted in 355 new businesses locating in a prime AA location. It has also seen a shift in popularity away from office buildings along highways and towards station locations, which are considered as sites of future value.

### Development contributions, San Francisco

During the late 1970s, substantial development in central San Francisco led to higher passenger levels and overcrowding during peak hours on light rail transport services. In order to meet the capital and operational costs of upgrading services, the municipality implemented a Transit Impact Development Fee (TIDF) for central office developments.

The TIDF is a one-off fee on office buildings to cover the cost of providing transit services over the building's 45-year useful life. The fee is based on floor area with a cap of US\$5 per gross square foot. Other developments, such as retail, personal services and entertainment facilities, are exempt from the TIDF because they are considered to have a relatively minor impact on peak period patronage levels.

Source: Victorian Competition and Efficiency Commission, 2006

**table 4. Summary of supply and demand measures**  
 Summary from Making the Right Choices: Options for Managing Transport Congestion

## SUPPLY SIDE MEASURES

Measure	Key Observations
<b>Traffic management – capacity enhancement</b>	
<ul style="list-style-type: none"> <li>• Improve traffic conditions through operational improvements that increase the efficiency and effective capacity of existing road infrastructure.</li> <li>• Ramp metering involves controlling traffic flows entering highway access ramps, which are used to temporarily queue vehicles in order to optimise flows on the main highway.</li> <li>• Incident management aims to minimise the extent of disruptions to network capacity caused by collisions and breakdowns. Integrated incident management systems, which combine detection, verification, and the subsequent response to incidents, are required.</li> </ul>	<ul style="list-style-type: none"> <li>• Most effective if implemented as part of a package, such as integrated network management systems. A network approach also reduces the risk of transferring congestion problems from one area to another.</li> </ul>
<b>traffic management – road space re-allocation</b>	
<ul style="list-style-type: none"> <li>• Aims to maximise the use of existing road infrastructure by improving the operation of the existing road network.</li> <li>• Traffic management measures can be divided into measures that aim to improve traffic conditions for all traffic, or which give preferential treatment to travel modes such as public transport, high occupancy vehicle lanes and cycling.</li> </ul>	
<i>Public transport priority</i>	
<ul style="list-style-type: none"> <li>• Bus lanes have been widely implemented overseas. They are often designated for use only during peak, congested periods, and are aimed at relieving peak period congestion by allowing buses to bypass congested road sections.</li> <li>• Bus lanes have typically resulted in patronage increases for buses, and sometimes in reduction in car traffic volumes.</li> <li>• Experience has shown that the degree of modal shift from car to public transport depends on the extent of the time savings achieved.</li> </ul>	<ul style="list-style-type: none"> <li>• Giving road space priority to public transport can improve its performance and increase its share of total travel. However, it may also increase car congestion.</li> <li>• Measures allowing public transport vehicles to jump the general traffic queue can often be implemented relatively easily and cheaply.</li> <li>• Many schemes have generated only minimal time savings. The most successful schemes in terms of increased public transport patronage, mode shift and traffic volumes have generally involved an integrated package of public transport ‘carrot’ measures and some ‘stick’ measures to make car travel relatively less attractive (e.g. car parking restrictions, re-allocation of road space).</li> </ul>

## DEMAND SIDE MEASURES

Measure	Key Observations
<b>road use charges</b>	
<ul style="list-style-type: none"> <li>• Fixed-rate toll roads are the most common road use charge, and are used in many countries including Australia. In most cases, the primary objective of toll roads is to raise revenue to finance improvements to the transport network. Toll roads may reduce traffic congestion, however this is usually a secondary concern.</li> <li>• London and Singapore have introduced cordon pricing, which charges motorists for their use of the road once they enter a defined area. In both cases the measures were introduced where effective public transport networks existed and additional network enhancements were planned.</li> </ul>	<ul style="list-style-type: none"> <li>• Pricing can reduce congestion levels and travel times.</li> <li>• Related measures, such as availability of public transport, are important. This includes capacity and service availability.</li> <li>• Pricing mechanisms will be most successful when they complement related policies.</li> <li>• As well as varying by time of day, prices can discriminate according to vehicle type and by number of occupants.</li> <li>• Hypothecation of revenues from road pricing to fund transport improvements is an important component of many, but not all, programs.</li> <li>• Although charging schemes are expected to raise revenue once fully operational, and are expected to have a positive cost-benefit ratio, money is still required to cover the establishment costs, which may be substantial.</li> <li>• High occupancy vehicle lanes can be under-utilised, resulting in an inefficient use of total road space.</li> </ul>

table 4. Summary of supply and demand measures

**parking policy measures**

The objectives of parking policies generally include one or more of:

- reducing inner city car traffic;
- reducing commuter traffic and congestion in peak periods; and
- re-allocating road space away from parking, and towards other purposes such as extra lanes during peak periods, or reversible lanes for public transport vehicles.

**Maximum number of total spaces in city centre**

- The traditional approach to parking supply is to require a minimum provision of off-street parking spaces for every new development.
- Parking maximums take a different approach, aiming to restrain traffic growth by limiting the number of car parking spaces, thereby encouraging a shift to alternative forms of transport.
- Parking maximums have been introduced in London, Zurich and Berne as well as several USA cities. A common feature of these approaches is the linking of parking standards to the availability and quantity of public transport, in recognition that parking restrictions on cars will be more effective if public transport is available.

**Long stay and short stay charges**

- Some Australian cities, including Melbourne and Sydney, have attempted to increase the demand for short-term car parking at the expense of long-term, commuter parking. The intent is to discourage commuters driving to work and parking in the CBD.
- Demand for parking spaces can be highly responsive to significant changes in price, although the effect is much greater for long-stay, commuter parking than for short-term parking. Best estimates of parking demand elasticities for CBD areas are that a 100% increase in parking charges will result in a 10% decrease in parking demand for people who park for up to two hours, and a 90% decrease in demand for long-term (over seven hours) spaces.

- Replacing minimum parking requirements with maximums can restrain car use. The maximum standards can vary according to the level and quality of public transport serving the area.
- Parking charges are a significant component of overall trip costs. Changes in the cost or availability of parking can have significant impacts on traffic volumes, especially long-stay travel.
- Parking policies will be most effective if they complement the outcomes of the planning system.
- Parking restraint measures are likely to be unsuccessful if they do not also affect commercial parking spaces, especially in the central business district.

**information and communication technology (ICT)**

- The objective is that, rather than changing the mode by which people travel, ICT can be used to alter the ways in which people access work, shopping and services.
- E-work pilots are the most relevant in the context of congestion reduction, as they can reduce commuting travel during the morning and evening peaks.
- Telecommuting centres, which involve working from a local office rather than the normal workplace, are popular around Washington and Los Angeles.
- Although travel reduction may be a significant outcome of ICT projects, they are rarely pursued with this as the primary aim. Impacts on direct business costs, such as reduced office rental expenditures, are usually more important.
- E-work, and the development of telework centres may reduce congestion by reducing commuting travel during the morning and evening peak periods. The impact will be highly dependent on the nature, location and frequency of the E-work, as well as the work it replaces.
- ICT measures are expected to be more effective in contributing to congestion reduction in the longer term, as technologies become more accepted and developed.
- Development and implementation of ICT will be driven by considerations other than reducing congestion.
- ICT trends of this sort will mostly occur naturally as a result of working arrangements in the private sector.
- There has been significant debate about whether teleworking actually reduces overall car use (after trips taken during the day and by other family members are accounted for).

## table 4. Summary of supply and demand measures

### financial and taxation measures

- In a number of countries, employers provide parking or other allowances to employees who car pool or use public transport. Many governments tax vehicle ownership or use, while some provide tax credits to public transport users. This approach does not encourage alternative mode travel, and may in fact actually foster car travel depending on the car travel rebate rate.
- Some countries have adjusted the deduction rules of the taxation system to encourage environmentally-friendly modes. The Netherlands, for example, abolished tax relief for car drivers' commuter expenses in January 2001, while continuing to allow deductions for the expenses of public transport users and cyclists.
- Taxation policy measures will be most effective when there is consistency in approach between different levels of government.
- The impacts on congestion of taxation measures are often a side-effect of policies, whose primary rationale may be unrelated to congestion.

### walking and cycling

- Walking and cycling can substitute for vehicle trips by replacing short trips, replacing part of a car journey with a walking/cycling trip or supplementing other forms of transport.
- Measures designed to promote walking and cycling can be divided into three types—marketing, infrastructure, and regulatory. In practice, programs usually involve a combination of these elements.
- Improved personal health, as well as environmental benefits. Traffic congestion may also be reduced, however this is usually a secondary objective.
- The impact on congestion of walking and cycling measures depends on the current importance of walking and cycling as forms of travel.
- Walking and cycling strategies can be implemented in a relatively short time-frame and can be cost-effective to implement.
- It is important that the potential for walking and cycling is considered during the initial stages of planning integrated transportation strategies.
- Walking and cycling measures can be locally applied and extended incrementally.

### land use planning

A wide range of policy tools has been used to try and reduce overall car travel, with the aim of reducing unnecessary congestion and making cities more liveable:

- *Higher residential densities.* Residential densities affect the viability of services, including public transport. Mass transit public service will be more viable when there are more residents living in close proximity.
- *Location of land uses.* Grouping common and complementary uses together around a public transport node can result in improved pedestrian accessibility, an ability to undertake multi-purpose trips, and a general reduction in travel distances.
- *Urban design.* Several aspects of urban design influence transport mode share and total distances travelled, including the layout of the transport network, timing of construction, design of pedestrian spaces, roads and buildings, and the extent and quality of facilities such as seating and shelters.
- Land-use policies are more likely to impact on the transport network over the longer, rather than the short-term.
- Policies aimed at solving regional problems require a consistent approach between different authorities to be successful.
- Financial incentives can sometimes be used instead of regulatory provisions to achieve desired planning outcomes.
- Developers have contributed to public transport improvements as well as roads in other countries.

This section continued over page.

## table 4. Summary of supply and demand measures

### land use planning... continued

- *Urban growth boundaries.* Boundaries on development can be used to curtail growth in transport demand, particularly where limited space is available along key transport corridors. However, there may be unintended consequences of such policies. There is some evidence that the urban growth boundary that has been in place in the British city of Cambridge since 1950 has led to increased land prices. As a consequence, new housing has been displaced to villages lying outside the protected greenbelt; the proportion of the working population of Cambridge living outside the city has increased steadily; and approaches to the city have become congested.

### mobility management

- Mobility management is a broad term covering a range of measures that seek to manage travel demand by changing behaviour.
- Types of schemes covered by the mobility management umbrella include: workplace and school travel plans; personalised travel planning; travel awareness campaigns; carpooling; shuttle buses; travel demand modification (through staggered work and school hours); and administrative measures.
- Workplace travel plans can be used to reduce car use. Plans that incorporate financial incentives have a larger impact than those only providing information.
- Staggered work and school hours can reduce peak period congestion in certain circumstances, but can present coordination challenges.
- Relative to many other policies, mobility management measures are cost-effective, and can be implemented.

Source: VCEC, 2006, Draft Report, Making the Right Choices: Option for Managing Transport Congestion.

## accessibility: the wider context for Tasmania

Understanding impediments to travel and improving accessibility should be a key focus of any transport planning framework and congestion needs to be considered within this context. Approximately one-third of Tasmanian journey to work each day; mostly in private vehicles. The maintenance of a certain level of travel efficiency for these commuters needs to be considered alongside the transport needs of both non-commuters and the commercial transport sector. From a whole-of-community perspective - and in the absence of serious impacts on efficiency - improving commuter travel speeds (by what is likely to be only a small amount over the short term) may be less critical than improving personal accessibility and commercial freight efficiency outcomes.

### State Infrastructure Planning System (SIPS)

A GIS-based approach with repeatable analytical capabilities, SIPS allows an assessment of infrastructure need by modelling infrastructure supply against current and future demand. In terms of congestion, SIPS will enable analysis of the impact of different land use decisions on the transport network, such as the:

- impact of a new subdivision on the road network, including trip generation over time and impact on travel times;

- performance of new infrastructure over time, using demand forecasting - for example - future travel times and speeds based on residential growth scenarios; and
- network impact of re-locating or consolidating industrial activity in a particular location.

As part of SIPS, DIER is involved in a number of key projects developing the following projects examining issues related to accessibility and urban traffic flows.

- **Travel demand model** for the Hobart region. The model will analyse existing traffic conditions and enable forecasting of future traffic flows over the network. The model will include capacity and congestion constraints in deriving travel speeds, enabling congestion forecasting (average travel speeds and flow versus capacity) based on various scenarios including network changes, population growth, and employment location and growth.
- Definition and mapping of **accessibility profiles** to fit land-use activities - which have a certain mobility profile - with a matching accessibility profile. The profiles will match the accessibility of a location and the public's ability to access these locations, with the mobility profile of both businesses and people. These profiles can be divided into destination and origin accessibility, where destination accessibility considers the accessibility of opportunity and service locations, while origin accessibility considers the ability of people to access these locations from their place of residence.



- **Journey to Work** analysis. For its population size, metropolitan Hobart has a highly dispersed settlement pattern. For many people living beyond the metropolitan area, the journey to work is 'cross-town'; meaning travel is not necessarily linear from outer urban areas to the central Hobart core. This travel pattern makes addressing congestion issues more complex, particularly for public passenger transport responses. This project essentially analyses ABS Journey to Work data from 1976-2001.

## Southern Outlet analysis

The Kingborough municipality has been experiencing rapid population growth in recent years (from a population of 25,441 in 1991, to 30,961 in 2004). This growth has generated community concern regarding traffic flows on the Southern Outlet, particularly during the morning peak period.

DIER, RACT, Metro Tasmania, Kingborough and the Hobart City Council convened the Southern Outlet Flow Investigation Group to examine issues of congestion on the Southern Outlet, including the nature of any congestion and potential solutions consistent with the nature and level of traffic delays.

As the analysis below indicates, of Hobart's major outlets, the Southern Outlet experiences the highest traffic speeds and least delays. Traffic problems on the Southern Outlet are generally related to the Macquarie and Davey Streets intersections, where previously free-flowing traffic from the Southern Outlet stops or slows in response to the Davey Street traffic lights. This situation causes traffic to 'bank up' along the Outlet.

In this context, the Group identified a number of small-scale engineering solutions at the intersection, which would generate potentially significant improvements in traffic flows into the central business district area.

Associated research identified the following key points.

### Travel Time

- Although the level of congestion on the Southern Outlet is perceived to be a problem, actual delays for motorists are less severe than those experienced by motorists travelling via the Brooker and Tasman-South Arm Highways, as well as by motorists interstate.

### Journey To Work

- The role of buses in transporting commuters from the Kingborough/Huon area to workplaces in Hobart decreased over the decade 1991 and 2001. At the same time, car use increased.
- Between 1991 and 2001, the Kingborough-Huon area exhibited the largest increase as an origin for journey to work trips, and the proportion of people travelling within this region also increased over this period.
- However, the Hobart CBD became less important as a JTW destination, particularly for residents of the Kingborough-Huon area.

- This suggests that, although the Hobart CBD has the greatest potential as a destination for bus users, it has declined as an employment destination from Kingborough/Huon and this limits the capacity of buses to cater for commuters.

### Public transport in Kingborough

- The Tasmanian Government's core policy objective in providing subsidised bus services is to mitigate the impact of transport and socio-economic disadvantage, by meeting the essential travel needs of the community.
- The majority of Census Collector Districts in the Kingston/Blackmans Bay area have an 'average' level of transport need. The level of service (in terms of frequency and route coverage) in Kingston/Blackmans Bay is similar to that of the Taroona area, an area with a similar measured transport need.
- A significant proportion of addresses (and therefore population) are located within 500 metres or less of a bus service, and nearly 80% of addresses are within 500 metres of a primary route, which run at intervals of approximately 20-30 minutes during peak periods. An additional 15% of addresses are located within 500 metres of a bus service, albeit at a reduced temporal span and frequency.

## Hobart travel speeds and congestion

**Map 10** shows traffic volumes and growth on some key arterial roads in metropolitan Hobart over the two decades 1983-2003. The highest volumes are experienced on the eastern end of the Tasman Bridge and toward the southern end of the Brooker Highway.

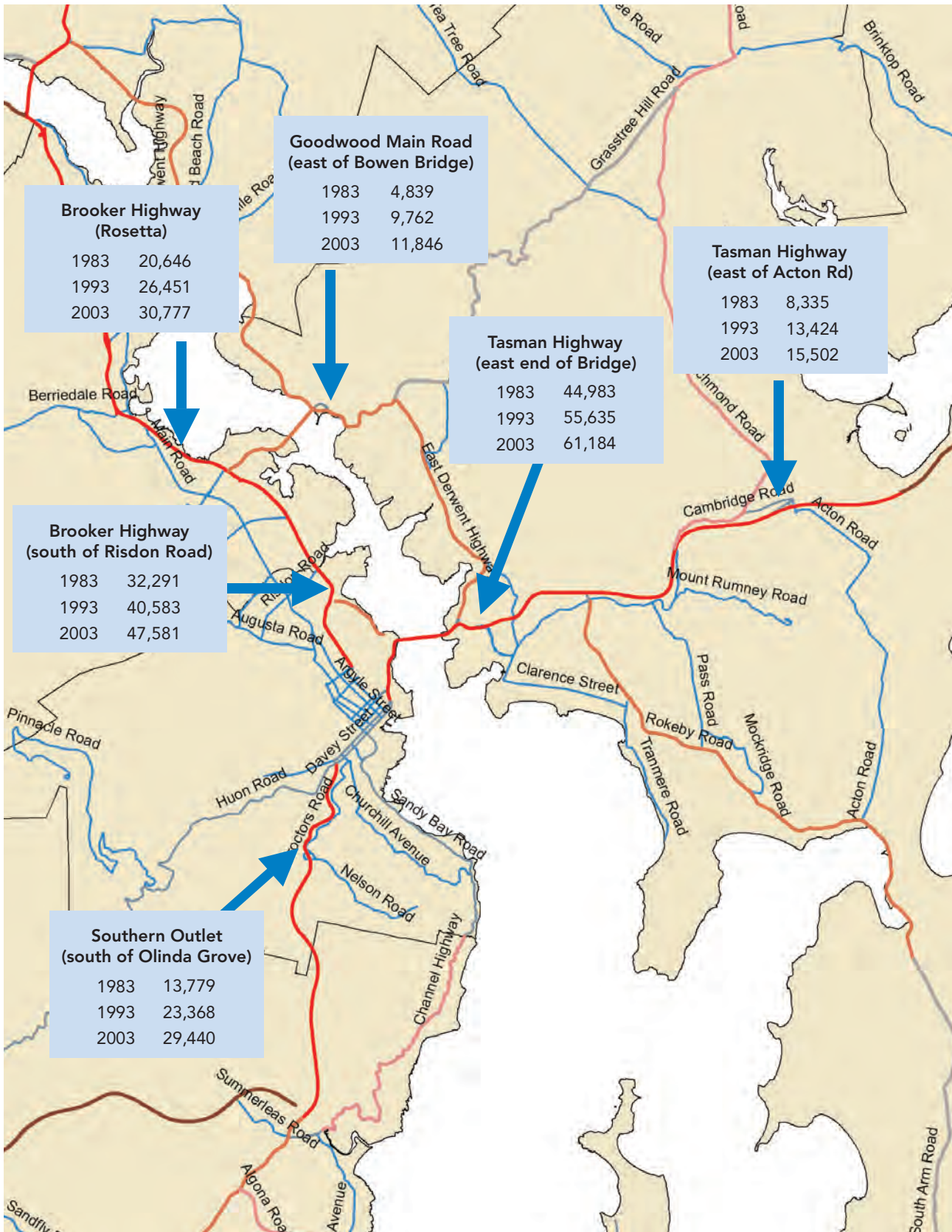
### travel time and speed comparisons

A variety of approaches can be used to measure road congestion. Volume to capacity ratio is often used, which describes the ratio of the average number of vehicles using a road per hour with the estimated design capacity of the road. However, this ratio does not necessarily reflect actual driving conditions.

Observation based user indicators are a more useful way to reflect actual driving conditions; examples include average travel times, delays or travel speeds, and travel time variability. Austroads uses nominal travel time when calculating delays. This approach describes the time taken to travel a particular road segment at the posted speed limit.

The analysis below uses nominal travel times. It should be noted that on some roads, in particular the Brooker Highway, there may be considerable discrepancy between the nominal travel time and the free flow speed due to the number of traffic signals.

map 10. average annual daily traffic, major Hobart arterial roads



## data

The data was collected by driving over the defined road segment using a GPS to record driver position and time. The data was used to calculate travel time for the nominate routes. Each route was driven a number of times during the AM and PM peak periods, and during the intra (off) peak period. A 'floating car' method was used, which attempts to keep the car in an average position within the traffic.

Data was collected across five major routes feeding into the Hobart CBD:

1. Brooker Highway (City Roundabout to Pontville) (**Map 11**)
2. Southern Outlet (Macquarie St to Margate) (**Map 12**)
3. South Arm Highway (Davey St to Lauderdale) (**Map 13**)
4. Tasman Highway (Davey St to Sorell) (**Map 14**)
5. East Derwent Highway (Davey St to Midland Highway) (**Map 15**)

### Total route length analysis (table 5 and 6, figures 15 & 16)

- All routes experienced a significant reduction in average travel speeds and an increase in travel times during the AM peak on the inward run into the Hobart CBD.

- Similar levels of delay were experienced on the AM peak inward run on the Brooker and South Arm Highways, and Southern Outlet; the East Derwent and Tasman Highways experienced less delay.
- During other periods, there was little change in travel speeds and times. The Brooker Highway experienced more than the other four routes.

In terms of the AM peak, the slowest average travel speeds were recorded on the South Arm Highway, Brooker Highway and Southern Outlet.

Afternoon and evening traffic peaks tend to be less concentrated than during morning periods, reflecting variability in finishing times for schools and to some extent, employment. Optional trips such as shopping also tend to be undertaken in the evening, contributing to staggered departure times.

In terms of the PM peak, the slowest average travel speeds were recorded on the Brooker Highway, followed by the South Arm Highway and Southern Outlet.

table 5. average travel speed (km/h – entire route)

	AM Peak In	AM Peak Out	PM Peak In	PM Peak Out	Off Peak In	Off Peak Out
S. Arm Highway	42.68	67.66	69.37	65.61	72.24	70.95
Brooker Highway	45.81	63.34	64.24	59.91	69.77	67.28
Southern Outlet	46.77	74.36	77.27	66.19	76.99	77.40
E. Derwent Highway	49.38	66.48	66.85	66.63	69.59	71.52
Tasman Highway	54.14	79.03	80.07	76.75	79.66	83.24

figure 15. average speed, entire route

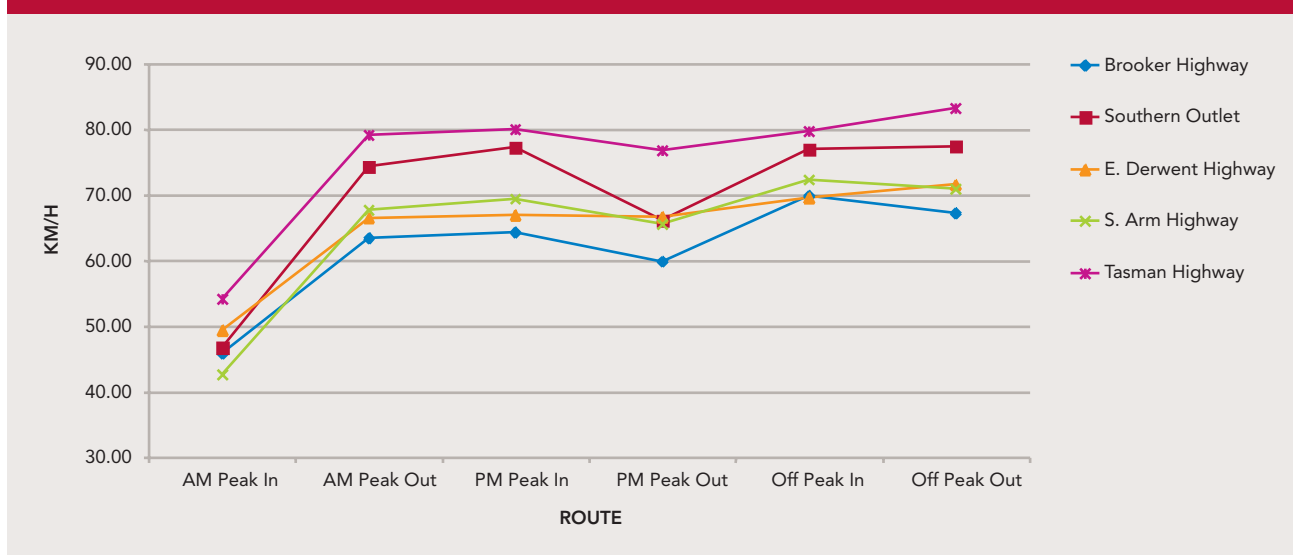
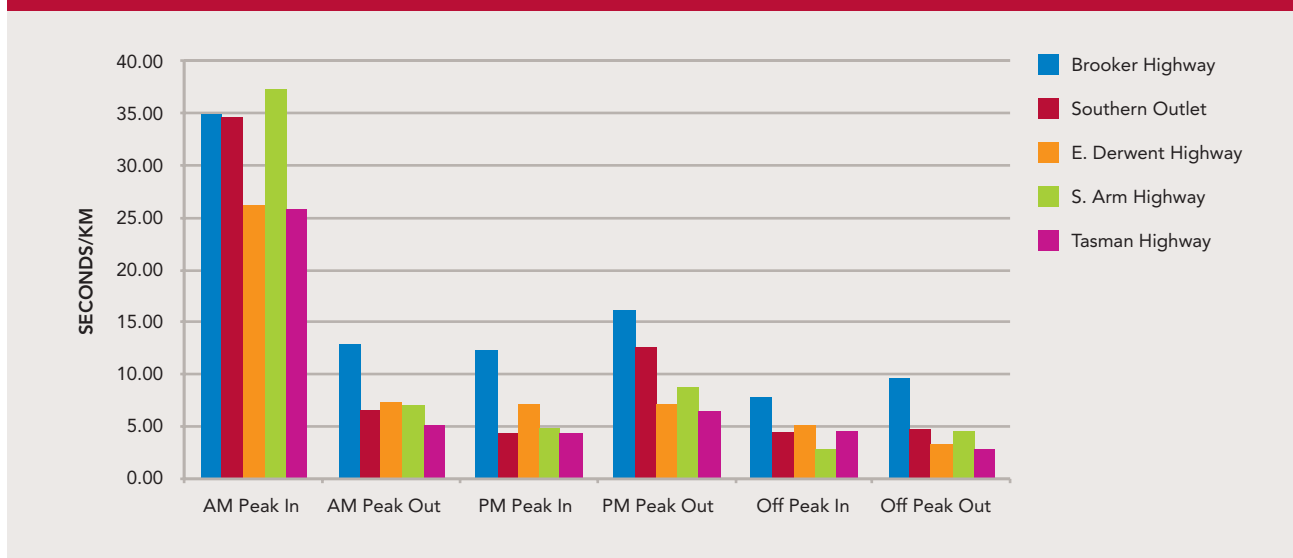


table 6. delay/km (in seconds based on nominal speed – entire route)

	AM Peak In	AM Peak Out	PM Peak In	PM Peak Out	Off Peak In	Off Peak Out
E. Derwent Highway	26.24	7.22	7.18	7.10	5.06	3.41
Southern Outlet	34.63	6.60	4.25	12.59	4.41	4.70
Brooker Highway	34.84	12.88	12.29	16.13	7.85	9.56
S. Arm Highway	37.32	7.07	4.87	8.72	2.81	4.60

figure 16. delay/km - entire route



### 10km route analysis

The above analysis is influenced by the total length of the routes chosen, which includes parts of the network experiencing comparatively more congestion near the Hobart CBD extending through outlying suburbs experiencing minimal to no congestion. For example, from the Brooker Highway near Risdon Road and Derwent Park Road compared to areas adjacent to Claremont and Granton.

Consequently, travel speeds and delays were also calculated for a 10km distance along the nominated routes, extending outwards from central Hobart. The route provides an equivalent distance for comparison purposes for each of the routes and is also (generally) located within built up areas experiencing higher traffic volumes.

As with the entire route analysis above, the AM peak inward run experienced the highest delays. Travel speeds are considerably lower and delay greater than for the entire route.

### Observations (tables 7 and 8, figures 17 and 18)

- The Brooker Highway experienced the longest delays and slowest travel speeds at all times and in both directions.
- The Southern Outlet and Tasman Highway experienced the least delay and fastest travel speeds at all times and in both directions.
- It should be noted that the Southern Outlet does experience significant delays outside the 10km distance in the AM Peak inward (near Huntingfield).
- To a lesser extent the Tasman Highway experienced a delay outside the 10km distance in the AM Peak inward near the Midway Point roundabout.

table 7. average Travel Speed (km/h – 10km)

	AM Peak In	AM Peak Out	PM Peak In	PM Peak Out	Off Peak In	Off Peak Out
Brooker Highway	27.12	46.64	49.32	42.17	58.02	54.73
E. Derwent Highway	32.72	59.25	59.28	55.66	63.98	66.09
S. Arm Highway	34.46	71.50	72.65	64.83	75.08	75.25
Tasman Highway	42.83	85.57	82.51	76.55	84.32	85.95
Southern Outlet	43.51	84.74	82.06	76.51	81.50	85.39

figure 17. average speed, 10km route

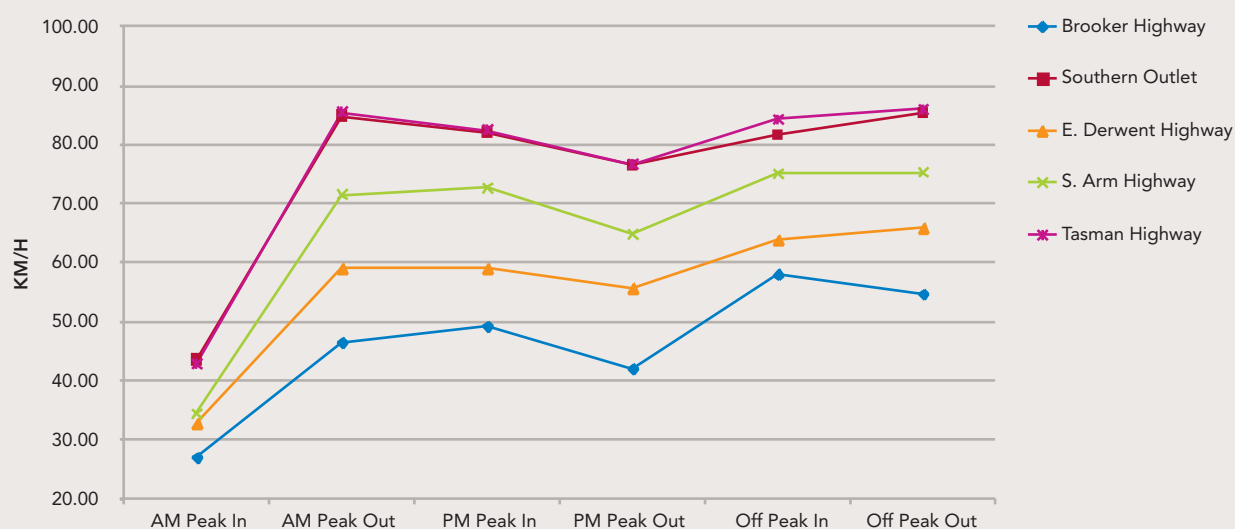
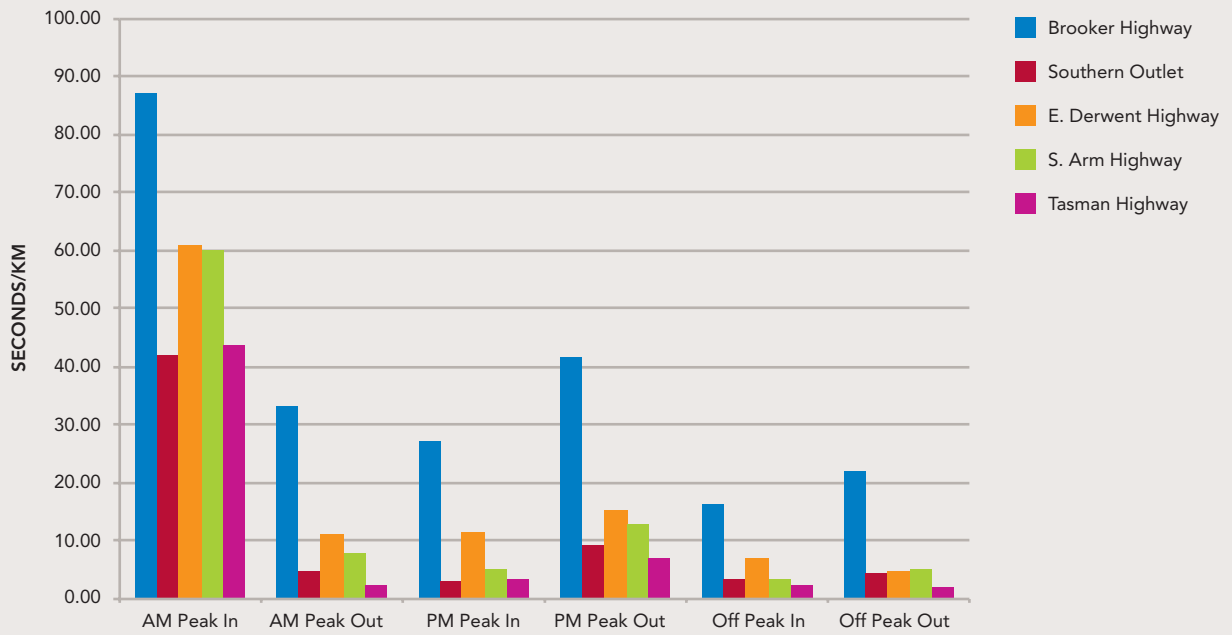


table 8. delay/km (in seconds based on nominal speed – 10km route)

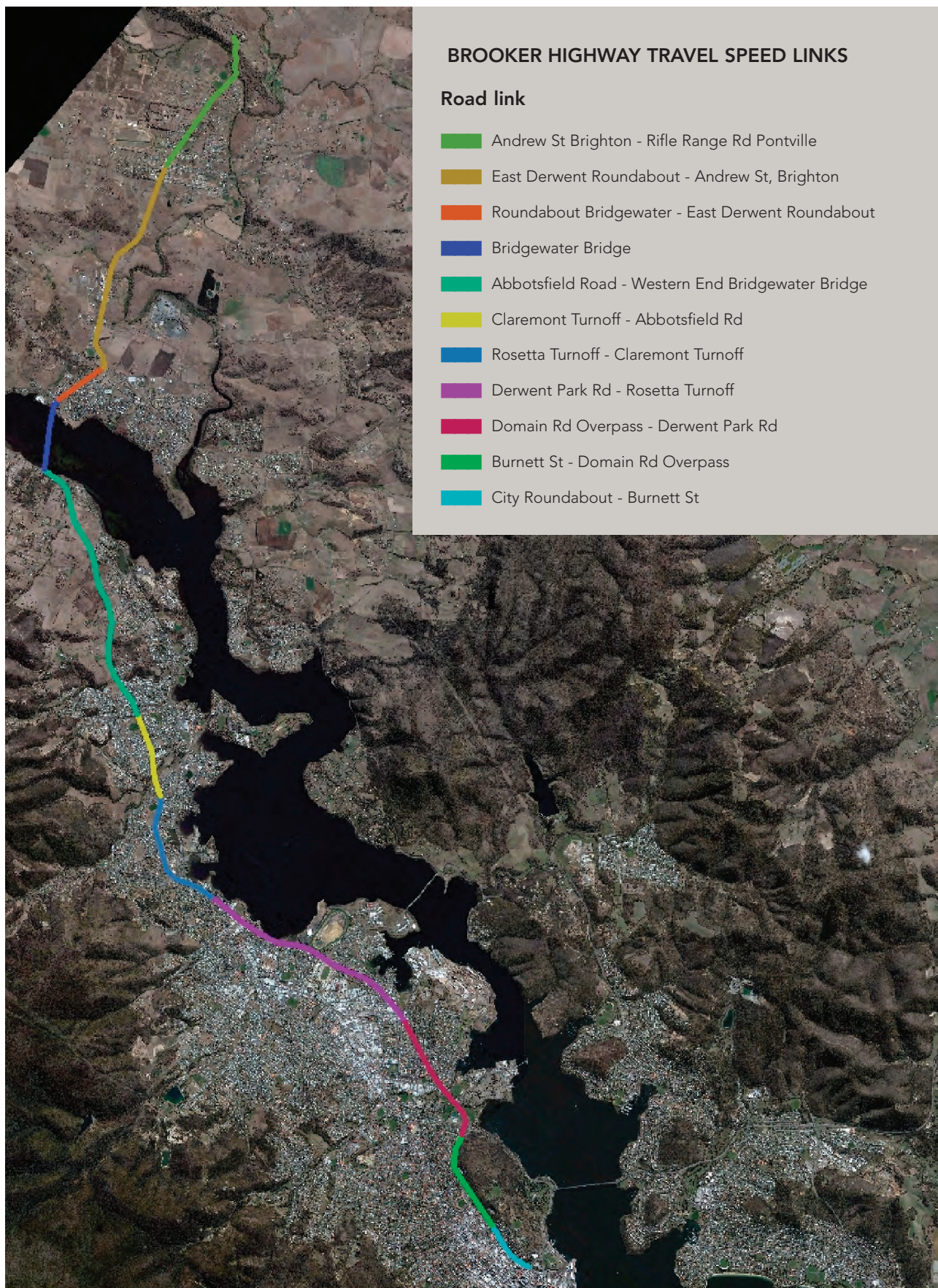
	AM Peak In	AM Peak Out	PM Peak In	PM Peak Out	Off Peak In	Off Peak Out
Brooker Highway	87.10	33.45	27.34	41.64	16.39	22.04
E. Derwent Highway	60.96	11.27	11.66	15.18	7.19	4.98
S. Arm Highway	60.10	7.73	5.17	12.92	3.57	5.23
Tasman Highway	43.73	2.29	3.31	7.26	2.38	2.11
Southern Outlet	42.05	4.78	3.19	9.35	3.49	4.46



figure 18. delay/km – 10km route



map 11. Brooker Highway



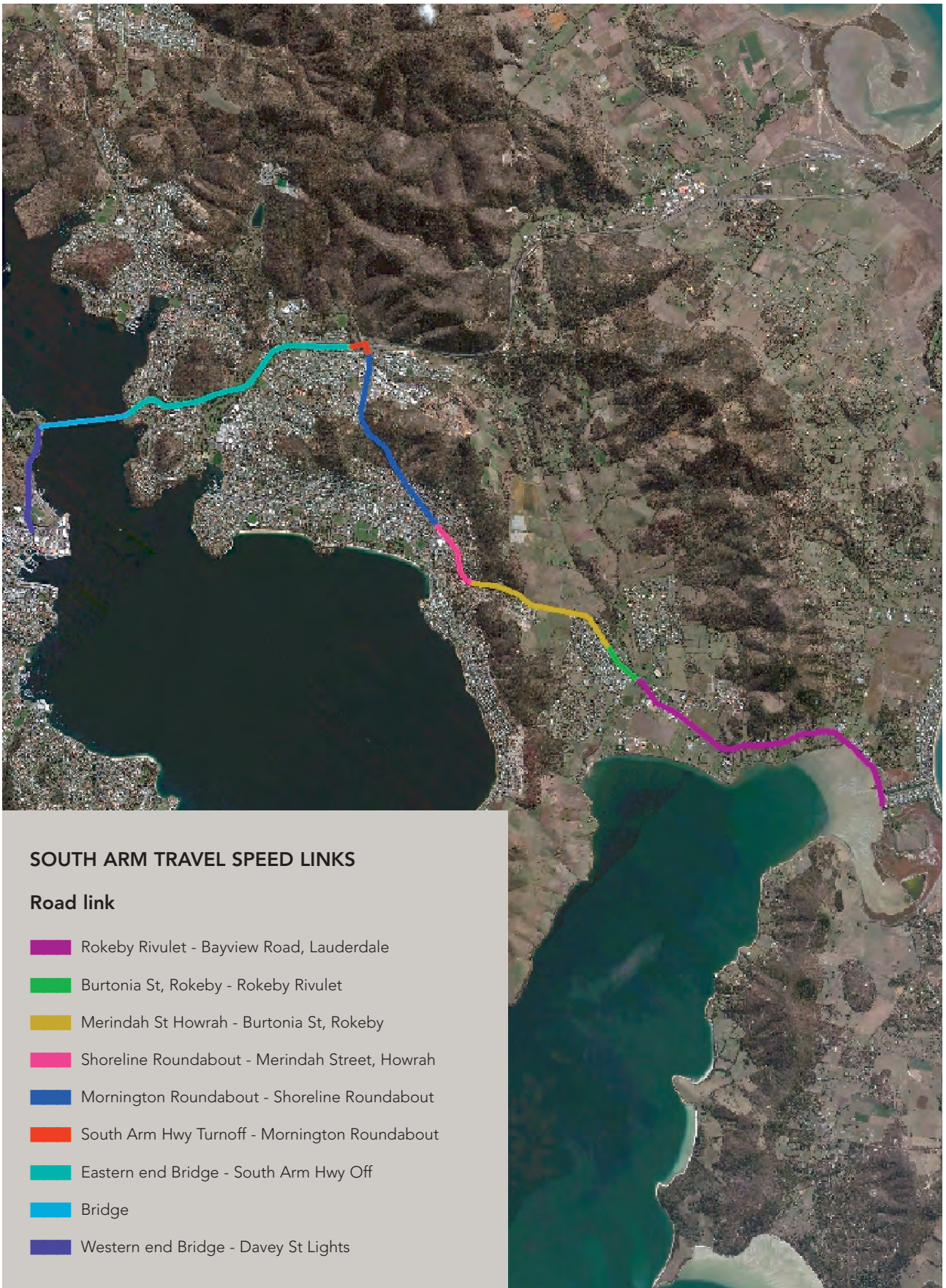


map 12. Southern Outlet





map 13. South Arm Highway





map 14. Tasman Highway





map 15. East Derwent Highway

