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Department of Transport and Regional Services

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Freight Measurement and Modelling in Australia

Report 112

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FOREWORD

Consistent time series estimates of freight carriage in Australia must be constructed from disparate data sources.

This report aims to construct consistent time series datasets on as many Australian freight sectors as possible. This allows two further tasks. First, the sectors can be modelled so that people using the data can understand the forces driving the growth in freight. Secondly, the sectors can then be forecast, and future growth rates estimated.

This study was undertaken and prepared over a ten year period and was project lead by Dr David Gargett. Dr Gargett and David Mitchell compiled the report material while Mark Cregan and Afzal Hossain were instrumental to the report finalisation.

Numerous other Bureau researchers (past and present) have contributed to this report. Notable are: David Cosgrove, Dion Epstein, Russell Thompson, and Adam Sidebottom.

Phil Potterton
Executive Director
Bureau of Transport and Regional Economics
March 2006

AT A GLANCE

Freight Measurement and Modelling in Australia aims to summarise the existing state of knowledge on freight in Australia and to present the time series data, analysis and sources which underpin the BTRE's long term freight forecasts.

Consistently measured time series data are required to model and forecast freight flows. The report describes the methodologies evolved by the BTRE to do this. It also includes the results of modelling and forecasting undertaken using the derived series.

Non-bulk freight is projected to increase by 82 per cent in tonne-kilometre terms between 2003 and 2020 (average 3.6 per cent a year). The expected rate of growth in gross domestic product and reductions in freight rates are the key drivers of this growth as well as a continuing trend to national distribution by manufacturers, wholesalers and importers. With Treasury projecting some fall-off in the long term economic growth going forward, the non-bulk growth rate is slightly lower than in the recent past.

Based on past trends, road's share of national non-bulk freight is projected to increase marginally from 74 per cent to 76 per cent, with the rail share declining from 21 per cent to 17 per cent and sea freight making up the balance (with air freight vanishingly small in tonne-kilometre terms, albeit not in value). These mode share projections, however, do not take account of the potential for rejuvenation of rail on north-south routes, in somewhat the same manner as has already occurred on east-west routes.

Capital city freight tonne-kilometres are projected to grow by 3.0 per cent a year between 2003 and 2020 (compared with a 1971–2003 average of 5.0 per cent). While heavy vehicles comprise only 4 per cent of the metropolitan traffic stream, growth of this level implies a slight increase in the heavy vehicle proportion (to 4.2 per cent in 2020).

Rail is expected to remain the largest mode in shipping bulk freight (46 per cent share in 2003, 45 per cent in 2020), followed by sea freight (30 per cent and 29 per cent shares respectively). Rail is well suited for transporting to port Australia's large export tonnages in coal, other minerals and grains. Rail freight has fallen in most other bulk commodities.

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EXECUTIVE SUMMARY

High growth rates in freight—past and future—have some important implications for the likely future costs of providing and maintaining road, rail and port infrastructure around Australia. The research presented here standardises the measurement, modelling and forecasting of freight flows—especially at the state and local level.

Consistently measured time series data are required to model and forecast freight flows. Much of the present work describes the methodologies evolved by the Bureau of Transport and Regional Economics (BTRE) to do this. It also includes the results of modelling and forecasting undertaken using the derived series.

Australian domestic freight can usefully be divided into bulk and non-bulk, and urban, interstate and rest of state. Table ES1 shows estimates from 1961 to 2003 and forecasts of the Australian domestic surface freight task until 2020.

The first thing to notice is the current composition of the freight. In terms of tonne-kilometres, only 10 per cent is urban. Ninety per cent is non-urban—that is, interstate and rest of state.

The sheer weight and volume of bulk freight, means that bulk freight comprises two-thirds of the total freight task—most of which is also non-urban.

However, when the forecasts are analysed, the bulk freight tasks are projected to grow more slowly than the non-bulks. Bulk freight is expected to grow by 2.3 per cent per year from 2003 to 2020, driven mainly by increases in the production of bulk commodities. Non-bulk freight is expected to grow by 3.6 per cent per year, driven by economic growth and some continued reductions in real freight rates.

The fastest growing task is non-bulk interstate freight. Interstate road freight is still tending to gain mode share, and thus grows faster than other modes in the business-as-usual projections—see Table ES2. However it is possible that rail freight will increase more quickly than shown, if north-south interstate operations replicate recent experience in the east-west corridor.

TABLE ES 1 THE AUSTRALIAN DOMESTIC FREIGHT TASK

(billion tonne-kilometres)

Year	Bulk				Non-Bulk				Total			
	Bulk Urban	Bulk Interstate	Rest of State	Total Bulk	Non-Bulk Urban	Non-Bulk Interstate	Rest of State	Total Non-Bulk	Total Urban	Total Interstate	Rest of State	Total Domestic Freight
1961	1.27	24.54	16.22	42.02	2.96	10.65	6.15	19.75	4.23	35.19	22.36	61.77
1962	1.37	24.61	16.82	42.79	3.20	10.75	6.32	20.26	4.56	35.36	23.13	63.06
1963	1.57	25.29	17.43	44.29	3.66	11.85	7.14	22.66	5.23	37.14	24.57	66.95
1964	1.67	27.46	19.46	48.60	3.90	12.88	7.71	24.49	5.57	40.34	27.17	73.09
1965	1.87	29.59	21.41	52.88	4.37	13.93	8.41	26.71	6.25	43.52	29.82	79.59
1966	1.98	33.00	26.75	61.73	4.62	14.48	8.59	27.68	6.60	47.48	35.34	89.41
1967	2.18	33.85	28.77	64.80	5.09	15.06	9.10	29.26	7.28	48.91	37.87	94.06
1968	2.29	39.29	32.36	73.94	5.34	16.55	9.70	31.59	7.63	55.85	42.05	105.53
1969	2.49	43.49	37.39	83.37	5.82	18.01	10.48	34.31	8.31	61.50	47.87	117.68
1970	2.60	46.32	40.73	89.65	6.07	19.36	11.17	36.60	8.67	65.68	51.90	126.25
1971	2.73	50.49	45.67	98.88	6.37	20.16	11.65	38.18	9.10	70.65	57.32	137.07
1972	2.90	59.02	51.84	113.76	6.76	20.94	11.33	39.03	9.66	79.96	63.17	152.79
1973	3.06	64.18	57.22	124.46	7.14	21.49	11.39	40.03	10.20	85.67	68.62	164.49
1974	3.38	68.95	66.82	139.14	7.88	23.16	11.37	42.40	11.25	92.11	78.19	181.55
1975	3.50	73.49	73.31	150.30	8.17	22.45	11.99	42.60	11.67	95.94	85.29	192.90
1976	3.69	76.39	70.63	150.71	8.61	22.93	12.58	44.11	12.30	99.32	83.21	194.83
1977	3.95	75.38	72.94	152.27	9.21	23.35	12.78	45.34	13.15	98.73	85.73	197.61
1978	4.05	77.82	75.33	157.21	9.45	23.10	14.17	46.72	13.51	100.92	89.50	203.93
1979	4.37	78.26	74.64	157.27	10.20	24.49	15.52	50.22	14.58	102.75	90.16	207.49
1980	4.83	79.13	79.41	163.36	11.26	26.22	15.81	53.29	16.09	105.34	95.22	216.65
1981	5.22	83.88	83.71	172.81	12.18	27.60	15.51	55.29	17.41	111.48	99.22	228.10
1982	5.60	75.50	81.09	162.20	13.07	28.95	15.16	57.18	18.67	104.46	96.25	219.38
1983	5.58	64.26	73.27	143.11	13.02	26.33	14.62	53.97	18.61	90.59	87.89	197.08
1984	6.01	75.73	79.65	161.40	14.03	29.71	15.68	59.43	20.05	105.44	95.34	220.82
1985	6.50	78.47	86.92	171.89	15.16	31.25	16.98	63.39	21.65	109.73	103.90	235.28
1986	7.10	82.48	92.94	182.52	16.56	32.77	19.12	68.45	23.65	115.25	112.06	250.97
1987	7.26	77.42	93.98	178.66	16.94	33.76	19.46	70.17	24.20	111.18	113.43	248.82
1988	7.92	75.40	95.73	179.05	18.48	36.71	20.21	75.40	26.40	112.11	115.94	254.45
1989	8.39	71.59	93.84	173.81	19.57	40.35	21.66	81.58	27.95	111.94	115.50	255.39
1990	8.70	73.32	104.35	186.37	20.30	42.05	22.18	84.53	29.01	115.36	126.54	270.91
1991	8.46	73.13	107.38	188.96	19.75	40.72	22.97	83.43	28.21	113.84	130.34	272.40
1992	8.19	75.28	115.20	198.68	19.12	40.54	23.42	83.07	27.31	115.82	138.62	281.75
1993	8.43	75.40	114.94	198.77	19.67	42.92	25.56	88.15	28.10	118.32	140.50	286.92
1994	8.59	78.50	117.40	204.49	20.04	44.90	26.86	91.80	28.63	123.40	144.26	296.29
1995	9.29	90.12	124.05	223.46	21.69	47.22	27.72	96.63	30.98	137.34	151.77	320.09
1996	10.08	87.07	129.37	226.53	23.53	50.43	27.16	101.12	33.61	137.50	156.53	327.65
1997	10.43	90.53	139.28	240.23	24.33	53.17	27.91	105.41	34.76	143.69	167.18	345.64
1998	10.92	93.10	145.00	249.02	25.47	57.53	32.13	115.13	36.39	150.63	177.13	364.15
1999	11.27	84.80	148.60	244.67	26.29	61.09	33.94	121.32	37.56	145.89	182.54	365.99
2000	11.43	83.93	154.28	249.63	26.68	66.78	34.49	127.95	38.11	150.71	188.77	377.58
2001	11.96	74.96	161.19	248.12	27.91	70.01	34.86	132.78	39.88	144.97	196.05	380.90
2002	12.56	83.03	173.47	269.06	29.31	74.08	35.80	139.20	41.88	157.11	209.27	408.26
2003	12.91	86.49	184.05	283.44	30.12	78.96	37.24	146.33	43.03	165.45	221.29	429.78
2004	13.44	88.92	189.57	291.93	31.36	83.13	38.61	153.10	44.80	172.05	228.18	445.03
2005	13.98	90.12	194.33	298.43	32.63	87.22	40.53	160.38	46.61	177.34	234.86	458.81
2006	14.59	91.51	199.91	306.00	34.03	91.55	42.08	167.66	48.62	183.05	241.99	473.66
2007	15.25	92.89	205.26	313.41	35.59	96.09	43.48	175.16	50.84	188.99	248.74	488.57
2008	15.80	94.24	210.16	320.20	36.88	99.84	44.87	181.58	52.68	194.07	255.03	501.78
2009	16.38	95.75	214.38	326.51	38.21	103.66	46.28	188.14	54.59	199.41	260.66	514.66
2010	16.96	97.45	219.52	333.93	39.57	107.55	47.72	194.84	56.53	205.00	267.24	528.77
2011	17.51	99.06	224.72	341.30	40.86	111.51	49.30	201.66	58.37	210.57	274.02	542.96
2012	18.09	100.85	229.99	348.93	42.21	115.54	50.85	208.60	60.30	216.39	280.85	557.53
2013	18.69	102.67	235.33	356.69	43.60	119.63	52.43	215.67	62.29	222.30	287.76	572.36
2014	19.29	104.60	240.67	364.57	45.01	123.70	54.02	222.73	64.30	228.30	294.70	587.30
2015	19.91	106.65	246.10	372.66	46.46	127.81	55.62	229.90	66.37	234.46	301.72	602.56
2016	20.55	108.76	251.56	380.86	47.95	131.98	57.23	237.16	68.51	240.73	308.79	618.02
2017	21.22	110.96	257.06	389.25	49.51	136.18	58.83	244.52	70.72	247.15	315.90	633.76
2018	21.89	113.33	262.66	397.88	51.08	140.42	60.47	251.97	72.97	253.75	323.12	649.84
2019	22.57	115.73	268.31	406.61	52.67	144.70	62.14	259.50	75.24	260.43	330.45	666.12
2020	23.26	118.21	274.04	415.51	54.27	149.00	63.86	267.13	77.53	267.21	337.90	682.63
						Annual growth rate (per cent)						
2003–20	3.5	1.9	2.4	2.3	3.5	3.8	3.2	3.6	3.5	3.8	3.2	2.8

TABLE ES 2 INTERSTATE NON-BULK FREIGHT

(billion tonne-kilometres)

Year	Road	Rail	Coastal	Air	Total
1961	2.47	5.02	3.13	0.02	10.65
1962	2.66	4.93	3.13	0.02	10.75
1963	3.04	5.56	3.22	0.03	11.85
1964	3.23	6.12	3.49	0.03	12.88
1965	3.61	6.52	3.76	0.04	13.93
1966	3.80	6.42	4.21	0.05	14.48
1967	4.18	6.53	4.30	0.05	15.06
1968	4.37	7.11	5.01	0.06	16.55
1969	4.75	7.64	5.55	0.07	18.01
1970	4.94	8.42	5.91	0.09	19.36
1971	5.12	8.38	6.58	0.09	20.16
1972	5.86	8.43	6.56	0.09	20.94
1973	6.79	8.56	6.27	0.09	21.72
1974	7.63	9.10	6.56	0.11	23.39
1975	7.91	8.65	6.22	0.11	22.89
1976	8.46	8.93	5.84	0.11	23.35
1977	9.21	9.22	5.62	0.11	24.15
1978	9.49	8.93	5.82	0.11	24.34
1979	10.70	9.69	5.59	0.11	26.09
1980	11.90	10.45	5.84	0.11	28.30
1981	13.02	10.93	5.84	0.11	29.89
1982	14.04	11.31	5.73	0.12	31.20
1983	13.86	9.95	3.96	0.12	27.89
1984	15.35	11.40	4.39	0.14	31.28
1985	16.93	11.31	4.24	0.15	32.62
1986	18.60	11.40	4.09	0.14	34.23
1987	19.25	11.78	4.05	0.13	35.21
1988	21.11	12.92	3.94	0.15	38.12
1989	22.88	14.54	4.59	0.15	42.15
1990	24.55	14.70	4.48	0.08	43.81
1991	24.18	13.57	4.43	0.13	42.30
1992	23.90	13.57	4.55	0.15	42.16
1993	25.48	14.21	4.78	0.16	44.63
1994	26.97	14.50	5.08	0.17	46.72
1995	29.67	13.92	5.36	0.20	49.14
1996	32.27	14.41	5.53	0.20	52.41
1997	34.13	15.27	5.52	0.22	55.14
1998	37.07	15.93	6.02	0.22	59.25
1999	40.00	16.50	6.10	0.23	62.83
2000	43.37	17.45	6.76	0.23	67.81
2001	45.23	17.64	6.85	0.23	69.96
2002	49.11	18.59	7.19	0.22	75.12
2003	51.86	19.54	8.12	0.23	79.75
2004	55.45	20.40	8.24	0.24	84.33
2005	59.17	21.04	8.37	0.24	88.81
2006	62.91	21.70	8.49	0.25	93.35
2007	66.85	22.30	8.62	0.26	98.03
2008	70.36	22.85	8.75	0.27	102.23
2009	73.97	23.41	8.88	0.27	106.53
2010	77.68	23.97	8.99	0.28	110.92
2011	81.48	24.54	9.09	0.29	115.40
2012	85.37	25.10	9.20	0.30	119.98
2013	89.36	25.67	9.31	0.31	124.65
2014	93.36	26.23	9.42	0.32	129.34
2015	97.45	26.79	9.54	0.33	134.11
2016	101.61	27.35	9.63	0.34	138.93
2017	105.83	27.91	9.73	0.35	143.81
2018	110.12	28.46	9.83	0.36	148.76
2019	114.46	29.02	9.92	0.37	153.77
2020	118.85	29.58	10.02	0.38	158.83
			Annual growth rate (per cent)		
2003-20	5.0	2.5	1.4	3.0	4.1

TABLE ES 3 PROJECTED ANNUAL AVERAGE GROWTH RATES FROM 2004 TO 2020 IN STATE AND CAPITAL CITY ROAD FREIGHT

State	Annual Growth in Road Freight (per cent)	Capital City	Annual Growth in Road Freight (per cent)
NSW	3.8	Sydney	2.9
VIC	3.5	Melbourne	3.0
QLD	3.9	Brisbane	3.6
SA	3.8	Adelaide	2.4
WA	3.6	Perth	3.3
TAS	2.1	Hobart	2.3
NT	5.0	Darwin	3.7
ACT	2.8	Canberra	2.8
AUSTRALIA	3.7	All Capitals	3.1

The freight task in Australia's capital cities is also fast growing. Current modelling suggests that freight in Australia's cities will increase by 80 per cent in the 17 years between 2003 and 2020. In some cities road freight grows quickly—for example, Brisbane. In other cities,—for example, Hobart—road freight grows more slowly. These trends tend to be replicated at the state level as well. For example, Queensland's projected annual growth rate in road freight is higher than Tasmania's. These differences basically relate to differing expected rates of population and economic growth. Table ES3 shows the projected growth rates in road freight across states and capital cities.

Chapter 1 of this report presents an overview of the Australian freight task. But given the diversity of the freight task, subsequent chapters tend to focus on one mode or on specific geographical areas.

Chapter 2 examines the statistics on road freight and the methodology necessary to derive consistent time-series measurements.

Chapter 3 examines capital city road freight.

Chapter 4 does the same for state-based land freight movements (road and rail).

Chapter 5 examines interstate non-bulk freight (by road, rail and sea).

Chapter 6 presents estimates and models for intercapital non-bulk freight (road, rail, and sea) for seven corridors.

Chapter 7 presents statistics by state on rail carriage of bulk commodities over forty years.

Chapter 8 examines freight rates in Australia.

Chapter 9 profiles the road freight industry in Australia.

Chapter 10 outlines a model of interregional freight flows by commodity.

Finally, Chapter 11 presents a model of road freight in Sydney.

Chapters 6, 8, 9, 10 and 11 are adapted from previous BTRE publications.

CHAPTER 1

THE AUSTRALIAN DOMESTIC FREIGHT TRANSPORT TASK

1.1 INTRODUCTION

The Australian freight transport task consists of a diverse range of services and activities, with greatly differing scales of operation. Any line of inquiry involving the freight transport sector or its societal influences will require knowledge of the levels of aggregate transport tasks. In particular, concern over future transport infrastructure needs and the impact of transport activities on congestion and the environment—especially from greenhouse gas and noxious emissions—focuses attention on transport demand issues. Proper assessment of these issues is founded on measuring how much the different modes are used. One of the imperatives for national debate on the management of the freight transport task is an adequate understanding of the task components and their trend rates of growth.

There are various theoretical difficulties with deriving national freight transport aggregates. For example, accounting for the use of private cars to transport goods—such as groceries. This is generally counted as only a passenger movement in transport activity surveys. Yet, if consumers asked for their orders to be delivered, their carriage would be recorded as freight movements. However, such theoretical impediments to calculating task estimates are minor compared with the practical difficulties resulting from the fragmented nature of data collection on the extent of Australian freight movements.

Several factors make it difficult to produce a trend analysis based on these past estimates. They include:

- a shortage of comparisons between years
- deficient coverage of some modes
- often conflicting estimates derived
- a lack of adequate discussion of the estimation methods.

This report strives to draw together the disparate estimates from existing sources.

By reconciling inconsistent sources and developing appropriate measurement methodologies, the BTRE has derived estimates of the domestic freight transport task from 1960–61 until 2002–03. Forecasts are provided up until 2019–20.

The freight task is measured in this report in terms of tonne-kilometres (one tonne transported one kilometre). However there are several alternatives, e.g. volume, tonnes, and value of freight moved. If value of freight moved was used as a measure, for example, the air freight industry would show up as much more important in its contribution to the freight task.

Similarly, the emphasis on measuring and modelling the freight task in tonnes or tonne-kilometres ignores the issue of the vehicle performing the task, e.g. the contribution of freight vehicles to road traffic.

However, bearing in mind these limitations, the report allows one to easily focus on the nature of the freight task.

1.2 THE FREIGHT TASK

The total Australian freight task in 1999–2000 is estimated to have amounted to 382.5 billion (10^9) tonne-kilometres. The movement of freight within Australia comprises a collection of activities as diverse in character as in geographical location. They include the:

- long-haul movement of domestic raw materials for secondary industry—primarily iron ore, oil and coal—by coastal sea freight
- carriage of primary products from inland mines and farms to coastal city markets and export ports by railway
- urban and intercity distribution, by road transport, of non-bulk goods for consumption.

Table 1.1 presents the estimated modal composition of the Australian freight task from 1970–71 until 1999–2000. The urban freight task—detailed in Table 1.2—is accomplished almost exclusively by road transport, so the other modes are assumed to involve non-urban freight movement only. There is a wide variation in the average length of haul across the different modes. Thus, tasks that appear equivalent in tonne-kilometre terms may involve greatly differing amounts of freight. For comparison purposes, Table 1.3 gives estimates of tonnes consigned by mode over the period. Figure 1.1 illustrates the current modal split of the total—bulk plus non-bulk—Australian tonne-kilometres performed. The split is:

- 37.3 per cent by road
- 33.1 per cent by rail
- 29.5 per cent by coastal shipping
- 0.1 per cent by air.

TABLE 1.1 THE AUSTRALIAN DOMESTIC FREIGHT TASK BY SECTOR AND MODE: ESTIMATES OF TONNE-KILOMETRES PERFORMED, 1970–71 TO 1999–00

(billion tonne-kilometres)

Year Ending June	Road		Railway				
	Urban	Non-urban	Public-access	Private	Sea	Air	Total
1971	9.39	16.67	25.2	13.8	72	0.1	137.16
1985	23.77	44.58	44.21	28.4	96.3	0.15	237.41
2000	46.13	96.5	79.28	47.45	112.9	0.2	382.46

Sources: BTRE (2002a), BTRE estimates.

TABLE 1.2 THE AUSTRALIAN ROAD FREIGHT TASK BY SECTOR AND VEHICLE TYPE: ESTIMATES OF TONNE-KILOMETRES PERFORMED, 1970–71 TO 1999–00

(billion tonne-kilometres)

Year Ending June	Urban			Non-Urban			
	LCV	Rigid	Articulated	LCV	Rigid	Articulated	Total
1971	0.71	4.65	4.03	0.25	5.89	10.53	26.06
1985	1.66	9.39	12.71	1.16	7.69	35.73	68.35
2000	4.56	17.35	24.22	0.93	8.14	87.43	142.63

Source: BTRE estimates.

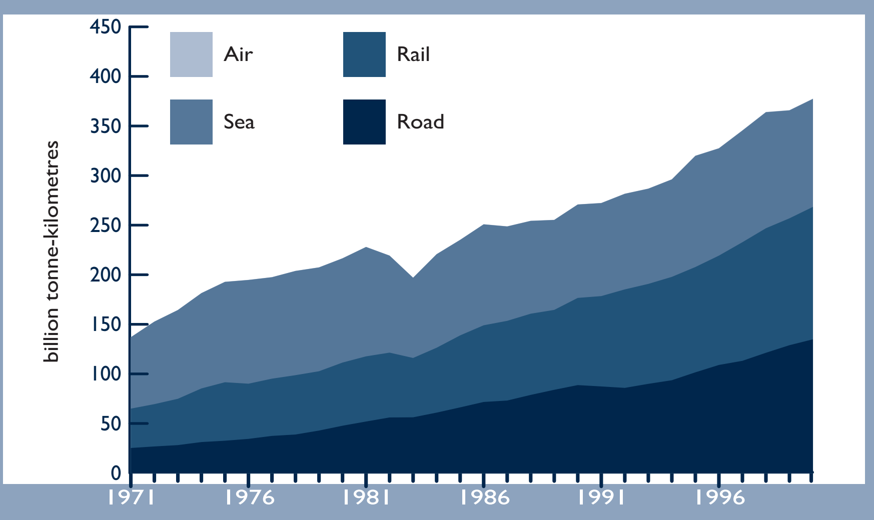
TABLE 1.3 AUSTRALIAN DOMESTIC FREIGHT BY MODE: ESTIMATES OF TONNES CONSIGNED, YEAR ENDING JUNE 2000

(million tonnes)

Year Ending June	Road	Railway			Sea	Air	Total
		Government	Private	Total			
2000	1 399.00	278.97	203.47	482.44	50.33	0.15	1 931.92

Sources: ABS (2001a and earlier issues), BTRE Indicators Database, BTRE estimates.

FIGURE 1.1 MODAL SPLIT AND MAJOR TRENDS, 1970–71 TO 1999–00, OF THE TOTAL (BULK PLUS NON-BULK) DOMESTIC FREIGHT TASK



Source: BTRE estimates.

Over the years, the freight task transported by road in Australia has increased substantially. In the last 15 years, the tonne-kilometres have more than doubled—see Table 1.1. Of this, approximately 70 per cent is due to non-bulk commodities. The growing demand for door-to-door delivery has helped the road freight industry capture an increasing share of the non-bulk freight task from rail. Road now performs approximately 75 per cent of the non-bulk freight task. Approximately 30 per cent of the road task is completed by interstate trucking while more than 95 per cent of long distance road freight is hauled on articulated trucks. The most common configuration of these trucks is a three-axle prime mover with a tri-axle trailer. These trucks accomplish almost 40 per cent of Australia's total road freight movement (ABS 2001a). In terms of tonnes consigned—see Table 1.3—road has by far the dominant modal share of Australian freight.

The public access rail systems account for a similar proportion of the overall non-urban task as the road freight industry. However, since most of the rail tonnage is bulk commodities—approximately 85 per cent—rail currently handles only one-third of the total intercity non-bulk freight task.

Private railways perform approximately 42 per cent of the rail freight task. These non-government railways are used almost entirely for the transfer of bulk materials—iron ore, sugar, coal and various minerals—often over short distances.

Most of the Australian domestic sea task consists of long-haul movements of iron ore, petroleum and bauxite. Coastal shipping carries almost 90 per cent of the tonne-kilometres due to bulk interstate freight.

Air freight is a very small segment of the national total. Less than one per cent of interstate non-bulk freight—both tonne-kilometres and tonnes consigned—is carried by air (BTRE 2002a). Of course, neither of these definitions of task includes the value added in the industries involved. If value adding was included, the air freight industry would be a significant contributor to the freight task.

The trends in modal freight activity are quite varied. Since 1984–85, the average per annum rates of growth, in terms of tonne-kilometres, have been:

- urban road—3.9 per cent
- non-urban road—5.2 per cent
- government rail—4.5 per cent
- private rail—4.5 per cent
- air—approximately 2.5 per cent
- sea freight—0.5 per cent.

Clearly, the road freight industry has had the highest level of responsiveness to the economic growth over the time frame examined.

Table 1.4 presents BTRE estimates of Australian domestic freight task trends. The original data sources, and the methods of derivation, are described in Appendix I. The units are in billions of tonne-kilometres.

TABLE 1.4 AUSTRALIAN FREIGHT TASK TRENDS, 1960–61 TO 2019–20.

(billion tonne-kilometres)

	Road										
	By area		By load (all areas)		By vehicle type (all areas)				Interstate		
Year	Urban	Non-urban	Bulk	Non-bulk	LCV[1]	Rigid	Articulated	Total	Bulk	Non-bulk	Total Interstate
1961	4.23	7.85	3.62	8.45	0.51	6.64	4.93	12.08	0.19	2.47	2.66
1962	4.56	8.44	3.90	9.10	0.54	6.96	5.51	13.00	0.20	2.66	2.86
1963	5.23	9.63	4.46	10.40	0.61	7.74	6.52	14.86	0.23	3.04	3.27
1964	5.57	10.22	4.74	11.05	0.64	7.99	7.16	15.79	0.24	3.23	3.47
1965	6.25	11.40	5.29	12.35	0.71	8.67	8.27	17.65	0.27	3.61	3.88
1966	6.60	11.98	5.57	13.00	0.73	8.86	8.98	18.58	0.29	3.80	4.09
1967	7.28	13.16	6.13	14.30	0.80	9.45	10.19	20.44	0.31	4.18	4.50
1968	7.63	13.74	6.41	14.96	0.82	9.57	10.97	21.36	0.33	4.37	4.70
1969	8.31	14.91	6.97	16.26	0.88	10.07	12.27	23.22	0.36	4.75	5.11
1970	8.67	15.48	7.25	16.91	0.90	10.12	13.13	24.15	0.37	4.94	5.31
1971	9.10	16.17	7.58	17.69	0.93	10.22	14.11	25.27	0.39	5.12	5.50
1972	9.66	17.17	8.05	18.78	1.00	10.28	15.55	26.83	0.44	5.86	6.30
1973	10.20	17.98	8.45	19.73	1.09	10.38	16.71	28.18	0.51	6.79	7.30
1974	11.25	20.00	9.38	21.88	1.28	11.21	18.77	31.25	0.57	7.63	8.20
1975	11.67	20.92	9.78	22.81	1.39	11.23	19.96	32.59	0.60	7.91	8.50
1976	12.30	22.16	10.34	24.12	1.48	11.35	21.63	34.46	0.64	8.46	9.10
1977	13.15	24.31	11.24	26.22	1.72	11.91	23.83	37.46	0.69	9.21	9.90
1978	13.51	25.36	11.66	27.20	1.87	12.11	24.89	38.86	0.71	9.49	10.20
1979	14.58	28.26	12.85	29.99	1.98	12.47	28.38	42.84	0.81	10.70	11.50
1980	16.09	31.65	14.32	33.41	2.05	13.69	32.00	47.73	0.90	11.90	12.80
1981	17.41	34.55	15.59	36.37	2.20	15.05	34.71	51.96	0.98	13.02	14.00
1982	18.67	37.40	16.82	39.25	2.28	15.77	38.02	56.07	1.06	14.04	15.10
1983	18.61	37.60	16.86	39.35	2.37	15.17	38.67	56.21	1.04	13.86	14.90
1984	20.05	40.88	18.28	42.65	2.59	15.89	42.45	60.93	1.16	15.35	16.50
1985	21.65	44.57	19.87	46.35	2.73	16.55	46.94	66.22	1.27	16.93	18.20
1986	23.65	48.03	21.50	50.18	3.22	18.01	50.46	71.68	1.40	18.60	20.00
1987	24.20	48.92	21.94	51.19	3.47	18.39	51.26	73.12	1.45	19.25	20.70
1988	26.40	52.40	23.64	55.16	3.95	19.83	55.02	78.80	1.59	21.11	22.70
1989	27.95	55.99	25.18	58.76	4.22	20.90	58.82	83.95	1.72	22.88	24.60
1990	29.01	59.70	26.61	62.09	4.49	21.91	62.31	88.70	1.85	24.55	26.40
1991	28.21	59.13	26.20	61.14	4.73	21.47	61.14	87.34	1.82	24.18	26.00
1992	27.31	58.57	25.77	60.12	4.57	20.34	60.98	85.89	1.80	23.90	25.70
1993	28.10	61.86	26.99	62.97	4.15	20.13	65.67	89.96	1.92	25.48	27.40
1994	28.63	64.98	28.08	65.53	4.11	19.55	69.95	93.61	2.03	26.97	29.00
1995	30.98	70.59	30.47	71.10	4.45	20.30	76.83	101.57	2.23	29.67	31.90
1996	33.61	75.38	32.70	76.30	4.55	21.80	82.65	109.00	2.43	32.27	34.70
1997	34.76	78.42	33.95	79.22	4.71	22.56	85.91	113.17	2.57	34.13	36.70
1998	36.39	84.90	36.39	84.90	5.39	23.80	92.10	121.29	2.79	37.07	39.86
1999	37.56	91.37	38.68	90.25	5.65	24.76	98.52	128.93	3.01	40.00	43.01
2000	38.11	96.76	40.46	94.41	5.98	26.03	102.86	134.87	3.26	43.37	46.64
2001	39.88	99.36	41.77	97.47	6.10	26.75	106.38	139.24	3.40	45.23	48.64
2002	41.88	105.29	44.15	103.01	6.48	28.40	112.29	147.16	3.70	49.11	52.80
2003	43.03	110.59	46.09	107.53	6.78	30.15	116.69	153.62	3.90	51.86	55.76
2004	44.80	116.36	48.35	112.82	7.02	30.91	123.24	161.17	4.11	54.67	58.78
2005	46.61	122.78	50.82	118.58	7.31	31.74	130.34	169.40	4.33	57.48	61.81
2006	48.62	128.91	53.26	124.27	7.57	32.50	137.46	177.53	4.55	60.44	64.99
2007	50.84	135.21	55.82	130.24	7.84	33.27	144.93	186.05	4.78	63.54	68.33
2008	52.68	140.56	57.97	135.27	8.06	33.75	151.43	193.24	4.98	66.12	71.10
2009	54.59	145.99	60.17	140.40	8.27	34.21	158.09	200.58	5.18	68.76	73.93
2010	56.53	151.54	62.42	145.65	8.52	34.64	164.91	208.07	5.38	71.45	76.82
2011	58.37	157.35	64.71	151.00	8.76	35.06	171.90	215.71	5.58	74.19	79.77
2012	60.30	163.20	67.05	156.45	9.01	35.45	179.05	223.50	5.79	76.97	82.77
2013	62.29	169.14	69.43	162.00	9.26	35.81	186.36	231.43	6.01	79.81	85.81
2014	64.30	175.06	71.81	167.55	9.51	36.14	193.71	239.36	6.22	82.63	88.85
2015	66.37	181.03	74.22	173.18	9.76	36.43	201.21	247.40	6.43	85.49	91.92
2016	68.51	187.06	76.67	178.89	10.02	36.77	208.78	255.56	6.65	88.38	95.03
2017	70.72	193.11	79.15	184.68	10.28	37.07	216.48	263.83	6.87	91.30	98.17
2018	72.97	199.24	81.66	190.54	10.58	37.35	224.27	272.20	7.09	94.25	101.35
2019	75.24	205.43	84.20	196.47	10.89	37.60	232.18	280.67	7.32	97.23	104.54
2020	77.53	211.70	86.77	202.46	11.22	37.83	240.18	289.23	7.54	100.22	107.76
	Average annual growth rate (per cent)										
1985–2003	3.9	5.2	4.8	4.8	5.2	3.4	5.2	4.8	6.4	6.4	6.4
2003–2020	3.5	3.9	3.8	3.8	3.0	1.3	4.3	3.8	4.0	4.0	4.0

1. Light commercial vehicle.

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TABLE 1.4 AUSTRALIAN FREIGHT TASK TRENDS, 1960–61 TO 2019–20 (continued)

(billion tonne-kilometres)

Rail

	(Rail—public-access)			(Rail—private)	All operators			Interstate		
	Non-Urban			Non-urban		Non-urban				
	Bulk	Non-bulk	Total	Bulk	Bulk	Non-bulk	Total	Bulk	Non-bulk	Total
1961	5.95	7.98	13.93	0.75	6.70	7.98	14.68	0.89	5.02	5.92
1962	6.32	7.84	14.15	0.88	7.19	7.84	15.03	0.95	4.93	5.88
1963	6.22	8.83	15.06	1.00	7.22	8.83	16.06	0.93	5.56	6.49
1964	7.18	9.73	16.91	1.35	8.53	9.73	18.26	1.08	6.12	7.20
1965	7.79	10.36	18.15	1.75	9.54	10.36	19.90	1.17	6.52	7.69
1966	8.09	10.20	18.29	5.50	13.59	10.20	23.79	1.21	6.42	7.63
1967	9.07	10.37	19.44	6.12	15.19	10.37	25.57	1.36	6.53	7.89
1968	9.52	11.29	20.81	7.29	16.80	11.29	28.09	1.43	7.11	8.54
1969	10.50	12.13	22.63	9.75	20.25	12.13	32.38	1.57	7.64	9.21
1970	11.40	13.38	24.78	11.23	22.62	13.38	36.01	1.71	8.42	10.13
1971	12.29	13.62	25.90	13.80	26.09	13.62	39.70	1.84	8.38	10.22
1972	12.68	13.39	26.06	16.60	29.28	13.39	42.66	1.90	8.43	10.33
1973	12.80	13.96	26.76	19.95	32.75	13.96	46.71	1.79	8.56	10.35
1974	13.74	13.89	27.62	26.45	40.19	13.89	54.07	1.79	9.10	10.88
1975	15.19	13.71	28.91	30.08	45.27	13.71	58.99	1.98	8.65	10.63
1976	15.22	14.22	29.44	26.21	41.43	14.22	55.65	1.98	8.93	10.91
1977	16.47	13.98	30.44	27.28	43.75	13.98	57.72	2.06	9.22	11.27
1978	16.90	14.63	31.53	28.31	45.21	14.63	59.84	2.11	8.93	11.04
1979	18.38	15.91	34.29	25.54	43.92	15.91	59.83	2.21	9.69	11.90
1980	20.09	15.81	35.90	27.80	47.89	15.81	63.70	2.41	10.45	12.86
1981	21.76	15.07	36.82	28.89	50.65	15.07	65.72	2.61	10.93	13.54
1982	23.84	14.13	37.97	27.40	51.24	14.13	65.37	2.62	11.31	13.93
1983	22.88	11.96	34.84	25.00	47.88	11.96	59.84	2.52	9.95	12.46
1984	26.40	13.65	40.05	25.39	51.79	13.65	65.44	2.90	11.40	14.30
1985	30.36	13.85	44.21	28.40	58.75	13.85	72.60	3.04	11.31	14.34
1986	32.87	15.35	48.23	29.11	61.98	15.35	77.33	3.29	11.40	14.69
1987	33.65	16.10	49.74	30.61	64.26	16.10	80.36	3.36	11.78	15.14
1988	33.36	17.41	50.77	31.12	64.48	17.41	81.89	3.34	12.92	16.26
1989	32.66	19.72	52.38	28.20	60.86	19.72	80.58	3.27	14.54	17.80
1990	35.36	19.49	54.86	33.06	68.42	19.49	87.92	3.54	14.70	18.23
1991	36.20	19.17	55.36	35.76	71.96	19.17	91.12	3.80	13.57	17.37
1992	37.35	19.72	57.07	42.25	79.59	19.72	99.31	4.11	13.57	17.67
1993	37.92	21.78	59.69	41.09	79.01	21.78	100.79	4.55	14.21	18.76
1994	38.81	22.65	61.46	42.76	81.56	22.65	104.22	5.05	14.50	19.54
1995	40.71	21.69	62.40	43.79	84.50	21.69	106.19	5.00	13.92	18.92
1996	42.58	20.90	63.48	46.77	89.35	20.90	110.25	4.90	14.41	19.30
1997	47.97	22.25	70.22	49.40	97.36	22.25	119.62	4.80	15.27	20.07
1998	48.93	25.51	74.44	51.15	100.08	25.51	125.59	4.50	15.93	20.43
1999	50.08	26.33	76.41	51.55	101.63	26.33	127.96	4.51	16.50	21.01
2000	57.17	27.39	84.57	49.00	106.17	27.39	133.57	5.15	17.45	22.60
2001	57.46	27.95	85.41	51.50	108.96	27.95	136.91	5.10	17.64	22.74
2002	62.90	29.60	92.50	57.96	120.86	29.60	150.46	6.00	18.59	24.59
2003	67.19	30.99	98.18	62.93	130.12	30.99	161.11	5.90	19.54	25.44
2004	68.74	31.96	100.70	64.89	133.63	31.96	165.59	6.19	20.40	26.59
2005	70.32	32.96	103.28	66.92	137.24	32.96	170.20	6.33	21.17	27.50
2006	71.94	33.99	105.93	69.02	140.96	33.99	174.95	6.47	22.00	28.48
2007	73.47	34.93	108.40	70.92	144.40	34.93	179.33	6.61	22.86	29.48
2008	74.94	35.80	110.73	72.68	147.62	35.80	183.42	6.74	23.52	30.26
2009	76.42	36.67	113.10	74.47	150.89	36.67	187.56	6.88	24.17	31.05
2010	77.93	37.56	115.49	76.26	154.19	37.56	191.75	7.01	24.83	31.84
2011	79.45	38.45	117.89	78.06	157.51	38.45	195.96	7.15	25.49	32.64
2012	80.97	39.33	120.30	79.85	160.82	39.33	200.15	7.29	26.14	33.43
2013	82.51	40.21	122.73	81.65	164.17	40.21	204.38	7.43	26.79	34.21
2014	84.06	41.09	125.15	83.44	167.49	41.09	208.59	7.57	27.42	34.98
2015	85.62	41.97	127.59	85.22	170.84	41.97	212.81	7.71	28.04	35.74
2016	87.19	42.85	130.03	87.00	174.19	42.85	217.03	7.85	28.65	36.50
2017	88.77	43.72	132.49	88.77	177.54	43.72	221.26	7.99	29.26	37.25
2018	90.37	44.59	134.96	90.53	180.90	44.59	225.49	8.13	29.86	37.99
2019	91.98	45.46	137.45	92.31	184.29	45.46	229.75	8.28	30.44	38.72
2020	93.62	46.34	139.97	94.10	187.72	46.34	234.06	8.43	31.02	39.45
Average annual growth rate (per cent)										
1985–2003	4.5	4.6	4.5	4.5	4.5	4.6	4.5	3.8	3.1	3.2
2003–2020	2.0	2.4	2.1	2.4	2.2	2.5	2.2	2.1	2.8	2.6

CONTINUED

TABLE 1.4 AUSTRALIAN FREIGHT TASK TRENDS, 1960–61 TO 2019–20 (continued)

(billion tonne-kilometres)

	Sea						Air	
	Non-urban Bulk	Non-bulk	Total	Interstate Bulk	Non-bulk	Total	Non-urban Non-bulk	Interstate Non-bulk
1961	31.70	3.30	35.00	23.46	3.13	26.59	0.02	0.02
1962	31.70	3.30	35.00	23.46	3.13	26.59	0.03	0.02
1963	32.61	3.39	36.00	24.13	3.22	27.35	0.03	0.03
1964	35.33	3.67	39.00	26.14	3.49	29.63	0.04	0.03
1965	38.04	3.96	42.00	28.15	3.76	31.91	0.04	0.04
1966	42.57	4.43	47.00	31.50	4.21	35.71	0.05	0.05
1967	43.48	4.52	48.00	32.17	4.30	36.47	0.06	0.05
1968	50.72	5.28	56.00	37.54	5.01	42.55	0.07	0.06
1969	56.16	5.84	62.00	41.56	5.55	47.11	0.08	0.07
1970	59.78	6.22	66.00	44.24	5.91	50.15	0.09	0.09
1971	65.22	6.78	72.00	48.26	6.58	54.84	0.10	0.09
1972	76.43	6.77	83.20	56.68	6.56	63.24	0.10	0.09
1973	83.26	6.24	89.50	61.88	6.05	67.93	0.10	0.09
1974	89.58	6.52	96.10	66.59	6.32	72.91	0.12	0.11
1975	95.25	5.95	101.20	70.92	5.77	76.70	0.12	0.11
1976	98.95	5.65	104.60	73.77	5.42	79.20	0.12	0.11
1977	97.28	5.02	102.30	72.63	4.82	77.44	0.12	0.11
1978	100.34	4.76	105.10	75.00	4.57	79.57	0.12	0.11
1979	100.50	4.20	104.70	75.25	3.99	79.24	0.12	0.11
1980	101.15	3.95	105.10	75.82	3.75	79.57	0.12	0.11
1981	106.57	3.73	110.30	80.29	3.54	83.83	0.12	0.11
1982	94.14	3.66	97.80	71.83	3.48	75.31	0.13	0.12
1983	78.37	2.53	80.90	60.70	2.40	63.10	0.13	0.12
1984	91.33	2.97	94.30	71.67	2.82	74.50	0.15	0.14
1985	93.27	3.03	96.30	74.16	2.88	77.04	0.16	0.15
1986	99.03	2.77	101.80	77.79	2.63	80.42	0.15	0.14
1987	92.46	2.74	95.20	72.61	2.60	75.21	0.14	0.13
1988	90.93	2.67	93.60	70.47	2.53	73.01	0.16	0.15
1989	87.77	2.93	90.70	66.60	2.79	69.39	0.16	0.15
1990	91.34	2.86	94.20	67.93	2.72	70.65	0.09	0.08
1991	90.81	2.99	93.80	67.51	2.84	70.35	0.14	0.13
1992	93.32	3.08	96.40	69.38	2.93	72.30	0.16	0.15
1993	92.77	3.23	96.00	68.93	3.07	72.00	0.17	0.16
1994	94.84	3.44	98.28	71.43	3.26	74.69	0.19	0.17
1995	108.49	3.63	112.11	82.88	3.44	86.33	0.21	0.20
1996	104.48	3.70	108.18	79.75	3.55	83.30	0.21	0.20
1997	108.91	3.69	112.61	83.16	3.55	86.71	0.23	0.22
1998	112.55	4.48	117.03	85.81	4.30	90.12	0.24	0.22
1999	104.36	4.49	108.85	77.28	4.36	81.64	0.25	0.23
2000	103.00	5.90	108.90	75.52	5.72	81.24	0.25	0.23
2001	97.38	7.12	104.50	66.45	6.90	73.36	0.25	0.23
2002	104.05	6.35	110.40	73.33	6.16	79.49	0.24	0.22
2003	107.24	7.56	114.80	76.69	7.33	84.02	0.25	0.23
2004	109.95	8.07	118.02	78.62	7.82	86.44	0.25	0.24
2005	110.37	8.58	118.95	79.46	8.33	87.79	0.26	0.24
2006	111.78	9.13	120.91	80.48	8.86	89.34	0.27	0.25
2007	113.19	9.72	122.91	81.50	9.43	90.93	0.28	0.26
2008	114.60	10.24	124.84	82.51	9.93	92.44	0.29	0.27
2009	115.45	10.77	126.22	83.70	10.45	94.15	0.30	0.27
2010	117.32	11.33	128.65	85.06	10.99	96.04	0.30	0.28
2011	119.07	11.90	130.98	86.33	11.55	97.87	0.31	0.29
2012	121.06	12.50	133.56	87.77	12.13	99.89	0.32	0.30
2013	123.09	13.12	136.21	89.24	12.72	101.97	0.33	0.31
2014	125.26	13.75	139.01	90.82	13.33	104.15	0.34	0.32
2015	127.60	14.39	142.00	92.51	13.96	106.47	0.35	0.33
2016	130.01	15.06	145.07	94.26	14.61	108.86	0.36	0.34
2017	132.56	15.75	148.30	96.10	15.27	111.38	0.37	0.35
2018	135.31	16.45	151.77	98.10	15.96	114.06	0.39	0.36
2019	138.12	17.18	155.29	100.14	16.66	116.80	0.40	0.37
2020	141.02	17.92	158.94	102.24	17.38	119.62	0.41	0.38
Average annual growth rate (per cent)								
1985–2003	0.8	5.2	1.0	0.2	5.3	0.5	2.5	2.4
2003–2020	1.6	5.2	1.9	1.7	5.2	2.1	3.0	3.0

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TABLE 1.4 AUSTRALIAN FREIGHT TASK TRENDS, 1960–61 TO 2019–20 (continued)

(billion tonne-kilometres—all modes)

	All areas			Interstate		
Year	Bulk	Non-bulk	Total	Bulk	Non-bulk	Total
1961	42.02	19.75	61.77	24.54	10.65	35.19
1962	42.79	20.26	63.06	24.61	10.75	35.36
1963	44.29	22.66	66.95	25.29	11.85	37.14
1964	48.60	24.49	73.09	27.46	12.88	40.34
1965	52.88	26.71	79.59	29.59	13.93	43.52
1966	61.73	27.68	89.41	33.00	14.48	47.48
1967	64.80	29.26	94.06	33.85	15.06	48.91
1968	73.94	31.59	105.53	39.29	16.55	55.85
1969	83.37	34.31	117.68	43.49	18.01	61.50
1970	89.65	36.60	126.25	46.32	19.36	65.68
1971	98.88	38.18	137.07	50.49	20.16	70.65
1972	113.76	39.03	152.79	59.02	20.94	79.96
1973	124.46	40.03	164.49	64.18	21.49	85.67
1974	139.14	42.40	181.55	68.95	23.16	92.11
1975	150.30	42.60	192.90	73.49	22.45	95.94
1976	150.71	44.11	194.83	76.39	22.93	99.32
1977	152.27	45.34	197.61	75.38	23.35	98.73
1978	157.21	46.72	203.93	77.82	23.10	100.92
1979	157.27	50.22	207.49	78.26	24.49	102.75
1980	163.36	53.29	216.65	79.13	26.22	105.34
1981	172.81	55.29	228.10	83.88	27.60	111.48
1982	162.20	57.18	219.38	75.50	28.95	104.46
1983	143.11	53.97	197.08	64.26	26.33	90.59
1984	161.40	59.43	220.82	75.73	29.71	105.44
1985	171.89	63.39	235.28	78.47	31.25	109.73
1986	182.52	68.45	250.97	82.48	32.77	115.25
1987	178.66	70.17	248.82	77.42	33.76	111.18
1988	179.05	75.40	254.45	75.40	36.71	112.11
1989	173.81	81.58	255.39	71.59	40.35	111.94
1990	186.37	84.53	270.91	73.32	42.05	115.36
1991	188.96	83.43	272.40	73.13	40.72	113.84
1992	198.68	83.07	281.75	75.28	40.54	115.82
1993	198.77	88.15	286.92	75.40	42.92	118.32
1994	204.49	91.80	296.29	78.50	44.90	123.40
1995	223.46	96.63	320.09	90.12	47.22	137.34
1996	226.53	101.12	327.65	87.07	50.43	137.50
1997	240.23	105.41	345.64	90.53	53.17	143.69
1998	249.02	115.13	364.15	93.10	57.53	150.63
1999	244.67	121.32	365.99	84.80	61.09	145.89
2000	249.63	127.95	377.58	83.93	66.78	150.71
2001	248.12	132.78	380.90	74.96	70.01	144.97
2002	269.06	139.20	408.26	83.03	74.08	157.11
2003	283.44	146.33	429.78	86.49	78.96	165.45
2004	291.93	153.10	445.03	88.92	83.13	172.05
2005	298.43	160.38	458.81	90.12	87.22	177.34
2006	306.00	167.66	473.66	91.51	91.55	183.05
2007	313.41	175.16	488.57	92.89	96.09	188.99
2008	320.20	181.58	501.78	94.24	99.84	194.07
2009	326.51	188.14	514.66	95.75	103.66	199.41
2010	333.93	194.84	528.77	97.45	107.55	205.00
2011	341.30	201.66	542.96	99.06	111.51	210.57
2012	348.93	208.60	557.53	100.85	115.54	216.39
2013	356.69	215.67	572.36	102.67	119.63	222.30
2014	364.57	222.73	587.30	104.60	123.70	228.30
2015	372.66	229.90	602.56	106.65	127.81	234.46
2016	380.86	237.16	618.02	108.76	131.98	240.73
2017	389.25	244.52	633.76	110.96	136.18	247.15
2018	397.88	251.97	649.84	113.33	140.42	253.75
2019	406.61	259.50	666.12	115.73	144.70	260.43
2020	415.51	267.13	682.63	118.21	149.00	267.21
Average annual growth rate (per cent)						
1985–2003	2.8	4.8	3.4	0.5	5.3	2.3
2003–2020	2.3	3.6	2.8	1.9	3.8	2.9

CHAPTER 2

MEASURING ROAD FREIGHT GROWTH

Road freight growth is obviously important for planning road systems. This is true for designing pavement strengths for new roads—and thus their cost—and also for the expected growth in maintenance expenditures due to pavement damage. This is in addition to the obvious importance of road freight for the smooth interchange of goods in our market economy.

The Australian Bureau of Statistics (ABS) has produced the Survey of Motor Vehicle Use (SMVU) since the early 1970s. It has been the principal source of our understanding of the growth in the freight task over the years. However, there has been a major methodological adjustment in 1998 that complicates the use of the data in computing growth rates in road freight.

The Bureau of Transport and Regional Economics (BTRE) recently completed an exercise in adjusting past survey freight data to make it comparable to the current (2003) survey methodology. This chapter details these adjustments, and then uses the 'cleaned' data to look at the implied growth rates for road freight into the future.

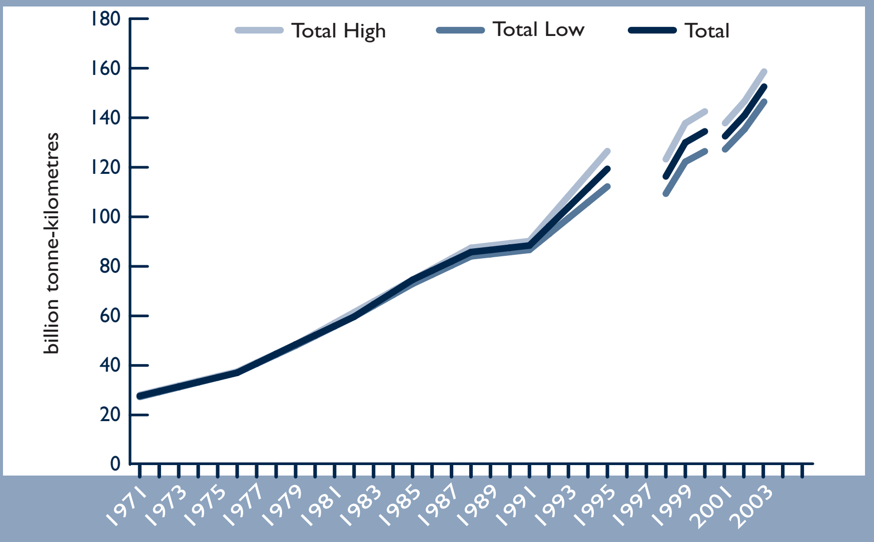
2.1 CHANGES IN SURVEY METHODOLOGY AND ADJUSTING FOR THEM

The Survey of Motor Vehicle Use estimates kilometres travelled, fuel consumption and tonne-kilometres travelled by registered vehicles in Australia. This data is available for all of Australia and disaggregated by vehicle type and State/Territory of registration. From 1971 to 1995 the survey was conducted every three to five years. Since 1998, it has been conducted annually. However, because there is no overlap between the samples selected in consecutive years, it has not been specifically designed to measure the change between years. Thus the ABS warns that 'Caution must be used when using the SMVU to measure change'.

However, given the importance of growth in road freight, this chapter attempts to develop methods to compare different survey periods. The major methodological adjustment that complicates the use of the data in computing growth rates occurred in 1998. Before 1998, the old

12-month recall survey was fairly unchanged from 1971 to 1995—the last year of that survey. In 1998 a new three month pre-advice survey methodology was instituted. Figure 1 shows the aggregate road freight task—and 95 per cent confidence intervals—as measured by the various surveys, with simple interpolation between surveys. The task in this paper is to construct a standardised time series out of this disjointed and non-comparable data. The method of standardisation is termed 'disaggregation correction'. It was first used in an earlier paper by BTRE authors (Cosgrove & Mitchell 2001).

FIGURE 2.1 RAW SMVU FREIGHT



The correction method use two 'disaggregations'. The first disaggregation is by vehicle type:

- articulated trucks (artics)
- rigid trucks (rigids)
- light commercial vehicles (LCVs).

The second disaggregation (using articulated trucks as the example for the rest of the discussion) works off the following equation:

Stock of registered Artics	*	Proportion with laden business kilometres	*	Average laden business kilometres for those laden	*	Average load when laden	=	Total Artic Freight Task

Equals
Number of Laden Artics

In the survey three mutually exclusive sub-groups make up the stock of registered artics:

- those vehicles unused during the survey time period—currently about 6 per cent of the artic stock for any three month period
- those used but unladen—currently about 1.5 per cent of artics
- those laden during the three months—about 92.5 per cent artics.

Only the last group carries any freight. So as reflected in the equation above, it is the focus of the adjustment methodology developed.

The table below shows how the items for the framework are calculated and the sources of data for the years from 1998 until 2003.

TABLE 2.1 CALCULATING THE RAW DATA FOR DISAGGREGATION CORRECTION—ARTICULATED VEHICLES

A	B	C	D	E	F	G	H	I	J	K	L
Year	**SMVU Artics**	Total laden bus kms	Av laden bus kms	No. laden artics	**Prop. with lbkms**	Total TKM	Total laden bus kms	**Av load when laden**	**Av. laden Bus kms**	**Calcul'd SMVU total TKM**	Actual SMVU total TKM
	(no.)	(000)	(kms)	(no.)	(%)	(million)	(000)	(kgs)	(kms)	(Btkm)	(Btkm)
1998	**59573**	3563	66.9	53259	**0.89401**	88759	3563	**24911**	**66.9**	**88.8**	88.8
1999	**62493**	3946	70.7	55813	**0.89311**	101024	3946	**25602**	**70.7**	**101.0**	101.0
2000	**61117**	4071	72.8	55920	**0.91497**	103515	4071	**25427**	**72.8**	**103.5**	103.5
2001	**61502**	3933	69.6	56509	**0.91881**	101892	3933	**25907**	**69.6**	**101.9**	101.9
2002	**61519**	4012	70.4	56989	**0.92636**	106977	4012	**26664**	**70.4**	**107.0**	107.0
2003	**62982**	4399	75.9	57958	**0.92023**	115656	4399	**26291**	**75.9**	**115.7**	115.7
Source or Calcu-lation	*ABS 2003b P9*	*ABS 2003b P10*	*ABS 2003b P10*	***C/D*** **1000*	***E/B*****100*	*ABS 2003b P10*	**C**	***G/H*** **1000*	**D**	*(**B*F**/100 ***I**/1000 ***J***1000) /1 billion*	*ABS 2003b P10*

Note: The average load for laden vehicles is an average excluding both unused vehicles and vehicles used but unladen.

The numbers in bold are then input to the disaggregation correction framework.

The disaggregation correction for articulated trucks

For convenience the equation on the previous page is reordered to read:

Stock x Average load x Average laden x % laden = Total artic tkm

This then becomes the framework for the disaggregation corrections.

We will use the framework to adjust its components to standardise on the current (2003) survey methodology.

The major change to be adjusted for comes from the major methodological change to the survey. It was split into two component periods: 1971–1995, and 1998–2003 (ABS 2003b).

Table 2.2 below sets out the three major differences between survey periods to be adjusted for. The next three sections of the chapter describe the standardisation procedures followed to adjust for each of these major differences. There are also miscellaneous changes made in individual instances.

TABLE 2.2 MAJOR DIFFERENCES BETWEEN CURRENT AND PAST SURVEY PERIODS

Survey period	Stock of artics	Average laden business-kms	Percentage with laden kms
1971 to 1995	As at 30 September	12-month recall method	Respondent has laden kms anytime over 12 months
1998 to 2003	Average over year to 31 July, except 2000 on—average over year to 31 October	Three-month pre-advice method	Respondent has laden kms in the three months of survey

Finally, in 1991, the definitions of light commercial vehicles and rigids were changed. This made it necessary to correct the stock numbers and average loads of these vehicle types before that date.

Adjusting the stock of vehicles

There are two sources of data on the stock of articulated vehicles: the Survey of Motor Vehicle Use (SMVU—the survey), and the Motor Vehicle Census (MVC—the census), which is also conducted by the ABS (ABS 2002).

Table 2.3 shows the calculations used in this chapter to adjust past survey numbers to the current survey stock period of the average of the year to 31 October. It was assumed that this corresponds to a stock number at the middle of the year—30 April—and vehicle numbers in previous years are adjusted to this date using growth rates per year then current.

TABLE 2.3 SMVU DISAGGREGATION CALCULATIONS OF ARTICULATED VEHICLE NUMBERS

Year	Raw Artics SMVU	Date of SMVU	Adjust. to 30 April	Adjust. Artics SMVU	Raw Artics MVC	Raw% ch per Year	Date of MVC	Adjust. to 30 April	Adjust. Artics MVC
1971	32 000	30-Sep	less 5 mo	31 464	31 982		30-Sep	less 5 mo	31 446
1976	39 735	30-Sep	less 5 mo	39 069	38 950	4.02084	30-Sep	less 5 mo	38 297
1979	43 949	30-Sep	less 5 mo	43 243	43 683	3.85697	30-Sep	less 5 mo	42 981
1982	46 575	30-Sep	less 5 mo	46 076	47 179	2.57322	30-Sep	less 5 mo	46 673
1985	49 641	30-Sep	less 5 mo	49 210	50 220	2.08272	30-Sep	less 5 mo	49 784
1988	48 722	30-Sep	less 5 mo	48 906	48 857	-0.90391	30-Sep	less 5 mo	49 041
1991	52 106	30-Sep	less 5 mo	51 697	51 697	1.88206	30-Sep	less 5 mo	51 292
1995	57 939	31-May	less 1 mo	57 791	58 322	3.06039	31-May	less 1 mo	58 173
1998	59 573	aver 31 jul	plus 3 mo	59 899	62 274	2.18721	31-Oct	less 6 mo	61 593
1999	62 493	aver 31 jul	plus 3 mo	62 749	63 295	1.63953	31-Oct	less 6 mo	62 776
2000	61 117	aver 31 oct	none	61 117			none		62 695
2001	61 502	aver 31 oct	none	61 502	62 597	0.32500	31-Mar	plus 1 mo	62 614
2002	61 519	aver 31 oct	none	61 519	63 905	2.08956	31-Mar	plus 1 mo	64 016
2003	62 982	aver 31 oct	none	62 982	64 261	0.55708	31-Mar	plus 1 mo	64 291
2004					66 300	3.17300	31-Mar	plus 1 mo	66 475

For example, the 1976 survey reports that the artic stock number is 39 735—at 30 September. Adjusting this to April 30 would remove five months growth at the then- current growth rate of four per cent per year. The resulting adjusted stock figure is 39 069. Similar adjustments are done for the census stock numbers. The two standardised series generally agree—see Table 2.3.

The exception is over the period of the new three-month pre-advice survey—from 1998 on—when the survey series drops inexplicably below the census numbers. The Australian Bureau of Statistics says that this occurs because a number of articulated trucks on the census register turn out to actually be rigids when their owners are surveyed. The number is about three per cent of the census artic numbers. Accordingly, the census adjusted numbers, minus three per cent, were taken as a standardised time series of artic numbers. The trucks removed each year from the artic stock were added to the rigid stock calculations. This produced the MVC(-) and MVC(+) series of Table 2.7 presented later.

Finally, in 1991, the definitional boundary between rigids and light commercial vehicles (LCVs) was raised—in tonnage terms. This resulted in reduced rigid numbers and an increase in their average load. At the same time, light commercial vehicle numbers, and their average load, increased. Corrections for this remaining series break will be discussed in a section below. The corrections affect both the stock of vehicles and the average loads of rigids and light commercial vehicles.

Adjusting the average laden business kilometres

The major change to be adjusted for here is the change in methodology. From 1971 until 1995, the methodology was based on a 12-month recall. In 1998, the survey period was changed to quarterly. Since then, the methodology has been based on a three-monthly pre-advice basis.

The ABS has always maintained that the annual recall method significantly overstated distance travelled—except in its 1985 report where 'no statistical evidence of bias' was claimed—ABS 1987, p.3. For artics, the ABS conducted checking validation studies. In 1988 (ABS 1990, p.41), the ABS estimated that the distance travelled by artics was overstated by 5.5 per cent. In the same year, the BTRE estimated that the distance travelled by rigids was overestimated by 9.3 per cent. For the 1995 survey (ABS 1996, p.24) the estimate was 4.8 per cent for artics.

Accordingly, the pre-1998 survey estimates for laden business kilometres in Table 2.4 have been reduced by five per cent. The estimates for rigids and light commercial vehicles were also reduced by the same amount.

This is one of the three major adjustments to the historical data made in this paper. The others are the number of vehicles as described above, and the proportion of vehicles with laden business kilometres as described below.

A one-off change was made by the BTRE to the laden business kilometres for 1995, which were still judged to be overstated. The 1995 laden business kilometres were set four-sevenths of the way between the adjusted 1991 and 1998 figures.

Finally, the laden business kilometres for 1999 to 2003 were set at a rough interpolation between the 1998 and 2003 figures. The original levels in 2001 and 2002 were especially low, due to "post-sample stratification".

TABLE 2.4 AVERAGE LADEN BUSINESS KILOMETRES

Year	Raw average laden business kilometres (000)	Adjusted laden business kilometres (000)
1971	32.5	**30.9**
1976	35.2	**33.4**
1979	41.2	**39.1**
1982	46.4	**44.1**
1985	53.4	**50.7**
1988	59.6	**56.6**
1991	57.8	**54.9**
1995	67.3	**61.8**
1998	66.9	**66.9**
1999	70.7	**69.1**
2000	72.8	**71.3**
2001	69.6	**72.8**
2002	70.4	**74.4**
2003	75.9	75.9

The proportion with laden business kilometres

The adjustment problem here is more apparent than real.

Table 2.5 shows the major drop in the raw proportion of vehicles with laden business kilometres after 1995,—that is, with the advent of the new quarterly survey. However, a substantial reduction is to be expected, and should have no effect on the estimates. However, the reduction in the level of the raw proportion in 1998 and 1999 especially seems overstated. It may be related to the use of out-of-date sample frames in those years. Since 2000 the frame has become progressively better at sampling the newly registered vehicles.

Thus the major adjustment to this component, as shown in Table 4, is to set the post-1995 proportion at 92.5 per cent. In addition a smoothing of the pre-1995 trend has been introduced.

TABLE 2.5 PERCENTAGE OF VEHICLES WITH LADEN BUSINESS KILOMETRES

Year	Raw proportion with laden business kilometres	Adjusted proportion with laden business kilometres
1971	100.0	100.0
1976	99.8	99.8
1979	99.7	99.7
1982	99.1	99.1
1985	99.5	**98.3**
1988	99.6	**97.6**
1991	97.3	**97.0**
1995	96.9	96.9
1998	89.4	**92.5**
1999	89.3	**92.5**
2000	91.5	**92.5**
2001	91.9	**92.5**
2002	92.6	**92.5**
2003	92.0	**92.5**

Miscellaneous adjustments

Several miscellaneous adjustments have been made. First, vehicle numbers in some years have been set to the survey adjusted numbers. These years are:

- artics—1985 and 1991
- rigids—1982 to 1995
- light commercial vehicles—1991.

The average laden business kilometres have been interpolated in some years. These years are:

- artics—1995, 1999 to 2002
- rigids—1982, 1988, 1995, 2000, 2002
- light commercial vehicles—1985, 1988, 1998, 1999, 2001 and 2002.

The average load per truck has also been interpolated in some years. These years are:

- artics—1985 and 1991
- rigids—1979, 1982, 1995, 1998, 2001 and 2002
- light commercial vehicles—1991 to 2002.

Finally, for various years the proportion of vehicles with laden business kilometres has been smoothed.

The 1991 vehicle definition changes

In 1991 the definition of light commercial vehicles and rigids changed.

Table 2.6, drawn from a special ABS run for Apelbaum Consulting, shows the 1988 survey's vehicle data—using old vehicle definitions—categorised by Gross Vehicle Mass. The new definition classifies vehicles with a mass of up to 3.5 tonnes as light commercial vehicles. Vehicles with a mass greater than 3.5 tonnes are classified as rigids.

TABLE 2.6 1988 SMVU RIGID AND LCV NUMBERS BY GROSS VEHICLE MASS

(tonnes)

Type of Vehicle	Weight	Category		(Gross vehicle mass)		
	Below 2.5	2.5–3.0	3.0–3.5	Above 3.5	Not stated	Total
LCVs	478 171	193 092	93 761	16 059	397 816	1 178 899
Rigids	36 646	29 605	13 077	325 330	0	404 658
Artics				48 722	0	48 722
Other trucks					23 138	

Note that the 16 059 vehicles with a mass greater than 3.5 tonnes would have been reclassified under the 1991 definition from light commercial vehicles to rigids. Similarly, the 79 328 vehicles (36 646+29 605+13 077) with a mass of less than 3.5 tonnes were reclassified from rigids to light commercial vehicles.

In this paper, a correction for the 1991 vehicle definition change is needed. It was assumed that the amount of freight task (tkm) moving between categories each way was balanced.

It was also assumed that the laden business kilometres and the percentage laden also remained unchanged. This made it possible to adjust the stock numbers and calculate average loads—using the dissaggregation correction identity.

The number of light commercial vehicles and rigids switching categories in earlier surveys was based on the 1988 percentages held constant. That is, 19.6 per cent of rigids were reclassified as light commercial vehicles, and 1.36 per cent of light commercial vehicles were reclassified as rigids. This assumes the ‘not stated’ vehicles were all utes—with a mass of less than 3.5 tonnes.

Finally, the 1991 definition change also resulted in about 6.6 per cent of what were previously light commercial vehicles being reclassified as cars—and therefore assumed to carry no load. This percentage was kept constant to enable a downward adjustment of the pre-1991 light commercial vehicle stock numbers. This correction was done before the final calculation was made of the new average load figures.

Adjusted versus unadjusted tonne-kilometres

In summary, adjustments have been made in three major areas affecting the estimate of the aggregate freight task:

- artic stock numbers have been adjusted to approximate the average number in the 12 months ending October 31
- average laden business kilometres in the old 12-month recall survey have been decreased by five per cent to adjust to the current three-month pre-advice methodology
- the percentage of vehicles laden was increased in 1998 and 1999 to account for deficiencies in the sample frame.

In addition, miscellaneous changes have been made, For example adjustments were made for the effect of the 1991 vehicle definition change on rigid and light commercial vehicle stock numbers and average load.

The effects of these revisions are shown in Tables 2.7 and 2.8, and in Figures 2.2 to 2.5 for, respectively, artics, rigids, light commercial vehicles and the total. Extrapolating the components in the framework allows a rough forecast one year ahead of the data.

TABLE 2.7 SUMMARY OF CHANGES BY TYPE OF VEHICLE

ARTICS

Year	raw artics no. SMVU	adj artics no. MVC(-)	raw aver kgm load/lbk	adj aver kgm load/lbk	raw aver laden '000 bus km	adj aver laden '000 bus km	raw propor % with lbk	adj propor % with lbk	raw artic btkm freight	adj artic btkm freight
1971	32 000	30 503	14 616	14 616	32.5	30.9	100.0	100.0	15.2	13.8
1976	39 735	37 149	16 510	16 510	35.2	33.4	99.8	99.8	23.0	20.5
1979	43 949	41 692	17 656	17 656	41.2	39.1	99.7	99.7	31.9	28.7
1982	46 575	45 273	18 784	18 784	46.4	44.1	99.1	99.1	40.2	37.2
1985	49 641	47 320	19 959	19 716	53.4	50.7	99.5	98.3	52.7	46.5
1988	48 722	47 570	20 648	20 648	59.6	56.6	99.6	97.6	59.7	54.3
1991	52 106	49 753	21 474	21 474	57.8	54.9	97.3	97.0	62.9	56.9
1995	57 939	55 463	23 659	23 438	67.3	61.8	96.9	96.9	89.4	77.8
1998	59 573	59 745	24 911	24 911	66.9	66.9	89.4	92.5	88.8	92.1
1999	62 493	60 893	25 602	25 313	70.7	69.1	89.3	92.5	101.0	98.5
2000	61 117	60 814	25 427	25 645	72.8	71.3	91.5	92.5	103.5	102.9
2001	61 502	60 736	25 907	26 000	69.6	72.8	91.9	92.5	101.9	106.4
2002	61 519	62 096	26 664	26 288	70.4	74.4	92.6	92.5	107.0	112.3
2003	62 982	62 362	26 291	26 652	75.9	75.9	92.0	92.5	115.6	116.7
2004		64 481		26 652		77.0		92.5		122.4

RIGIDS

Year	raw rigids no. SMVU	adj rigids no. MVC(+)	raw aver kgm load/lbk	adj aver kgm load/lbk	raw aver laden '000 bus km	adj aver laden '000 bus km	raw propor % with lbk	adj propor % with lbk	raw rigid btkm freight	adj rigid btkm freight
1971	365 800	301 424	3 048	3 702	10.3	9.8	96.7	95.0	11.1	10.4
1976	383 227	309 736	3 206	3 859	10.4	9.9	94.6	95.0	12.1	11.2
1979	350 563	344 613	3 686	4 060	11.4	10.8	95.1	95.0	14.0	14.4
1982	442 823	363 952	3 156	4 255	12.6	11.4	94.8	94.0	16.7	16.5
1985	426 272	353 834	3 724	4 433	12.5	11.9	93.6	93.0	18.6	17.3
1988	404 658	339 910	3 955	4 687	14.5	12.7	92.7	92.0	21.5	18.6
1991	330 784	355 116	4 795	4 795	14.2	13.5	91.2	91.0	20.5	20.9
1995	335 430	338 053	5 284	5 116	15.5	14.2	91.2	90.0	25.0	22.1
1998	344 817	347 415	5 416	5 357	14.7	14.7	83.1	87.0	22.8	23.8
1999	349 736	348 902	5 437	5 437	15.0	15.0	83.2	87.0	23.7	24.8
2000	346 628	344 595	5 547	5 547	16.1	15.7	81.3	87.0	25.2	26.0
2001	332 102	340 289	5 305	5 567	16.3	16.3	86.6	86.6	24.9	26.8
2002	341 651	343 662	5 867	5 586	16.2	17.0	87.3	87.3	28.3	28.4
2003	346 538	351 214	5 606	5 606	17.6	17.6	88.9	87.0	30.4	30.1
2004		360 376		5 626		18.0		87.0		31.8

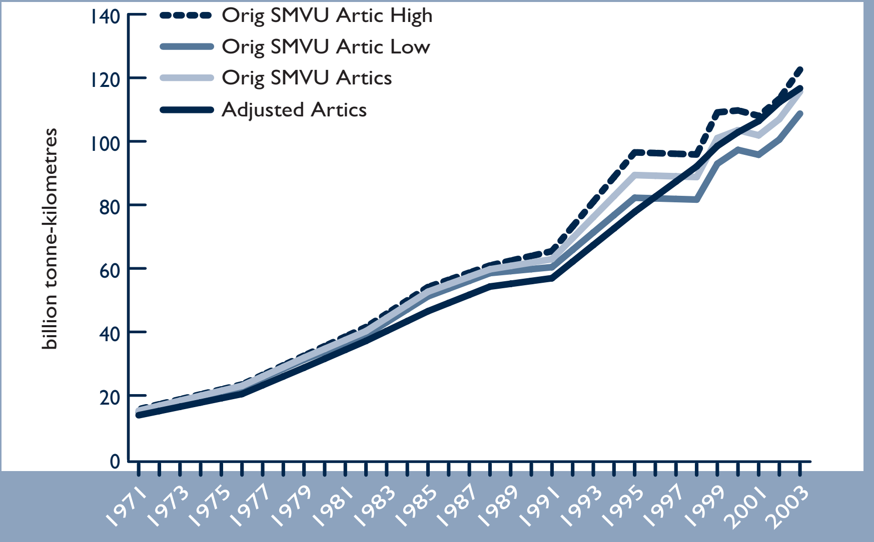
LCVs

Year	raw LCVs no. SMVU	adj LVCs no. MVC	raw aver kgm load/lbk	adj aver kgm load/lbk	raw aver laden '000 bus km	adj aver laden '000 bus km	raw propor % with lbk	adj propor % with lbk	raw LCVs btkm freight	adj LCVs btkm freight
1971	532 700	547 245	301	284	9.7	9.2	63.7	63.7	1.0	0.9
1976	723 846	749 783	385	377	9.1	8.6	62.2	62.2	1.6	1.5
1979	939 424	873 630	419	413	9.9	9.4	57.4	57.4	2.2	1.9
1982	1 004 112	991 714	388	385	12.6	12.0	49.2	49.2	2.4	2.3
1985	1 136 166	1 113 526	414	417	13.8	12.0	47.2	47.2	3.1	2.6
1988	1 178 899	1 162 900	436	441	15.4	12.0	54.3	54.3	4.3	3.3
1991	1 346 416	1 303 563	484	436	12.6	12.0	57.8	57.8	4.8	3.9
1995	1 566 628	1 526 192	415	436	13.8	13.8	53.5	53.5	4.8	4.9
1998	1 566 161	1 658 380	394	436	13.2	14.3	56.2	55.0	4.6	5.7
1999	1 621 634	1 703 458	425	436	12.9	14.5	57.5	55.0	5.1	5.9
2000	1 696 631	1 737 521	434	436	14.7	14.7	52.6	55.0	5.7	6.1
2001	1 719 654	1 771 584	407	436	15.3	14.8	52.8	55.0	5.6	6.3
2002	1 810 071	1 824 314	400	436	14.0	14.8	55.5	55.5	5.6	6.5
2003	1 893 122	1 884 899	437	437	14.9	14.9	54.4	55.0	6.7	6.8
2004		1 958 781		437		14.9		55.0		7.0

TABLE 2.8 TOTAL ROAD FREIGHT ESTIMATES AND DATA

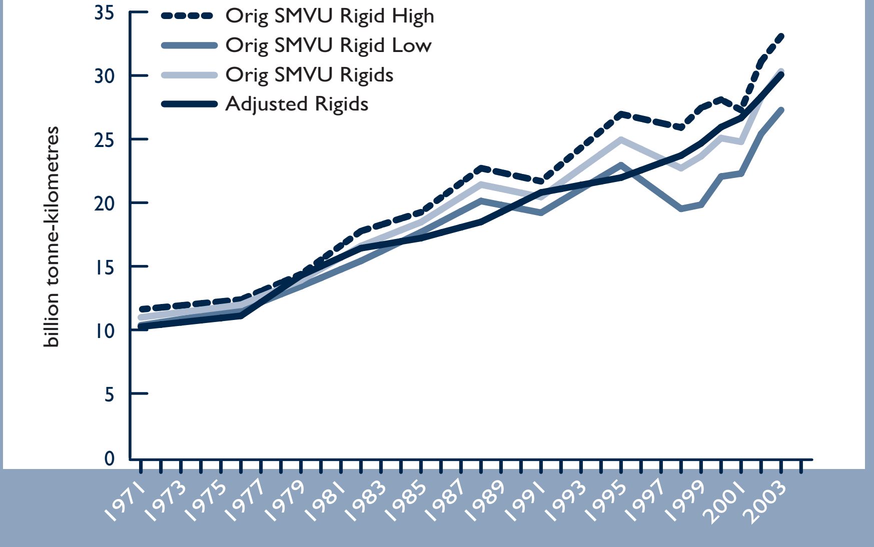
fin' year	SMVU Raw Total Btkm	SMVU adjd Total Btkm	pred Marul Btkm	pred GDP Btkm	ACG Total Btkm	GDP $1998	road Rate c/ntk	cpi 1990 =100	marulan Trucks no.	SMVU load Artics kg	GDP Index 1998 =100	Adjd Total % ch	GDP % ch	Pred Marul GDP % ch
1971	27.3	25.1	25.5	25.3		246 212	1.44	17.95	258 977	14 616	46.3			
1972	29.2	26.7	27.8	26.8		255 680	1.51	19.12	283 384	14 995	48.1	6.5	3.8	9.2
1973	31.1	28.3	26.9	28.2		264 505	1.62	20.68	339 856	15 374	49.7	6.1	3.5	-3.4
1974	32.9	29.9	30.3	31.3		278 124	1.77	23.71	388 363	15 752	52.3	5.8	5.1	12.7
1975	34.8	31.6	31.8	32.6		281 052	2.00	27.71	404 622	16 131	52.8	5.4	1.1	5.0
1976	36.7	33.2	34.9	34.5		288 602	2.18	31.02	447 299	16 510	54.3	5.2	2.7	9.8
1977	40.5	37.2	36.3	37.5		297 870	2.35	35.22	460 711	16 892	56.0	12.1	3.2	4.1
1978	44.3	41.2	42.0	38.9		300 195	2.46	38.05	457 692	17 274	56.4	10.8	0.8	15.5
1979	48.1	45.2	45.1	42.8		316 750	2.58	41.37	491 852	17 656	59.6	9.7	5.5	7.4
1980	51.9	48.8	49.3	47.7		324 485	2.61	45.85	541 879	18 032	61.0	7.9	2.4	9.3
1981	55.6	52.4	52.1	52.0		334 865	2.69	49.85	570 679	18 408	63.0	7.3	3.2	5.6
1982	59.4	56.0	54.7	56.1		345 290	2.85	55.22	597 451	18 784	64.9	6.8	3.1	5.1
1983	64.4	59.5	53.9	56.2		336 257	3.04	61.37	530 303	19 175	63.2	6.3	-2.6	-1.6
1984	69.3	63.0	62.7	60.9		354 126	3.10	63.80	635 346	19 567	66.6	5.9	5.3	16.4
1985	74.3	66.5	64.2	66.2		372 053	3.22	68.00	642 906	19 959	70.0	5.6	5.1	2.4
1986	78.0	69.7	69.8	71.7		387 724	3.38	73.76	708 456	20 189	72.9	4.9	4.2	8.6
1987	81.8	73.0	70.5	73.1		397 491	3.74	80.59	710 019	20 419	74.7	4.6	2.5	1.0
1988	85.5	76.2	76.7	78.8	96.5	418 795	3.96	86.34	785 201	20 648	78.7	4.4	5.4	8.8
1989	86.4	78.1	82.2	83.9	100.5	435 727	4.19	92.88	849 382	20 923	81.9	2.5	4.0	7.2
1990	87.3	80.0	85.3	88.7	104.5	451 977	4.46	100.00	879 360	21 198	85.0	2.4	3.7	3.7
1991	88.2	81.9	86.1	87.3	108.5	451 563	4.69	103.41	878 834	21 474	84.9	2.4	-0.1	0.9
1992	96.0	87.6	86.9	85.9	114.2	452 779	4.86	104.68	869 994	21 965	85.1	7.0	0.3	1.0
1993	103.7	93.4	92.2	90.0	119.8	469 355	4.94	106.63	920 700	22 456	88.2	6.6	3.7	6.1
1994	111.5	99.1	96.6	93.6	125.5	487 611	5.07	108.49	958 654	22 947	91.7	6.2	3.9	4.8
1995	119.2	104.9	101.0	101.6	131.1	507 945	5.11	113.37	995 356	23 438	95.5	5.8	4.2	4.6
1996		110.4	108.8	109.0	136.8	529 355	5.15	116.88	1 075 127	23 929	99.5	5.2	4.2	7.7
1997		115.8	115.2	113.2	142.4	548 814	5.21	117.27	1 136 062	24 420	103.2	4.9	3.7	5.9
1998	116.1	121.3	121.7	118.9	148.1	573 243	5.27	118.05	1 196 996	24 911	107.8	4.7	4.5	5.6
1999	129.9	128.9	129.3	126.7	152.6	603 446	5.33	119.32	1 275 568	25 313	113.5	6.3	5.3	6.2
2000	134.4	134.9	136.6	134.9	164.1	627 559	5.48	124.70	1 354 139	25 645	118.0	4.6	4.0	5.7
2001	132.4	139.2	140.2	140.9	160.9	638 597	5.66	132.20	1 382 489	26 000	120.1	3.2	1.8	2.6
2002	140.9	147.2	146.5	150.3	173.4	662 676	5.70	136.00	1 449 107	26 288	124.6	5.7	3.8	4.5
2003	152.5	153.6	152.5	154.1		682 300	5.95	140.20	1 507 071	26 652	128.3	4.4	3.0	4.1
2004		161.2		161.6		707 450	6.07	143.50			133.0		3.7	4.9
2005				169.4		732 211	6.04	143.50					3.5	4.8
2006				177.5		757 838	6.01	143.50					3.5	4.8
2007				186.1		784 362	5.98	143.50					3.5	4.8
2008				193.2		805 932	5.95	143.50					2.8	3.9
2009				200.6		827 693	5.92	143.50					2.7	3.8
2010				208.1		849 626	5.89	143.50					2.7	3.7
2011				215.7		871 717	5.86	143.50					2.6	3.7
2012				223.5		893 946	5.83	143.50					2.6	3.6
2013				231.4		916 294	5.80	143.50					2.5	3.5
2014				239.4		938 285	5.77	143.50					2.4	3.4
2015				247.4		960 335	5.74	143.50					2.4	3.4
2016				255.6		982 423	5.72	143.50					2.3	3.3
2017				263.8		1 004 527	5.69	143.50					2.3	3.2
2018				272.2		1 026 627	5.66	143.50					2.2	3.2
2019				280.7		1 048 699	5.63	143.50					2.2	3.1
2020				289.2		1 070 722	5.60	143.50					2.1	3.0

FIGURE 2.2 ADJUSTED VS ORIGINAL ARTICULATED



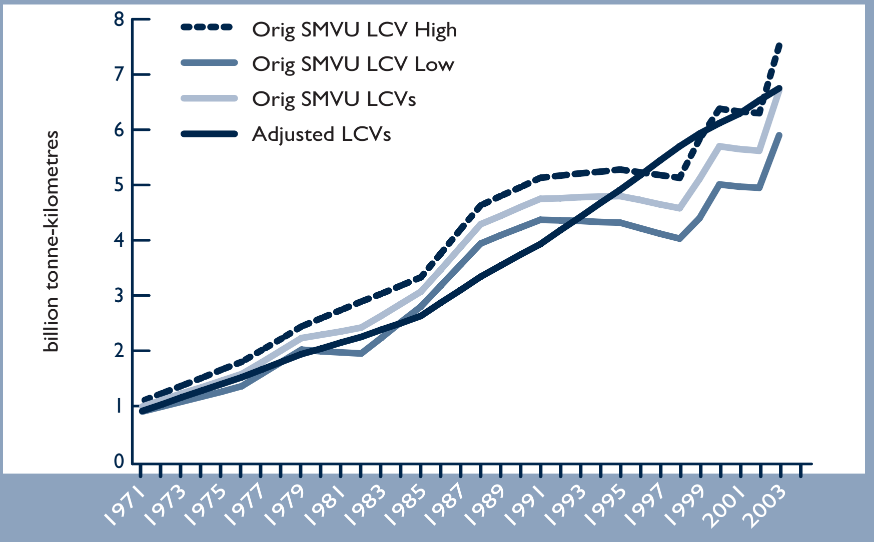
Source: BTRE estimates.

FIGURE 2.3 ADJUSTED VS ORIGINAL RIGID



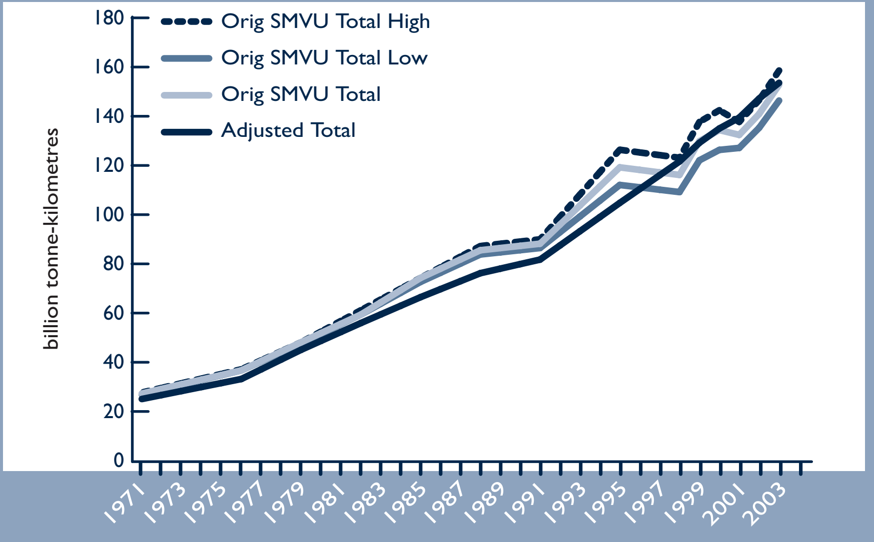
Source: BTRE estimates.

FIGURE 2.4 ADJUSTED VS ORIGINAL LCV



Source: *BTRE estimates.*

FIGURE 2.5 ADJUSTED VS ORIGINAL TOTAL



Source: *BTRE estimates.*

Using the cleaned data

Once the cleaned data is available, the first question is: How valid are the adjusted data as a representation of the total road freight task? There are only two long-term series useful in answering this question: the series of truck counts at Marulan, and the Apelbaum Consulting Group estimates—see Table 2.8.

The Marulan series is drawn from data subject to a lot of measurement error since 1995, and this report attempts to correct this. Using this series multiplied by the artic load per truck series from the Survey of Motor Vehicle Use produces a series approximating road freight tonnages through Marulan. This is a fast-growing intercapital route. The elasticity of total road freight—including bulk plus non- bulk, and urban plus non-urban—with respect to Marulan freight is expected to be less than one. The equation—fitted from 1971 to 2003, with dummy variables between 1973 and 1977 and between 1978 and 1982—confirms this:

$$\text{Total road freight (Btkm)} = \exp(-13.4682+0.7575\text{x}\log(\text{Marulan freight})-0.1908\text{xdum7377}-0.0588\text{xdum7882})$$

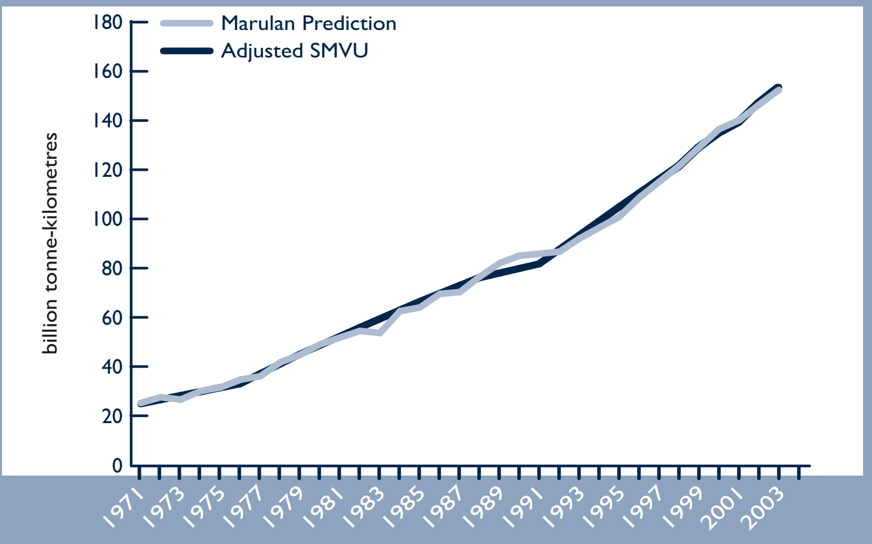
Figure 2.6 shows that the three variables resulted in a fair match with the adjusted total road freight task—especially over the major break-in-series between 1995 and 1998.

The Apelbaum Consulting Group has derived bottom-up estimates of the total road freight task (Apelbaum Consulting Group 2004). These differ in level from the adjusted series presented here, but from 1988 broadly support its trend—see Figure 2.7. The issue of whether the current ABS survey correctly estimates the *level* of road freight remains an open question, but one that is not relevant here.

The adjusted data can also be used to estimate implied income and price elasticities. Using real gross domestic product (GDP) and the real road freight rate, produced the following equation—fitted over 1971 to 2003:

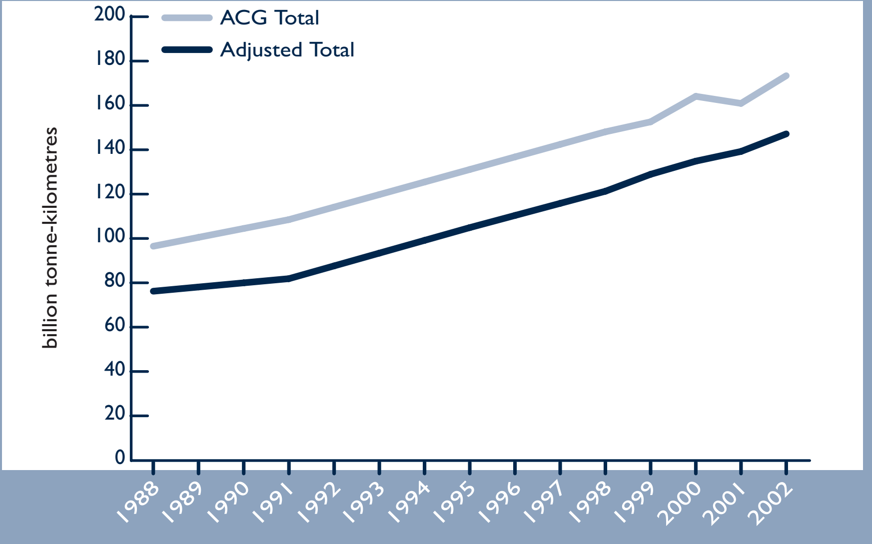
$$\text{Total road freight (Btkm)} = \exp(-10.3506 + 1.2379\text{x}\log(\text{real GDP}) - 0.8583\text{x}\log(\text{real road rate}))$$

FIGURE 2.6 ADJUSTED SMVU VS MARULAN PREDICTION



Source: BTRE estimates.

FIGURE 2.7 ADJUSTED VS APPLEBAUM CONSULTING GROUP

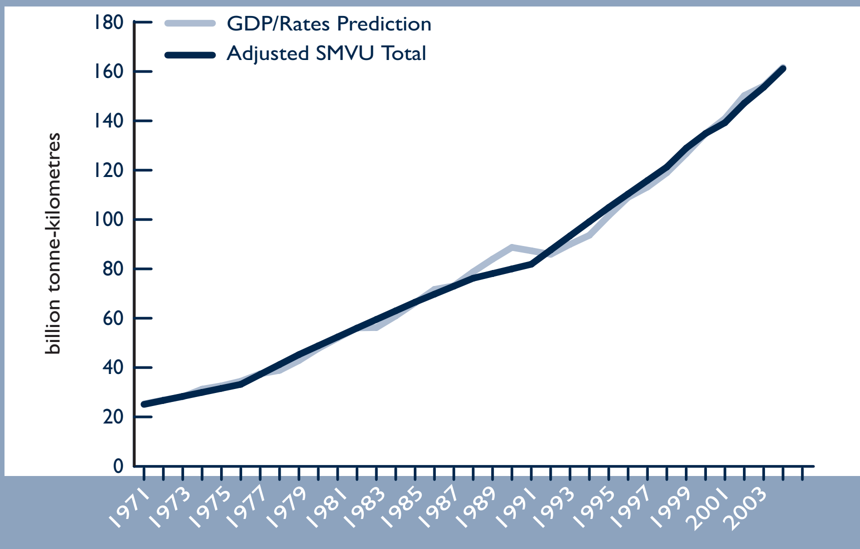


Sources: BTRE estimates and Applebaum Consulting Group.

Thus past growth suggests that the total road freight task has a 1.24 income elasticity and a –0.86 price elasticity. Figure 2.8 shows the fit.

The 1.24 income elasticity means that total road freight grows substantially faster than GDP. Figure 2.9 shows the adjusted road freight task and an index of real GDP on the same scale.

FIGURE 2.8 ADJUSTED SMVU VS GDP/RATES PREDICTION

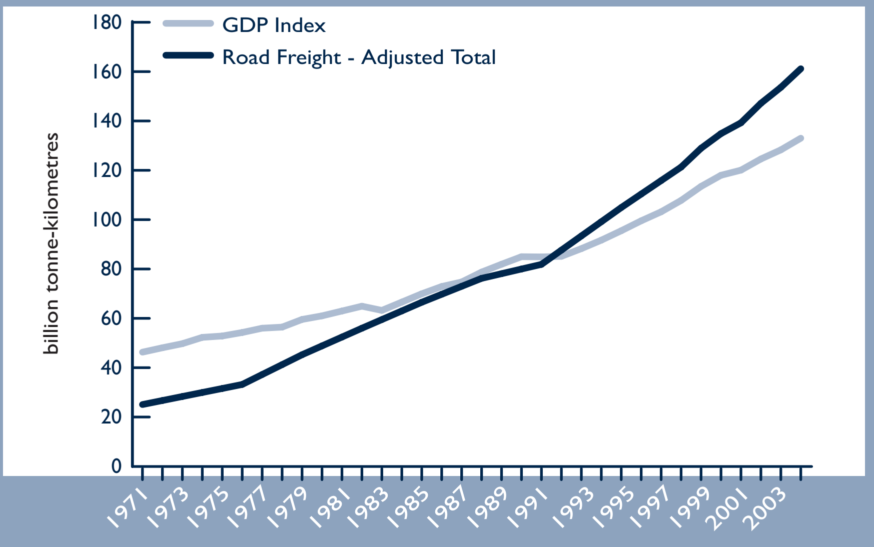


Source: BTRE estimates.

To forecast the total road freight task—that is urban plus non-urban and bulk plus non-bulk—specific assumptions were made about GDP growth and real road freight rates. It was assumed that real GDP would increase by 2.7 per cent per year between 2000 and 2020 and that real road freight rates would decrease by 0.5 per cent per year over the same period. If this assumption is valid, the total road-freight task will more than double between 2000 and 2020. It will increase from an estimated 134.9 billion tonne–kilometres in 2000 to 289.2 billion tonne–kilometres in 2020—more than doubling (2.7 times 1.2379 = 3.34; -0.5 x -0.8583 = 0.43; 1.0334 x 1.0043 = 1.0378, ie a 3.78% per year growth rate; 1.0378^{20} = 2.10 times). Figure 2.10 shows the past and predicted levels of the total road freight task.

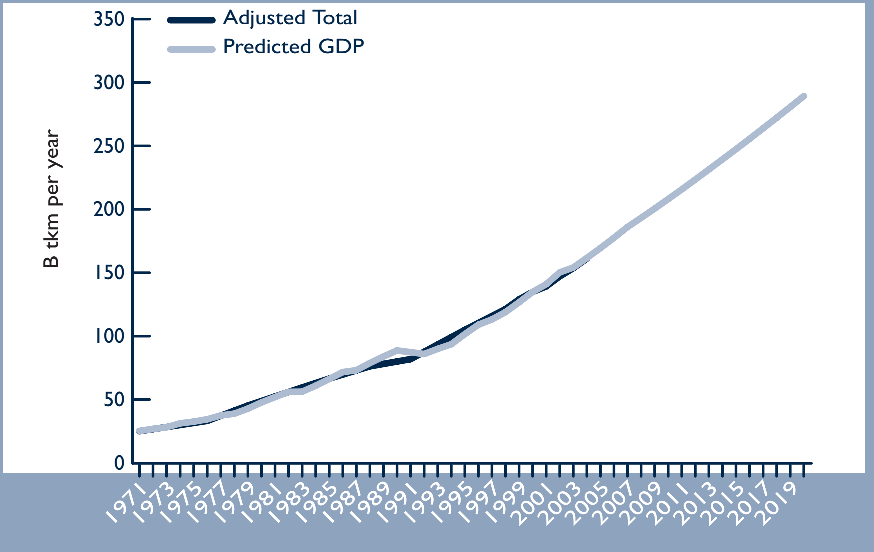
Figure 2.11 compares the annual percentage change in total road freight estimated from the Marulan equation, with the annual GDP growth rate. The Marulan equation has the advantage of annual measurement. The

FIGURE 2.9 ROAD FREIGHT AND GDP



Source: *BTRE estimates.*

FIGURE 2.10 ESTIMATED AND PREDICTED TOTAL ROAD FREIGHT TASK

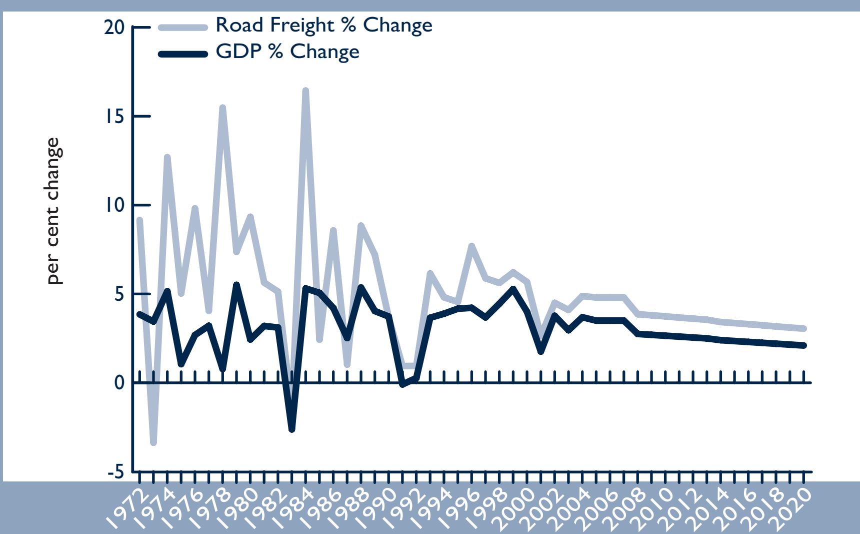


Source: *BTRE estimates.*

first thing to notice is the close relationship between the annual movements of the two series. The recessions of 1983 and 1991 to 1992 are in both data series, as is the 2001 slowdown. The second thing to notice is the much higher growth rates in total road freight than GDP in the 1970s and 1980s. This was when real road freight rates fell substantially, making freight cheaper and encouraging its rapid growth. In the 1990s, decreases in freight rates slowed substantially. The third thing to notice is that, at the same time, the ratio of freight growth to economic growth fell towards the 24 per cent faster relationship estimated above.

The GDP and rates assumptions mentioned above produce the forecast growth rates shown in Figure 2.11. The growth rate in total road freight is expected to remain above a declining GDP growth rate. This implies that the expected growth rate in the road freight task will also decline. However, as the calculations above also show, the absolute growth over 20 years should still be substantial.

FIGURE 2.11 ROAD FREIGHT VS GDP CHANGE



Source: BTRE estimates.

2.2 CONCLUSION

The data from past and present Surveys of Motor Vehicle Use cannot be used interchangeably.

The raw data must be adjusted to account for a major methodological adjustment. This creates three major problem areas, that need to be adjusted within what is called a disaggregation correction framework. These problem areas are:

- adjusting vehicle stock numbers
- adjusting for overstating of vehicle kilometres travelled in the recall surveys pre-1998
- correcting the proportion of laden vehicles—especially in 1998 and 1999.

The resulting adjusted total road freight data is consistent with validating road freight data from Marulan, and implies an income elasticity of 1.24 and a price elasticity of –0.86. If suitable assumptions about income and price are applied, total road freight is expected to more than double between 2000 and 2020.

CHAPTER 3

CAPITAL CITY ROAD FREIGHT

By 2001, approximately two out of every three Australians lived in the eight major capital cities (ABS 2003). The transport of goods and services is an integral part of the supply chain satisfying the demand of urban consumers and producers.

Urban freight movement is largely the preserve of road transport. Rail carries very little of the urban freight task. The urban road freight task can be characterised into a few main groups:

- urban goods movements—from docks to warehouses, warehouses to retailers, retailers to consumers
- courier parcel services and mail delivery
- bulk materials associated with building and construction and waste management
- the urban component of long distance intercity freight transport.

The data presented in Appendix II shows that between 1971 and 2003, capital city freight transport, as a percentage of the total road freight transport task decreased from 28 percent to 22 percent. (ABS 2002a and earlier issues). Urban freight tends to grow slightly less rapidly than non-urban road freight.

What will be the level of freight transport in our urban areas in 2020? What implications would increased urban freight transport have on the costs of urban traffic congestion, emissions and the cost of transporting goods and services in urban areas? This chapter reviews the evidence on urban freight transport demand in Australia, and derives an aggregate urban freight forecasting model, and forecasts urban road freight demand to 2020.

What is not presented here, is the link between growth in the urban road freight task and the effects on traffic growth in the metropolitan areas. This issue has been covered in Gargett and Cosgrove (2004).

Most freight tonnage moved in urban areas is carried by heavy trucks.

Although heavy truck traffic in the cities is growing rapidly, its small share of the traffic stream (4 per cent) means that this growth will not greatly impact on congestion, except in localised areas.

In contrast, light commercial vehicle (LCV) traffic, although it carries very little of the freight, makes up a large fraction of the traffic stream (15 per cent).

This LCV traffic is also growing quickly, and because of its weighting in the traffic stream, this growth will be a major contribution to traffic congestion over the next 15 years. So it must be borne in mind that the projections of tonnage growth as presented below do not equate to traffic growth.

3.1 URBAN ROAD FREIGHT DEMAND GROWTH

Historically, the growth rate of urban freight has been substantial. Table 3.1 shows the estimates of aggregate urban road freight tasks in capital

TABLE 3.1 ESTIMATES OF THE CAPITAL CITY ROAD FREIGHT TASK

(billion tonne-kilometres)

Year	SYD	MEL	BNE	ADL	PER	HOB	DRW	CBR	8 CAPS
1971	2.82	1.96	0.62	0.67	0.78	0.11	0.04	0.10	7.11
1972	2.98	2.09	0.68	0.71	0.84	0.13	0.05	0.11	7.58
1973	3.14	2.21	0.75	0.75	0.89	0.14	0.05	0.11	8.04
1974	3.29	2.34	0.81	0.79	0.94	0.15	0.05	0.12	8.50
1975	3.44	2.47	0.88	0.83	1.00	0.16	0.06	0.13	8.96
1976	3.59	2.60	0.95	0.87	1.05	0.18	0.06	0.13	9.43
1977	3.85	2.83	1.12	0.94	1.15	0.19	0.06	0.14	10.28
1978	4.10	3.06	1.30	1.00	1.24	0.21	0.06	0.16	11.13
1979	4.34	3.29	1.49	1.07	1.34	0.23	0.06	0.17	11.98
1980	4.53	3.47	1.66	1.05	1.41	0.24	0.09	0.18	12.63
1981	4.72	3.66	1.84	1.02	1.49	0.24	0.13	0.18	13.28
1982	4.90	3.84	2.03	0.98	1.56	0.25	0.17	0.19	13.93
1983	5.05	4.00	2.11	1.02	1.60	0.27	0.18	0.20	14.44
1984	5.20	4.16	2.20	1.06	1.64	0.29	0.19	0.21	14.95
1985	5.34	4.32	2.29	1.10	1.68	0.32	0.20	0.21	15.46
1986	5.64	4.64	2.43	1.17	1.79	0.33	0.20	0.23	16.42
1987	5.92	4.96	2.57	1.24	1.90	0.33	0.21	0.24	17.37
1988	6.21	5.28	2.72	1.31	2.01	0.34	0.21	0.25	18.33
1989	6.37	5.51	2.80	1.35	2.09	0.34	0.22	0.26	18.94
1990	6.53	5.73	2.89	1.38	2.18	0.35	0.23	0.27	19.55
1991	6.69	5.96	2.97	1.42	2.27	0.35	0.24	0.28	20.17
1992	6.99	6.30	3.13	1.48	2.38	0.35	0.24	0.27	21.14
1993	7.29	6.64	3.30	1.55	2.50	0.34	0.24	0.26	22.12
1994	7.58	6.99	3.47	1.62	2.62	0.33	0.23	0.26	23.10
1995	7.88	7.34	3.64	1.68	2.74	0.33	0.23	0.25	24.08
1996	8.19	7.67	3.86	1.76	2.86	0.31	0.24	0.25	25.12
1997	8.49	8.00	4.08	1.83	2.98	0.29	0.25	0.24	26.17
1998	8.80	8.33	4.31	1.91	3.10	0.27	0.26	0.24	27.22
1999	8.95	8.61	4.64	1.93	3.17	0.27	0.29	0.24	28.10
2000	9.35	9.20	4.99	2.01	3.40	0.28	0.26	0.25	29.74
2001	9.62	9.45	5.18	2.04	3.52	0.29	0.22	0.24	30.56
2002	10.02	10.06	5.50	2.15	3.75	0.31	0.19	0.25	32.22
2003	10.39	10.28	5.71	2.25	3.87	0.32	0.19	0.26	33.27
				Average annual growth rate (per cent)					
1985–2003	3.8	4.9	5.2	4.1	4.7	0.0	-0.3	1.2	4.3

Source: *Appendix II.*

cities—see Appendix II for derivation. Between 1971 and 2003, capital city tonne-kilometres increased by five percent per annum—compared with six or more per cent for non-capital city freight.

Of particular importance to urban transport planners is the future impact of large commercial vehicles on urban traffic congestion, as their slow acceleration contributes to congestion.

The SMVU from the ABS reports total commercial vehicle kilometres travelled within the capital cities.

Between 1971 and 2000, commercial vehicle use in capital cities, expressed as kilometres travelled, increased by an average of 3.4 per cent per annum. Most of the growth in commercial vehicle traffic in capital cities has come from light commercial vehicles (LCVs)—the largest vehicle class.

In terms of capital city traffic *levels*, according to the survey, commercial vehicles make up around 19 per cent of the capital city traffic stream. However, commercial vehicle travel, as a *share* of total urban travel, has not increased significantly since 1976. For heavy freight vehicles—rigid trucks and articulated trucks—the survey estimates indicate that their share of the total capital city traffic stream is about 4 per cent.[1]

There is a range of factors that will affect the growth of freight in our large urban centres. Economic growth will flow through to increased demand for urban freight. However, the increasing share of the services and telecommunications sectors in the economy may provide some decoupling of freight growth from overall economic activity. Any saturation of freight transport demand will primarily be driven by the relative price of urban freight transport.

Offsetting any decoupling of freight growth from overall economic growth, however, is the trend to increased home delivery of goods and services. Increasing home delivery may see further substitution of urban freight transport for passenger car trips, thus increasing demand for urban freight transport. Similarly, just-in-time systems in business have led to a progressive substitution of a larger number of freight deliveries for inventory.

Evidence from the United States

Does the United States experience shed any light on the future of Australian urban freight transport? In particular, does the United States data indicate that the pace of growth in urban freight has shown any

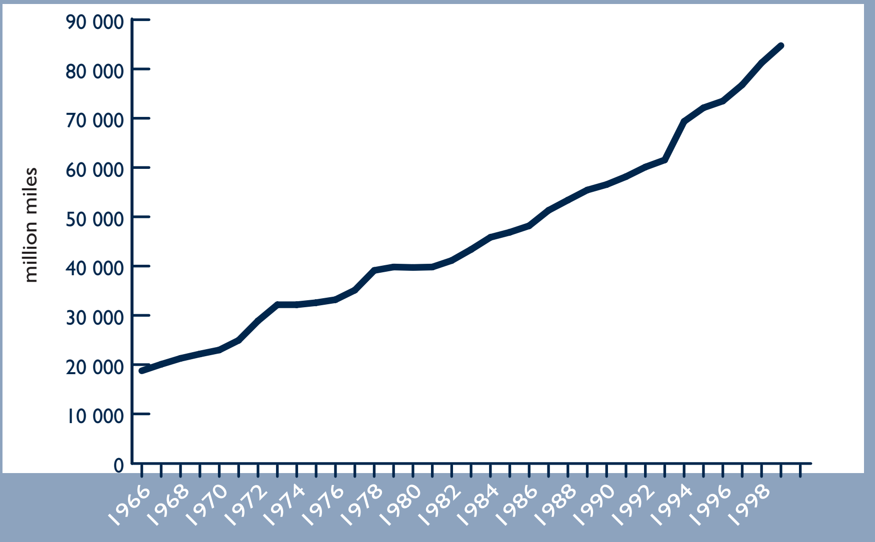
1 Note that the change in vehicle classification in 1991 resulted in a reallocation of vehicles from rigid trucks to LCVs, which explains part of the observed decline, between the 1991 and 1995 SMVUs, in the share of urban vehicle kilometres travelled by heavy commercial vehicles.

sign of saturating? Or is urban freight traffic growing proportionately, as the size of the services sector of the economy has increased?

The evidence from the United States is not conclusive. The aggregate United States data on urban freight movements is limited to vehicle kilometres travelled by trucks in urban areas[2] (Federal Highway Administration 2000a, 2000b and earlier issues). Total urban truck mileage increased from 23 000 million miles to 84 700 million miles between 1970 and 1999—see Figure 3.1—an average of 4.6 per cent per annum. In that period, urban truck mileage, as a share of total truck mileage, increased from under 37 per cent to over 41 per cent.

As a share of the total urban traffic stream, which is more important for urban congestion and urban emissions, trucks comprise only five per cent of the task—up from 4 per cent in 1970—see Figure 3.2.

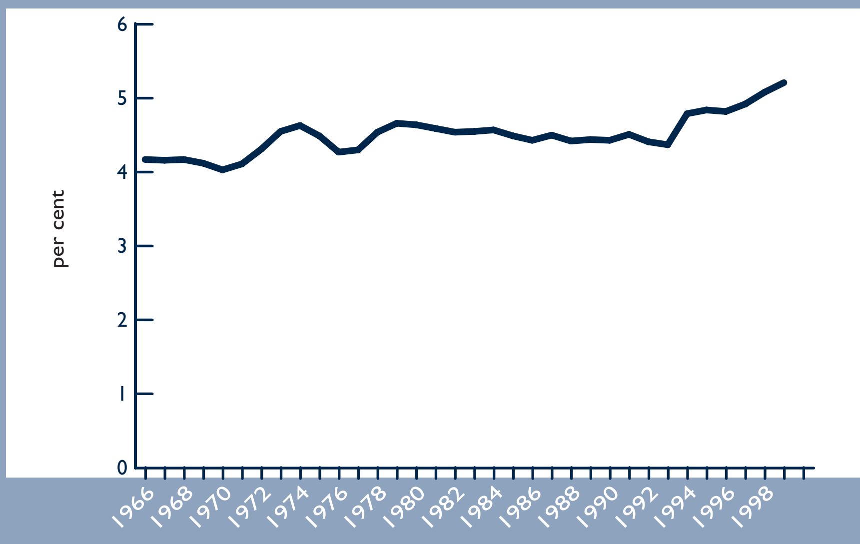
FIGURE 3.1 TOTAL UNITED STATES URBAN TRUCK MILEAGE, 1966–1999



Sources: Federal Highway Administration (2000a, 2000b and earlier issues).

2 The US Federal Highway Administration classifies urban travel as all travel on roads and streets in urban places with a population of 5 000 or more.

FIGURE 3.2 TRUCK MILEAGE AS A PROPORTION OF TOTAL URBAN VEHICLE MILEAGE, 1966–1999



Sources: Federal Highway Administration (2000a, 2000b and earlier issues).

3.2 URBAN ROAD FREIGHT DEMAND MODEL

Using the data derived in Appendix II for capital city tonne-kilometres, the BTRE has estimated two simple models of urban road freight demand.

The BTRE models relate urban freight transport to measures of city incomes and real urban freight rates. The models can be used to forecast the future capital city road freight transport tasks. The freight transport task projections may then be converted into vehicle movement estimates by dividing by projected average vehicle loads.

The first simple model was a cross-section, time series model. This model relates total freight tonne-kilometres in each capital city to city incomes/production and real freight rates:

$$\ln(\text{Urban Freight}_i) = \beta_{0,i} D_i + \beta_1 \ln(\text{Population}_i \times \text{Real national - level per capita GDP}) + \beta_2 \ln(\text{Real freight rate}) \quad (1)$$

where

D_i = city-specific dummy variables and city-specific time dummy variables, city i.

β_1 and β_2 = elasticity of demand with respect to city economic activity and real freight rate, respectively.

Urban $freight_i$ = billion tonne-kilometres in urban area i.

$Population_i$ = total population within urban area i.

Real per capita GDP = national-level per capita real gross domestic product.

Freight rate = real road freight rate for short-haul road freight.

Cross-section, time series data

Raw data for total tonne-kilometres for each capital city—as derived in Appendix II—was obtained from the survey (ABS 2004 and earlier issues). The survey asks respondents to report the number of kilometres travelled within capital cities, other provincial urban areas, other within state and interstate. The survey's urban freight task estimate, therefore, should include intraurban freight, freight movements to and from major ports, and the urban component of inter-urban road freight movements.

Estimated resident population data for each capital city was obtained from a combination of various ABS data products. Population estimates for the period 1971 to 1996 are from the Integrated Regional Database (ABS 1996). Estimates for subsequent years were obtained from ABS (2004), which provides population estimates to 2003 and projections to 2020. The measure of output within a city was assumed to be equal to the product of national-level real gross domestic product per capita times the estimated resident population within each city (ABS Cat. No. 5206.0).

TransEco publishes a series of short haul road freight rates. This is discussed in more detail in Chapter 10. The series is only available from the fourth quarter in 1984 to the present. However, short haul freight rates appear to move roughly in parallel to movements in long haul road freight rates. Therefore, where measures of short-haul freight rates were not available, we have used movements in long-haul freight rates as a proxy. This is also discussed in more detail in Chapter 10.

Estimation results for the cross-section, time series freight model

Estimation of tonne-kilometres was undertaken for each of the capital cities, using pooled cross-section, time series regression techniques. The Ordinary Least Squares model results are given in Table 3.2. The real income elasticity was 0.96 and the real freight rate elasticity was –0.78. Figure 3.3 shows the fit to the data.

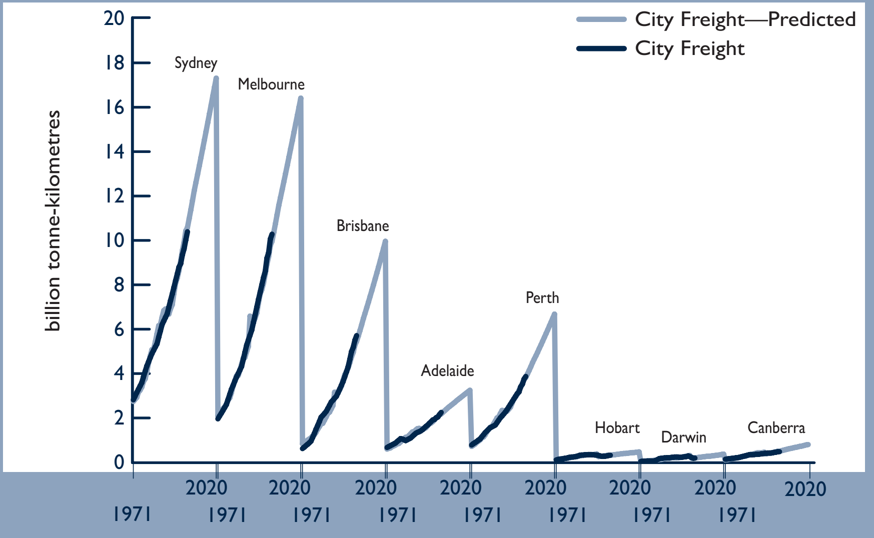
TABLE 3.2 CROSS-SECTION, TIME SERIES URBAN ROAD FREIGHT MODEL: ORDINARY LEAST SQUARES PARAMETER ESTIMATES

	Capital city		
No. observations	264		
R^2	.995		
Real income	0.960 (0.053)		
Real freight rate	-.781 (0.068)		
City dummy variables		**Time dummy variables**	
Sydney	-7.887 (0.698)	D90on	-0.029 (.038)
Melbourne	-8.010 (0.690)	D90on	0.193 (.038)
Brisbane	-7.888 (0.638)	D90on	0.158 (.042)
Adelaide	-8.196 (0.632)	D90on	-0.031 (.038)
Perth	-7.845 (0.630)	D90on	-0.058) (.041)
Hobart	-8.062 (0.543)	D96on	-0.415 (.043)
Darwin	-7.836 (0.496)	D01on	-0.525 (.067)
Canberra	-8.230 (0.557)	D95on	-0.264 (.045)

Note: Standard errors given in parentheses.

Source: BTRE estimates.

FIGURE 3.3 CROSS-SECTION, TIME-SERIES DATA AND FIT



Note: Canberra City taken here to include interstate.

An aggregate model of the Australian 'metro' freight task

The second simple model was estimated by aggregating the tonne-kilometre tasks for the eight capital cities. This produced what is referred to as the Australian 'metropolitan' freight task.

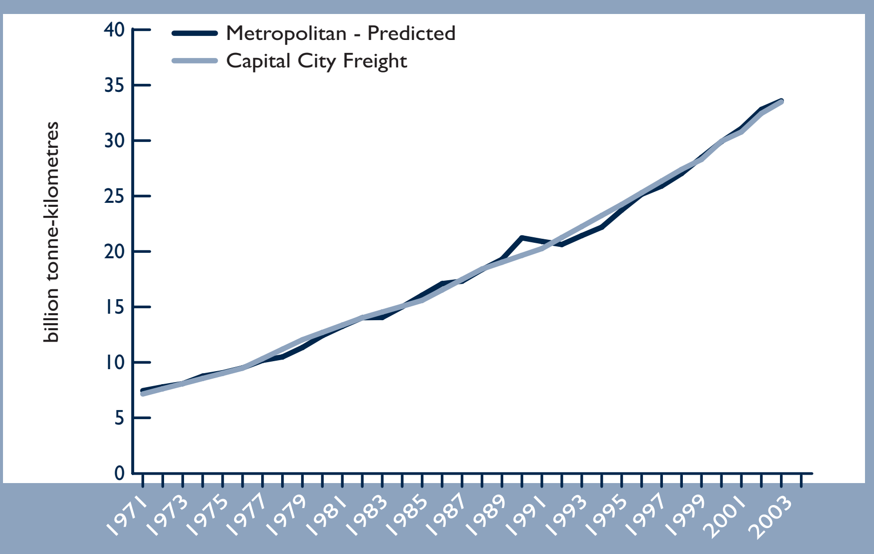
This was then regressed against metropolitan GDP—national-level GDP per person times metropolitan population—real road freight rates as before, and a dummy variable for 1990 onwards.

The aggregate model results are shown in Table 3.3. The real income and real freight rate elasticities are similar to those derived for the cross-section, time series model. Figure 3.4 shows the fit to the data.

TABLE 3.3 AGGREGATE URBAN ROAD FREIGHT MODEL: ORDINARY LEAST SQUARES PARAMETER ESTIMATES

	Capital city
No. observations	33
$\bar{R}^2$	.996
Constant	-8.717 (.819)
Real income	1.014 (0.060)
Real freight rate	-.685 (0.058)
Dum90on	0.052 (0.022)

FIGURE 3.4 'AGGREGATE' MODEL DATA AND FIT



Source: BTRE estimates.

3.3 FORECASTING URBAN FREIGHT MOVEMENTS

The results from the simple models may be combined with assumptions about future average income, population growth, and trends in average freight rates, to produce forecasts of future urban freight transport.

The BTRE has produced forecasts of urban freight tonne-kilometres using ABS median projections of population growth, together with an assumed growth of 2.7 per cent per annum in real non-farm domestic product, and a 0.5 per cent per annum assumed decline in real urban freight rates. The latter reflects assumed benefits from continuing technological change.

The forecast growth in capital city freight tonne-kilometres from both models is about 3.0 per cent per annum between 2003 and 2020. This compares with growth of 5.0 per cent per annum for the capital cities between 1971 and 2003.

The forecasts for each capital city are listed in Table 3.4 and plotted individually in Appendix III, Figures III.1 to III.8. These forecasts are derived in three steps. First, the aggregate metro model is used to forecast the total metropolitan freight task. Then the cross-section, time series model is used to derive each city's provisional freight task. Finally each city's share of the cross-section, time series total for the eight capitals is multiplied by the aggregate 'metro' forecast to get the city's final forecast freight task.

TABLE 3.4 CAPITAL CITY ROAD FREIGHT PROJECTIONS

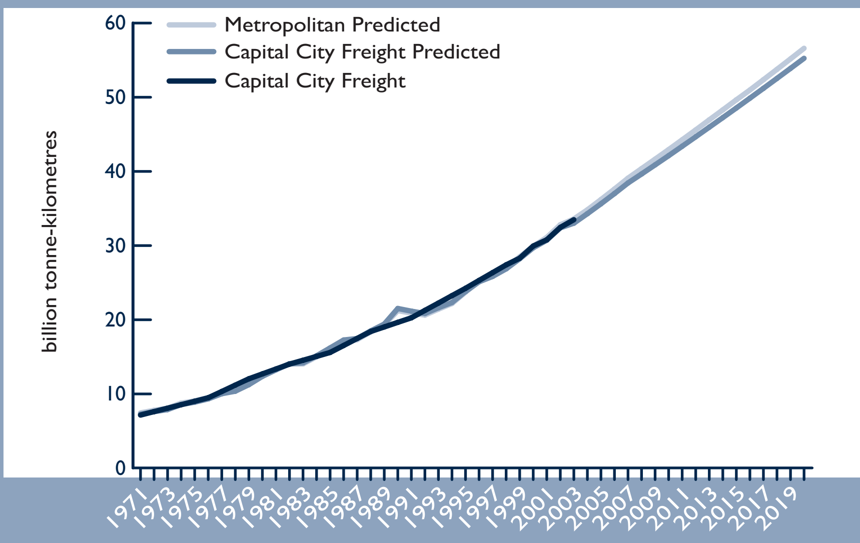
(billion tonne-kilometres)

Year	SYD	MEL	BNE	ADL	PER	HOB	DRW	CBR	METRO (AGGR)
2003act	10.39	10.28	5.71	2.25	3.87	0.32	0.19	0.26	33.27
2003pred	10.84	10.21	5.58	2.23	3.91	0.33	0.20	0.28	33.59
2004	11.22	10.58	5.81	2.30	4.07	0.34	0.21	0.29	34.82
2005	11.64	11.00	6.08	2.37	4.24	0.35	0.23	0.30	36.20
2006	12.08	11.43	6.35	2.45	4.41	0.36	0.24	0.31	37.62
2007	12.54	11.86	6.64	2.52	4.60	0.37	0.25	0.32	39.09
2008	12.93	12.23	6.89	2.58	4.77	0.38	0.26	0.33	40.37
2009	13.32	12.61	7.15	2.65	4.92	0.39	0.27	0.34	41.65
2010	13.71	12.99	7.41	2.71	5.09	0.40	0.28	0.35	42.94
2011	14.11	13.36	7.68	2.77	5.27	0.41	0.29	0.36	44.26
2012	14.52	13.75	7.96	2.85	5.44	0.41	0.29	0.37	45.59
2013	14.94	14.15	8.23	2.91	5.62	0.42	0.30	0.38	46.95
2014	15.34	14.54	8.51	2.97	5.79	0.43	0.31	0.39	48.29
2015	15.76	14.93	8.79	3.04	5.97	0.44	0.32	0.40	49.65
2016	16.16	15.31	9.07	3.10	6.14	0.45	0.33	0.41	50.97
2017	16.58	15.71	9.36	3.16	6.33	0.45	0.34	0.42	52.36
2018	17.04	16.14	9.68	3.23	6.52	0.46	0.35	0.43	53.86
2019	17.43	16.51	9.96	3.29	6.70	0.47	0.37	0.44	55.17
2020	17.85	16.92	10.27	3.35	6.89	0.48	0.38	0.45	56.60
				Average annual growth rate (per cent)					
2003pred–2020	3.0	3.0	3.7	2.4	3.4	2.2	3.8	2.8	3.1

Source: BTRE estimates.

Figure 3.5 shows the projections of the freight task of the eight capital cities combined. The projections use both the aggregate model and the cross-section, time series total before adjustment.

FIGURE 3.5 ACTUAL AND PROJECTED TOTAL URBAN FREIGHT, CAPITAL CITIES AND PROVINCIAL URBAN AREAS, 1971–2020



Source: *BTRE estimates.*

CHAPTER 4

ESTIMATING TOTAL STATE BASED LAND FREIGHT MOVEMENTS

State transport agencies are interested in state-based movements of road and public access rail freight for transport and infrastructure planning. Until now, there has been no consistent measure of total road or rail freight movements by state within which the freight is moved. This chapter presents annual estimates of the road and public access rail freight transport task, by state of operation. The BTRE's methodology for constructing these estimates is also described.

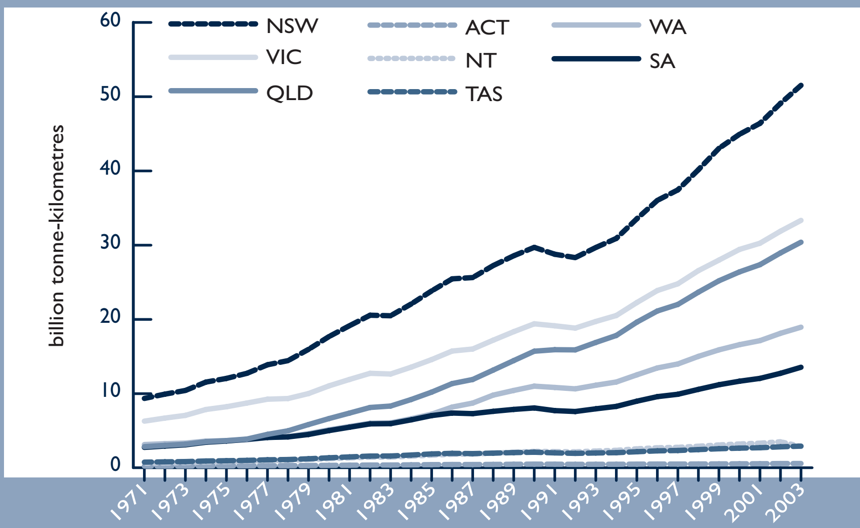
For road freight, the Survey of Motor Vehicle Use (SMVU) records total freight movements by state of vehicle registration for every year of the survey. But the survey has only relatively recently reported vehicle movements by state of operation—that is, the state within which the vehicle movement occurred. Estimates of freight moved by state of registration reflect the number of vehicles registered within each state. Freight movements by state of operation statistics more accurately reflect where the freight transport activity is undertaken.

For rail freight, the ABS (Cat. No. 9213.0), Australasian Railways Association (ARA) and annual reports of state rail authorities provide figures for the freight task by state of operation until 1994. With the deregulation of rail in the mid 1990s, estimates of rail freight by state of operation have been derived using data provided by Australasian Railways Association and various rail and track operators.

4.1 ESTIMATES OF THE ROAD FREIGHT TASK BY STATE OF OPERATION

Figure 4.1 illustrates the BTRE estimates of the road freight task by state of operation since 1970–71. Appendix II explains how these estimates were derived. Approximately one-third of the road freight task is carried on New South Wales roads and 20 per cent on Victorian roads. Taken together, almost three-quarters of the road freight is carried on New South Wales, Victorian and Queensland roads.

FIGURE 4.1 ROAD FREIGHT TASK BY STATE OF OPERATION, 1970–71 TO 2002–03



Sources: ABS (1978, 1981a, 1983, 1986, 1990, 1993, 1996, 2000a and 2000c, 2001a), Commonwealth Bureau of Census and Statistics (1973), BTRE estimates.

4.2 FORECASTS OF THE ROAD FREIGHT TASK BY STATE OF OPERATION

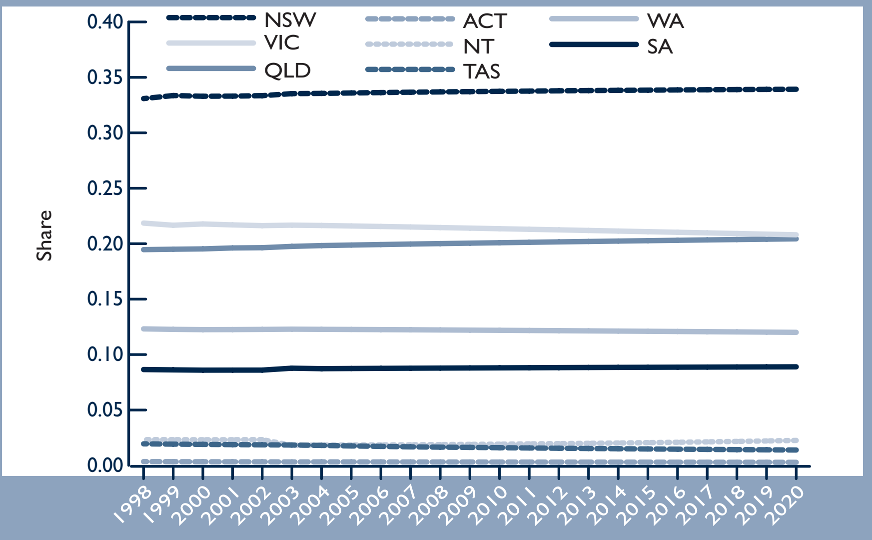
Adjusted state shares of the total Australian road freight task were used to derive estimates of state freight. Forecasts of these shares are used to calculate state road freight projections from projections of the total Australian task.

The adjusted state shares of the Australian freight task—these are described in Appendix II—were used as input to a simple linear model for each state.

The larger states of New South Wales, Victoria, Queensland, Western Australia and South Australia all had a linear equation fitted to the most recent state of operation share data—1998–2003. This was then projected to get a forecast share of the total aggregate road freight task generated in Chapter 2. For the smaller states, the forecast state of operation shares were specified by either projecting the rest of state shares and then adding the three road freight components—that is, interstate, capital city and rest of state; or by setting the rest of state projections to zero. This last method was applied to the Australian Capital Territory.

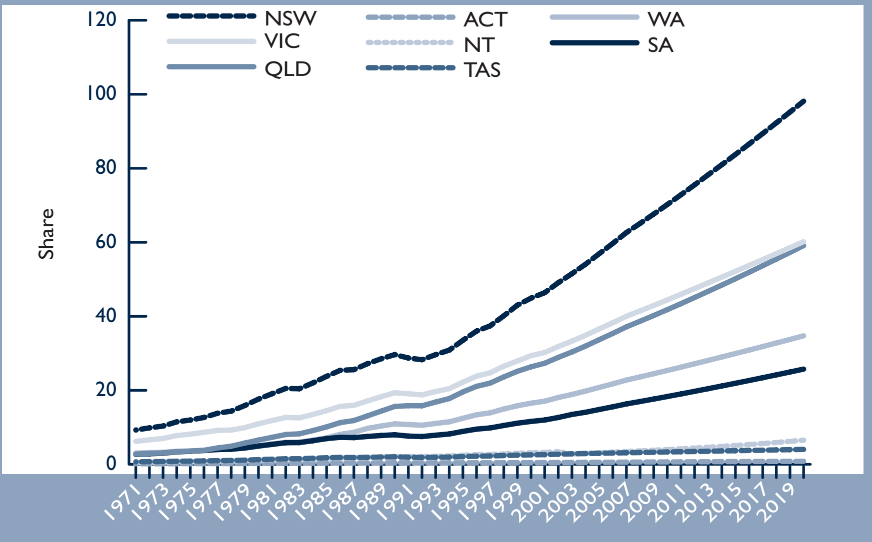
The estimated share of the freight task, by state and territory of operation was then normalised. The final results are illustrated in Figure 4.2.

FIGURE 4.2 SHARES OF ROAD FREIGHT TASK BY STATE AND TERRITORY OF OPERATION, 1998–2020



Sources: ABS (1978, 1981a, 1983, 1986, 1990, 1993, 1996, 2000a and 2000c, 2001a), Commonwealth Bureau of Census and Statistics (1973), BTRE estimates.

FIGURE 4.3 STATE ROAD FREIGHT TASK ESTIMATES AND PROJECTIONS (SHARE OF AGGREGATE FREIGHT TASK MODEL)



Sources: ABS (1978, 1981a, 1983, 1986, 1990, 1993, 1996, 2000a and 2000c, 2001a), Commonwealth Bureau of Census and Statistics (1973), BTRE estimates.

Chapter 2 presented forecasts of the total Australian road freight task to 2020 based on adjusted estimates of the survey. The aggregate forecasts rely on a range of assumptions about future economic activity, relative prices of road transport and the structure of road freight demand. The estimated shares presented in Figure 4.2 have been applied to the forecasts of the aggregate road freight task presented in Chapter 2. This enabled the BTRE to model estimates and forecasts of the state road freight task. The results are presented in Figure 4.3 and Table 4.1.

TABLE 4.1 STATE ROAD FREIGHT TASK ESTIMATES AND PROJECTIONS—SHARE OF AGGREGATE FREIGHT TASK MODEL

(billion tonne-kilometres)

SMVU	NSW	Vic	Qld	SA	WA	Tas	NT	ACT	Aust.
1971	9.27	6.20	2.76	2.66	3.04	0.67	0.52	0.14	25.27
1972	9.85	6.62	2.94	2.84	3.16	0.71	0.57	0.15	26.83
1973	10.34	6.98	3.09	3.01	3.24	0.75	0.61	0.16	28.18
1974	11.47	7.78	3.43	3.36	3.51	0.83	0.70	0.17	31.25
1975	11.97	8.14	3.58	3.52	3.58	0.86	0.75	0.18	32.59
1976	12.66	8.65	3.79	3.75	3.69	0.91	0.82	0.19	34.46
1977	13.81	9.16	4.42	4.00	3.99	0.99	0.89	0.20	37.46
1978	14.37	9.25	4.90	4.07	4.12	1.02	0.92	0.20	38.86
1979	15.89	9.92	5.75	4.41	4.52	1.13	1.02	0.21	42.84
1980	17.62	10.96	6.55	4.93	5.04	1.26	1.14	0.24	47.73
1981	19.08	11.83	7.30	5.39	5.48	1.38	1.24	0.26	51.96
1982	20.49	12.66	8.05	5.83	5.92	1.49	1.35	0.28	56.07
1983	20.42	12.56	8.24	5.87	5.98	1.50	1.35	0.28	56.21
1984	22.01	13.48	9.12	6.38	6.53	1.63	1.47	0.31	60.93
1985	23.78	14.51	10.12	6.95	7.15	1.78	1.61	0.33	66.22
1986	25.40	15.66	11.27	7.30	8.10	1.86	1.73	0.35	71.68
1987	25.58	15.94	11.82	7.22	8.64	1.82	1.76	0.35	73.12
1988	27.20	17.13	13.09	7.53	9.72	1.89	1.89	0.36	78.80
1989	28.52	18.27	14.37	7.79	10.34	1.96	2.01	0.39	83.65
1990	29.65	19.34	15.64	7.99	10.92	2.01	2.13	0.40	88.08
1991	28.72	19.07	15.84	7.62	10.75	1.92	2.10	0.39	86.42
1992	28.27	18.76	15.82	7.50	10.56	1.86	2.07	0.38	85.21
1993	29.63	19.65	16.82	7.87	11.05	1.91	2.17	0.38	89.49
1994	30.86	20.46	17.77	8.19	11.49	1.95	2.27	0.38	93.36
1995	33.51	22.20	19.56	8.90	12.45	2.07	2.47	0.40	101.57
1996	35.99	23.83	21.07	9.51	13.38	2.19	2.61	0.42	109.00
1997	37.41	24.74	21.95	9.83	13.92	2.24	2.67	0.41	113.17
1998	40.13	26.51	23.61	10.49	14.94	2.37	2.82	0.42	121.29
1999	43.01	27.93	25.14	11.12	15.82	2.48	2.99	0.44	128.93
2000	44.91	29.37	26.34	11.59	16.52	2.56	3.13	0.45	134.87
2001	46.38	30.21	27.31	11.97	17.06	2.62	3.23	0.46	139.24
2002	49.08	31.83	28.90	12.66	18.05	2.74	3.42	0.48	147.16
2003	51.51	33.29	30.35	13.48	18.88	2.83	2.79	0.49	153.62
2004	54.08	34.88	31.96	14.07	19.78	2.91	2.97	0.52	161.17
2005	56.91	36.59	33.67	14.81	20.77	2.98	3.13	0.54	169.40
2006	59.70	38.26	35.37	15.55	21.75	3.05	3.29	0.56	177.53
2007	62.63	40.01	37.15	16.32	22.77	3.12	3.46	0.58	186.05
2008	65.10	41.46	38.66	16.97	23.62	3.19	3.63	0.60	193.24
2009	67.62	42.93	40.21	17.64	24.48	3.26	3.81	0.62	200.58
2010	70.20	44.43	41.79	18.32	25.36	3.33	4.00	0.64	208.07
2011	72.83	45.94	43.41	19.01	26.26	3.40	4.20	0.65	215.71
2012	75.52	47.49	45.07	19.72	27.17	3.46	4.40	0.67	223.50
2013	78.25	49.05	46.75	20.45	28.09	3.54	4.62	0.70	231.43
2014	80.97	50.60	48.44	21.17	29.01	3.61	4.85	0.72	239.36
2015	83.74	52.16	50.15	21.90	29.94	3.68	5.09	0.73	247.40
2016	86.55	53.74	51.90	22.65	30.88	3.75	5.35	0.75	255.56
2017	89.40	55.33	53.67	23.41	31.83	3.81	5.62	0.77	263.83
2018	92.28	56.94	55.46	24.17	32.78	3.89	5.90	0.79	272.20
2019	95.19	58.55	57.27	24.95	33.75	3.96	6.21	0.80	280.67
2020	98.13	60.17	59.11	25.73	34.72	4.03	6.52	0.81	289.23
Average annual growth rate (per cent)									
1985–2003	4.4	4.7	6.3	3.7	5.5	2.6	3.1	2.2	4.8
2003–2020	3.9	3.5	4.0	3.9	3.6	2.1	5.1	3.0	3.8

Source: BTRE estimates.

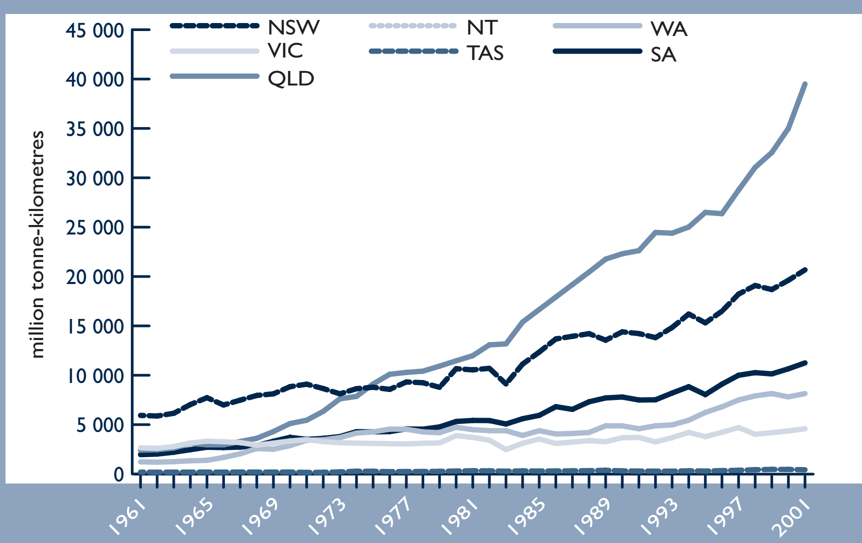
4.4 ESTIMATION OF THE RAIL FREIGHT TASK BY STATE OF OPERATION

The following section describes methods for deriving estimates of the public access rail freight task by state of operation. Public access rail is defined here as those systems open to use by the general public. Effectively, these are all systems other than the private railways carrying iron ore in Western Australia.

Comparisons between road and rail freight by state of operation are not made in this section. Aggregate information—that is, not broken down by commodity—is of limited use for the purposes of determining mode shift. Chapter 5 explores in more detail the area of greatest competition between road and rail freight—the interstate non-bulk freight task.

Figure 4.4 and Table 4.2 provide BTRE estimates of the public access rail freight task by state of operation for the period 1961–2001. Almost half the total public access rail freight task in 2001 was undertaken within Queensland. Approximately 80 per cent of this was coal movements. This is discussed in more detail in Chapter 7. Taken together, Queensland and New South Wales accounted for almost three-quarters of the public access rail freight task in 2001. Figure 4.5 shows the proportion of the total rail freight task undertaken within each state between 1961 and 2001.

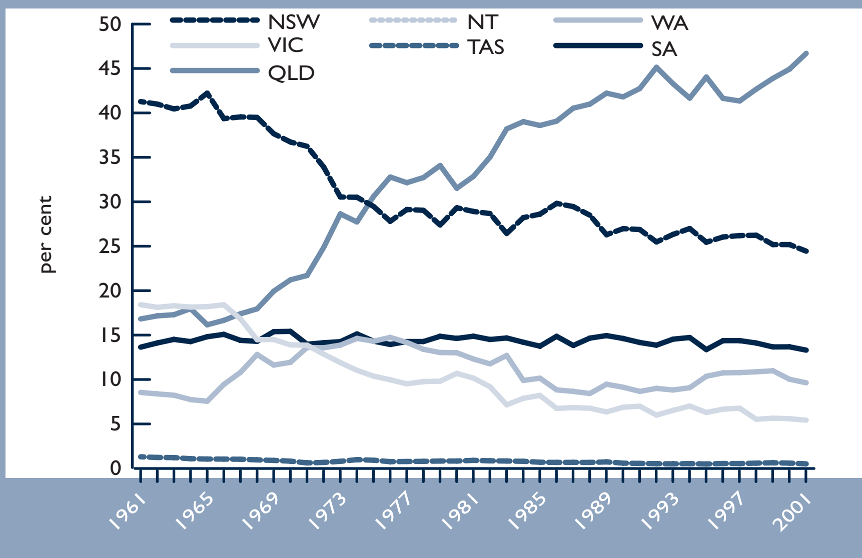
FIGURE 4.4 RAIL FREIGHT TASK BY STATE OF OPERATION, 1960–61 TO 2000–01



Note: Excludes iron ore movements in Western Australia.

Sources: Australasian Railways Association (pers. comm), rail annual reports, ABS (Cat. No. 9212.0 and 9213.0), Glenn Edwards (pers. comm), Ian Burnett (pers. comm), BTRE estimates.

FIGURE 4.5 SHARE OF RAIL FREIGHT TASK BY STATE OF OPERATION, 1960–61 TO 2000–01



Note: Excludes iron ore movements in Western Australia.

Sources: Australasian Railways Association (pers. comm), rail annual reports, ABS (Cat. No. 9212.0 and 9213.0), Glenn Edwards (pers. comm), Ian Burnett (pers. comm), BTRE estimates.

Methods for deriving consistent series of state rail freight task

Table 4.2 lists the raw data on freight task by system for the period 1960–61 to 2000–01. This date is used as the basis for determining the rail freight task by state of operation. The table includes ‘other’ freight that is not immediately classifiable by system, as well as iron ore movements in Western Australia. These are not discussed further in this chapter.

From 1960–61 to 1993–94, the ABS recorded the total rail freight task undertaken within each state. Its records included the intrastate task and the intersystem task undertaken within a particular state’s borders (ABS 1999a and earlier issues). The ABS also records the Commonwealth freight task undertaken by Australia National Railways on the old Commonwealth railways until 1976–77.

From 1977–78 until 1993–94, when Australia National controlled the South Australian and Tasmanian (public) intrastate systems, the task of these two states is included in the Australian National Railways figures. For these years it was necessary to estimate the South Australian and Tasmanian task.

TABLE 4.2 RAIL FREIGHT TASK ESTIMATES BY SYSTEM

(million tonne-kilometres)

Year ending	NSW	VIC	QLD	WA	SA	TAS	AN	NR	Other[a]	Iron ore[b]	Total
1961	5 933	2 647	2 417	1 228	1 059	187	902			na	14 374
1962	5 873	2 596	2 458	1 200	1 067	176	954			na	14 325
1963	6 147	2 780	2 628	1 251	1 115	184	1 090			na	15 195
1964	7 032	3 130	3 099	1 335	1 238	187	1 222			na	17 243
1965	7 728	3 330	2 958	1 383	1 256	192	1 455			na	18 302
1966	6 988	3 268	2 956	1 677	1 230	186	1 447			na	17 751
1967	7 480	3 181	3 290	2 043	1 215	194	1 510			na	18 913
1968	7 955	2 917	3 615	2 581	1 118	192	1 761			na	20 140
1969	8 116	3 125	4 298	2 506	1 320	193	1 997			na	21 555
1970	8 842	3 345	5 108	2 872	1 556	196	2 155			na	24 075
1971	9 095	3 479	5 446	3 412	1 621	155	1 884			na	25 092
1972	8 652	3 278	6 342	3 463	1 590	170	2 016			na	25 512
1973	8 118	3 165	7 613	3 686	1 588	211	2 201			20 000	46 582
1974	8 643	3 126	7 855	4 143	1 753	278	2 532			26 500	54 829
1975	8 782	3 092	9 118	4 262	1 757	273	2 507			30 200	59 992
1976	8 567	3 071	10 101	4 543	1 687	232	2 609			26 300	57 109
1977	9 320	3 042	10 287	4 532	1 834	248	2 732			27 300	59 295
1978	9 243	3 109	10 417	4 263			4 794			28 400	60 226
1979	8 777	3 145	10 925	4 179			5 030			25 600	57 656
1980	10 665	3 888	11 465	4 731			5 618			27 800	64 166
1981	10 543	3 704	11 982	4 489			5 751			28 900	65 369
1982	10 705	3 427	13 079	4 390			5 731			27 400	64 732
1983	9 117	2 468	13 177	4 384			5 348			25 000	59 494
1984	11 131	3 111	15 391	3 903			5 912			25 393	64 841
1985	12 349	3 543	16 656	4 381			6 233			28 396	71 558
1986	13 678	3 094	17 921	4 052			7 123			29 106	74 974
1987	9 124	3 236	19 187	4 100			6 866			30 612	73 126
1988	14 213	3 378	20 452	4 203			7 647			30 998	80 891
1989	13 553	3 271	21 763	4 881			8 077			28 671	80 216
1990	14 395	3 672	22 307	4 872			8 112			32 478	85 836
1991	14 222	3 700	22 620	4 583			7 789			35 347	88 261
1992	13 811	3 249	24 461	4 878			7 799			35 078	89 276
1993	14 837	3 678	24 391	4 970			8 480			35 767	92 123
1994	16 203	4 212	25 011	5 447			9 159	13 916		37 747	97 779
1995	9 000	1 790	26 492	4 682			1 500	16 600		38 110	98 174
1996	10 067	1 970	26 368	5 055			1 379	16 900	1 500	40 823	104 149
1997	12 140	2 270	28 754	5 285			1 516	16 000	3 500	42 000	111 232
1998	12 950	1 400	30 119	5 484	1 300	431		15 900	5 190	48 900	121 674
1999	12 893	1 500	31 605	5 561	1 400	465		15 100	5 650	50 500	124 674
2000	13 364	1 500	34 050	5 225	1 500	462		16 200	5 600	53 400	131 300
2001	14 078	1 540	38 500	5 443	1 600	426		17 100	5 900	51 800	136 387

Notes: *a. Includes Toll, SCT, Patrick, Comalso and sugar carried in Queensland.*
b. Includes Gworthy, Newman, Hamersley and Robe River.

Sources: *ABS Yearbooks (2001 and earlier), ABS (Cat. No. 9212.0 and 9213.0), Australasian Railways Association, rail annual reports, BTRE estimates.*

From 1994–95, estimating the rail task by state of operation is far more difficult with the entry of new operators to the market, including National Rail. The sharp decline in most state systems and the Australian National Railways system in 1995 corresponds to National Rail's takeover of the interstate task. The data on task by rail system from 1993–94 was gained primarily from the Australasian Railways Association. For the most part it was based on rail operators' annual reports. South Australian figures are the Australian Southern Railroad task, and the Western

Australian figures were supplied by Ian Burnett of WestNet (pers. comm, 27 May, 2002) for the period 1994–95 to 1997–98. The Tasmanian figures are based on Australasian Railways Association and BTRE estimates of the TasRail and Old Emu Railways tasks.

Several steps were required to derive consistent series of the rail task by state of operation. They included:

- estimating the South Australian and Tasmanian task between 1978 and 1997
- estimating the proportion of the Old Commonwealth Railway (AN/NRC) task undertaken in Western Australia and South Australia/Northern Territory
- estimating the proportion of the National Rail interstate task undertaken in each state
- estimating the proportion of the 'Other' task undertaken in each state.

Each of these is considered in turn in the following sections.

South Australian and Tasmanian intrastate task, 1978–1997

The BTRE Transport Indicators database has tonnage figures for the Tasmanian rail task between 1977–78 and 2000–01. These figures include both the TasRail and Old Emu Railways tasks. Tonne-kilometre figures were estimated using an average haul of 140 kilometres.

Glenn Edwards of the Australian Rail Track Corporation (pers. comm., 27 May 2002) provided the figure for the South Australian task in 1993–94—1951 million tonne-kilometres. This figure included both the intrastate task and that part of the interstate task not undertaken on the Old Commonwealth Railways. It was therefore consistent with the 1976–77 figure for South Australia. A simple interpolation was made for the years between 1977–78 and 1992–93. Australian National Railways did not operate the interstate track between 1994–1995 and 1996–1997. The South Australian intrastate task for those years was calculated by subtracting the TasRail task from the Australian National Railways task.

Proportion of National Rail interstate task undertaken within each state

The first complete year of measurement of the National Rail freight task was in 1993–94. However, it is not included in the total task due to obvious double counting of the task in that year. This is illustrated by the substantial drop in state tasks in 1994-95 when states, and Australian National Railways, ceased recording the interstate component undertaken within their borders. The combined New South Wales, Victorian, West Australian, South Australian and Australia National task dropped by 18.7 billion tonne-kilometres between the period 1993-94 to 1994–95. The drop on the Old Commonwealth Railways—Western Australia and Australian National Railways—represents 45 per cent of this total. A rough estimate of the proportion of the National Rail task undertaken within each state was made based on this approximate loss of interstate task by each state to National Rail in 1994–95. Table 4.3 lists the estimated proportions.

TABLE 4.3 PROPORTION OF NATIONAL RAIL TASK UNDERTAKEN IN EACH STATE OR ON THE OLD COMMONWEALTH RAILWAYS

Year ending	NSW	VIC	QLD	SA[a]	Old Commonwealth Railways[b]
1995	0.38	0.12	..	0.05	0.45
1996	0.38	0.12	..	0.05	0.45
1997	0.38	0.12	..	0.05	0.45
1998	0.38	0.12	..	0.05	0.45
1999	0.38	0.12	..	0.05	0.45
2000	0.38	0.12	..	0.05	0.45
2001	0.38	0.12	..	0.05	0.45

.. negligible or still recorded by State Rail Authority.
a. Interstate task not on Old Commonwealth Railways (south of Port Pirie).
b. Includes Western Australia, South Australia/Northern Territory.
Sources: Glenn Edwards (pers. comm.), BTRE estimates.

Based on this, and the previous section, the BTRE has developed consistent series of the South Australian, Tasmanian and Australian National Railways/National Rail task on the Old Commonwealth Railways. This is listed in Table 4.4. It should be noted that, except for Western Australia, each state recorded the component of the interstate task undertaken within its borders until 1993–94. Western Australia, however, recorded the Old Commonwealth Railways task undertaken there until 1993–94. The next section will explore how the task was allocated between Western Australia and South Australia/Northern Territory from 1994-95.

Proportion of Old Commonwealth Railways task in Western Australia and South Australia/Northern Territory from 1994–95

The National Rail component of the interstate task undertaken in Western Australia between 1994–95 and 1996–97 was provided to the BTRE by Ian Burnett of WestNet (pers. comm, 27 May 2002). For the years 1997–98 to 2000–01, it was assumed that 15 per cent of the Old Commonwealth Railways task was undertaken within Western Australia and the remainder in South Australia.

TABLE 4.4 SOUTH AUSTRALIAN, TASMANIAN AND COMMONWEALTH RAILWAYS RAIL FREIGHT TASK ESTIMATES

(million tonne-kilometres)

Year ending	South Australia[a]	Tasmania	Old Commonwealth Railways[b]
1961	1 059	187	902
1962	1 067	176	954
1963	1 115	184	1 090
1964	1 238	187	1 222
1965	1 256	192	1 455
1966	1 230	186	1 447
1967	1 215	194	1 510
1968	1 118	192	1 761
1969	1 320	193	1 997
1970	1 556	196	2 155
1971	1 621	155	1 884
1972	1 590	170	2 016
1973	1 588	211	2 201
1974	1 753	278	2 532
1975	1 757	273	2 507
1976	1 687	232	2 609
1977	1 834	248	2 732
1978	1 841	252	2 702
1979	1 848	265	2 916
1980	1 855	300	3 463
1981	1 862	328	3 561
1982	1 868	317	3 546
1983	1 875	286	3 187
1984	1 882	313	3 717
1985	1 889	298	4 046
1986	1 896	306	4 920
1987	1 903	319	4 644
1988	1 910	332	5 405
1989	1 917	375	5 785
1990	1 923	314	5 874
1991	1 930	294	5 565
1992	1 937	285	5 576
1993	1 944	284	6 252
1994	1 951[c]	320	6 888
1995	2 092	296	7 470
1996	1 922	345	7 605
1997	2 029	374	7 200
1998	2 100	431	7 155
1999	2 200	465	6 795
2000	2 300	462	7 290
2001	2 400	426	7 695

Notes: a. Intrastate and interstate not on Old Commonwealth Railways (south of Port Pirie)
b. Refers to interstate task undertaken by Australian National Railways within South Australia or the Northern Territory until 1993–94, and interstate task undertaken by National Rail within Western Australia and South Australia/Northern Territory from 1994–95.
c. Glenn Edwards, Australian Rail Track Corporation (pers. comm.).

Sources: Australasian Railways Association (2002), rail annual reports, ABS (Cat. No. 9212.0 and 9213.0), BTRE estimates.

Proportion of 'Other' task undertaken in each state

The category of 'other' includes interstate operators—Toll, SCT, and Patrick Corporation—and intrastate movements in Queensland and New South Wales, (including sugar and alumina). The interstate tonne-kilometres were allocated based on the proportion of the Melbourne–Perth route or the Melbourne–Adelaide route undertaken within Victoria, South Australia and Western Australia. Toll and SCT operated on the Melbourne–Perth route while Patrick Corporation operated on the Melbourne–Adelaide route.

Consistent series of state rail task

Figure 4.4 and Table 4.5 list consistent estimates for the rail freight task by state of operation for the period 1960–61 to 2000–01. No forecasts have been made based on this series as it includes both bulk and non-bulk freight. Non-bulk rail freight is closely correlated to growth in Gross Domestic (Non-Farm) Product, whereas bulk rail freight is closely correlated to coal and grain exports (BTCE 1995).

TABLE 4.5 RAIL FREIGHT TASK ESTIMATES BY STATE OF OPERATION

(million tonne-kilometres)

Year ending	NSW[a]	VIC	QLD	WA[b]	SA[c]	TAS	Total
1961	5 933	2 647	2 417	1 228	1 961	187	14 374
1962	5 873	2 596	2 458	1 200	2 022	176	14 325
1963	6 147	2 780	2 628	1 251	2 205	184	15 195
1964	7 032	3 130	3 099	1 335	2 460	187	17 243
1965	7 728	3 330	2 958	1 383	2 711	192	18 302
1966	6 988	3 268	2 956	1 677	2 677	186	17 751
1967	7 480	3 181	3 290	2 043	2 724	194	18 913
1968	7 955	2 917	3 615	2 581	2 879	192	20 140
1969	8 116	3 125	4 298	2 506	3 317	193	21 555
1970	8 842	3 345	5 108	2 872	3 711	196	24 075
1971	9 095	3 479	5 446	3 412	3 504	155	25 092
1972	8 652	3 278	6 342	3 463	3 606	170	25 512
1973	8 118	3 165	7 613	3 686	3 790	211	26 582
1974	8 643	3 126	7 855	4 143	4 285	278	28 329
1975	8 782	3 092	9 118	4 262	4 264	273	29 792
1976	8 567	3 071	10 101	4 543	4 296	232	30 809
1977	9 320	3 042	10 287	4 532	4 566	248	31 995
1978	9 243	3 109	10 417	4 263	4 542	252	31 826
1979	8 777	3 145	10 925	4 179	4 764	265	32 056
1980	10 665	3 888	11 465	4 731	5 318	300	36 366
1981	10 543	3 704	11 982	4 489	5 423	328	36 469
1982	10 705	3 427	13 079	4 390	5 414	317	37 332
1983	9 117	2 468	13 177	4 384	5 062	286	34 494
1984	11 131	3 111	15 391	3 903	5 599	313	39 448
1985	12 349	3 543	16 656	4 381	5 935	298	43 162
1986	13 678	3 094	17 921	4 052	6 816	306	45 868
1987	13 945	3 236	19 187	4 100	6 547	319	47 334
1988	14 213	3 378	20 452	4 203	7 315	332	49 893
1989	13 553	3 271	21 763	4 881	7 702	375	51 545
1990	14 395	3 672	22 307	4 872	7 798	314	53 358
1991	14 222	3 700	22 620	4 583	7 495	294	52 914
1992	13 811	3 249	24 461	4 878	7 514	285	54 198
1993	14 837	3 678	24 391	4 970	8 196	284	56 356
1994	16 203	4 212	25 011	5 447	8 839	320	60 032
1995	15 308	3 782	26 492	6 234	8 040	296	60 151
1996	16 489	4 220	26 368	6 804	9 101	345	63 326
1997	18 220	4 709	28 754	7 496	10 000	374	69 552
1998	19 092	4 018	31 059	7 909	10 266	431	72 774
1999	18 681	4 190	32 555	8 146	10 136	465	74 174
2000	19 620	4 354	35 000	7 811	10 654	462	77 900
2001	20 676	4 587	39 500	8 145	11 253	426	84 587
			Average annual growth rate (per cent)				
1985–2003	3.3	1.6	5.5	4.0	4.1	2.3	4.3

Notes: a. Includes the Australian Capital Territory.
b. Excludes iron ore carried on private railways.
c. Includes the Northern Territory.

Sources: Australasian Railways Association (2002), rail annual reports, ABS (Cat. No. 9212.0 and 9213.0), BTRE estimates.

4.5 CONCLUSION

This chapter provides estimates of the road and public access rail freight task undertaken within each state and forecasts of the state road freight task to 2020. The estimates and forecasts are a useful tool for state transport and infrastructure planners and analysts. They are the first consistent series of this type that the BTRE is aware of.

Road has grown more rapidly than rail in all states except Queensland. Thirty years ago rail was the dominant mode of transport in all states except New South Wales and Victoria. Today, Queensland is the only state where most of the freight task is undertaken on public access railways. This is largely due to the fact that coal is transported exclusively by rail.

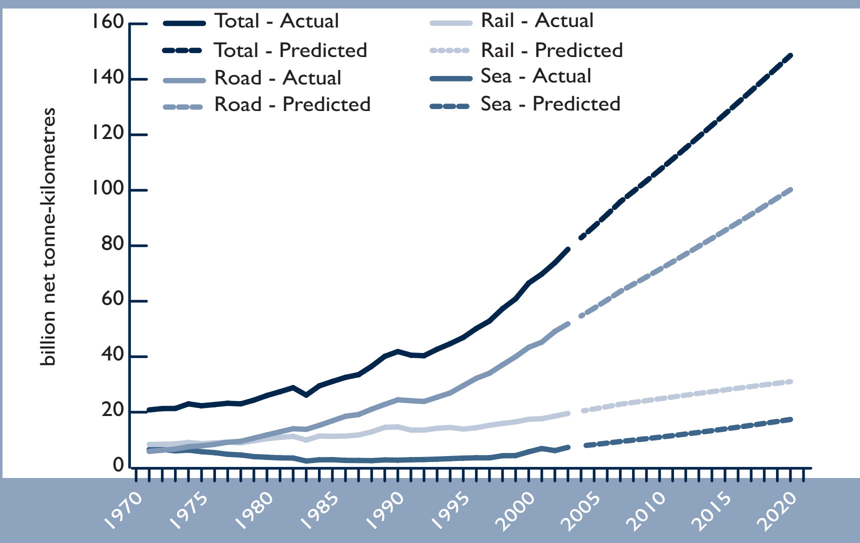
CHAPTER 5

INTERSTATE NON-BULK FREIGHT

Interstate non-bulk freight is a substantial and fast-growing part of the Australian transport task. This chapter presents estimates of the task by mode from 1991–2003, together with forecasts by mode to 2020.

By 2020, if past trends hold, road can be expected to have lifted its share of the interstate non-bulk freight task slightly — from 66 per cent to 67 per cent. Figure 5.1 provides estimates of the interstate non-bulk task and projections from 2004 to 2020 under historical trends. These figures assume no relative improvement in interstate rail's share of the non-bulk freight task.

FIGURE 5.1 ESTIMATED AND PROJECTED INTERSTATE NON-BULK FREIGHT TASK



Source: BTRE estimates.

5.1 INTRODUCTION

The main arena of competition between rail and road is in interstate non-bulk freight. Interstate non-bulk freight, at 78.73 billion tonne–kilometres in 2003, is a small part of the total freight task. It comprises only 18.5 per cent of the 430 billion tonne–kilometres performed domestically.[1] Intercapital non-bulk is even smaller at 42.5 billion tonne–kilometres in 2003. This is discussed in more detail in Chapter 6.

However, the interstate non-bulk freight task is growing rapidly—at about four per cent per year. At this rate, interstate non-bulk freight doubles in about 18 years. Moreover, interstate non-bulk road freight is growing even more rapidly.

Given the importance of interstate highway and rail infrastructure for Australian Government transport funding, the basic statistics and dynamics of interstate freight need to be understood. The present chapter updates the work by Perry and Gargett (1998) that laid the basis for such an understanding of interstate freight.

5.2 A MODEL OF TOTAL NON-BULK INTERSTATE FREIGHT

Using a variety of data sources and estimation procedures, the BTRE has derived a set of 33-year time series for interstate non-bulk freight by mode—see Table 5.1.

The data sources are diverse and scattered, and the operations needed to derive standardised series are complex. This explains why the data in Table 5.1 have not previously been available. Appendix V.I describes in detail how the data was derived.

The classic way to analyse a freight market is to determine what causes growth in the total traffic—by all modes—and then to study the trends in mode share.

Looking at the data in Table 5.1, it can be seen that total interstate non-bulk freight—by all modes—almost quadrupled in the 32 year period to 2003. This represents an average annual growth rate of about four per cent.

A regression of interstate non-bulk freight on real GDP gives an income elasticity of 1.40. Appendix Table V.1 shows the details of the estimated equation. The fit to the data is quite good—see Figure 5.2.

1 A tonne-kilometre (tkm) is a measure of the freight task. It is equal to one tonne moved one kilometre. At the national level most measures of task are in billions of tonne-kilometres (btkm).

TABLE 5.1 INTERSTATE NON-BULK FREIGHT TASK

(billion tonne-kilometres)

Year ending June	Total	Road	Rail	Coastal shipping
1971	20.08	5.12	8.38	6.58
1972	21.85	5.86	8.43	6.56
1973	21.40	6.79	8.56	6.05
1974	23.05	7.63	9.10	6.32
1975	22.33	7.91	8.65	5.77
1976	22.81	8.46	8.93	5.42
1977	23.25	9.21	9.22	4.82
1978	22.99	9.49	8.93	4.57
1979	24.38	10.70	9.69	3.99
1980	26.10	11.90	10.45	3.75
1981	27.49	13.02	10.93	3.54
1982	28.83	14.04	11.31	3.48
1983	26.22	13.86	9.95	2.40
1984	29.57	15.35	11.40	2.82
1985	31.13	16.93	11.31	2.88
1986	32.64	18.60	11.40	2.63
1987	33.63	19.25	11.78	2.60
1988	36.56	21.11	12.92	2.53
1989	40.21	22.88	14.54	2.79
1990	41.97	24.55	14.70	2.72
1991	40.59	24.18	13.57	2.84
1992	40.40	23.90	13.57	2.93
1993	42.76	25.48	14.21	3.07
1994	44.73	26.97	14.50	3.26
1995	47.03	29.67	13.92	3.44
1996	50.23	32.27	14.41	3.55
1997	52.95	34.13	15.27	3.55
1998	57.31	37.07	15.93	4.30
1999	60.86	40.00	16.50	4.36
2000	66.55	43.37	17.45	5.72
2001	69.78	45.23	17.64	6.90
2002	73.86	49.11	18.59	6.16
2003	78.73	51.86	19.54	7.33
		Average annual growth rate (per cent)		
1985–2003	5.3	6.4	3.1	5.3

Source: *See Appendix V.I.*

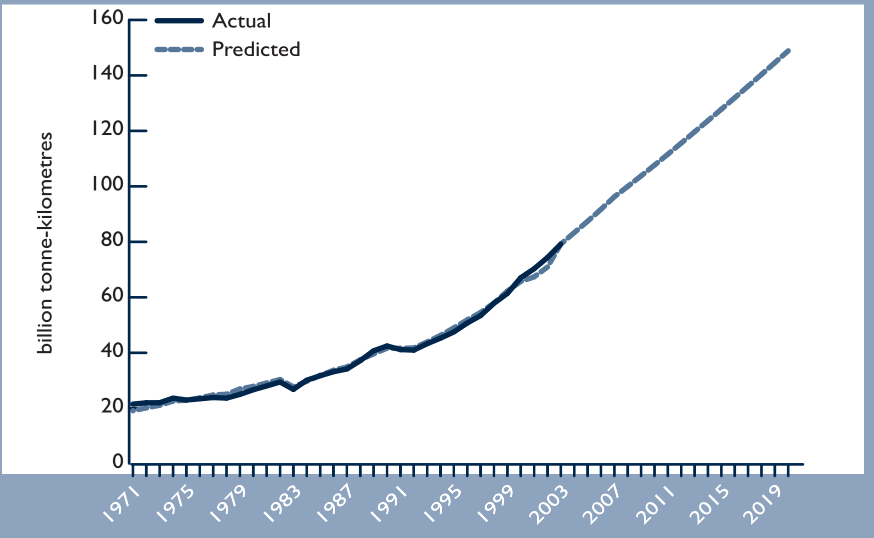
This equation for total interstate non-bulk freight implies a forecast growth rate of 3.7 per cent per year, if real income is assumed to grow at an average of 2.7 per cent to 2020. Using this assumption, total interstate non-bulk freight rises from about 79 billion tonne–kilometres in 2003 to about 149 billion tonne–kilometres in 2020—see Figure 5.2. Thus the total task is projected to nearly double between 2003 and 2020.

5.3 A MODEL OF MODE SHARE TRENDS

Figure 5.3 shows the trends over the past 33 years in each mode's share of interstate non-bulk freight. It also shows the forecasts derived using the competitiveness indexes for each mode drawn from the aggregate of corridor forecasts presented in the next chapter.

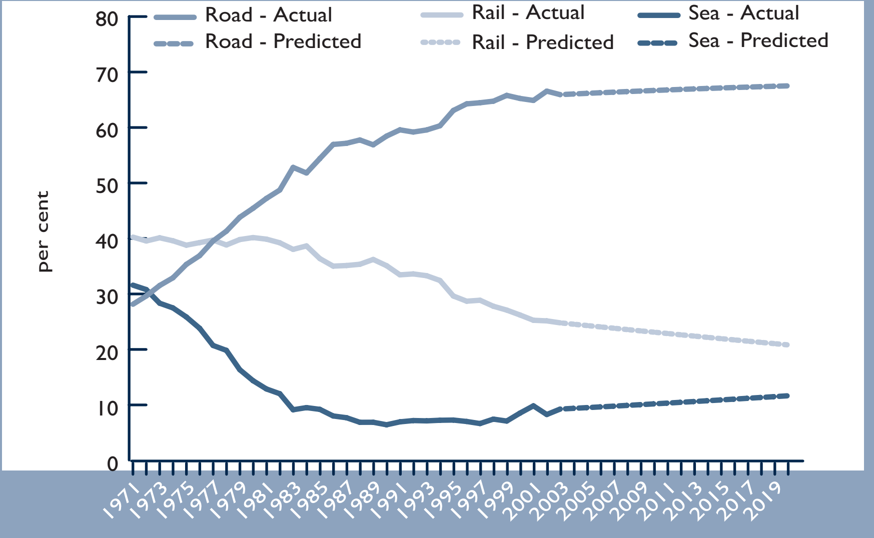
Coastal shipping decreased rapidly between 1971 and 1985. By the late 1980s, non-bulk coastal shipping had basically fallen back to the more or less irreducible coastal trades—ie to and from Tasmania, Western

FIGURE 5.2 TRENDS IN TOTAL INTERSTATE NON-BULK FREIGHT



Source: BTRE estimates.

FIGURE 5.3 TRENDS IN INTERSTATE NON-BULK FREIGHT MODE SHARE



Source: BTRE estimates.

Australia and the Northern Territory. Coastal shipping is also more prone than other modes to discontinuities. The sharp drop in 1982–83 appears to be attributable to the discontinuation of services that were not resumed after the recession of that year ended. Similarly, the improvement in the late 1990s was due to widespread use of single and continuous voyage permits—especially on the Perth–Eastern States route.

Rail share has been declining slowly but surely. However, as will be seen in Chapter 6, the aggregate trend hides very different outcomes on shorter-distance routes of less than 1 500 Kilometres (where rail is growing slowly), than on routes longer than 1 500 kilometres (where rail has been making steady gains). However, if the overall mode share trend continues, rail's share of the interstate non-bulk freight market would drop to 21 per cent by 2020. However, given the expected near doubling of the task, even this reduced rail share implies a rail task in 2020 of about 31 btkm, up by around 50 per cent from 20 btkm in 2003—see Table 5.2.

TABLE 5.2 INTERSTATE NON-BULK FREIGHT: GROWTH COMPARISONS

	Non-bulk freight				Growth		
	Actual			Forecast	Actual		Forecast
	1970–71	1984–85	2002–03	2019–20	1971–85	1985–03	2003–20
		(billion tonne-kilometres)				(per cent/year)	
Road	5.12	16.93	51.86	100.22	8.9	6.4	3.9
Rail	8.38	11.31	19.54	31.02	2.2	3.1	2.7
Coastal	6.58	2.88	7.33	17.38	-5.7	5.3	5.1
Total	**20.08**	**31.12**	**78.73**	**148.62**	**3.2**	**5.3**	**3.7**
Real GDP					3.0	3.5	2.7

Source: BTRE estimates.

The road share of the interstate non-bulk freight task grew especially rapidly between 1971 and 1985. Two factors contributed to this. First, road gained almost all the traffic that coastal shipping lost. A second factor was the halving of real road freight rates from 1975 to 1985, as large articulated trucks took over the linehaul between centres. In contrast to the falls in rail and coastal shipping shares, road's share in 2020 is likely to be over 67 per cent on a business as usual basis. This would imply interstate road freight of about 100 billion tonne–kilometres in 2020, compared to 51 billion tonne–kilometres in 2003. Appendix V, Tables V.3 and V.4 shows the trends and forecasts in the interstate non-bulk freight task and mode share for road, rail and coastal shipping.

There are several possible shocks that might upset these 'business as usual' projections. The actual growth rate in GDP might be higher or lower than 2.7 per cent per year. Freight transport might start decoupling from economic growth and start to saturate—as car ownership has in Australia. There might be large increases or decreases in relative freight rates. There might be a new mode introduced—such as a 'new rail' mode featuring roll-on roll-off carriage of the trailers from articulated trucks (BTE 1999). The new rail might have radically improved service characteristics, and would start to win share from both ‘old rail’ and from road.

Finally, there is the possible effect of radical upgrades of one mode’s infrastructure and performance. For example, because ‘old rail’ growth is forecast to continue at a rate half that of road, it is expected to continue to lose mode share — although growing in absolute terms. However this is not pre-ordained. In Chapter 6, the possibility of a rejuvenation of interstate (intercity) rail that would halt its forecast decline in mode share is discussed.

5.4 CONCLUSION

Interstate non-bulk freight is substantial and growing rapidly. On current trends, road looks set to retain its domination position in mode share, repeating patterns seen in most industrial countries. By 2020, if past trends hold, road can be expected to have lifted its share of the interstate non-bulk freight task slightly to 67 per cent, from 66 per cent currently. However, much depends on the results of attempts at rail rejuvenation over the next decade.

CHAPTER 6

INTERCAPITAL FREIGHT

This chapter outlines the aggregate intercapital non-bulk freight flows from 1964–65 to 2000–01.

These estimates of corridor freight flows are a critical input into the BTRE's forecasting models, which are also presented in this chapter. Forecasts are made to 2020 of the non-bulk freight flows between seven intercapital corridors. The ability to forecast intercity freight flows in Australia is critical to decisions regarding infrastructure provision. However, it is severely underdeveloped. The present chapter aims to provide a suite of models that will allow:

- forecasts of freight flows for all modes by route
- consequent forecasts of the growth in truck traffic on individual sections of Australia's road network.

The BTRE initiated preliminary research in response to knowledge gaps revealed during BTCE work for the 1997 Vaile/Neville Inquiry into Federal Road Funding. That inquiry resulted in the report *Planning Not Patching*. This chapter relies heavily on work already published as BTRE Information Sheet 22 *Freight between Australian Cities 1972 to 2001*.

There is no single comprehensive source of time series data on freight transport movements in Australia. Time series of Australian freight movements must be derived from a range of different sources together with a range of assumptions. Appendix VI examines the task of constructing consistent time series estimates of interstate non-bulk freight movements, by the major transport modes: road, rail and coastal shipping. It also outlines the methods and the raw data sources used to derive those estimates. The estimates update the work undertaken by the bureau in 1989. To the best of the BTRE's knowledge, they are the only consistent time series of intercity freight movements in Australia.

Data for the freight task on these corridors was obtained from several sources. The main sources of raw data were:

- ABS Survey of Motor Vehicle Use—every three to five years, and annually from 1998

- ABS Australia Yearbook (Annual)
- *FreightInfo*™ 1986–87, 1988–89, 1992–93, 1995–96
- ABS Freight Movements (2001a), Cat. No. 9220.0
- ABS 'Experimental Estimates' Cat. No. 9217.0 provides quarterly (experimental) estimates of freight movements by all modes, for the period June 1994 to June 1995 for rail, sea and air for the period September 1995 to December 1998
- ABS 'Freight Forwarder's Survey' Cat. No. 9212.0 provides annual estimates of interstate freight movements by all modes, for the period 1980–81 to 1990–91 (missing 1981-82). Cat. No. 9214.0 provides quarterly estimates of interstate road freight movements, for the period September 1982 to June 1994
- Bureau of Transport and Communications Economics (BTCE) 1990, Freight Flows in Australian Transport Corridors, BTE Occasional Paper 98, AGPS, Canberra
- BTRE Coastal Shipping database (www.btre.gov.au/statistics)
- BTRE Transport Statistics Database (www.btre.gov.au/statistics).

The issue of rail data is perhaps the most vexing. For the period from 1998 to 2001, the rail corridor freight estimates were derived from the ABS Freight Movements Survey State to State origin–destination data. City to City traffic was assumed to be a similar fraction of the *State to State* traffic as in 1995 to 1997—the last years for which *City to City* data was available. After 1997, the recently privatised railways have declined to permit the public release of City to City data. Furthermore, since 2001, they have not allowed *any* origin–destination data—even State to State—to be released. This raises severe difficulties for future estimates of rail flows on any of the corridors discussed here.

Appendix VI details the derivation of the intercapital freight flows for the three modes. The resulting estimates of freight flows for each corridor are shown in Table 6.1 in kilotonnes and Table 6.2 in billions of tonne-kilometres. Note that the total inter*capital* non-bulk freight flow in 2003 of 42.48 billion tonne–kilometres comprises a bit more than half of the non-bulk inter*state* flow in that year of 78.73 billion tonne–kilometres. This was discussed in Chapter 5.

TABLE 6.1 ACTUAL AND FORECAST INTERCAPITAL FREIGHT BY MODE

(kilotonnes)

Year	Mel–Syd				Syd–Bne				Mel–Bne				Syd–Adl			
	Road	Rail	Sea	Total	Road	Rail	Sea	Total	Road	Rail	Sea	Total	Road	Rail	Sea	Total
1972	1 616	1 082	180	2 878	850	516	143	1 509	370	135	230	735	310	101	3	414
1973	1 864	1 156	257	3 277	900	620	127	1 647	440	146	243	829	370	101	2	473
1974	2 039	1 183	227	3 449	970	663	70	1 703	550	154	257	961	460	101	1	562
1975	2 130	998	164	3 292	900	654	49	1 603	500	136	219	855	470	101	2	573
1976	2 378	977	76	3 431	860	651	37	1 548	460	163	129	752	480	99	0	579
1977	2 461	1 002	48	3 511	940	691	79	1 710	500	190	26	716	530	103	1	634
1978	2 461	916	27	3 404	950	624	32	1 606	580	171	16	767	560	100	1	661
1979	2 654	957	36	3 647	910	704	85	1 699	620	191	13	824	550	96	2	648
1980	2 948	1 072	61	4 081	1 000	780	80	1 860	680	205	18	903	610	105	1	716
1981	3 150	1 049	10	4 209	1 051	808	12	1 871	717	199	4	920	641	96	0	737
1982	3 280	1 007	11	4 298	1 118	899	5	2 022	772	234	2	1 008	660	99	0	759
1983	2 900	798	4	3 702	1 058	686	14	1 758	793	143	4	940	618	52	0	670
1984	3 450	925	9	4 384	1 227	751	15	1 993	865	175	5	1 045	679	61	0	740
1985	3 470	952	5	4 427	1 322	808	26	2 156	939	165	10	1 114	651	83	0	734
1986	3 810	961	5	4 776	1 573	932	11	2 516	1 072	190	1	1 263	759	103	4	866
1987	3 810	1 078	4	4 892	1 470	938	12	2 420	1 042	160	1	1 203	769	208	0	977
1988	4 220	1 188	1	5 409	1 548	954	5	2 507	1 149	191	0	1 340	730	233	0	963
1989	4 500	1 217	2	5 719	1 629	1 022	4	2 655	1 135	271	1	1 407	700	312	0	1 012
1990	4 790	1 131	0	5 921	1 504	990	19	2 513	1 203	315	0	1 518	711	376	0	1 087
1991	4 840	1 116	3	5 959	1 778	984	14	2 776	1 313	376	0	1 689	745	381	0	1 126
1992	4 810	1 159	4	5 973	1 973	987	8	2 968	1 467	546	3	2 016	821	353	3	1 177
1993	5 110	1 263	6	6 379	2 255	1 071	11	3 337	1 627	345	6	1 978	994	380	7	1 381
1994	5 340	1 163	17	6 520	2 565	1 039	15	3 619	1 886	358	11	2 255	1 045	350	11	1 406
1995	5 590	1 060	21	6 671	2 732	935	20	3 687	2 021	660	6	2 687	1 080	415	12	1 507
1996	5 916	983	23	6 922	3 014	971	7	3 992	2 023	594	12	2 629	1 125	367	3	1 495
1997	6 262	855	13	7 130	3 325	793	3	4 121	2 026	662	21	2 709	1 171	305	2	1 478
1998	6 627	921	23	7 571	3 669	992	17	4 678	2 028	750	14	2 792	1 220	325	4	1 549
1999	7 014	873	11	7 898	4 047	914	18	4 979	2 031	786	20	2 837	1 271	318	4	1 593
2000	7 423	1 139	47	8 609	4 465	1 022	39	5 526	2 033	961	50	3 044	1 323	317	9	1 649
2001	7 856	1 032	10	8 898	4 926	905	31	5 862	2 036	932	45	3 013	1 378	308	16	1 702
2002	8 312	1 032	10	9 354	5 232	905	31	6 168	2 063	982	38	3 083	1 444	308	16	1 768
2003	8 788	1 032	10	9 830	5 549	905	31	6 485	2 189	1 046	35	3 269	1 521	308	16	1 845
2004	9 259	1 032	10	10 301	5 843	905	31	6 779	2 301	1 104	32	3 436	1 597	308	16	1 921
2005	9 751	1 032	10	10 793	6 152	905	31	7 088	2 419	1 165	29	3 612	1 676	308	16	2 000
2006	10 267	1 032	10	11 309	6 477	905	31	7 413	2 542	1 229	26	3 796	1 758	308	16	2 082
2007	10 739	1 032	10	11 781	6 786	905	31	7 722	2 657	1 289	23	3 969	1 834	308	16	2 158
2008	11 180	1 032	10	12 222	7 079	905	31	8 015	2 765	1 347	21	4 133	1 904	308	16	2 228
2009	11 633	1 032	10	12 675	7 381	905	31	8 317	2 877	1 406	19	4 302	1 975	308	16	2 299
2010	12 095	1 032	10	13 137	7 691	905	31	8 627	2 991	1 468	17	4 475	2 047	308	16	2 371
2011	12 564	1 032	10	13 606	8 009	905	31	8 945	3 107	1 530	15	4 653	2 121	308	16	2 445
2012	13 038	1 032	10	14 080	8 327	905	31	9 263	3 224	1 594	14	4 831	2 194	308	16	2 518
2013	13 521	1 032	10	14 563	8 653	905	31	9 589	3 342	1 658	12	5 013	2 269	308	16	2 593
2014	14 004	1 032	10	15 046	8 981	905	31	9 917	3 461	1 724	11	5 196	2 343	308	16	2 667
2015	14 493	1 032	10	15 535	9 316	905	31	10 252	3 582	1 791	10	5 383	2 418	308	16	2 742
2016	14 985	1 032	10	16 027	9 655	905	31	10 591	3 705	1 859	9	5 573	2 493	308	16	2 817
2017	15 479	1 032	10	16 521	9 998	905	31	10 934	3 828	1 928	8	5 765	2 567	308	16	2 891
2018	15 978	1 032	10	17 020	10 346	905	31	11 282	3 953	1 999	7	5 959	2 642	308	16	2 966
2019	16 484	1032	10	17 526	10 702	905	31	11 638	4 081	2 071	6	6 158	2 718	308	16	3 042
2020	17 001	1 032	10	18 043	11 066	905	31	12 002	4 211	2 145	6	6 362	2 794	308	16	3 118
	Average annual growth rate (per cent)															
1985–2003	5.2	0.5	4.4	4.5	8.6	0.7	1.1	6.5	5.0	11.4	9.9	6.4	4.8	8.6		5.4
2003–2020	4.0	0.0	0.0	3.6	4.1	0.0	0.0	3.7	3.9	4.3	-10.2	4.0	3.6	0.0	0.0	3.1

CONTINUED

TABLE 6.1 ACTUAL AND FORECAST INTERCAPITAL FREIGHT BY MODE (continued)

(kilotonnes)

Year	Mel–Adl				ES–Per				Syd–Cbr			
	Road	Rail	Sea	Total	Road	Rail	Sea	Total	Road	Rail	Sea	Total
1972	750	425	12	1 187	50	352	714	1 116	268	116	0	384
1973	880	579	210	1 669	40	389	732	1 161	268	129	0	397
1974	930	619	18	1 567	40	509	671	1 220	340	116	0	456
1975	980	545	43	1 568	60	498	653	1 211	300	104	0	404
1976	940	522	46	1 508	90	583	536	1 209	388	94	0	482
1977	1 020	508	32	1 560	190	624	73	887	490	84	0	574
1978	1 000	553	77	1 630	250	617	66	933	398	90	0	488
1979	980	605	43	1 628	340	652	112	1 104	480	82	0	562
1980	1 080	594	79	1 753	380	673	146	1 199	528	26	0	554
1981	1 137	668	3	1 808	346	729	62	1 137	533	24	0	557
1982	1 184	814	5	2 003	364	791	47	1 202	639	23	0	662
1983	1 128	639	16	1 783	349	751	21	1 121	571	21	0	592
1984	1 245	772	0	2 017	389	805	24	1 218	672	27	0	699
1985	1 140	799	0	1 939	433	823	29	1 285	786	32	0	818
1986	1 573	823	0	2 396	554	912	95	1 561	1 016	25	0	1 041
1987	1 447	784	0	2 231	640	946	37	1 623	1 032	22	0	1 054
1988	1 490	858	0	2 348	590	1 005	65	1 660	1 097	21	0	1 118
1989	1 570	988	0	2 558	581	1 138	39	1 758	1 291	21	0	1 312
1990	1 616	926	0	2 542	748	1 218	9	1 975	1 609	15	0	1 624
1991	1 520	867	0	2 387	834	1 218	19	2 071	1 273	10	0	1 283
1992	1 689	942	0	2 631	928	1 225	85	2 238	1 377	70	0	1 447
1993	1 844	956	0	2 800	1 041	940	63	2 044	1 590	4	0	1 594
1994	1 889	967	5	2 861	1 067	1 107	95	2 269	1 241	50	0	1 291
1995	1 978	862	1	2 841	1 125	1 509	203	2 837	1 300	50	0	1 350
1996	2 192	831	2	3 025	1 089	1 501	196	2 786	1 379	0	0	1 379
1997	2 429	669	8	3 106	1 054	1 566	330	2 950	1 463	0	0	1 463
1998	2 691	712	14	3 417	1 018	1 702	331	3 051	1 553	0	0	1 553
1999	2 982	726	5	3 713	982	1 884	378	3 244	1 648	0	0	1 648
2000	3 305	834	11	4 150	947	2 043	600	3 590	1 749	0	0	1 749
2001	3 662	639	21	4 322	911	2 192	694	3 797	1 856	0	0	1 856
2002	3 858	639	21	4 518	955	2 317	704	3 976	1 937	0	0	1 937
2003	4 059	639	21	4 719	999	2 423	749	4 171	2 020	0	0	2 020
2004	4 247	639	21	4 907	1 041	2 525	794	4 360	2 112	0	0	2 112
2005	4 443	639	21	5 103	1 085	2 631	842	4 558	2 207	0	0	2 207
2006	4 648	639	21	5 308	1 131	2 743	893	4 766	2 307	0	0	2 307
2007	4 833	639	21	5 493	1 173	2 846	943	4 962	2 397	0	0	2 397
2008	5 004	639	21	5 664	1 213	2 942	992	5 147	2 481	0	0	2 481
2009	5 178	639	21	5 838	1 254	3 041	1 043	5 337	2 566	0	0	2 566
2010	5 355	639	21	6 015	1 295	3 141	1 096	5 533	2 653	0	0	2 653
2011	5 533	639	21	6 193	1 337	3 244	1 152	5 732	2 741	0	0	2 741
2012	5 713	639	21	6 373	1 379	3 345	1 209	5 933	2 830	0	0	2 830
2013	5 895	639	21	6 555	1 422	3 448	1 268	6 138	2 921	0	0	2 921
2014	6 077	639	21	6 737	1 464	3 552	1 328	6 344	3 011	0	0	3 011
2015	6 259	639	21	6 919	1 507	3 656	1 391	6 554	3 102	0	0	3 102
2016	6 441	639	21	7 101	1 550	3 760	1 456	6 766	3 193	0	0	3 193
2017	6 623	639	21	7 283	1 593	3 865	1 523	6 981	3 284	0	0	3 284
2018	6 805	639	21	7 465	1 637	3 970	1 591	7 198	3 376	0	0	3 376
2019	6 989	639	21	7 649	1 681	4 076	1 663	7 420	3 470	0	0	3 470
2020	7 175	639	21	7 835	1 725	4 185	1 737	7 647	3 564	0	0	3 564
	Average annual growth rate (per cent)											
1985–2003	7.6	-1.4		5.1	4.8	6.3	22.0	7.0	5.5			5.3
2003–2020	3.4	0.0	0.0	3.0	3.3	3.3	5.1	3.6	3.4			3.4

Source: *BTRE estimates (see Appendix VI).*

TABLE 6.2 ACTUAL AND FORECAST INTERCAPITAL FREIGHT BY MODE

(billion tonne-kilometres)

Year	Mel–Syd				Syd–Bne				Mel–Bne				Syd–Adl			
	Road	Rail	Sea	Total	Road	Rail	Sea	Total	Road	Rail	Sea	Total	Road	Rail	Sea	Total
1972	1.45	1.17	0.17	2.79	0.86	0.51	0.14	1.51	0.64	0.26	0.46	1.36	0.44	0.17	0.01	0.62
1973	1.67	1.25	0.25	3.17	0.91	0.61	0.12	1.65	0.77	0.28	0.49	1.53	0.53	0.17	0.00	0.70
1974	1.83	1.28	0.22	3.32	0.99	0.66	0.07	1.71	0.96	0.30	0.51	1.77	0.66	0.17	0.00	0.83
1975	1.91	1.08	0.16	3.15	0.91	0.65	0.05	1.61	0.87	0.26	0.44	1.57	0.67	0.17	0.00	0.85
1976	2.14	1.05	0.07	3.26	0.87	0.64	0.04	1.55	0.80	0.31	0.26	1.37	0.69	0.17	0.00	0.86
1977	2.21	1.08	0.05	3.34	0.96	0.68	0.08	1.71	0.87	0.37	0.05	1.29	0.76	0.17	0.00	0.94
1978	2.21	0.99	0.03	3.22	0.96	0.62	0.03	1.61	1.01	0.33	0.03	1.37	0.80	0.17	0.00	0.97
1979	2.38	1.03	0.03	3.45	0.92	0.70	0.08	1.70	1.08	0.37	0.03	1.47	0.79	0.16	0.00	0.95
1980	2.65	1.16	0.06	3.86	1.02	0.77	0.08	1.86	1.18	0.39	0.04	1.61	0.87	0.18	0.00	1.05
1981	2.83	1.13	0.01	3.97	1.07	0.80	0.01	1.88	1.25	0.38	0.01	1.64	0.92	0.16	0.00	1.08
1982	2.95	1.09	0.01	4.04	1.14	0.89	0.00	2.03	1.34	0.45	0.00	1.80	0.95	0.17	0.00	1.11
1983	2.60	0.86	0.00	3.47	1.07	0.68	0.01	1.77	1.38	0.28	0.01	1.66	0.89	0.09	0.00	0.97
1984	3.10	1.00	0.01	4.10	1.25	0.74	0.01	2.00	1.51	0.34	0.01	1.85	0.97	0.10	0.00	1.08
1985	3.12	1.03	0.00	4.15	1.34	0.80	0.02	2.17	1.63	0.32	0.02	1.97	0.93	0.14	0.00	1.07
1986	3.42	1.04	0.00	4.46	1.60	0.92	0.01	2.53	1.87	0.36	0.00	2.23	1.09	0.17	0.01	1.27
1987	3.42	1.16	0.00	4.59	1.49	0.93	0.01	2.43	1.81	0.31	0.00	2.12	1.10	0.35	0.00	1.45
1988	3.79	1.28	0.00	5.07	1.57	0.94	0.00	2.52	2.00	0.37	0.00	2.37	1.05	0.39	0.00	1.44
1989	4.04	1.31	0.00	5.35	1.65	1.01	0.00	2.67	1.98	0.52	0.00	2.50	1.00	0.53	0.00	1.53
1990	4.30	1.22	0.00	5.52	1.53	0.98	0.02	2.52	2.09	0.61	0.00	2.70	1.02	0.64	0.00	1.66
1991	4.35	1.20	0.00	5.55	1.81	0.97	0.01	2.79	2.29	0.72	0.00	3.01	1.07	0.64	0.00	1.71
1992	4.32	1.25	0.00	5.57	2.00	0.98	0.01	2.99	2.55	1.05	0.01	3.61	1.18	0.60	0.01	1.78
1993	4.59	1.36	0.01	5.96	2.29	1.06	0.01	3.36	2.83	0.66	0.01	3.51	1.42	0.64	0.01	2.08
1994	4.80	1.25	0.02	6.07	2.61	1.03	0.01	3.65	3.28	0.69	0.02	3.99	1.50	0.59	0.02	2.11
1995	5.02	1.14	0.02	6.18	2.78	0.92	0.02	3.72	3.52	1.27	0.01	4.80	1.55	0.70	0.02	2.27
1996	5.31	1.06	0.02	6.39	3.06	0.96	0.01	4.03	3.52	1.14	0.02	4.69	1.61	0.62	0.01	2.24
1997	5.62	0.92	0.01	6.56	3.38	0.78	0.00	4.16	3.53	1.27	0.04	4.84	1.68	0.52	0.00	2.20
1998	5.95	0.99	0.02	6.97	3.73	0.98	0.02	4.72	3.53	1.44	0.03	5.00	1.75	0.55	0.01	2.31
1999	6.30	0.94	0.01	7.25	4.11	0.90	0.02	5.03	3.54	1.51	0.04	5.09	1.82	0.54	0.01	2.37
2000	6.67	1.23	0.05	7.94	4.54	1.01	0.04	5.58	3.54	1.85	0.10	5.49	1.90	0.54	0.02	2.45
2001	7.05	1.11	0.01	8.18	5.00	0.89	0.03	5.93	3.54	1.79	0.09	5.43	1.97	0.52	0.03	2.52
2002	7.46	0.99	0.01	8.47	5.32	0.89	0.03	6.24	3.45	1.89	0.08	5.41	2.07	0.52	0.03	2.62
2003	7.89	0.99	0.01	8.89	5.64	0.89	0.03	6.56	3.65	2.01	0.07	5.74	2.18	0.52	0.03	2.73
2004	8.31	0.99	0.01	9.32	5.94	0.89	0.03	6.86	3.84	2.12	0.06	6.03	2.29	0.52	0.03	2.84
2005	8.76	0.99	0.01	9.76	6.25	0.89	0.03	7.17	4.04	2.24	0.06	6.34	2.40	0.52	0.03	2.95
2006	9.22	0.99	0.01	10.22	6.58	0.89	0.03	7.50	4.24	2.36	0.05	6.66	2.52	0.52	0.03	3.07
2007	9.64	0.99	0.01	10.65	6.89	0.89	0.03	7.82	4.44	2.48	0.05	6.96	2.63	0.52	0.03	3.18
2008	10.04	0.99	0.01	11.04	7.19	0.89	0.03	8.12	4.62	2.59	0.04	7.25	2.73	0.52	0.03	3.28
2009	10.45	0.99	0.01	11.45	7.50	0.89	0.03	8.42	4.80	2.70	0.04	7.55	2.83	0.52	0.03	3.38
2010	10.86	0.99	0.01	11.86	7.81	0.89	0.03	8.74	4.99	2.82	0.03	7.85	2.93	0.52	0.03	3.48
2011	11.28	0.99	0.01	12.29	8.14	0.89	0.03	9.06	5.19	2.94	0.03	8.16	3.04	0.52	0.03	3.59
2012	11.71	0.99	0.01	12.71	8.46	0.89	0.03	9.38	5.38	3.06	0.03	8.48	3.14	0.52	0.03	3.69
2013	12.14	0.99	0.01	13.14	8.79	0.89	0.03	9.71	5.58	3.19	0.02	8.80	3.25	0.52	0.03	3.80
2014	12.58	0.99	0.01	13.58	9.12	0.89	0.03	10.05	5.78	3.32	0.02	9.12	3.36	0.52	0.03	3.91
2015	13.01	0.99	0.01	14.02	9.46	0.89	0.03	10.39	5.98	3.44	0.02	9.45	3.47	0.52	0.03	4.02
2016	13.46	0.99	0.01	14.46	9.81	0.89	0.03	10.73	6.19	3.58	0.02	9.78	3.57	0.52	0.03	4.12
2017	13.90	0.99	0.01	14.90	10.16	0.89	0.03	11.08	6.39	3.71	0.02	10.12	3.68	0.52	0.03	4.23
2018	14.35	0.99	0.01	15.35	10.51	0.89	0.03	11.44	6.60	3.84	0.01	10.46	3.79	0.52	0.03	4.34
2019	14.80	0.99	0.01	15.81	10.87	0.89	0.03	11.80	6.81	3.98	0.01	10.81	3.89	0.52	0.03	4.44
2020	15.27	0.99	0.01	16.27	11.24	0.89	0.03	12.17	7.03	4.13	0.01	11.17	4.00	0.52	0.03	4.55
Average annual growth rate (per cent)																
1985–2003	5.2	0.5	4.4	4.4	8.6	0.7	1.1	6.5	5.0	11.4	9.9	6.6	4.8	8.6		5.5
2003–2020	4.0	0.0	0.0	3.6	4.1	0.0	0.0	3.7	3.9	4.3	-10.2	4.0	3.6	0.0	0.0	3.1

CONTINUED

TABLE 6.2 ACTUAL AND FORECAST INTERCAPITAL FREIGHT BY MODE (continued)

(billion tonne-kilometres)

Year	Mel–Adl				ES–Per				Syd–Cbr				7 Corridor Total			
	Road	Rail	Sea	Total	Road	Rail	Sea	Total	Road	Rail	Sea	Total	Road	Rail	Sea	Total
1972	0.55	0.32	0.01	0.88	0.17	1.18	2.22	3.58	0.08	0.04	0.00	0.12	4.21	3.64	3.01	10.87
1973	0.65	0.43	0.20	1.28	0.14	1.31	2.28	3.72	0.08	0.04	0.00	0.12	4.76	4.09	3.34	12.18
1974	0.69	0.46	0.02	1.16	0.14	1.71	2.09	3.94	0.10	0.04	0.00	0.14	5.36	4.61	2.91	12.88
1975	0.72	0.41	0.04	1.17	0.21	1.67	2.03	3.91	0.09	0.03	0.00	0.13	5.40	4.27	2.72	12.38
1976	0.69	0.39	0.04	1.13	0.31	1.96	1.67	3.94	0.12	0.03	0.00	0.15	5.62	4.55	2.08	12.26
1977	0.75	0.38	0.03	1.16	0.66	2.10	0.23	2.99	0.15	0.03	0.00	0.18	6.36	4.80	0.43	11.60
1978	0.74	0.41	0.07	1.22	0.87	2.07	0.21	3.15	0.12	0.03	0.00	0.15	6.72	4.62	0.37	11.71
1979	0.72	0.45	0.04	1.21	1.19	2.19	0.35	3.73	0.15	0.03	0.00	0.17	7.23	4.92	0.53	12.69
1980	0.80	0.44	0.08	1.31	1.33	2.26	0.45	4.04	0.16	0.01	0.00	0.17	8.01	5.21	0.70	13.92
1981	0.84	0.50	0.00	1.34	1.21	2.45	0.19	3.85	0.16	0.01	0.00	0.17	8.28	5.43	0.22	13.93
1982	0.87	0.61	0.00	1.48	1.27	2.66	0.15	4.07	0.20	0.01	0.00	0.20	8.71	5.86	0.17	14.74
1983	0.83	0.48	0.02	1.32	1.22	2.52	0.07	3.81	0.18	0.01	0.00	0.18	8.17	4.91	0.11	13.18
1984	0.92	0.57	0.00	1.49	1.36	2.70	0.07	4.14	0.21	0.01	0.00	0.22	9.31	5.47	0.11	14.88
1985	0.84	0.59	0.00	1.44	1.51	2.76	0.09	4.37	0.24	0.01	0.00	0.25	9.62	5.65	0.14	15.41
1986	1.16	0.61	0.00	1.77	1.94	3.06	0.30	5.30	0.31	0.01	0.00	0.32	11.38	6.18	0.32	17.88
1987	1.07	0.58	0.00	1.65	2.24	3.18	0.12	5.53	0.32	0.01	0.00	0.32	11.46	6.51	0.13	18.10
1988	1.10	0.64	0.00	1.74	2.06	3.38	0.20	5.64	0.34	0.01	0.00	0.34	11.91	7.01	0.21	19.12
1989	1.16	0.73	0.00	1.89	2.03	3.82	0.12	5.97	0.40	0.01	0.00	0.40	12.26	7.93	0.13	20.32
1990	1.19	0.69	0.00	1.88	2.62	4.09	0.03	6.73	0.49	0.00	0.00	0.50	13.25	8.22	0.05	21.51
1991	1.12	0.65	0.00	1.77	2.92	4.09	0.06	7.06	0.39	0.00	0.00	0.39	13.94	8.28	0.08	22.29
1992	1.25	0.70	0.00	1.95	3.24	4.11	0.26	7.62	0.42	0.02	0.00	0.45	14.97	8.71	0.29	23.96
1993	1.36	0.71	0.00	2.07	3.64	3.16	0.20	6.99	0.49	0.00	0.00	0.49	16.63	7.59	0.24	24.46
1994	1.39	0.72	0.00	2.12	3.73	3.72	0.30	7.74	0.38	0.02	0.00	0.40	17.69	8.01	0.37	26.07
1995	1.46	0.64	0.00	2.10	3.93	5.07	0.63	9.63	0.40	0.02	0.00	0.42	18.65	9.76	0.71	29.12
1996	1.62	0.62	0.00	2.24	3.81	5.04	0.61	9.46	0.42	0.00	0.00	0.42	19.36	9.44	0.67	29.47
1997	1.79	0.50	0.01	2.30	3.68	5.26	1.03	9.97	0.45	0.00	0.00	0.45	20.13	9.25	1.10	30.48
1998	1.99	0.53	0.01	2.53	3.56	5.72	1.03	10.30	0.48	0.00	0.00	0.48	20.98	10.21	1.12	32.31
1999	2.20	0.54	0.00	2.75	3.43	6.33	1.18	10.94	0.51	0.00	0.00	0.51	21.91	10.76	1.26	33.92
2000	2.44	0.62	0.01	3.07	3.31	6.86	1.87	12.04	0.54	0.00	0.00	0.54	22.92	12.10	2.08	37.10
2001	2.70	0.48	0.02	3.20	3.18	7.36	2.16	12.71	0.57	0.00	0.00	0.57	24.04	12.16	2.34	38.53
2002	2.85	0.53	0.02	3.40	3.34	8.09	2.19	13.62	0.59	0.00	0.00	0.59	25.08	12.92	2.36	40.35
2003	3.00	0.53	0.02	3.55	3.49	8.46	2.33	14.28	0.62	0.00	0.00	0.62	26.47	13.41	2.49	42.37
2004	3.13	0.53	0.02	3.69	3.64	8.81	2.47	14.92	0.65	0.00	0.00	0.65	27.80	13.88	2.62	44.30
2005	3.28	0.53	0.02	3.83	3.79	9.18	2.62	15.60	0.68	0.00	0.00	0.68	29.20	14.36	2.77	46.33
2006	3.43	0.53	0.02	3.98	3.95	9.57	2.78	16.30	0.71	0.00	0.00	0.71	30.66	14.87	2.92	48.45
2007	3.57	0.53	0.02	4.12	4.10	9.93	2.93	16.97	0.74	0.00	0.00	0.74	32.01	15.35	3.07	50.43
2008	3.69	0.53	0.02	4.25	4.24	10.27	3.09	17.60	0.76	0.00	0.00	0.76	33.27	15.80	3.22	52.29
2009	3.82	0.53	0.02	4.37	4.38	10.61	3.25	18.24	0.79	0.00	0.00	0.79	34.57	16.26	3.37	54.20
2010	3.95	0.53	0.02	4.51	4.53	10.96	3.41	18.90	0.81	0.00	0.00	0.81	35.90	16.73	3.54	56.16
2011	4.08	0.53	0.02	4.64	4.68	11.32	3.59	19.58	0.84	0.00	0.00	0.84	37.25	17.20	3.70	58.16
2012	4.22	0.53	0.02	4.77	4.82	11.67	3.76	20.26	0.87	0.00	0.00	0.87	38.60	17.68	3.88	60.16
2013	4.35	0.53	0.02	4.90	4.97	12.04	3.95	20.95	0.90	0.00	0.00	0.90	39.98	18.16	4.06	62.21
2014	4.48	0.53	0.02	5.04	5.12	12.40	4.14	21.65	0.92	0.00	0.00	0.92	41.37	18.65	4.25	64.26
2015	4.62	0.53	0.02	5.17	5.27	12.76	4.33	22.36	0.95	0.00	0.00	0.95	42.77	19.14	4.44	66.35
2016	4.75	0.53	0.02	5.31	5.42	13.12	4.53	23.08	0.98	0.00	0.00	0.98	44.18	19.64	4.64	68.46
2017	4.89	0.53	0.02	5.44	5.57	13.49	4.74	23.80	1.01	0.00	0.00	1.01	45.60	20.14	4.85	70.58
2018	5.02	0.53	0.02	5.58	5.72	13.85	4.95	24.53	1.04	0.00	0.00	1.04	47.03	20.64	5.06	72.72
2019	5.16	0.53	0.02	5.71	5.88	14.23	5.18	25.28	1.07	0.00	0.00	1.07	48.48	21.15	5.28	74.91
2020	5.30	0.53	0.02	5.85	6.03	14.60	5.41	26.04	1.09	0.00	0.00	1.09	49.97	21.67	5.51	77.15
	Average annual growth rate (per cent)															
1985–2003	7.6	-1.4		4.9	4.8	6.3	22.0	6.9	5.5			5.2	5.9	4.9	19.2	5.9
2003–2020	3.4	0.0	0.0	3.0	3.3	3.3	5.1	3.6	3.4			3.4	3.8	2.9	4.8	3.6

Source: *BTRE estimates (see Appendix VI).*

Tables 6.1 and 6.2 also show forecasts of freight flows—tonnes and tonne–kilometres—on the corridors (2002–2020). The following sections of this chapter detail the modelling that produced them.

6.1 A GRAVITY MODEL OF INTERCAPITAL NON-BULK FREIGHT DEMAND

A gravity model specification was estimated for the purpose of forecasting future inter–regional freight movements. The gravity model was of the form:

$$\text{Freight}_{ij} = \frac{A_{ij}\left(\text{EA}_i \times \text{EA}_j\right)^{\beta}}{\left(\text{Real generalised transport cost}_{ij}\right)^{\gamma}} \qquad (6.1)$$

where

Freight_{ij} = kilotonnes non-bulk intercapital freight movements—road, rail and sea for seven intercity corridors

EA_i = a measure of economic activity within region i, measured by population in i multiplied by national gross domestic product per capita

Real generalised transport cost_{ij} = the average cost of transporting non-bulk freight between regions i and j.

Data for the gravity model

Data on total freight activity was derived from several sources:

- Survey of Motor Vehicle Use (ABS 2003 and earlier)
- Experimental Estimates of Freight Movements (ABS 1996)
- Rail authorities
- Bureau of Transport and Communications Economics (BTCE 1990)
- Port Authority Cargo Statistics (Department of Transport and Communications 1998 and earlier)
- Sea Transport Statistics (Department of Transport 1995 and earlier)
- Coastal Freight in Australia (Bureau of Transport Economics 2000 and earlier)
- Australian Sea Freight (BTRE 2005 and earlier).

Historical measures of road freight movements are patchy, at best. There is a considerable degree of uncertainty associated with the raw data. The estimates the BTRE calculated represent the best attempt at constructing a consistent time series of road freight activity.

Rail and sea freight activity estimates are judged to be reliable. The estimates usually represent a census of total freight movements by those modes.

Road freight rates are again difficult to measure. There is no consistent systematic estimates of road freight rates paid. The consistent index used in the model is derived from a number of sources including Department of Transport/Bureau of Transport Economics *Transport Indicators* (1983–88) and the TranEco rates index among others.

Rail freight rates were estimated from total freight carried and total revenue received by state-owned rail authorities. This data was sourced from rail operators' annual reports and the ABS Yearbooks—1997 and earlier issues.

The majority of non-bulk coastal shipping cargo is carried to and from Tasmania. Therefore, all coastal shipping freight rate data is based on this route. Coastal shipping freight rates are taken from several sources including BTCE Occasional Paper 98 (BTCE 1990) and the Tasmanian Freight Equalisation Scheme Administrators.

Chapter 10 contains a detailed analysis of the compilation of a consistent time series of non-bulk freight rates.

Estimation of the gravity model

Estimation was by least squares applied to the gravity model. The estimating equation was:

$$\ln(\text{Freight}_{ijt}) = \alpha_{ij} + \beta \ln(\text{EA}_{it} \times \text{EA}_{jt}) + \gamma \ln(\text{Real generalised transport cost}_{ijt}) + \varepsilon_{ijt} \quad (6.2)$$

where

$\alpha_{ij} = \ln(A_{ij})$ denote route specific adjustment factors. Route specific adjustments may be ignored by assuming the α_{ij} are constant for all i and j

It was assumed that freight costs for each corridor were equal to the sum of Australia level road, rail and sea freight rates per tonne-kilometre, times the modal distances weighted by last year's share in the corridor freight task.

Forecast results

The parameter estimates derived by using Ordinary Least Squares are given in Table 6.3 whilst Figure 6.1 shows the actual and estimated freight derived from the gravity model.

In Table 6.3, Iij stands for the income effect, where the Economic Activity (EA) of both corridor ends (i and j) are multiplied together. Therefore, if both cities' Economic Activities were doubled, Iij would increase by four times. With a 0.64 coefficient, the income effect on freight would be $(4)^{0.64}=2.43$. Thus, the generalised real income elasticity implied by the model is 2.43/2.0=1.21. The real freight rate (TCij) elasticity is -0.28.

This equation can then be used to forecast total (all modes) non-bulk freight transport on the various corridors. However, to also forecast the task by mode, a model of mode split is needed. The next section examines the mode split forecasting models derived.

TABLE 6.3 ORDINARY LEAST SQUARES (OLS) PARAMETER ESTIMATES—GRAVITY MODEL OF INTERCAPITAL NON-BULK FREIGHT TRANSPORT

Coefficients:

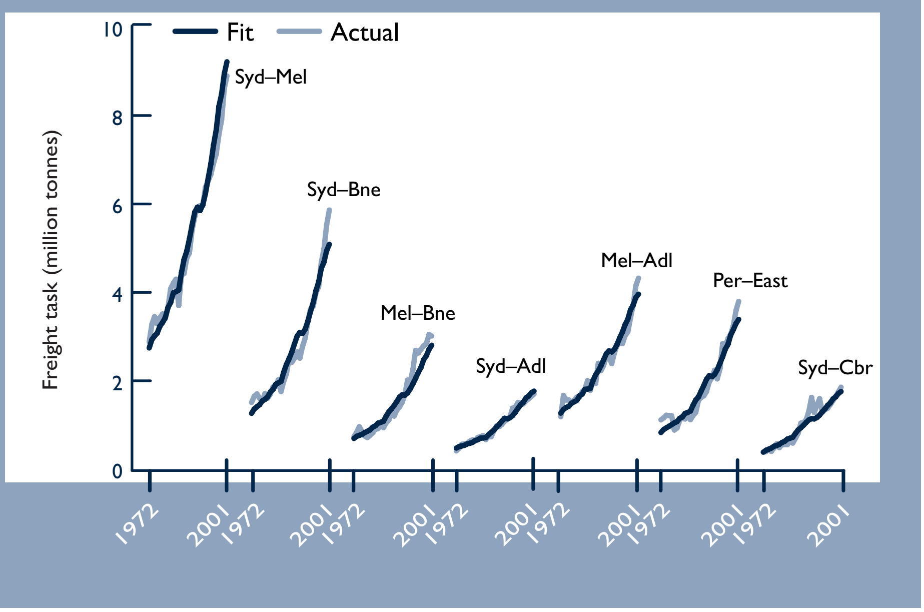
	Estimate	Std. error	t-value	significance
Mel–Syd	-5.04	1.00	-5.03	***
Syd–Bris	-5.09	0.98	-5.21	***
Mel–Bris	-5.46	1.01	-5.42	***
Syd–Adl	-5.87	1.00	-5.87	***
CMel–Adl	-5.06	0.95	-5.34	***
ES–Perth	-5.65	1.09	-5.20	***
Syd–Cbr	-5.40	0.86	-6.28	***
log(Iij)	0.64	0.03	19.68	***
log(TCij)	-0.28	0.07	-3.85	**

Significance codes:	Symbol
0	***
0.001	**

Notes: Parameter estimates obtained by using OLS.

Source: BTRE estimates.

FIGURE 6.1 ACTUAL AND PREDICTED INTERCAPITAL FREIGHT MOVEMENTS



Source: BTE estimates.

6.2 MODE SPLIT MODELS OF FREIGHT TRANSPORT

This section outlines the derivation of mode split models of intercapital non-bulk freight.

Mode split model estimates

The general mode split model is based on the method of multi–technological diffusion (substitution) models of Marchetti & Nakicenovic (1979) and Kwasnicki & Kwasnicka (1996). The model provides long-term estimates of mode share based on historical mode share trends. The model satisfies the properties of a good forecasting tool but does not give an adequate explanation of behavioural factors affecting freight transport.

The model's underlying philosophy is that some modes are more competitive than others. Thus the mode share of the more competitive modes will increase at the expense of less competitive modes.

These models are good for providing long-term forecasts, requiring few assumptions about the value of future exogenous variables. But they do not provide a method for differentiating between different influences.

The relative competitiveness term bundles many different influences such as prices, service time, reliability, and damage. Mode share forecasts based on the model implicitly assume that the effect of these factors will remain constant.

Mode share equations were estimated using logistic substitution models. The logistic substitution model is an evolutionary model of technology use. In this case technology refers to the freight transport mode. The model is based on the following simple assumptions:

- each technology at time t can be characterised by a single index describing its performance—its index of competitiveness
- the amount of technology i in use at time $t+1$ is proportional to the amount of technology in use in the previous period and its competitiveness.

These assumptions give the evolution equation:

$$f_i(t+1) = \frac{c_i}{c_{av}} f_i(t) \text{, for each i.} \qquad (6.3)$$

where

- $f_i(t)$ is the share total freight transport of mode i at time t

- c_i is the competitiveness of technology i
- $f_{av}(t)$ is the weighted average competitiveness of all modes at time t.

Rearranging (II.1) and back substituting gives (6.4):

$$\ln\frac{f_i(t)}{f_k(t)} = \ln\frac{f_i(t_0)}{f_k(t_0)} + \ln\frac{c_i}{c_k}(t-t_0) \tag{6.4}$$

where subscript k denotes the base, or reference, mode—in this case, road.

Equation (6.4) is then estimated using the estimating equation (6.5):

$$y_i(t) = a_i + b_i(t-t_0) \tag{6.5}$$

where $y_i(t) = \ln\frac{f_i(t)}{f_k(t)}$, $a_i = \ln\frac{f_i(t_0)}{f_k(t_0)}$ and $b_i = \ln\frac{c_i}{c_k}$.

Once b_i for rail is estimated the competitiveness index of rail can be calculated as $c_2 = \exp(b_2)$.

Results

In some cases, separate competitiveness indexes have been calculated for a distinct period of mode share change on each individual corridor (Table 6.4). In these cases, exogenous factors—which the model cannot account for—have affected the pattern of mode change. The future projections, therefore, are based on the latest period of uniform mode change.

TABLE 6.4 COMPETITIVENESS INDEXES FOR INTERCAPITAL FREIGHT

	Road	Rail	Sea		Road	Rail	Sea
Sydney–Brisbane				*Sydney–Adelaide*			
1971–72 to 1978–79	1	1.02	0.88	1971–72 to 1982–83	1	0.92	0.70
1978–79 to 1989–90	1	0.98	0.81	1982–83 to 1989–90	1	1.30	0.95
1989–90 to 2000–01	1	0.90	0.96	1989–90 to 2000–01	1	0.96	1.32
Melbourne–Brisbane				*Eastern States–Perth*			
1971–72 to 1975–76	1	0.98	0.83	1971–72 to 1977–78	1	0.81	0.48
1971–72 to 2000–01	1	1.00	0.86	1977–78 to 2000–01	1	0.98	1.03
Melbourne–Adelaide				*Sydney–Canberra*			
1971–72 to 1988–89	1	1.00	0.63	1971–72 to 2000–01	1	0.85	na
1988–89 to 2000–01	1	0.89	1.48				
Melbourne–Sydney							
1971–72 to 2000–01	1	0.95	0.87				

Note: Road was used as the base mode.

Source: BTRE estimates.

6.3 FORECASTS OF CORRIDOR FREIGHT TASKS BY MODE

Using the gravity equation, forecasts of total (all modes) freight flows in the corridors were calculated. Gross domestic product was assumed to grow by an average of 2.7 per cent over the 20 years from 2000 to 2020 (Treasury 2002). Median ABS population forecasts for the capitals were used (ABS 2003). Finally, real freight rates were assumed to fall by 0.5 per cent a year, assuming continuing benefits from technological change. The resulting forecasts of corridor total (all modes) freight flows are given in the Total columns of Tables 6.1 and 6.2.

To generate corridor freight forecasts by mode, two approaches were used:

- For the Melbourne–Brisbane and Eastern States–Perth routes, the 2001 estimated share for each mode multiplied each succeeding year by the competitiveness index from Table 6.4. The result was divided by the average of the three competitiveness indexes—weighted by their shares in the last year. This gave the next year's predicted share for the mode concerned. The resulting three time series of shares were then multiplied by the forecast total for each corridor. This produced the forecasts of freight flows by mode for the two corridors appearing in Table 6.1
- For all the other corridors, the absolute tonnages for rail and sea were held constant between 2000–01 and 2019–20, and the road tonnage forecasts were then calculated as total minus rail and sea. Table 6.1 shows the forecasts of freight flows by mode for the rest of the corridors.

Table 6.2 shows the forecasts of tonnages by mode for all corridors converted to tonne–kilometres.

6.4 TRENDS IN INTERCAPITAL FREIGHT

An examination of this data shows some interesting patterns.

- Intercapital non-bulk freight flows have grown faster than national income. Over the periods 1972 to 1980 and 1980 to 1990, the freight growth rate was, on average, 1.3 times the growth rate for the whole economy. Between 1990 and 2000, intercapital freight grew at 1.5 times the growth rate for the economy
- Non-bulk sea freight has declined on most corridors. However, since the mid 1990s it has increased strongly between the Eastern Capitals and Perth—largely at the expense of road
- Although total intercapital non-bulk rail freight has increased since the early 1970s, it has not grown as quickly as road freight. Consequently, rail's share of the intercapital non-bulk task has fallen on all corridors except Melbourne–Brisbane and Eastern States to Perth. The effect is more pronounced the shorter the corridor

- If the relationship between freight flows and national income demonstrated in the recent past holds, there will be substantial future growth in total non-bulk freight in all of the corridors considered. Freight flows in 2020 are projected to average twice their 2000 levels. If road continues to slowly increase mode share relative to rail, the growth in road freight will be even greater—2.2 times. The growth of intercapital freight is higher than the growth in total non-bulk freight—which includes a large range of slower growing sectors
- The trend for a continuing decline in rail's share can only be reversed by a significant improvement in rail's quality of service, relative to continually improving road service levels. This is discussed in more detail in the next section

There are also patterns that are specific to individual corridors.

Melbourne–Sydney. This route—930 kilometres—has by far the largest freight flow in tonnage terms. Non-bulk sea traffic is minimal—steel is counted as bulk. Road and rail shares have been mirror images. However, rail has not shared in the growth, and thus steadily carrying a smaller proportion of the total intercity task.

Sydney–Brisbane. This route—1000 kilometres—exhibits a freight mode share pattern similar to the Melbourne–Sydney market. After gaining share in the early 1970s, due to the decline in coastal shipping, rail's mode share has been declining.

Melbourne–Brisbane. On this corridor—1850 kilometres—the decline in rail's share was reversed in the late 1990s with the introduction of non-stop trains and other improvements to the service. This is an important illustration that it may not be impossible for rail to make the kind of quality of service improvements necessary to regain share from road. However, this conclusion depends on the accuracy of BTRE estimates of rail flows on the corridor.

Sydney–Adelaide. On this corridor—1550 kilometres—rail gained some rail-specific traffic in the late 1980s. However, this temporary boost in its mode share has since given way to a trend decline in share.

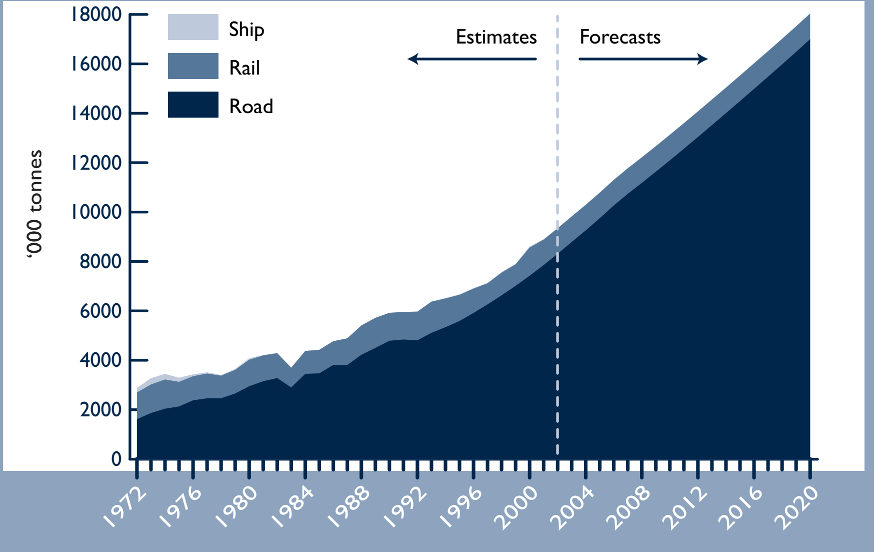
Melbourne–Adelaide. On this route—740 kilometres—road freight has increased due to the progressive introduction of B-doubles. This has turned this route into a short route where road is favoured. The recent opening of the freeway through the Adelaide Hills will benefit road freight further.

Eastern Capitals–Perth. This route—average 3400 kilometres—is the most favourable of the seven corridors for rail. Pick-up and delivery costs are a smaller proportion of total rail freight costs than on other, shorter, routes. Rail and road gained from the sharp drop in coastal shipping that followed the sealing of the Eyre Highway in 1976. But since then, rail's share has drifted downwards from around 70 per cent to close to 50 per cent. Since 1997, there has been a large increase in coastal shipping under the Single and Continuous Voyage Program. This increase in shipping share has come mainly at the expense of road. Rail has maintained its share in the face of the new competition from sea (and grown its tonnages very rapidly) by means of several mechanisms. In recent years, there has been a well-planned centralisation of investment under the aegis of the Australian Rail Track Corporation (ARTC). Standardisation of the gauge in Victoria was completed in 1995. Earlier concrete sleepering was extended during the 1990s and early 2000s. The adoption of National Rail class locomotives was completed by the lengthening of passing loops—allowing larger train lengths. In-cab signalling and points control meant trains no longer had to stop. By these means rail has been able to maintain its share on the corridor in the face of growing sea traffic.

Sydney–Canberra. This is a short route—315 kilometres. Line-haul rail has the greatest difficulty competing over short distances, where pick-up and delivery costs will necessarily comprise a higher share of total rail costs. Since 1980, non-bulk rail traffic has almost totally ceased, although there are still significant movements of bulk freight by rail into the Australian Capital Territory.

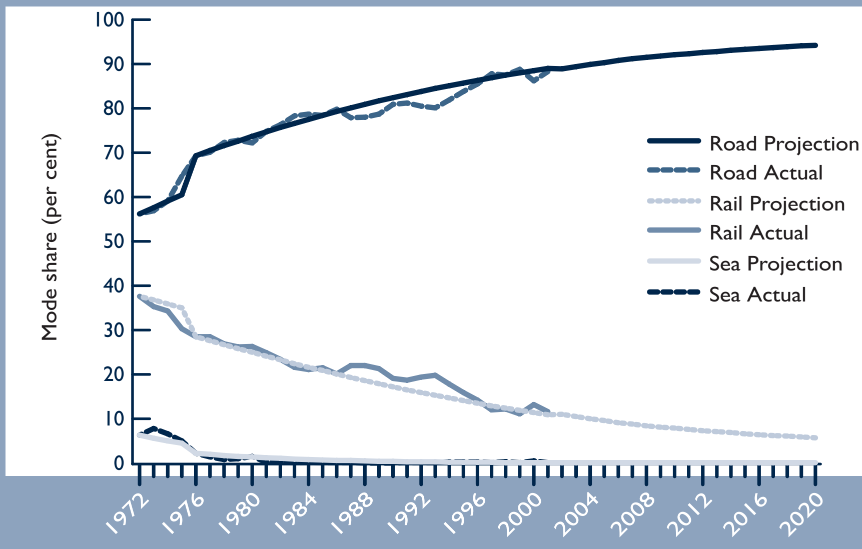
Figures 6.2 to 6.15 illustrate both the growth and mode share for each of the seven intercity corridors.

FIGURE 6.2 MELBOURNE–SYDNEY CORRIDOR FREIGHT BY MODE



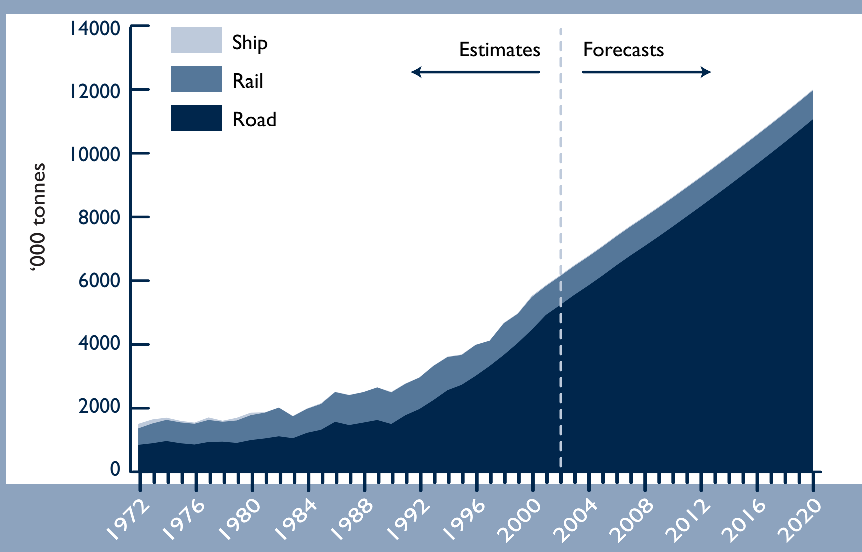
Source: Table 6.1.

FIGURE 6.3 MELBOURNE–SYDNEY CORRIDOR FREIGHT BY MODE SHARE



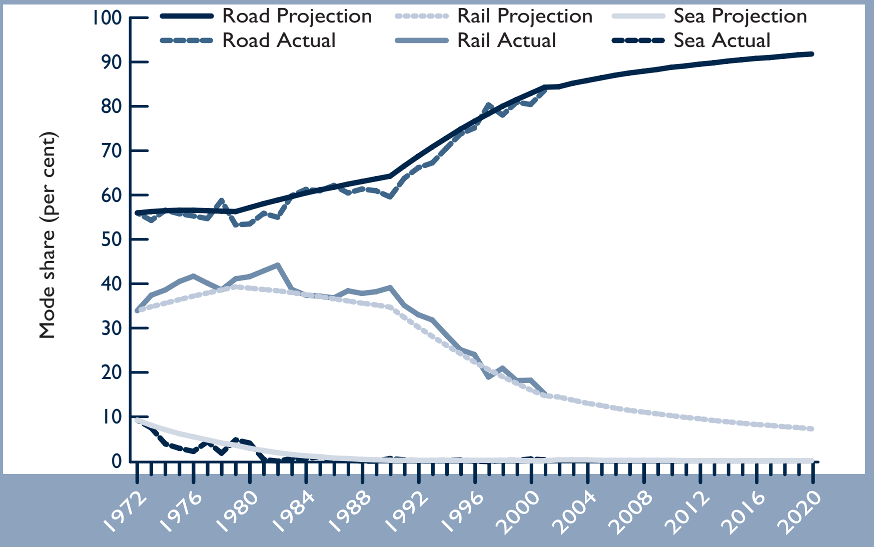
Source: Table 6.1.

FIGURE 6.4 SYDNEY–BRISBANE CORRIDOR FREIGHT BY MODE



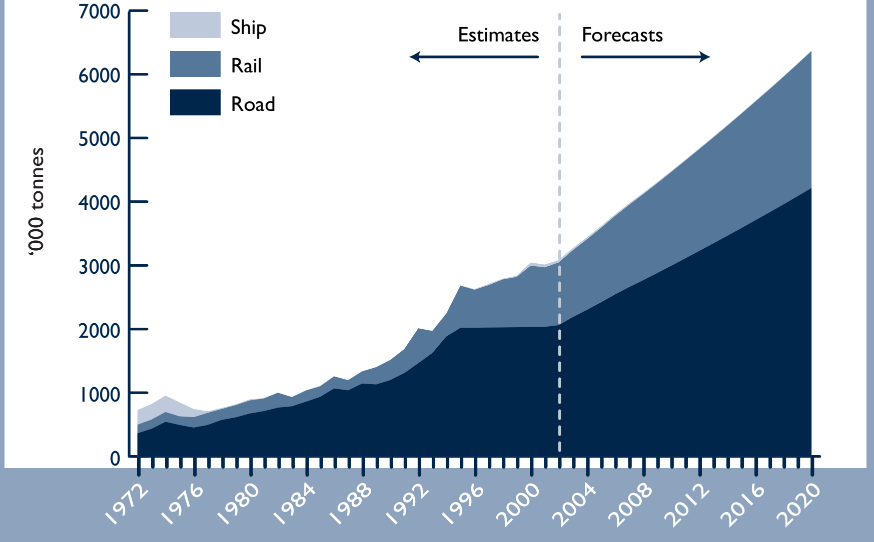
Source: Table 6.1.

FIGURE 6.5 SYDNEY–BRISBANE CORRIDOR FREIGHT BY MODE SHARE



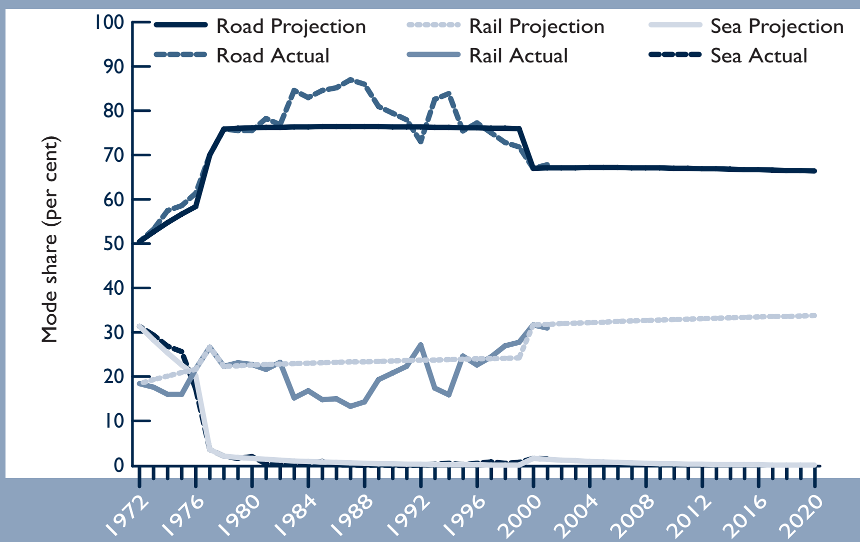
Source: Table 6.1.

FIGURE 6.6 MELBOURNE–BRISBANE CORRIDOR FREIGHT BY MODE



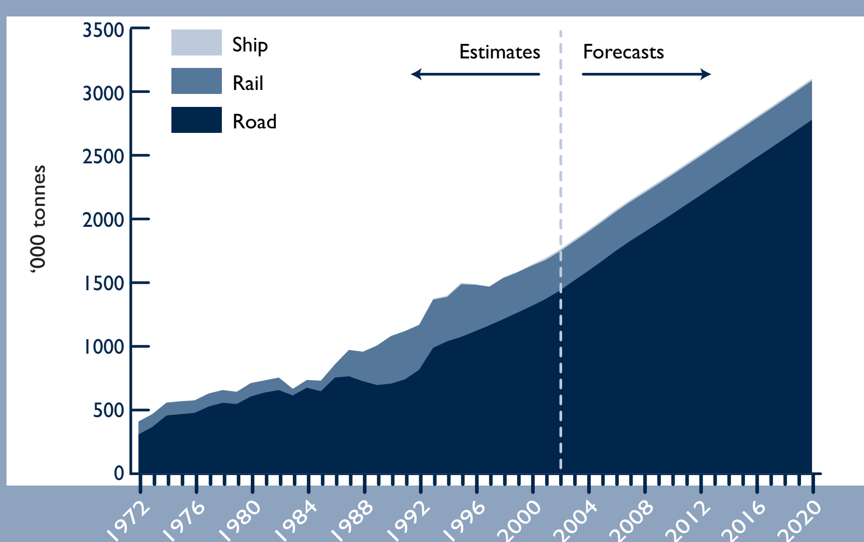
Source: Table 6.1.

FIGURE 6.7 MELBOURNE–BRISBANE CORRIDOR FREIGHT BY MODE SHARE



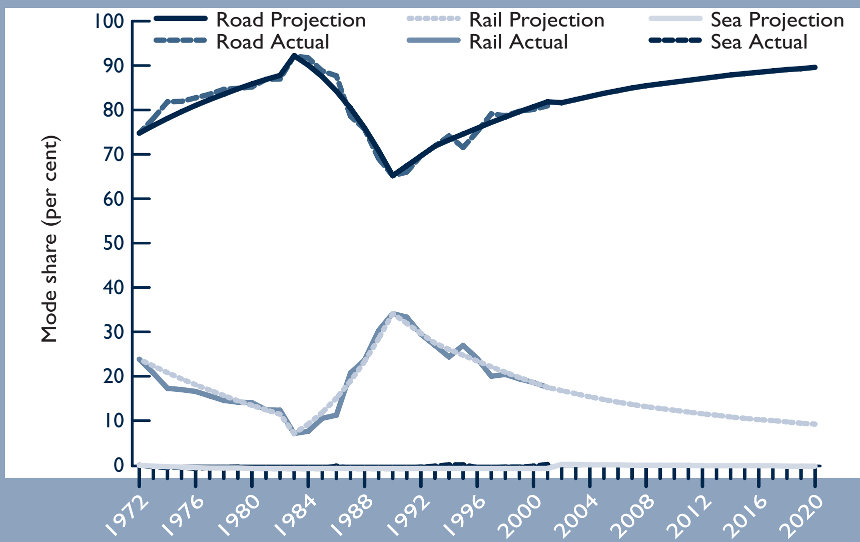
Source: Table 6.1.

FIGURE 6.8 SYDNEY–ADELAIDE CORRIDOR FREIGHT BY MODE



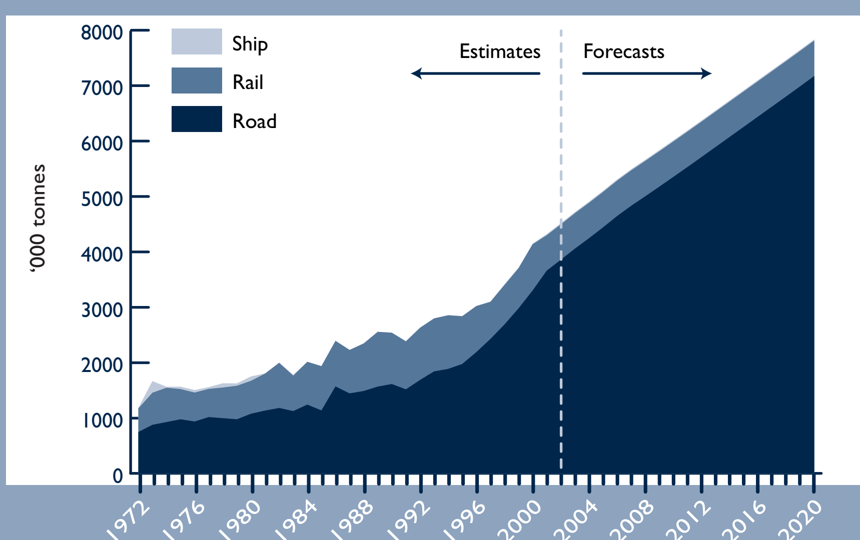
Source: Table 6.1.

FIGURE 6.9 SYDNEY–ADELAIDE CORRIDOR FREIGHT BY MODE SHARE



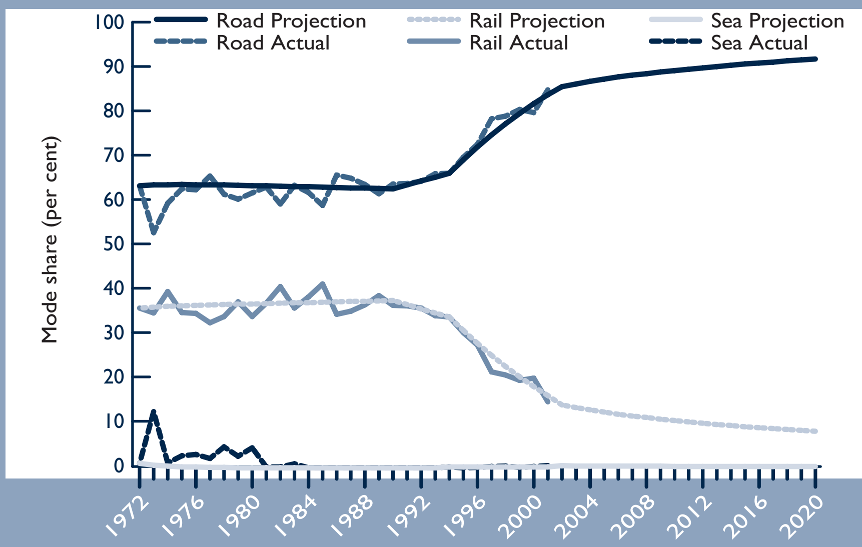
Source: Table 6.1.

FIGURE 6.10 MELBOURNE–ADELAIDE CORRIDOR FREIGHT BY MODE



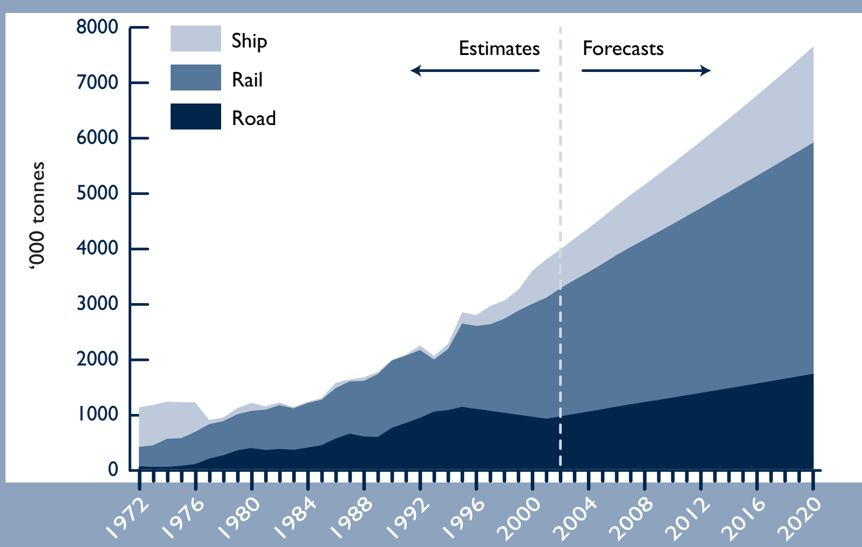
Source: Table 6.1.

FIGURE 6.11 MELBOURNE–ADELAIDE CORRIDOR FREIGHT BY MODE SHARE



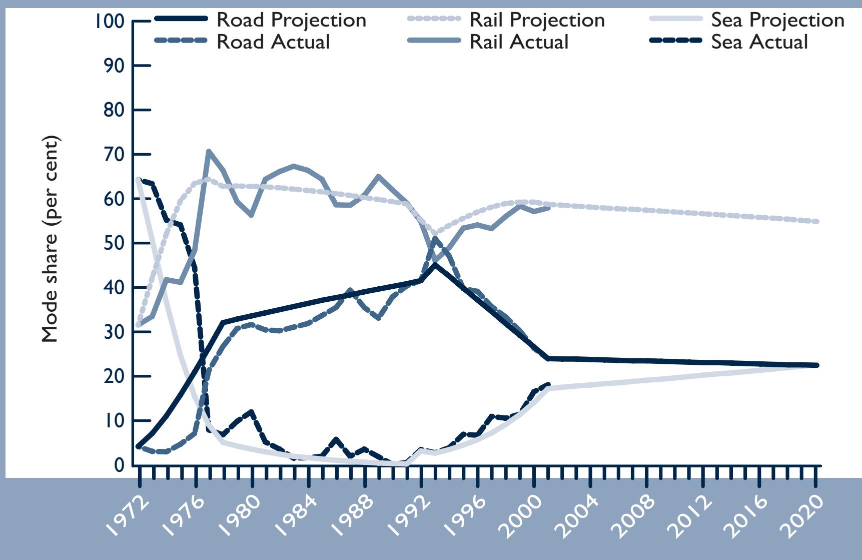
Source: Table 6.1.

FIGURE 6.12 EASTERN STATES–PERTH CORRIDOR FREIGHT BY MODE



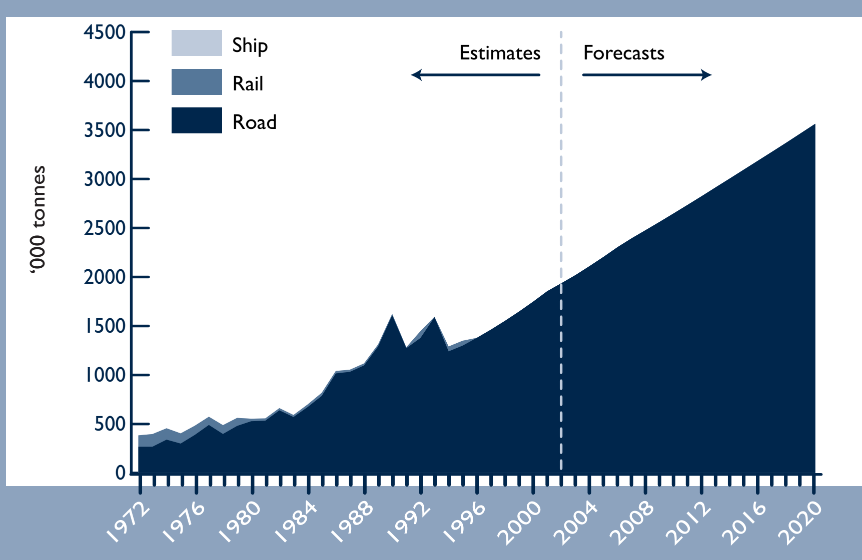
Source: Table 6.1.

FIGURE 6.13 EASTERN STATES–PERTH CORRIDOR FREIGHT BY MODE SHARE



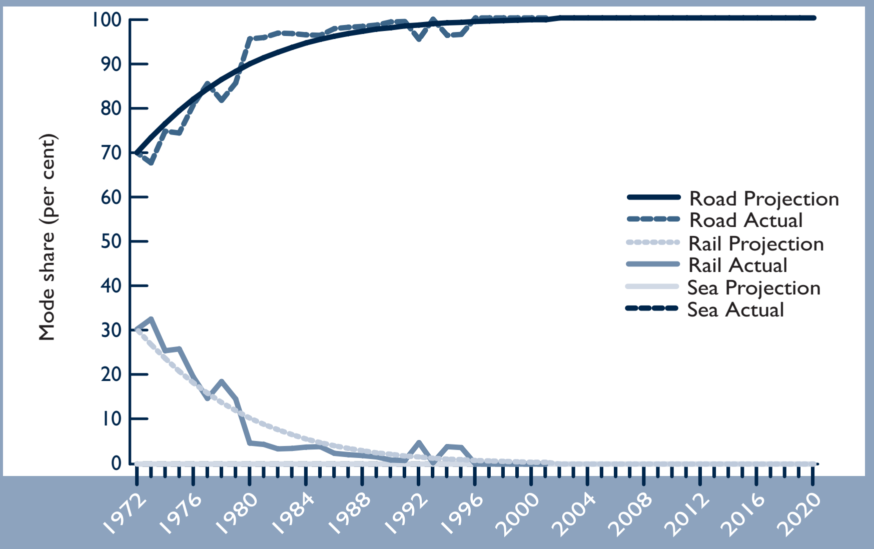
Source: Table 6.1.

FIGURE 6.14 SYDNEY–CANBERRA CORRIDOR FREIGHT BY MODE



Source: Table 6.1.

FIGURE 6.15 CANBERRA–SYDNEY CORRIDOR FREIGHT BY MODE SHARE



Source: Table 6.1.

6.5 GROWTH POTENTIAL FOR RAIL

The forecasts above assume the continuation of a past trend toward a long-term decline in rail's share of the intercity task—especially on the shorter East–Coast routes. But it is possible that intercity rail might be rejuvenated.

Intercity rail faces four problems. First is the terminal problem—that is, getting the freight off trucks and onto the train. It is quite possible that radical changes by private operators over the next few years might help to solve this problem.

The second problem is getting the trains out of the city in competition with urban passenger rail services. The new southern freight-only line into Sydney is one approach to this problem. Another might be to move the main terminal to the outskirts of the city concerned.

The third problem is the line-haul. This can also be perceived as an opportunity. There is potential for solving problems that currently exist. These include speed limits, passing loops, signalling and fragmented regulation—especially to do with safety and crewing.

The fourth problem arises from the industry that intercity rail finds itself in. Intercity rail is in the trucking industry—its trucks are just a bit different. The problem this poses for intercity rail is that the rest of its industry is highly efficient in delivering quality service at a competitive price. In addition as the trucking industry continues to evolve, the industry becomes more competitive, and rail has to continually improve its efficiency just to keep up.

On longer corridors, such as the East–West and Melbourne–Brisbane corridors, the "fixed costs" represented by terminals and city access get spread over the longer distances and travel times. Thus they represent less of an impost on the relatively lower costs of rail in the line-haul. In addition, any investments in the line-haul, (passing loops, locomotives, signalling) also have their benefits apply over longer distances.

Thus the major opportunities for intercapital rail lie on these two corridors, while on the shorter corridors rail will have to work that much harder to turn things around.

6.6 CONCLUSION

The main drivers of growth on the intercapital corridors are income growth (a 10 per cent increase in GDP generates a 12 per cent increase in freight) and real freight rates (a 10 per cent decrease in real freight rates generates a 3 per cent increase in freight).

Trends vary between corridors, but on the longer corridors (greater than 1 500 kilometres) rail has been holding its own against road.

Coastal shipping has made a come-back on the East–West corridor.

CHAPTER 7

COMMODITIES CARRIED BY PUBLIC ACCESS RAIL SYSTEMS

7.1 INTRODUCTION

The carriage of commodities by the Australian public-access rail systems has changed over the past 40 years. This chapter examines the part rail has played in moving bulk commodities to market. Production figures, in relation to the rail carriage of eight bulk commodities, are examined for each state. The commodities are:

- grains
- other agriculture
- livestock
- coal
- other minerals
- fertilisers
- cement
- timber.

In this way the trends in both the production and the movement of each commodity in each State are explored.

7.2 COMMODITY DEFINITIONS

The commodity classifications used throughout this chapter are based upon the following definitions;

- grains—includes the major agricultural commodity of wheat, as well as oats, barley, maize and sorghum
- other agriculture—groups together the remaining agricultural commodities, including all fruit and vegetables, wool, with the exception of sugar cane (which is carried by private sugar tramways in Queensland)

- livestock—is a measure of the live-weight of all cattle, pigs and sheep destined for slaughter and meat production
- coal—includes black coal and coke. Small quantities of brown coal briquettes are included in the rail statistics for Victoria. However most brown coal produced in Victoria is burnt on site, and thus not manufactured into briquettes
- other minerals—does not include iron ore as this is carried by private iron ore railways in Western Australia. Nor does it include bauxite in Queensland. This does not appear in Queensland Rail statistics. Other minerals include:
  - copper concentrates
  - mineral sands
  - lead concentrates
  - zinc concentrates
  - manganese
  - nickel
  - dolomite
  - gypsum
  - salt
  - silica
  - clays
  - limestone.
- fertilisers—includes the chemical fertilisers triple superphosphate, diammonium phosphate, monammonium phosphate, sulphate, nitrate, urea, potassic fertiliser and phosphate rock
- cement—includes bulk cement but does not include the other construction materials such as dimension stone, gravel and crushed or broken rock
- timber—includes all coniferous and broadleaved sawnwood, but does not include woodchips.

These commodity definitions give the production figures for each state and the Australian total production of each commodity grouping as presented in Appendix V, under Tables V.1 to V.14.

The share graphs assume that comparing rail carriage with total production gives an approximation of “rail share”. The non-rail share is assumed to be the total of production moved by all other modes (in most cases road).

7.3 AUSTRALIA LEVEL

Using national totals, the production and rail freight graphs—Figures 7.1 to 7.8—show that:

- All commodity production—except fertiliser and timber—is increasing
- The largest and fastest growing production tonnages are in coal and other minerals
- Rail tonnages are growing only for coal, grains and other minerals.

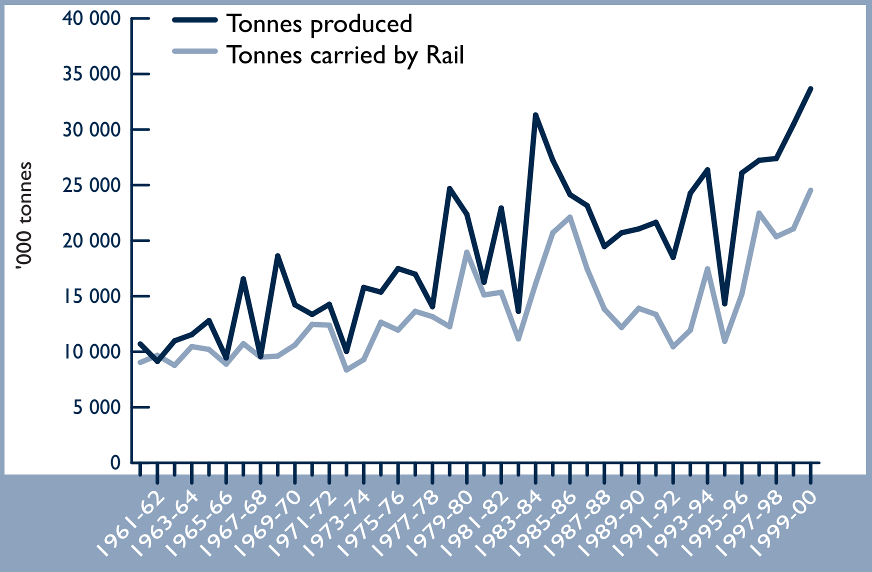
The rail mode share graphs—Figures 7.9 to 7.16— show that:

- Only in Coal and Other Minerals is rail maintaining its share of the carriage of a growing production
- In all other commodities rail has been steadily losing mode share — sometimes purposefully, as the traffic becomes non-profitable.

Considered individually, the share graphs show that:

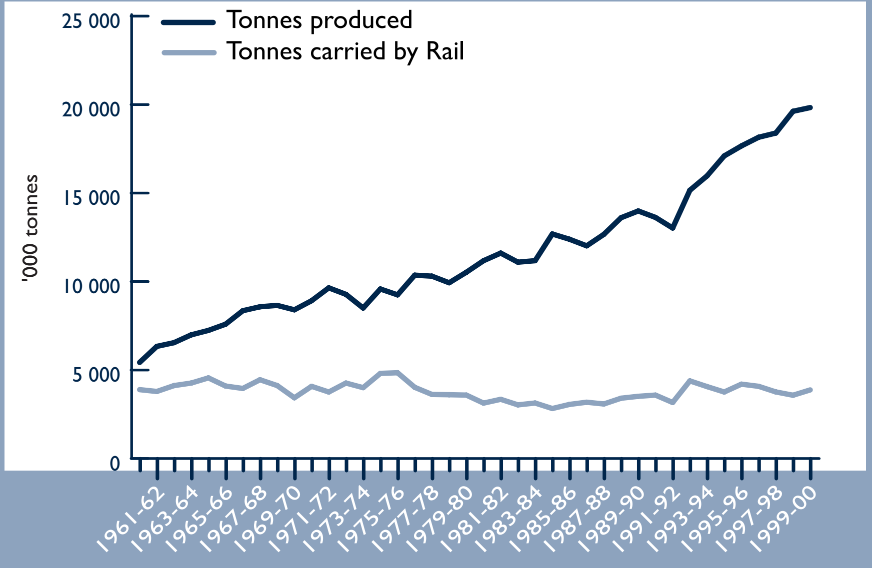
- Grain fluctuates with production but has decreased from 80 per cent rail to 65 per cent between 1960–61 and 1999-2000
- Other agriculture—decreased from 70 per cent rail to 20 per cent rail between 1960–61 and 1999–2000
- Livestock has decreased from 70 per cent rail to less than 10 per cent between 1960–61 and 1999–2000
- Fertiliser has followed a similar path, falling from 80 per cent rail to about five per cent between 1960–61 and 1999–2000
- Coal originally decreased from 65 per cent rail in 1960–61. But since the early 1970s it has increased to hold 80 per cent of production. This is a major and growing traffic of which rail seems assured a substantial and continuing share
- Other minerals has remained relatively constant at 30–45 per cent rail between 1960–61 and 1999–2000. In 1999–2000, rail held nearly 50 per cent
- Cement share decreased from about 50 per cent rail to about 20 per cent between 1960–61 and 1999–2000
- Timber has decreased from an initial 55 per cent rail share to a 10 per cent share between 1960–61 and 1999–2000.

FIGURE 7.1 AUSTRALIAN GRAINS PRODUCTION AND RAIL CARRIAGE



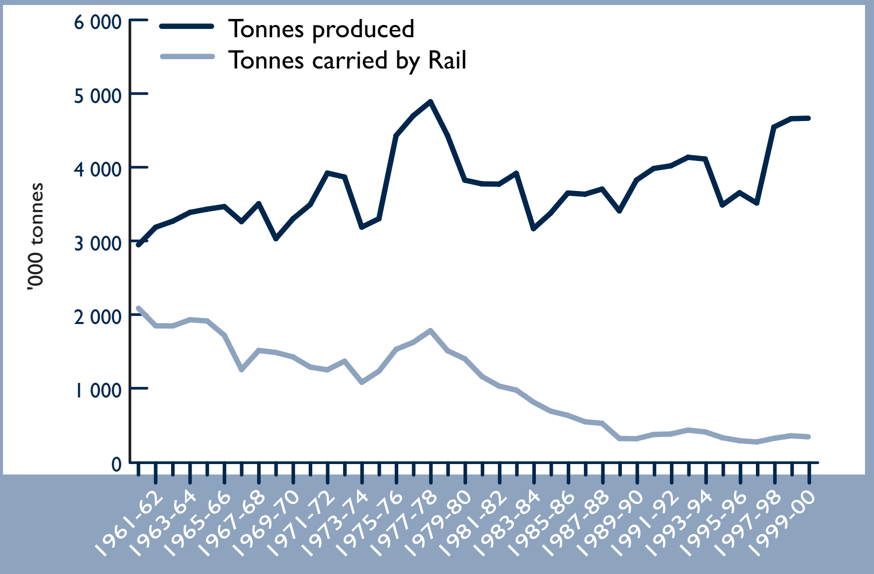
Sources: BTRE estimates, ABARE (2000 and earlier issues), ABS State and National Year Books (2001d and earlier issues), State Rail Authority, Vline, Westrail, Australian National Railways, FreightCorp and Queensland Rail Annual Reports (2000–01 and earlier issues), ABARE pers. comms., Australasian Railway Association pers. comms.

FIGURE 7.2 OTHER AGRICULTURE PRODUCTION AND RAIL CARRIAGE—AUSTRALIA



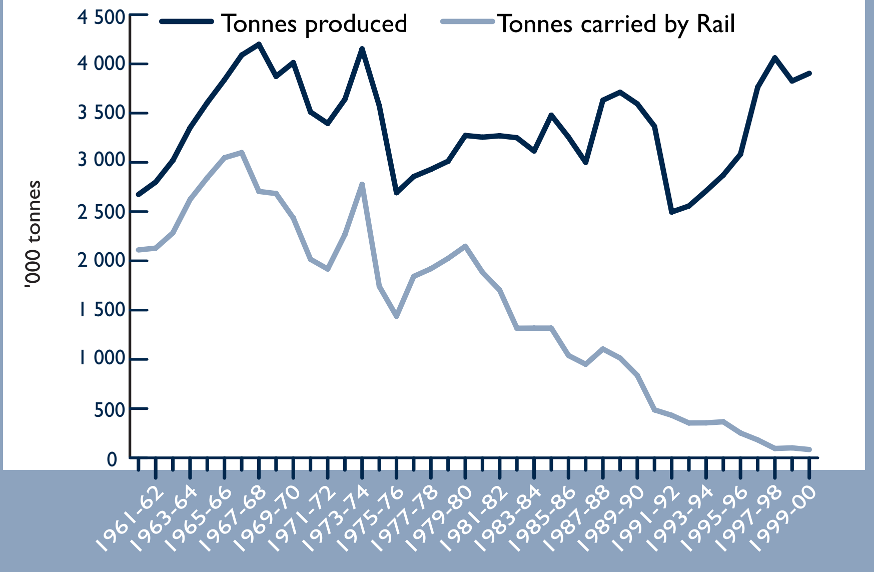
Sources: BTRE estimates, ABARE (2000 and earlier issues), ABS State and National Year Books (2001d and earlier issues), State Rail Authority, Vline, Westrail, Australian National Railways, FreightCorp and Queensland Rail Annual Reports (2000–01 and earlier issues), ABARE pers. comms., Australasian Railway Association pers. comms.

FIGURE 7.3 AUSTRALIAN LIVESTOCK PRODUCTION AND RAIL CARRIAGE



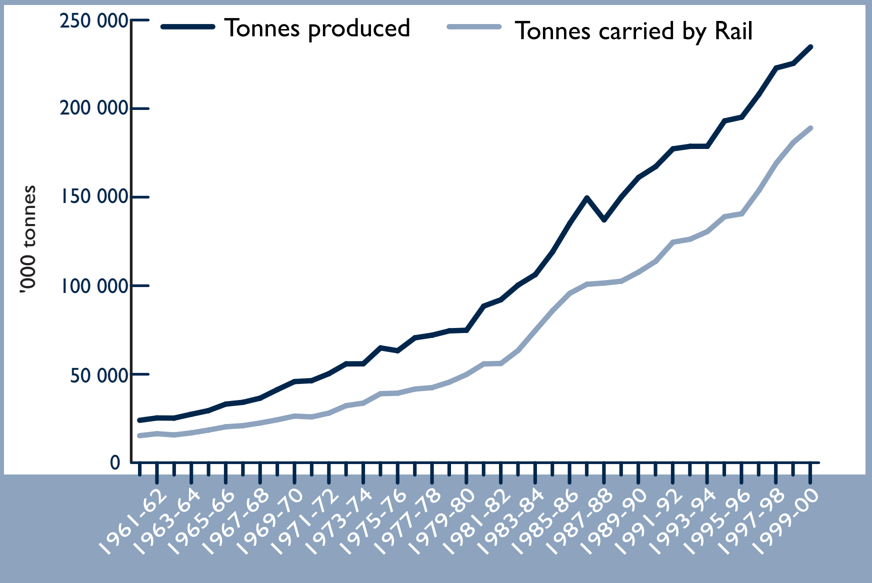
Sources: BTRE estimates, ABARE (2000 and earlier issues), ABS State and National Year Books (2001d and earlier issues), State Rail Authority, Vline, Westrail, Australian National Railways, FreightCorp and Queensland Rail Annual Reports (2000–01 and earlier issues), ABARE pers. comms., Australasian Railway Association pers. comms.

FIGURE 7.4 AUSTRALIAN FERTILISERS PRODUCTION AND RAIL CARRIAGE



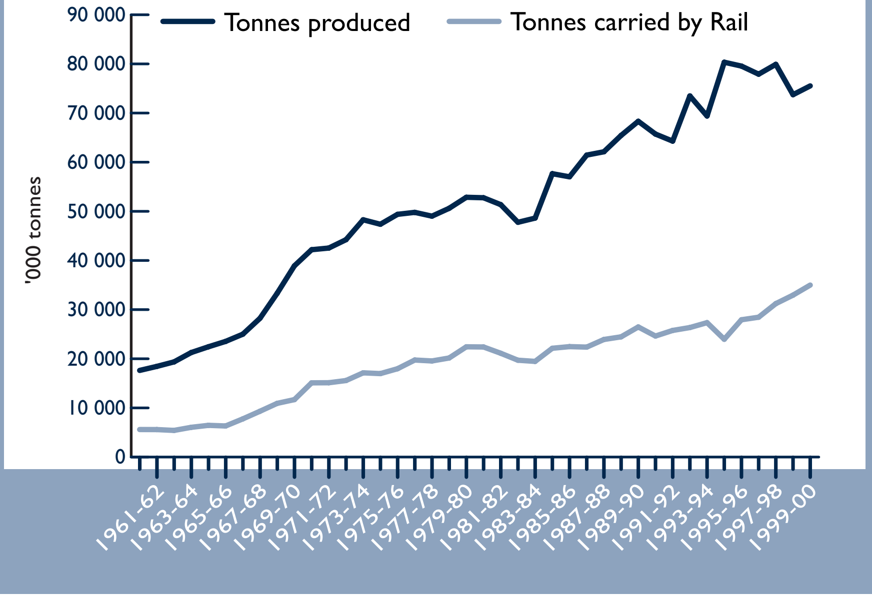
Sources: BTRE estimates, ABARE (2000 and earlier issues), ABS State and National Year Books (2001d and earlier issues), State Rail Authority, Vline, Westrail, Australian National Railways, FreightCorp and Queensland Rail Annual Reports (2000–01 and earlier issues), ABARE pers. comms., Australasian Railway Association pers. comms.

FIGURE 7.5 AUSTRALIAN COAL PRODUCTION AND RAIL CARRIAGE



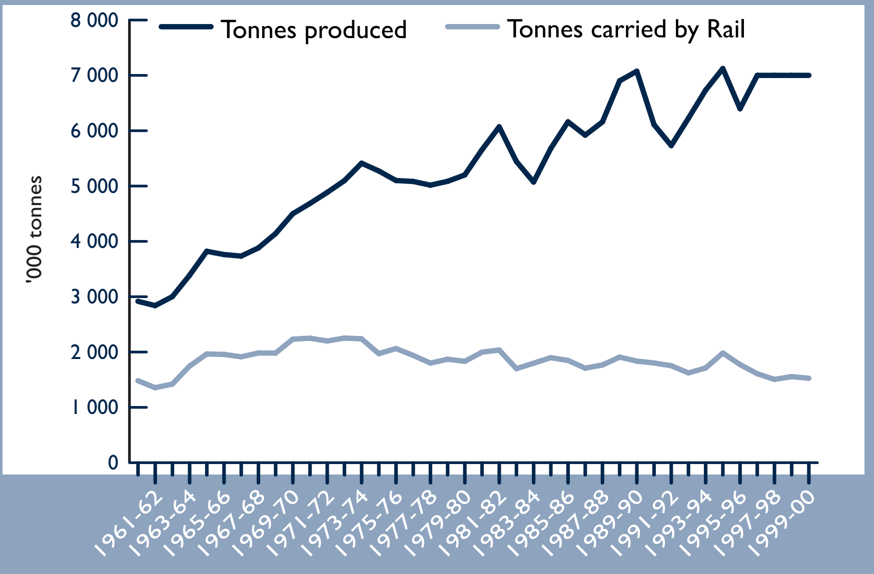
Sources: *BTRE estimates, ABARE (2000 and earlier issues), ABS State and National Year Books (2001d and earlier issues), State Rail Authority, Vline, Westrail, Australian National Railways, FreightCorp and Queensland Rail Annual Reports (2000–01 and earlier issues), ABARE pers. comms., Australasian Railway Association pers. comms.*

FIGURE 7.6 OTHER MINERALS PRODUCTION AND RAIL CARRIAGE—AUSTRALIA



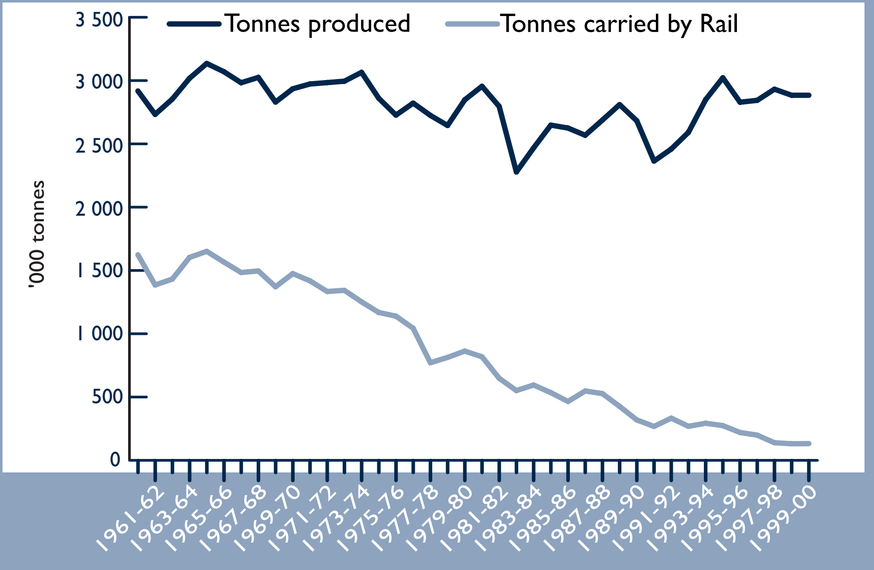
Sources: *BTRE estimates, ABARE (2000 and earlier issues), ABS State and National Year Books (2001d and earlier issues), State Rail Authority, Vline, Westrail, Australian National Railways, FreightCorp and Queensland Rail Annual Reports (2000–01 and earlier issues), ABARE pers. comms., Australasian Railway Association pers. comms.*

FIGURE 7.7 AUSTRALIAN CEMENT PRODUCTION AND RAIL CARRIAGE



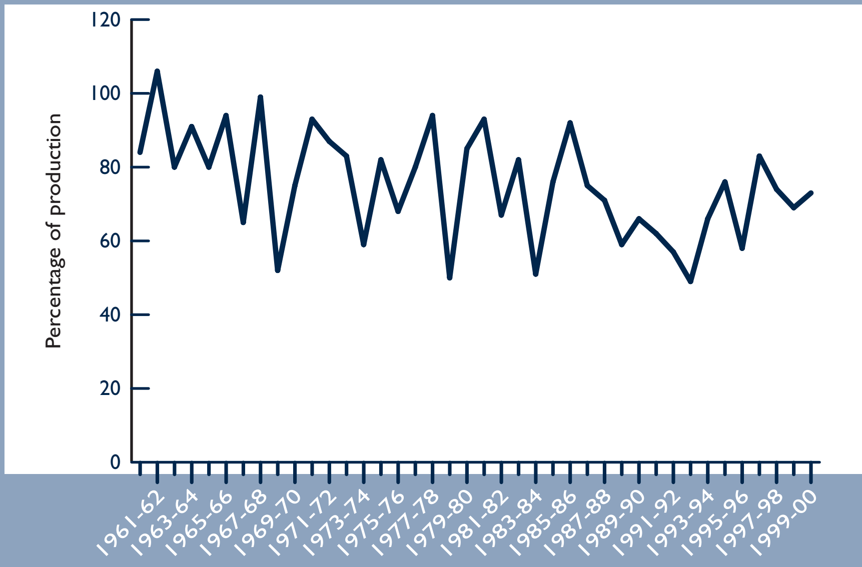
Sources: BTRE estimates, ABARE (2000 and earlier issues), ABS State and National Year Books (2001d and earlier issues), State Rail Authority, Vline, Westrail, Australian National Railways, FreightCorp and Queensland Rail Annual Reports (2000–01 and earlier issues), ABARE pers. comms., Australasian Railway Association pers. comms.

FIGURE 7.8 AUSTRALIAN TIMBER PRODUCTION AND RAIL CARRIAGE



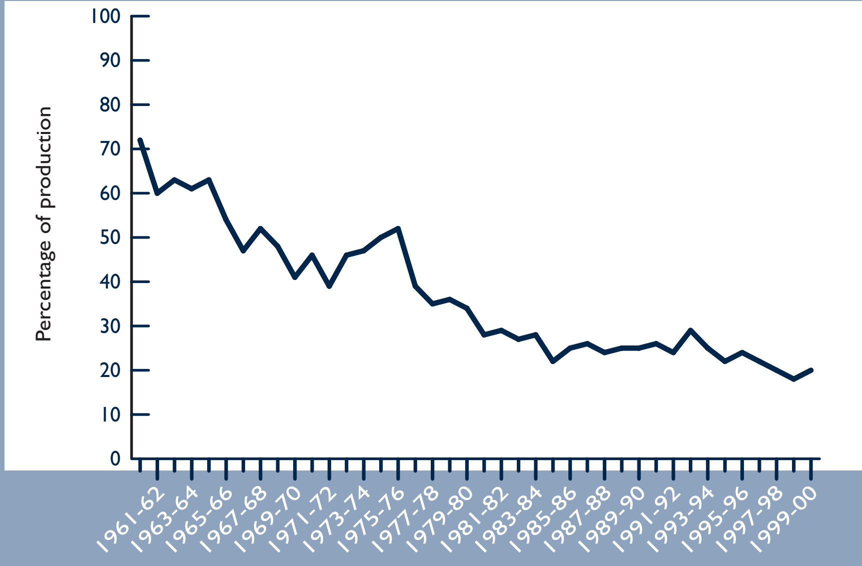
Sources: BTRE estimates, ABARE (2000 and earlier issues), ABS State and National Year Books (2001d and earlier issues), State Rail Authority, Vline, Westrail, Australian National Railways, FreightCorp and Queensland Rail Annual Reports (2000–01 and earlier issues), ABARE pers. comms., Australasian Railway Association pers. comms.

FIGURE 7.9 AUSTRALIAN RAIL SHARE OF GRAINS



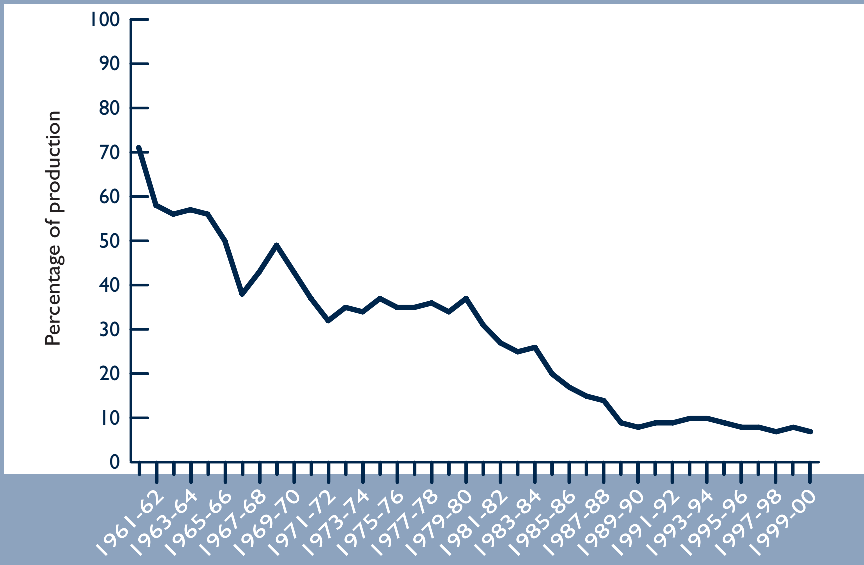
Sources: Appendix Tables VII.1 and VII.2.

FIGURE 7.10 OTHER AGRICULTURE RAIL SHARE—AUSTRALIA



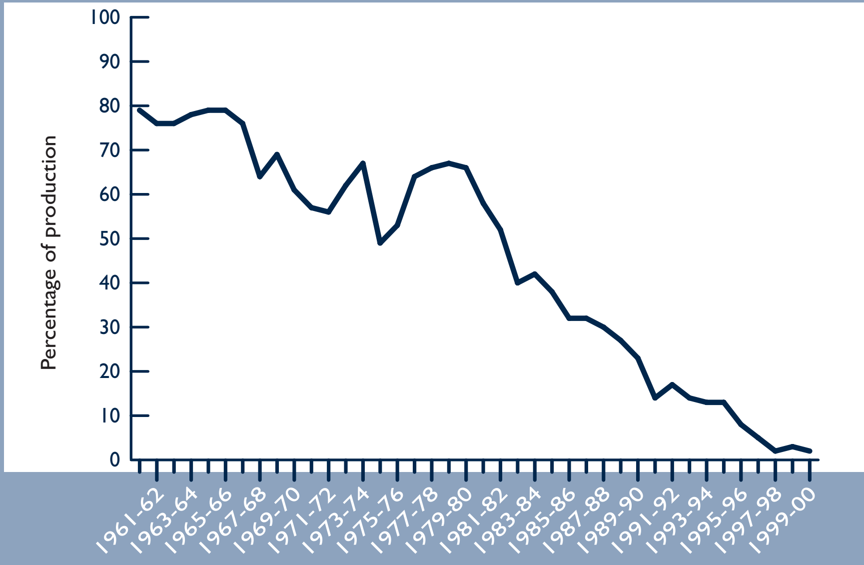
Sources: Appendix Tables VII.1 and VII.2.

FIGURE 7.11 RAIL SHARE OF LIVESTOCK—AUSTRALIA



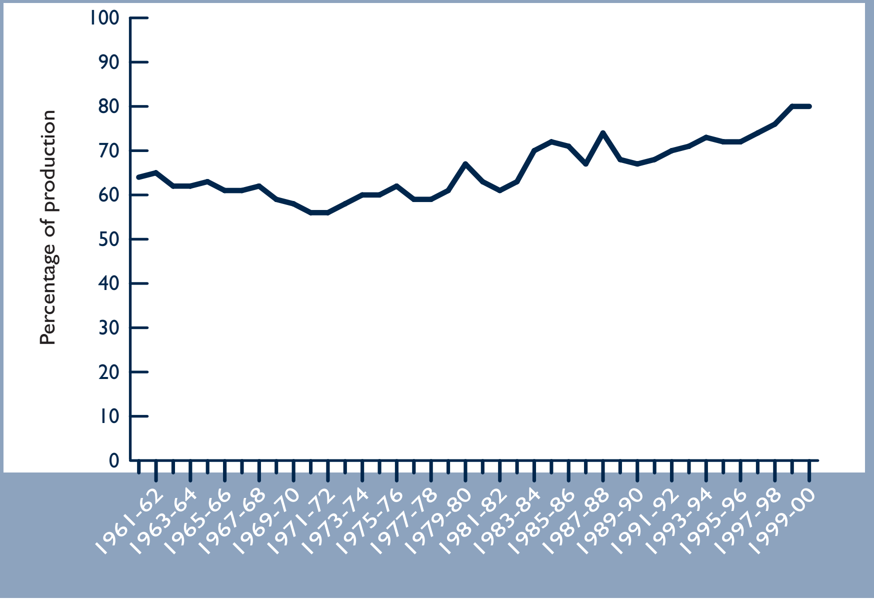
Sources: Appendix Tables VII.1 and VII.2.

FIGURE 7.12 RAIL SHARE OF FERTILISERS—AUSTRALIA



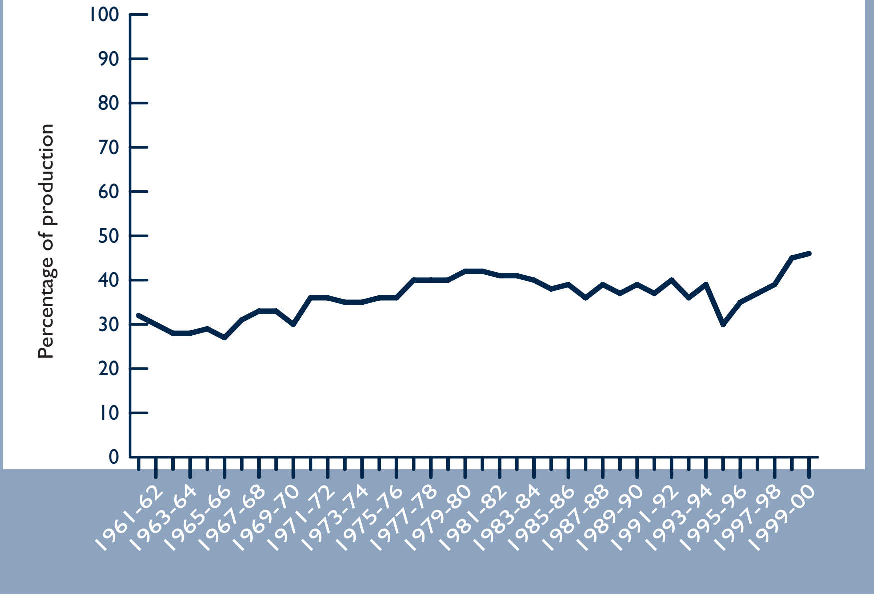
Sources: Appendix Tables VII.1 and VII.2.

FIGURE 7.13 RAIL SHARE OF COAL—AUSTRALIA



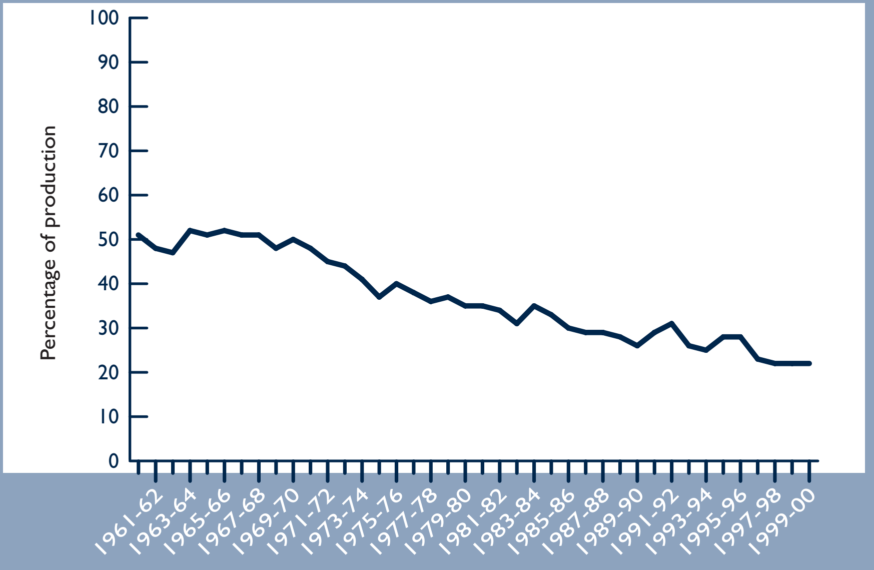
Sources: Appendix Tables VII.1 and VII.2.

FIGURE 7.14 RAIL SHARE OF OTHER MINERALS—AUSTRALIA



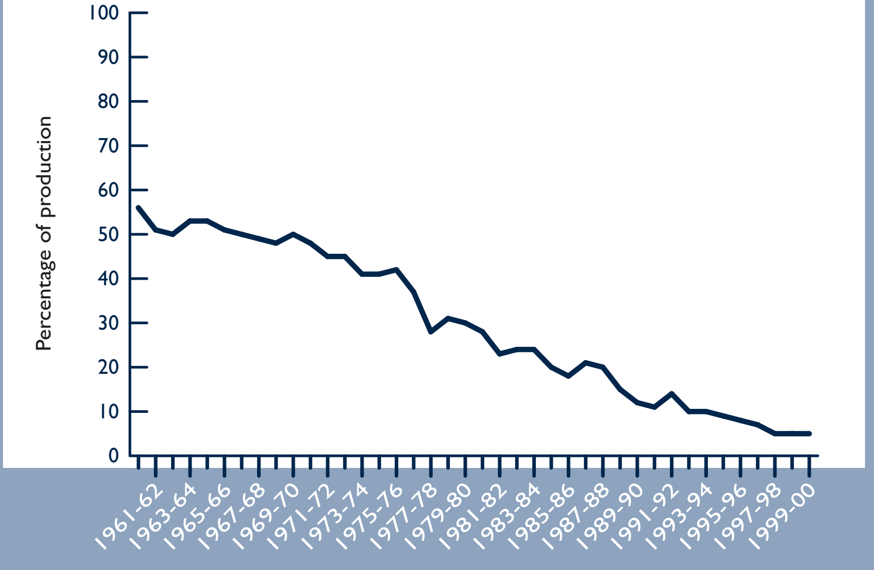
Sources: Appendix Tables VII.1 and VII.2.

FIGURE 7.15 AUSTRALIAN RAIL SHARE OF CEMENT



Sources: Appendix Tables VII.1 and VII.2.

FIGURE 7.16 AUSTRALIAN RAIL SHARE OF TIMBER



Sources: Appendix Tables VII.1 and VII.2.

7.4 MAPS OF AUSTRALIA LEVEL COMMODITY FLOWS

The maps in this section plot thousands of tonnes of freight carried (net tonne–kilometres). It should be noted that each map has a different scale—given in the bottom left corner. Flows on the private railway networks are included. The width of the line represents the volume of flow. All major rail lines are shown in the maps. Where there is no commodity flow a very thin line depicts the rail line. Note that the flows portrayed are the total flow in both directions along the line.

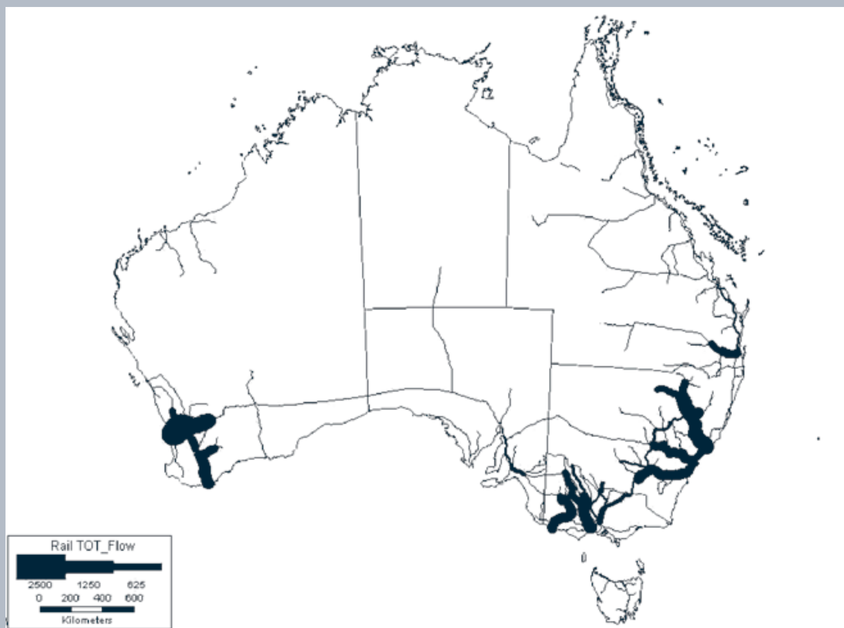
Grain traffic—Figure 7.17—has five different regional patterns:

- West Australian flows to the ports of Geraldton, Perth and Albany
- South Australian flows on the Eyre Peninsula to Port Lincoln and other areas to Port Pirie and Adelaide
- the flows from the Murray and Victorian grain areas to Portland and Melbourne
- the New South Wales flows to the Sydney area
- flows from the Darling Downs to the coast in Queensland.

The Coal map—Figure 7.18—shows that Queensland and New South Wales dominate the flows of black coal from the mines to the ports. Victoria produces many tonnes of brown coal. But this never gets on to the railways for interregional transport, because it is burnt on site to produce electricity.

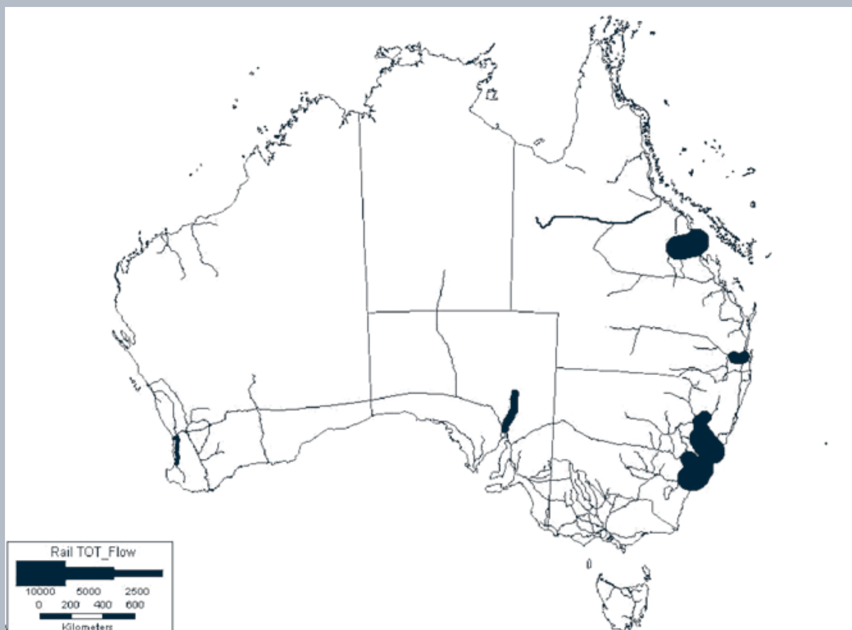
The Metallic minerals map—Figure 7.19—is dominated by the iron ore flows over private railways in the north-west of Western Australia. Other flows are from Broken Hill and Northern South Australia into Port Pirie, flows from Broken Hill to Sydney, and flows of bauxite and alumina between Perth and southwest Western Australia. There is also a significant flow of nickel ore in north Queensland.

FIGURE 7.17 INTERREGIONAL RAIL FREIGHT FLOW 1998–99—GRAINS (KT)



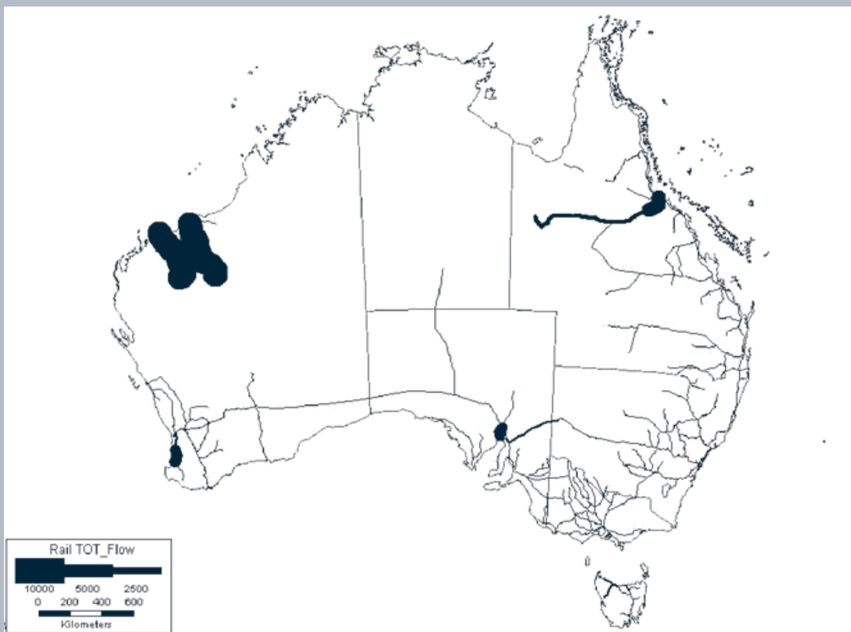
Sources: BTRE estimates, FDF FreightInfo99.

FIGURE 7.18 INTERREGIONAL RAIL FREIGHT FLOW 1998–99—COAL (KT)



Sources: BTRE estimates, FDF FreightInfo99.

FIGURE 7.19 INTERREGIONAL RAIL FREIGHT FLOW 1998–99—METALLIC MINERALS (KT)



Sources: BTRE estimates, FDF FreightInfo99.

7.5 STATE LEVEL

Both production and rail carriage data has been broken down into the six states with a public-access rail system. The following section examines each state in terms of tonnages of commodity produced and carried, and rail's relative mode share of each commodity.

New South Wales

The production and rail freight graphs—Figures 7.20 to 7.27—show that:

- All commodity production—except Fertilisers and Timber—is increasing.
- The fastest-growing production tonnages are in Coal and Other agriculture, followed by Other minerals.
- Rail tonnages are growing only for Coal, Other minerals and Other agriculture. Grains also indicate an upward, but fluctuating, growth.

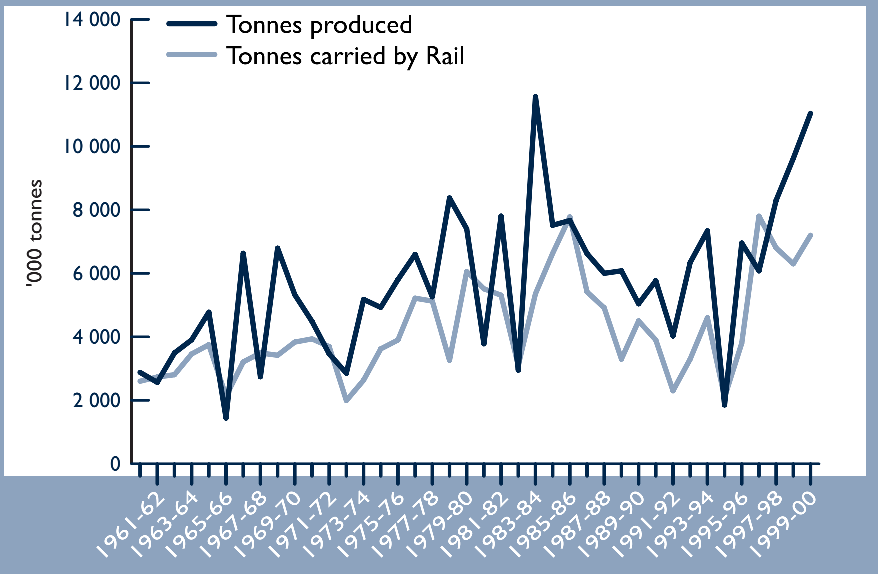
The rail mode share graphs—Figures 28 to 35—show that:

- Rail is maintaining its share of the carriage of a growing production, in Coal and Other minerals only.
- In all other commodities, rail has either steadily lost mode share—sometimes purposefully as the traffic becomes non-profitable—or maintained a constant share.

The share graphs show that:

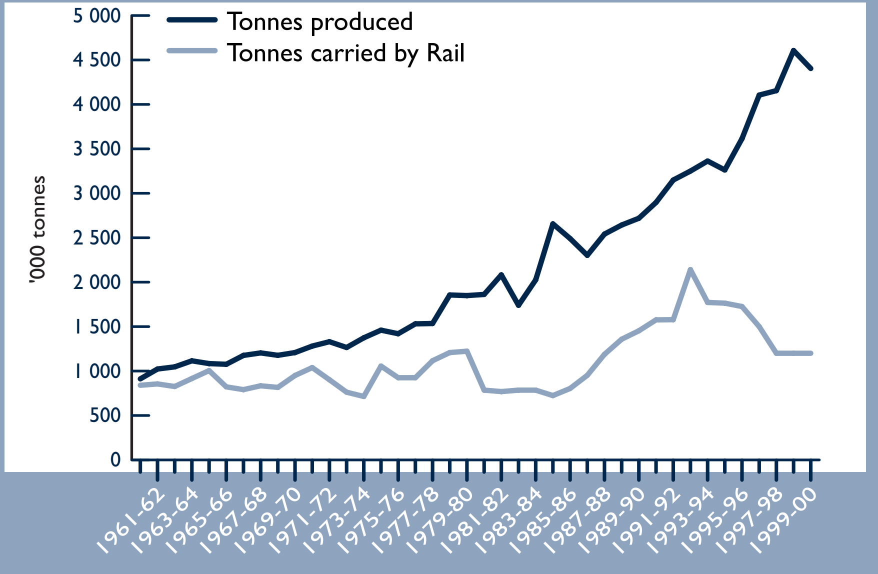
- Grain fluctuates with production, but has dropped from 90 per cent rail to 65 per cent between 1960–61 and 1999–2000.
- Other agriculture has fallen from 90 per cent rail to about 30 per cent between 1960–61 and 1999–2000. This is partially attributable to increased production of crops that are not as easy as grains to transport by rail.
- Livestock has declined from 95 per cent in 1960–61 to almost no share in 1999-2000.
- Fertiliser has declined from 90 per cent rail to less than one per cent between 1960–61 and 1999–2000.
- Coal has remained relatively steady, with rail claiming 60 per cent in 1960–61 and almost 70 per cent in 1999–2000. This is one of the major and growing traffics of which rail seems assured a dominant share.
- Other minerals has fluctuated between 35 and 50 per cent, with rail currently claiming a 45 per cent share. This is another major and growing traffic of which rail seems assured a substantial share.
- Cement has dropped from an initial 80 per cent rail in 1960–61 to a steady 35 per cent over the last four years.
- Timber has steadily decreased from approximately 40 per cent rail in 1960–61 to no share in 1999–2000.

FIGURE 7.20 NSW GRAINS PRODUCTION AND RAIL CARRIAGE



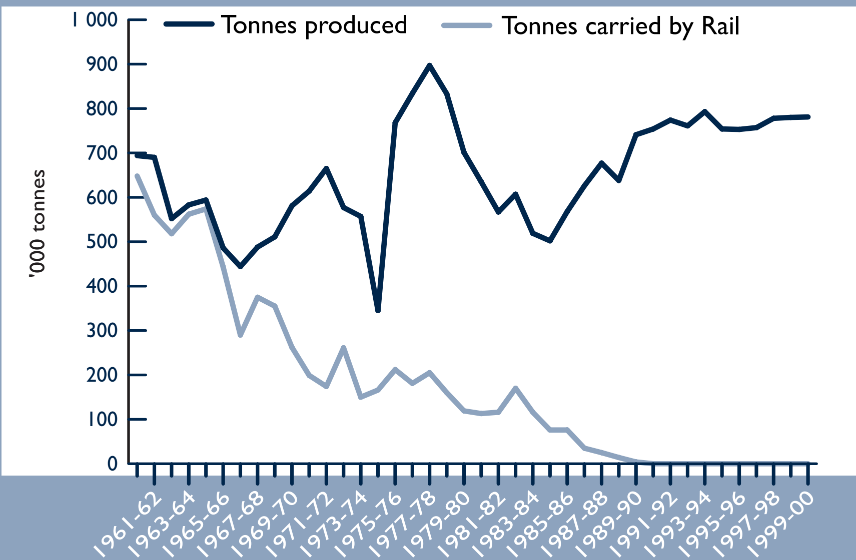
Sources: Appendix Tables VII.3 and VII.4.

FIGURE 7.21 OTHER AGRICULTURE PRODUCTION AND RAIL CARRIAGE—NSW



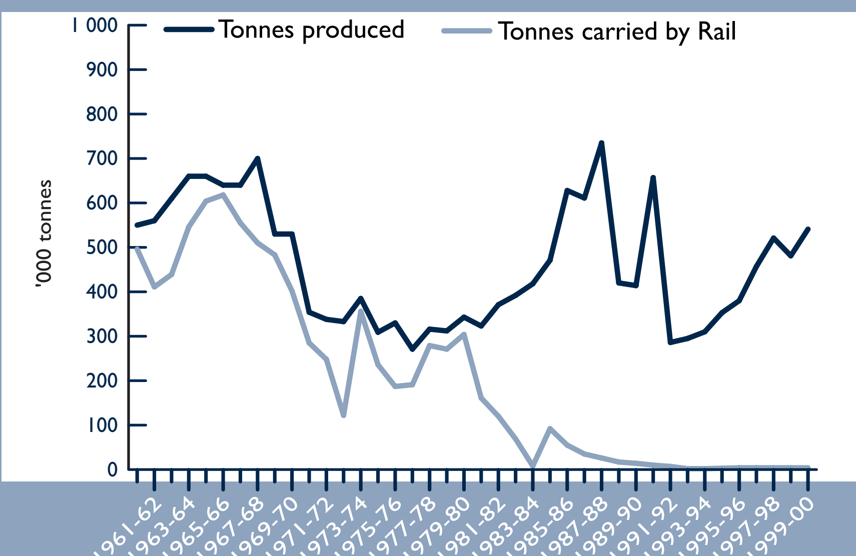
Sources: Appendix Tables VII.3 and VII.4.

FIGURE 7.22 NSW LIVESTOCK PRODUCTION AND RAIL CARRIAGE



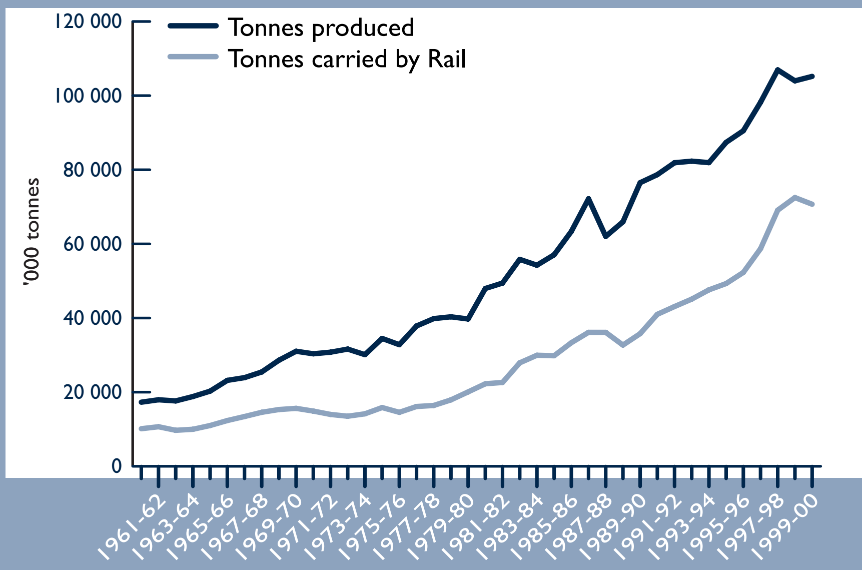
Sources: Appendix Tables VII.3 and VII.4.

FIGURE 7.23 NSW FERTILISERS PRODUCTION AND RAIL CARRIAGE



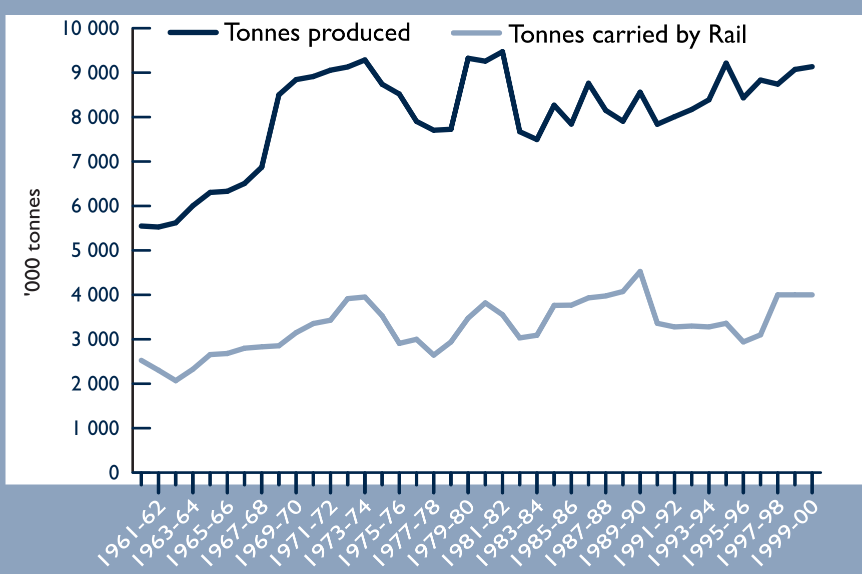
Sources: Appendix Tables VII.3 and VII.4.

FIGURE 7.24 NSW COAL PRODUCTION AND RAIL CARRIAGE



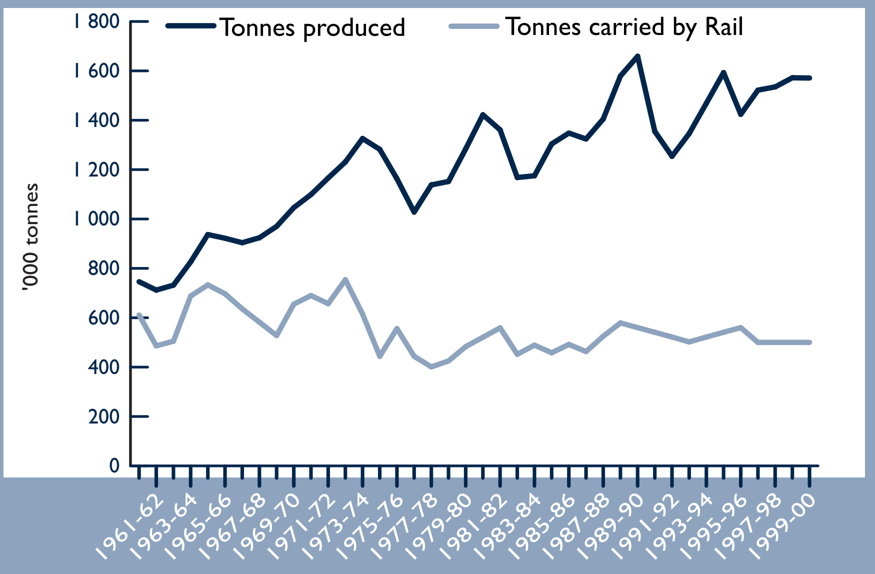
Sources: Appendix Tables VII.3 and VII.4.

FIGURE 7.25 OTHER MINERALS PRODUCTION AND RAIL CARRIAGE—NSW



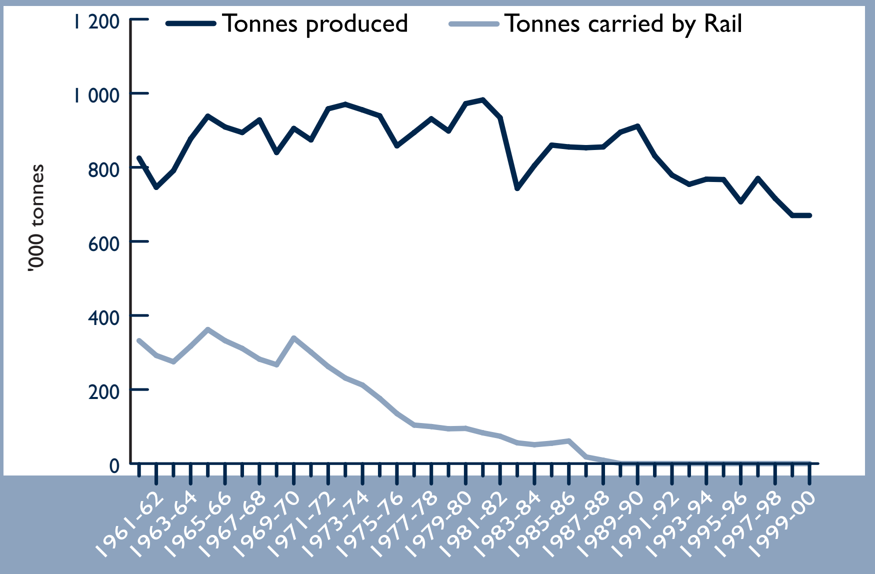
Sources: Appendix Tables VII.3 and VII.4.

FIGURE 7.26 NSW CEMENT PRODUCTION AND RAIL CARRIAGE



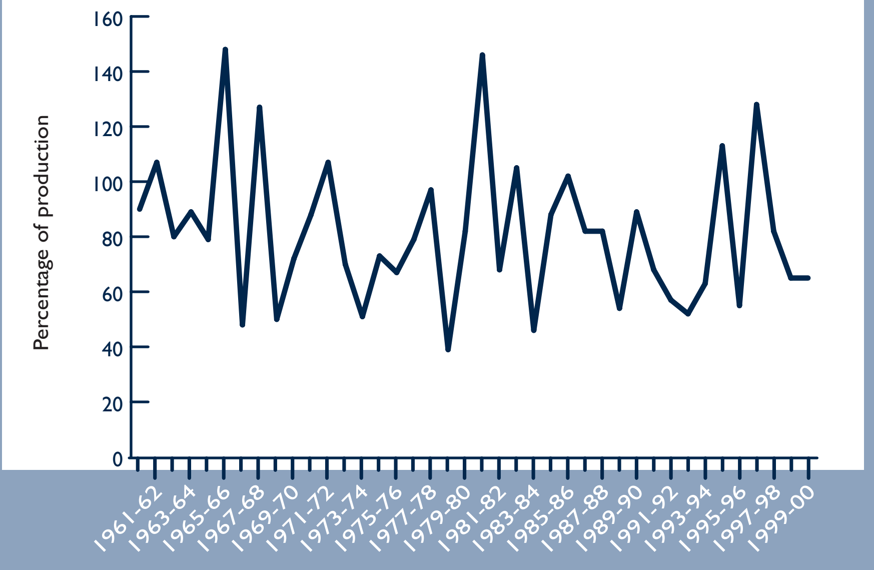
Sources: Appendix Tables VII.3 and VII.4.

FIGURE 7.27 NSW TIMBER PRODUCTION AND RAIL CARRIAGE



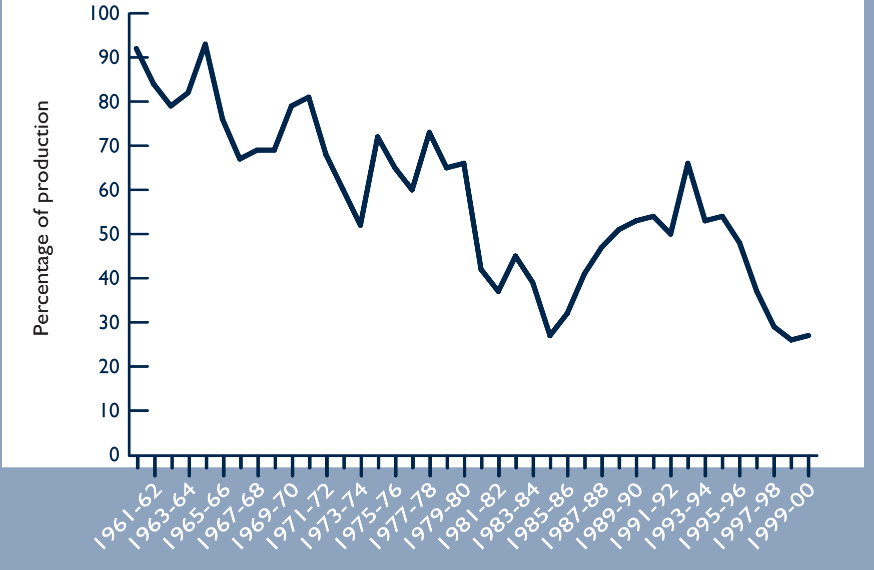
Sources: Appendix Tables VII.3 and VII.4.

FIGURE 7.28 NSW RAIL SHARE OF GRAINS



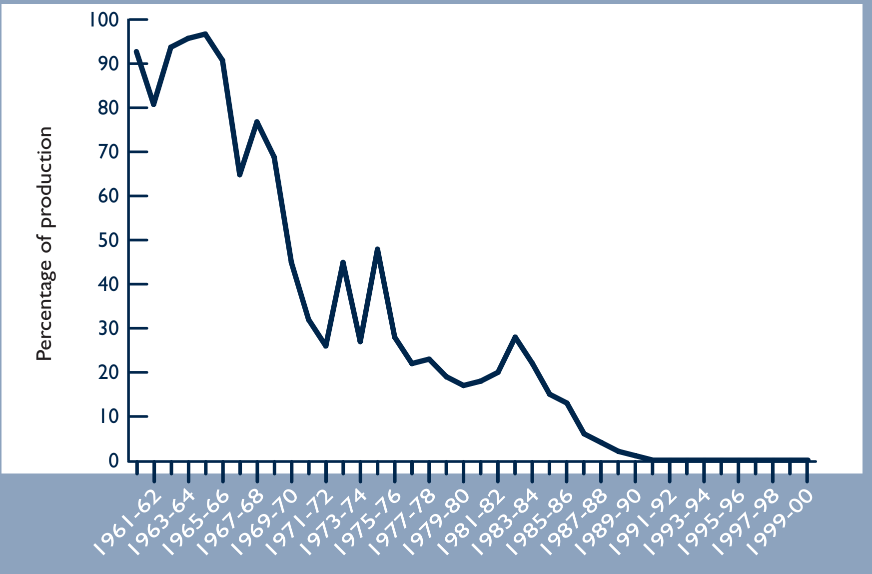
Sources: Appendix Tables VII.3 and VII.4.

FIGURE 7.29 NSW RAIL SHARE OF OTHER AGRICULTURE



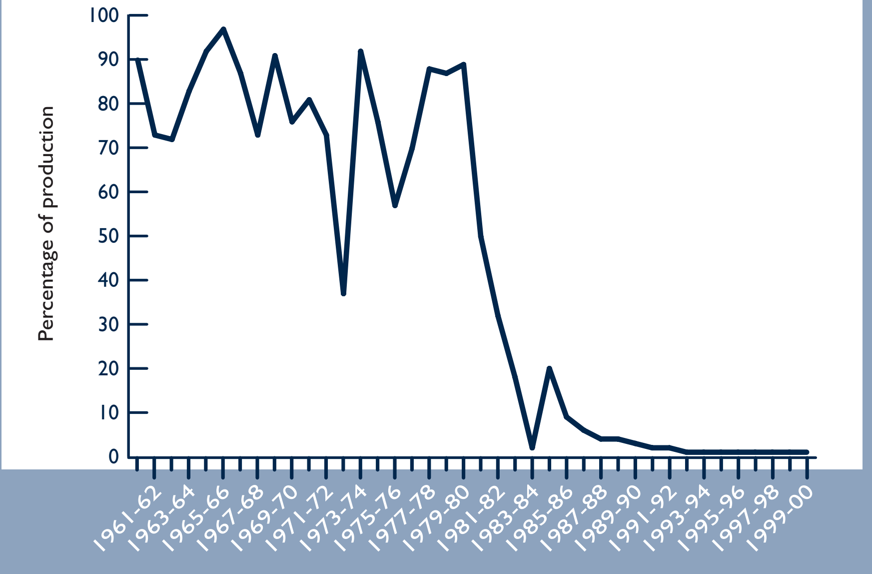
Sources: Appendix Tables VII.3 and VII.4.

FIGURE 7.30 NSW RAIL SHARE OF LIVESTOCK



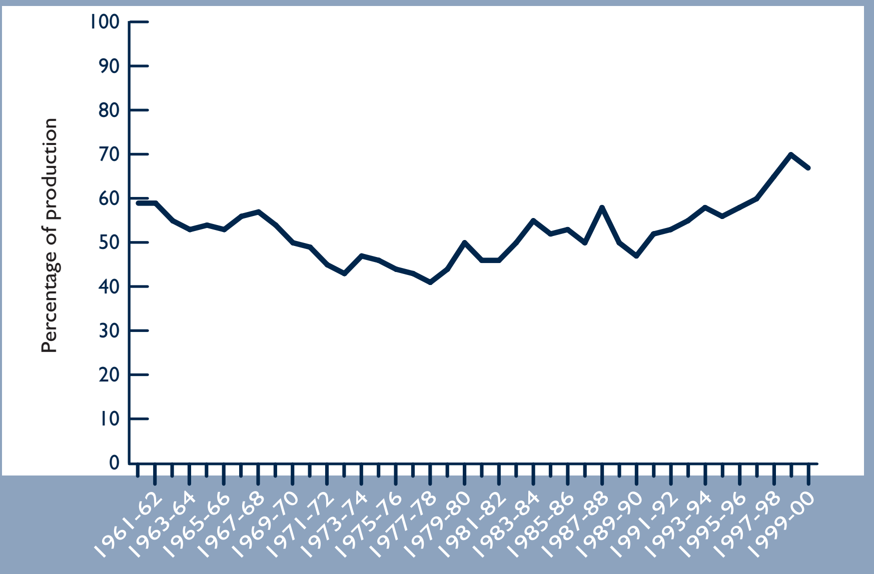
Sources: Appendix Tables VII.3 and VII.4.

FIGURE 7.31 NSW RAIL SHARE OF FERTILISERS



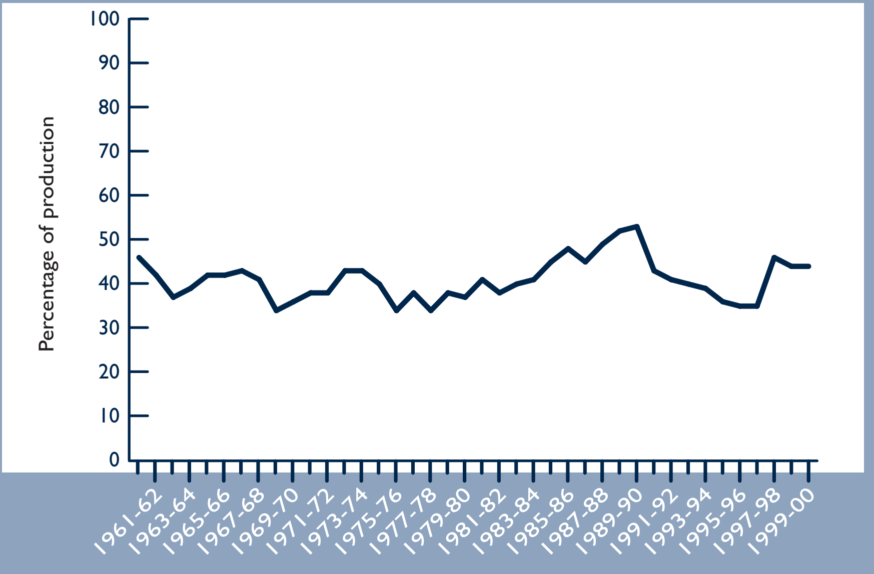
Sources: Appendix Tables VII.3 and VII.4.

FIGURE 7.32 NSW RAIL SHARE OF COAL



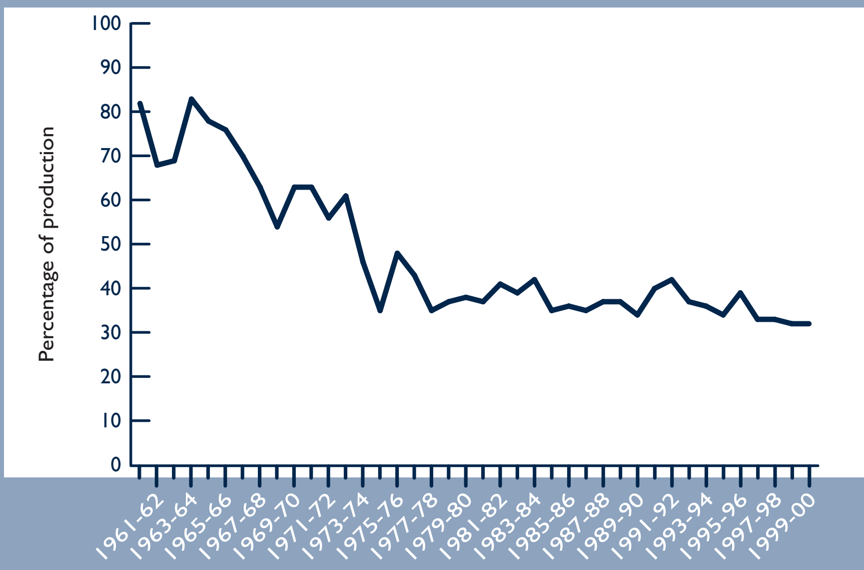
Sources: Appendix Tables VII.3 and VII.4.

FIGURE 7.33 NSW RAIL SHARE OF OTHER MINERALS



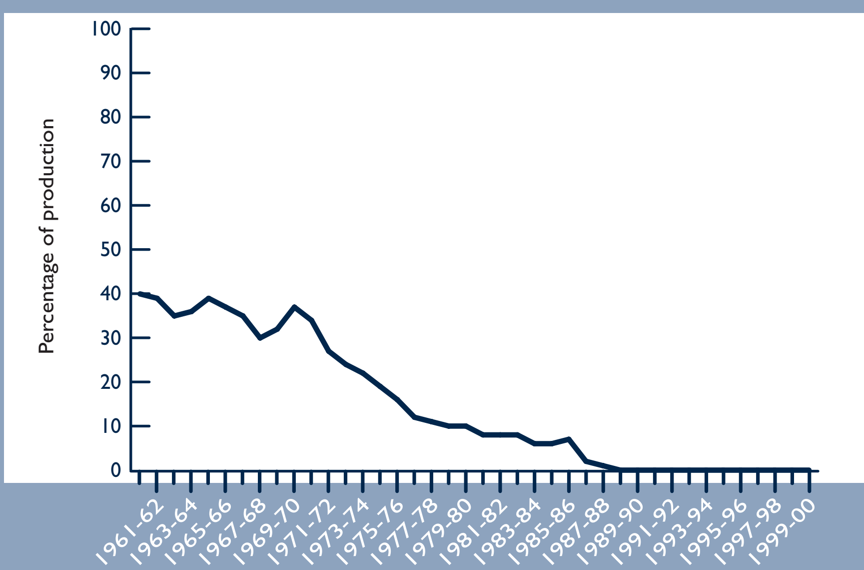
Sources: Appendix Tables VII.3 and VII.4.

FIGURE 7.34 NSW RAIL SHARE OF CEMENT



Sources: Appendix Tables VII.3 and VII.4.

FIGURE 7.35 NSW RAIL SHARE OF TIMBER



Sources: Appendix Tables VII.3 and VII.4.

Queensland

The production and rail freight graphs—Figures 7.36 to 7.43—show that:

- All commodity production is increasing.
- The largest and fastest-growing production tonnages are in Coal and Other minerals, followed by Other agriculture.
- Rail tonnages are growing in Coal, Other minerals and Grains only. Rail tonnages for cement have increased slightly.

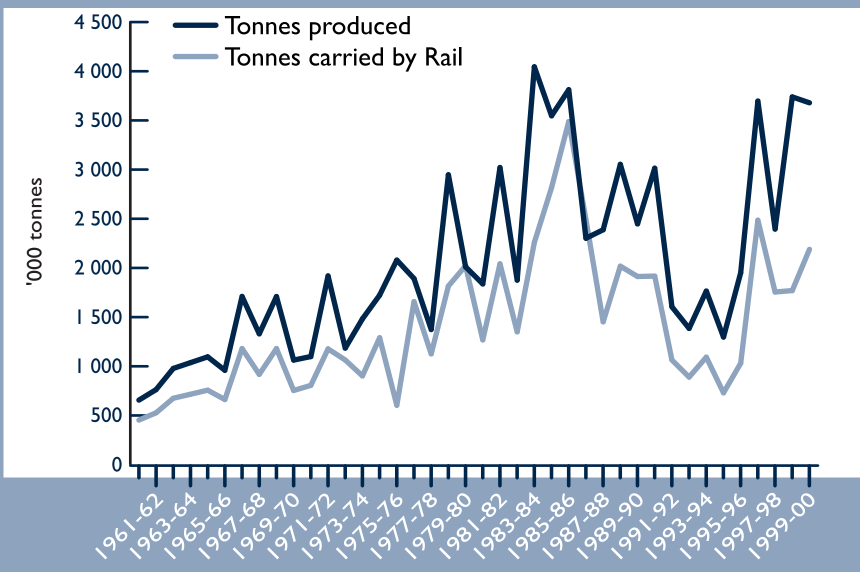
The rail mode share graphs—Figures 7.44 to 7.51—show that:

- Although commodity production is increasing across the board, rail is only increasing its carriage share for Coal and Other minerals.
- In all other commodities rail has either steadily lost mode share—sometimes purposefully, as the traffic becomes non-profitable—or maintained a constant share.

Considered individually, the share graphs show that:

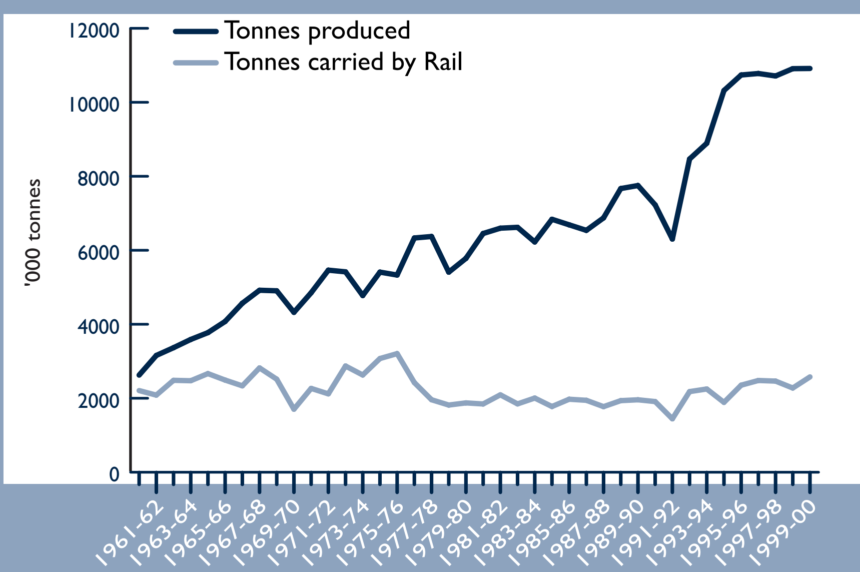
- Grain fluctuates with production, but has dropped from 65 per cent rail to 60 per cent between 1960–61 and 1999–2000.
- Other agriculture has fallen from 85 per cent rail to 25 per cent between 1960–61 and 1999–2000. This is partially attributable to the expansion in production of crops that are more difficult to transport by rail than grain crops.
- Livestock has decreased from 85 per cent rail to below 30 per cent between 1960–61 and 1999–2000.
- Fertiliser has decreased from 60 per cent rail to less than 10 per cent between 1960–61 and 1999–2000.
- Coal has been steadily increasing—from 55 per cent rail to 95 per cent between 1960–61 and 1999–2000. This is one of the major and growing traffics of which rail seems assured the dominant share.
- Other minerals experienced two major decreases—between 1960 and1970 and in the early 1990s. The share of other minerals has since increased to 95 per cent and the slow growth seems likely to continue. This is another major and growing traffic of which rail seems assured the dominant share.
- Cement has fluctuated around a constant 15 per cent rail.
- Timber has steadily decreased from around 60 per cent rail in 1960–61 to five per cent in 1999–2000.

FIGURE 7.36 QLD GRAINS PRODUCTION AND RAIL CARRIAGE



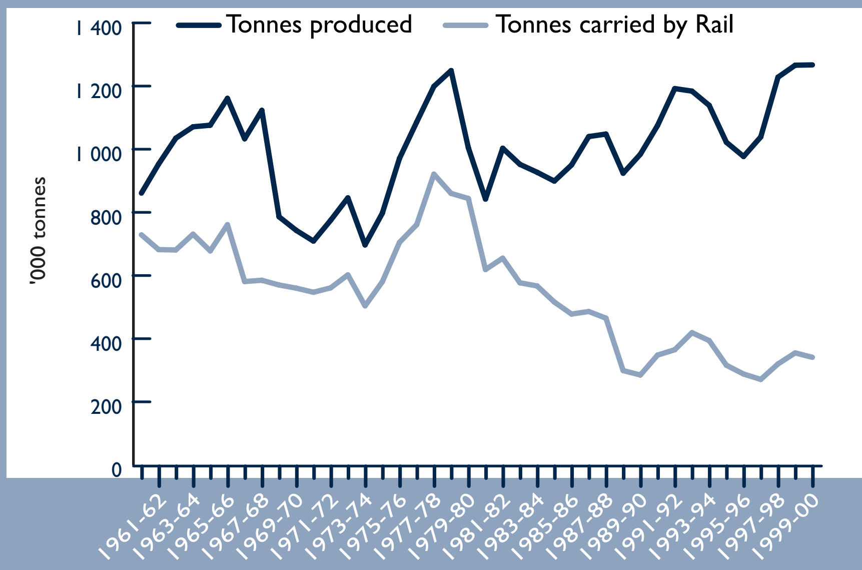
Sources: Appendix Tables VII.5 and VII.6.

FIGURE 7.37 OTHER AGRICULTURE PRODUCTION AND RAIL CARRIAGE—QLD



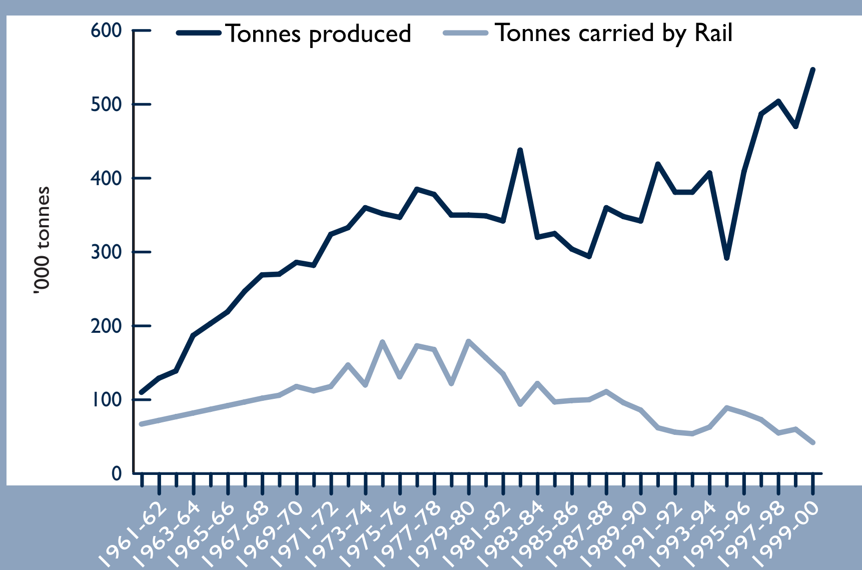
Sources: Appendix Tables VII.5 and VII.6.

FIGURE 7.38 QLD LIVESTOCK PRODUCTION AND RAIL CARRIAGE



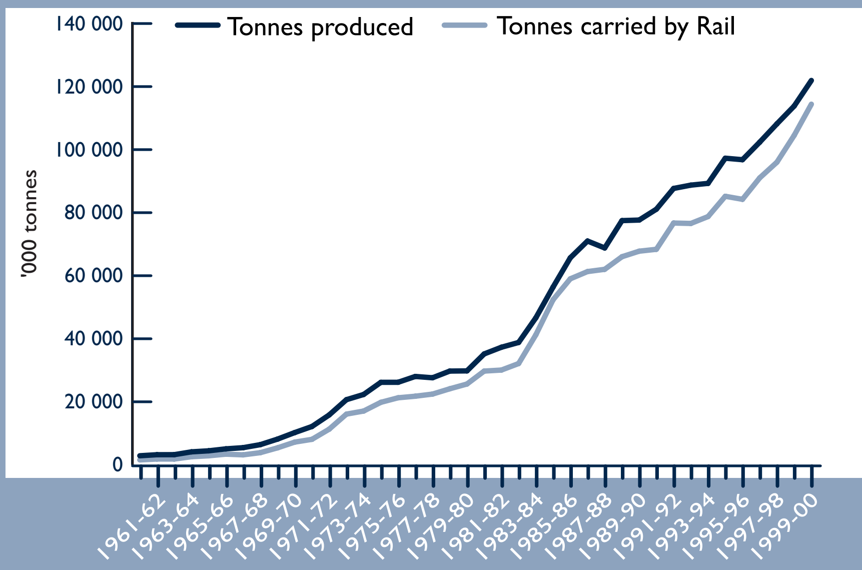
Sources: Appendix Tables VII.5 and VII.6.

FIGURE 7.39 QLD FERTILISERS PRODUCTION AND RAIL CARRIAGE



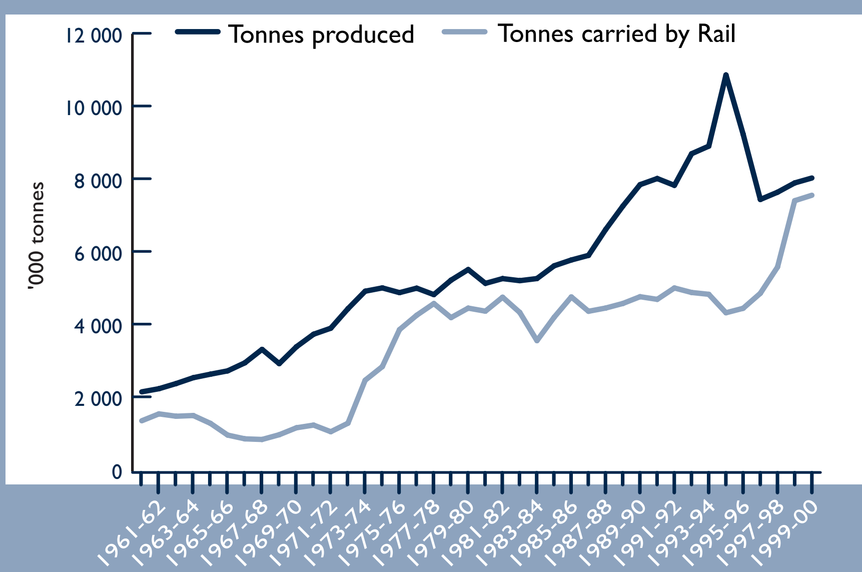
Sources: Appendix Tables VII.5 and VII.6.

FIGURE 7.40 QLD COAL PRODUCTION AND RAIL CARRIAGE



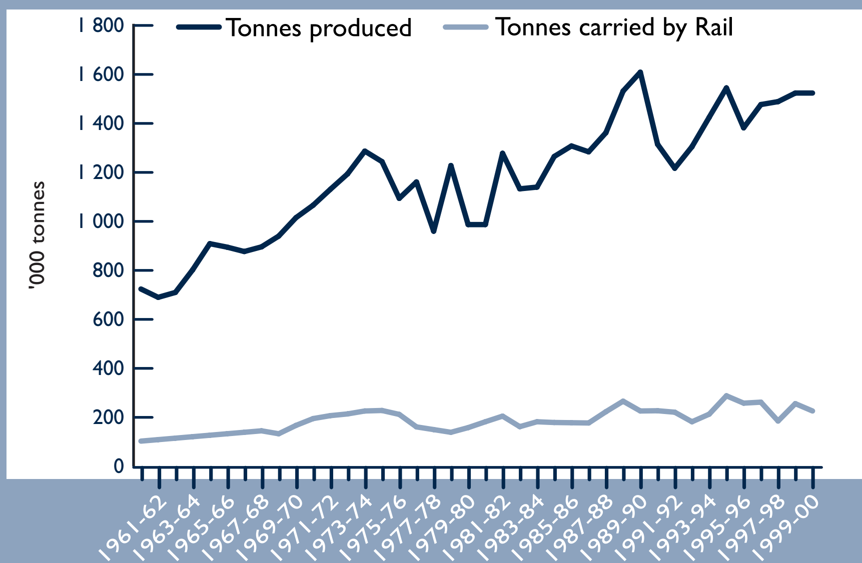
Sources: Appendix Tables VII.5 and VII.6.

FIGURE 7.41 OTHER MINERALS PRODUCTION AND RAIL CARRIAGE—QLD



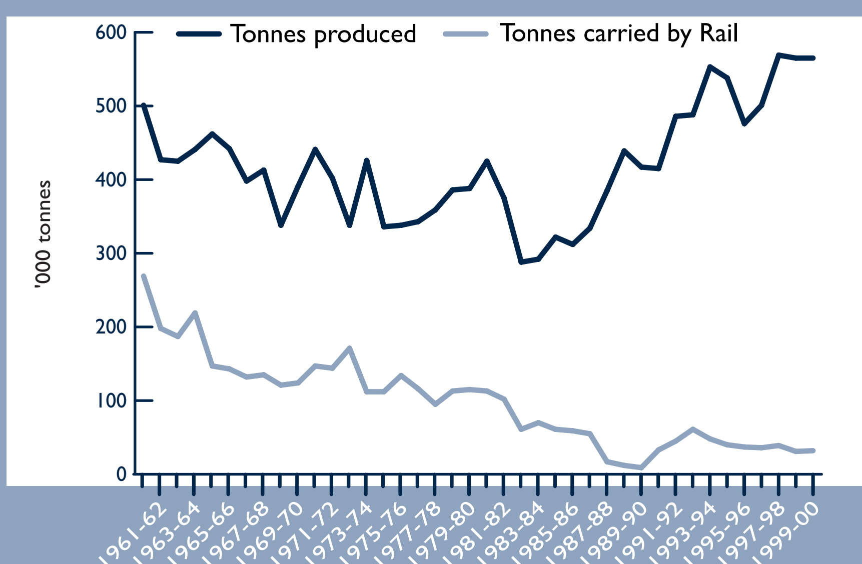
Sources: Appendix Tables VII.5 and VII.6.

FIGURE 7.42 QLD CEMENT PRODUCTION AND RAIL CARRIAGE



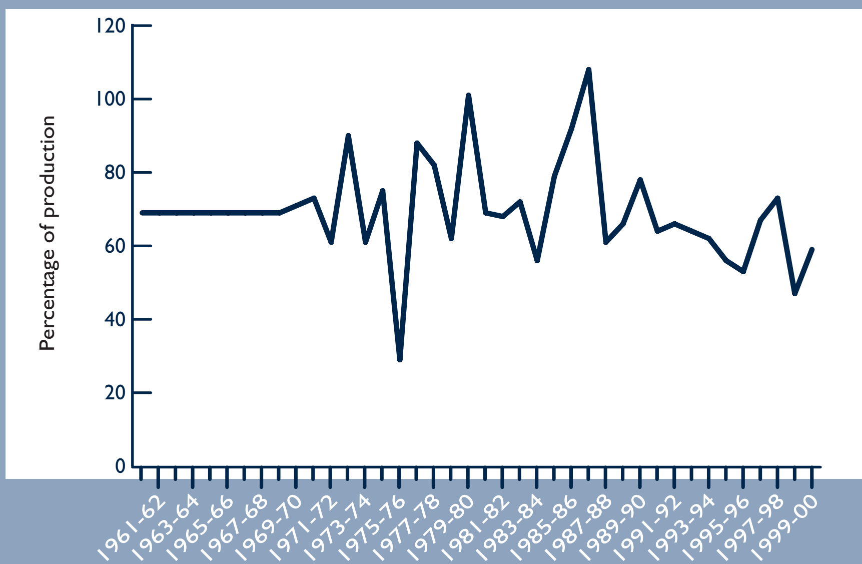
Sources: Appendix Tables VII.5 and VII.6.

FIGURE 7.43 QLD TIMBER PRODUCTION AND RAIL CARRIAGE



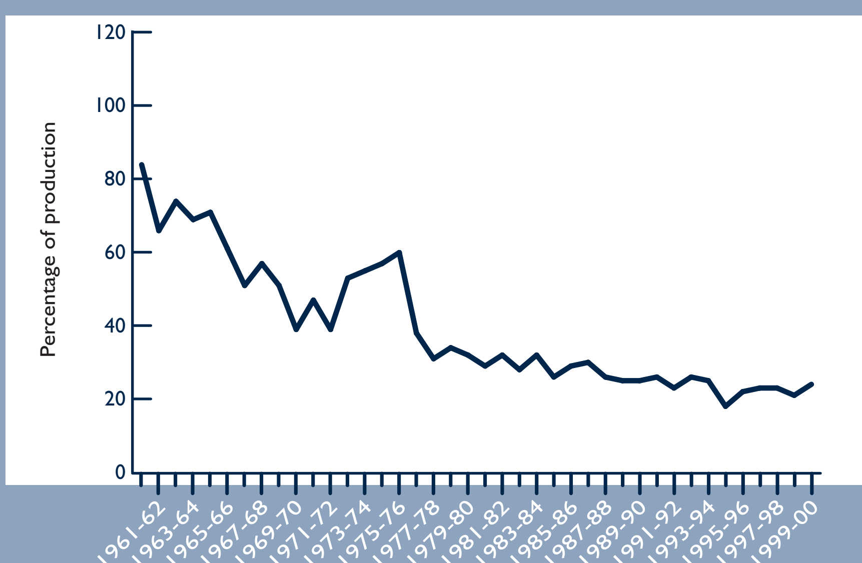
Sources: Appendix Tables VII.5 and VII.6.

FIGURE 7.44 QLD RAIL SHARE OF GRAINS



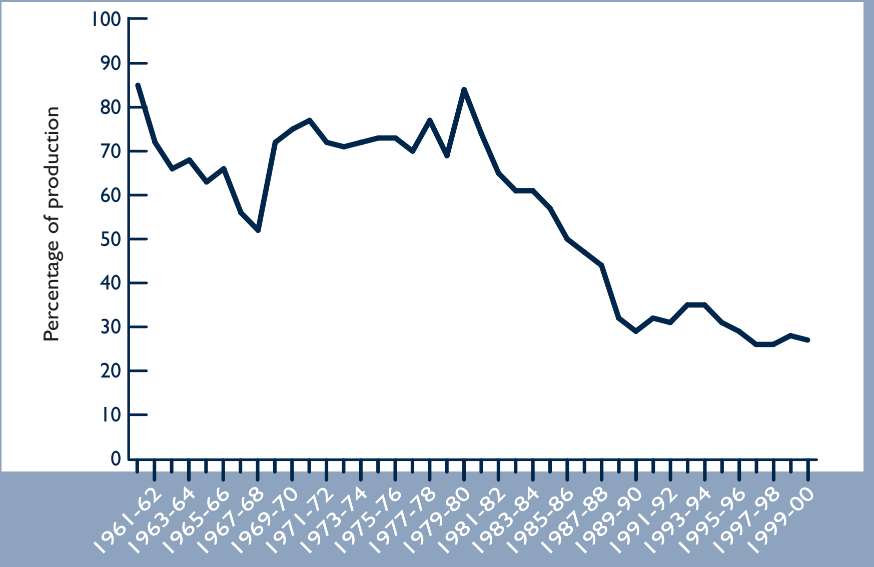
Sources: Appendix Tables VII.5 and VII.6.

FIGURE 7.45 QLD RAIL SHARE OF OTHER AGRICULTURE



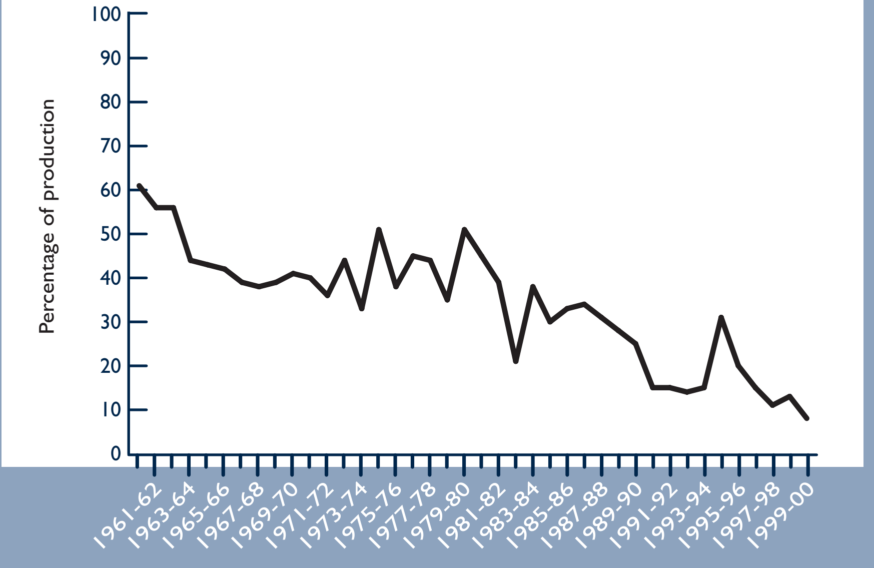
Sources: Appendix Tables VII.5 and VII.6.

FIGURE 7.46 QLD RAIL SHARE OF LIVESTOCK



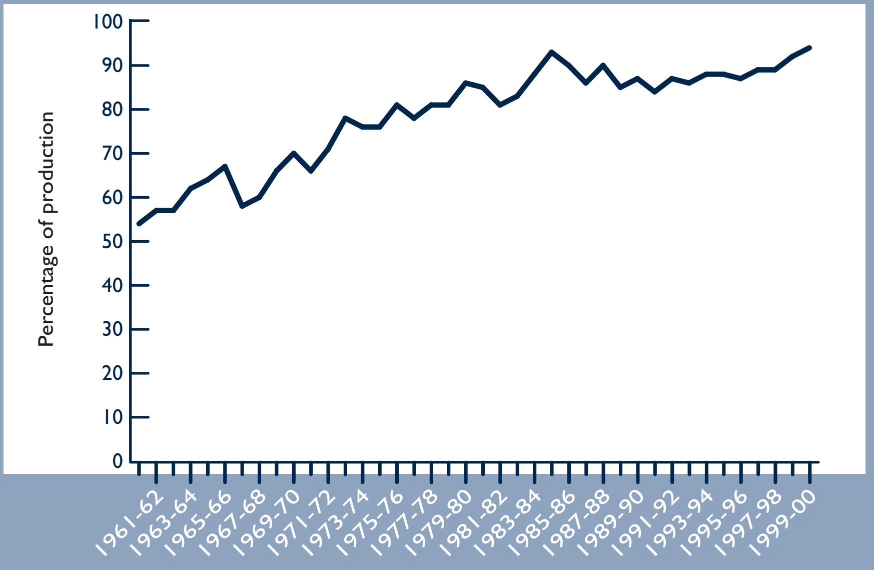
Sources: Appendix Tables VII.5 and VII.6.

FIGURE 7.47 QLD RAIL SHARE OF FERTILISERS



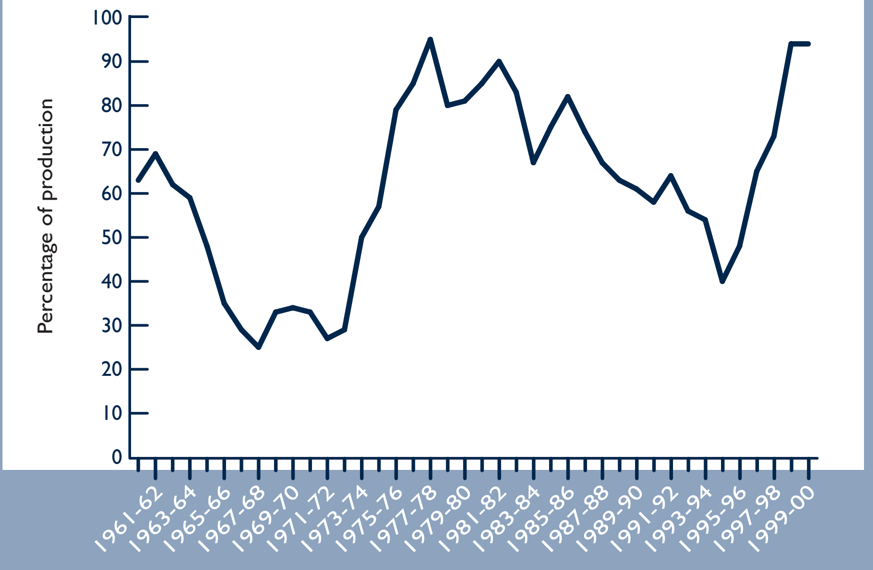
Sources: Appendix Tables VII.5 and VII.6.

FIGURE 7.48 QLD RAIL SHARE OF COAL



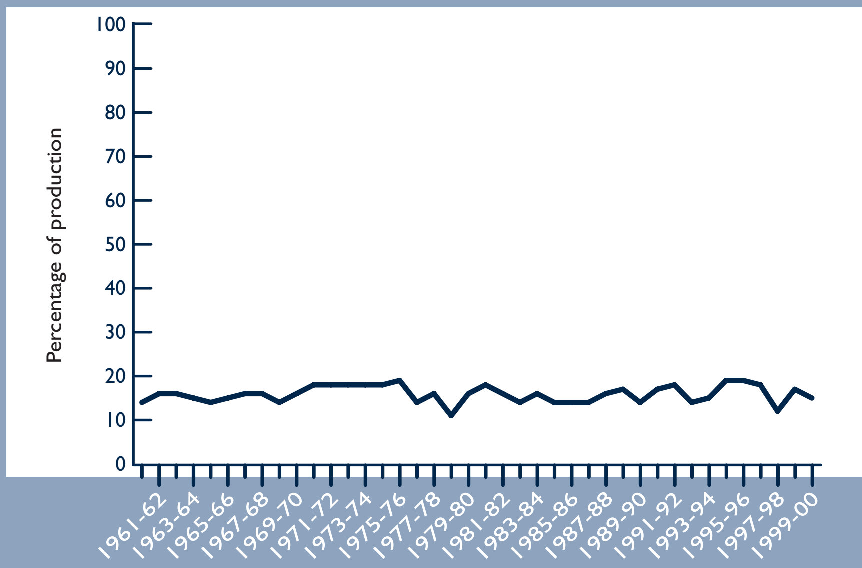
Sources: Appendix Tables VII.5 and VII.6.

FIGURE 7.49 QLD RAIL SHARE OF OTHER MINERALS



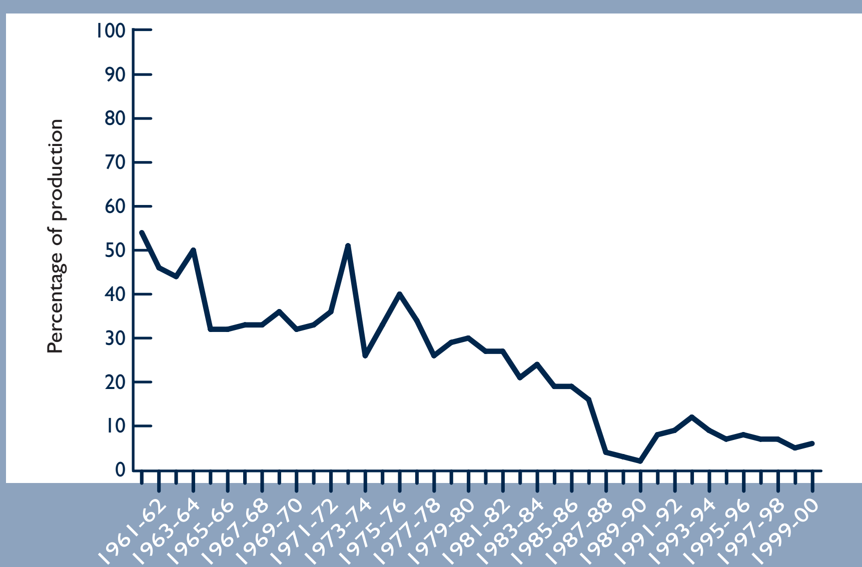
Sources: Appendix Tables VII.5 and VII.6.

FIGURE 7.50 QLD RAIL SHARE OF CEMENT



Sources: Appendix Tables VII.5 and VII.6.

FIGURE 7.51 QLD RAIL SHARE OF TIMBER



Sources: Appendix Tables VII.5 and VII.6.

Victoria

The production and rail freight graphs—Figures 7.52 to 7.59— show that:

- All commodity production, except Coal, is increasing.
- The largest and fastest-growing production tonnages are in Other minerals.
- Rail tonnages are growing in Other minerals only.

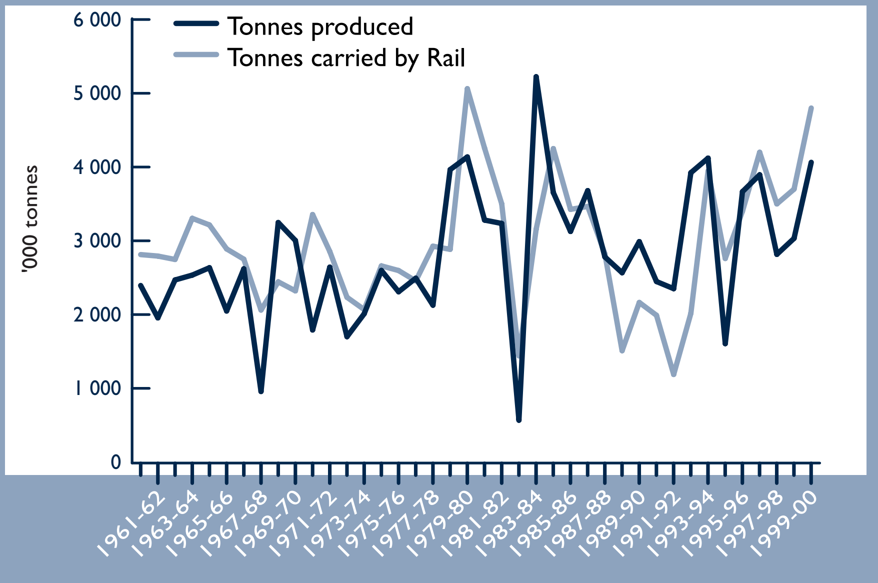
The rail mode share graphs—Figures 7.60 to 7.67— show that:

- Rail is maintaining its share of the carriage of a growing production only in Other minerals.
- In all other commodities, rail has steadily lost mode share—sometimes purposefully, as the traffic becomes non-profitable.

The share graphs show that:

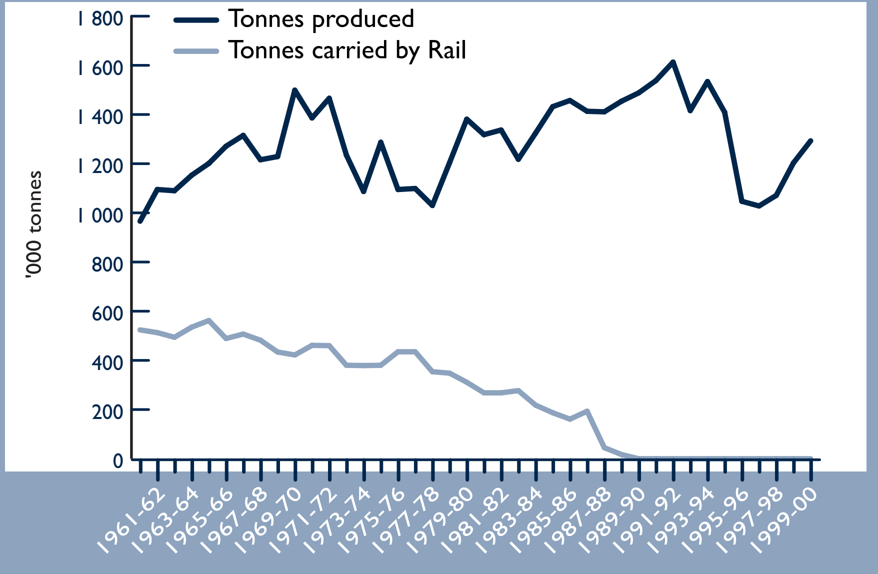
- Grain share railed fluctuates with production. Rail figures are sometimes higher than production because a portion of New South Wales Grains production is carried across the state border into Victoria by rail. This Grain is included in the Victorian rail carriage. Mode share has remained close to 100 per cent, with just a slight downward trend.
- Other agriculture has decreased from 55 per cent rail to no share between 1960–61 and 1999–2000.
- Livestock has decreased from 35 per cent rail to no share between 1960–61 and 1999–2000.
- Fertiliser has decreased from 95 per cent rail to less than five per cent between 1960–61 and 1999–2000.
- Coal has decreased from 100 per cent rail to 15 per cent between 1960–61 and 1999–2000. Both rail and production statistics include only brown coal briquettes. Most of Victoria's brown coal is burnt on site, and thus not manufactured into briquettes.
- Other minerals has fluctuated between 10 and 25 per cent rail. Currently rail maintains about a 15 per cent share. This is a major and growing traffic of which rail seems assured at least a continuing share.
- Cement has steadily decreased from 65 per cent rail to 15 per cent between 1960–61 and 1999–2000.
- Timber has steadily decreased from around 50 per cent rail to no share between 1960–61 and 1999–2000.

FIGURE 7.52 VIC GRAINS PRODUCTION AND RAIL CARRIAGE



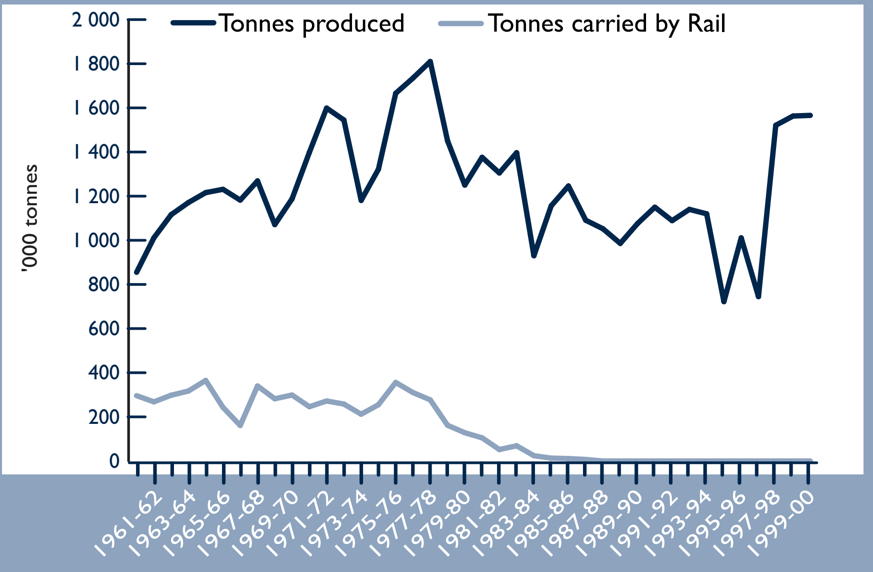
Sources: Appendix Tables VII.7 and VII.8.

FIGURE 7.53 OTHER AGRICULTURE PRODUCTION AND RAIL CARRIAGE—VIC



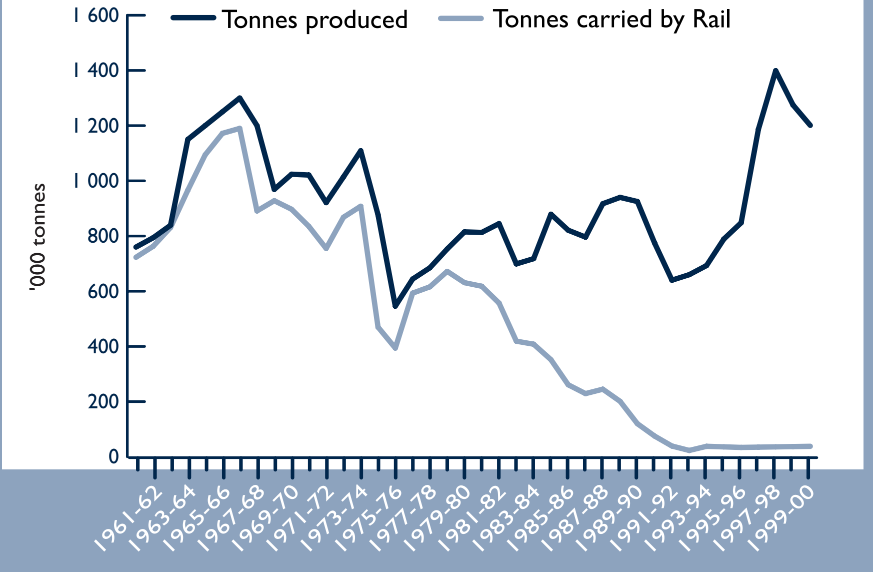
Sources: Appendix Tables VII.7 and VII.8.

FIGURE 7.54 VIC LIVESTOCK PRODUCTION AND RAIL CARRIAGE



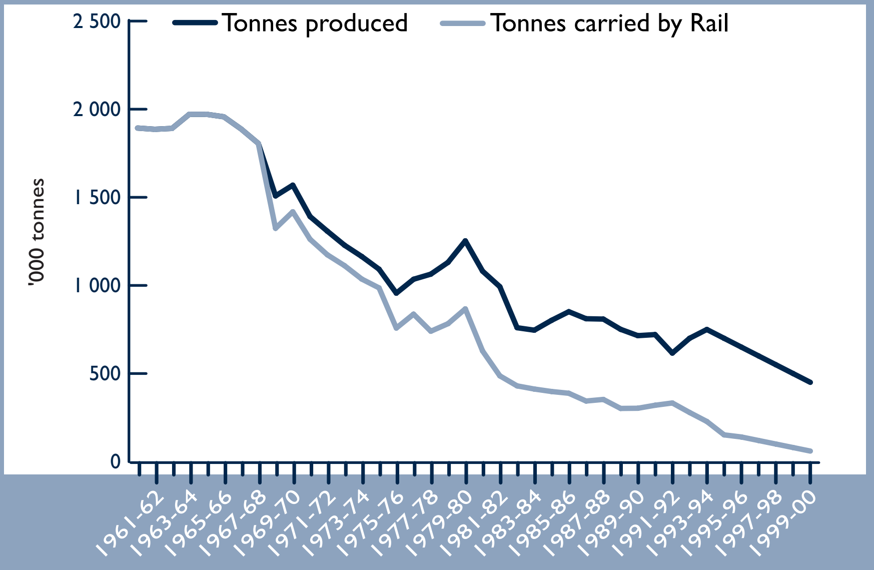
Sources: Appendix Tables VII.7 and VII.8.

FIGURE 7.55 VIC FERTILISERS PRODUCTION AND RAIL CARRIAGE



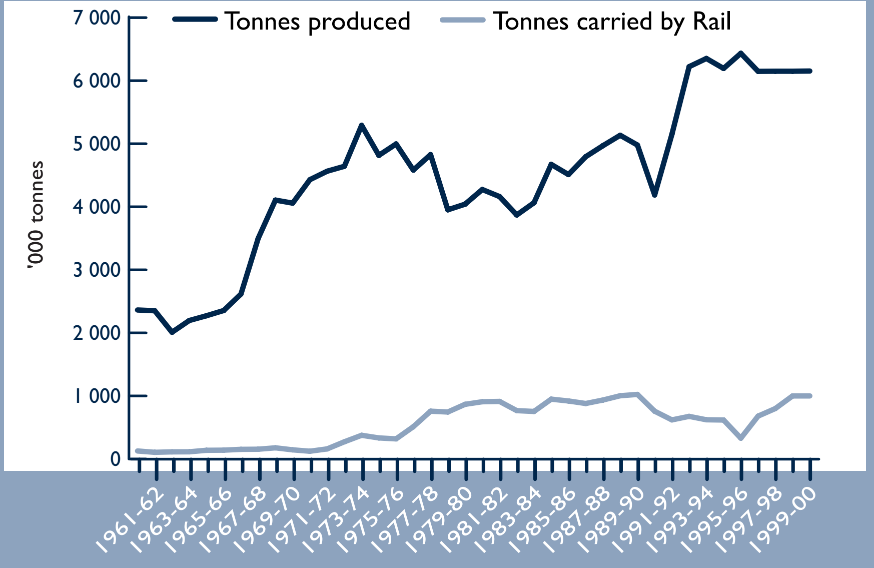
Sources: Appendix Tables VII.7 and VII.8.

FIGURE 7.56 VIC COAL PRODUCTION AND RAIL CARRIAGE



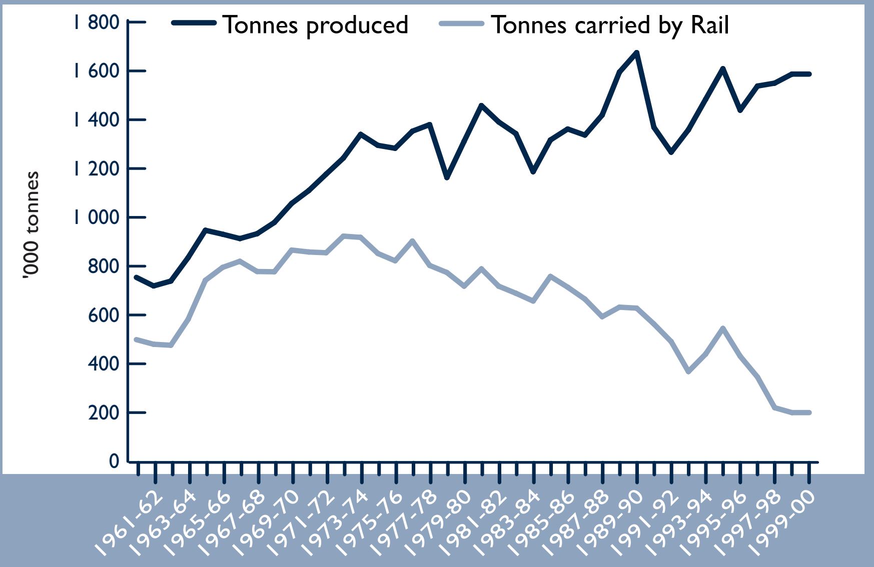
Sources: Appendix Tables VII.7 and VII.8.

FIGURE 7.57 OTHER MINERALS PRODUCTION AND RAIL CARRIAGE—VIC



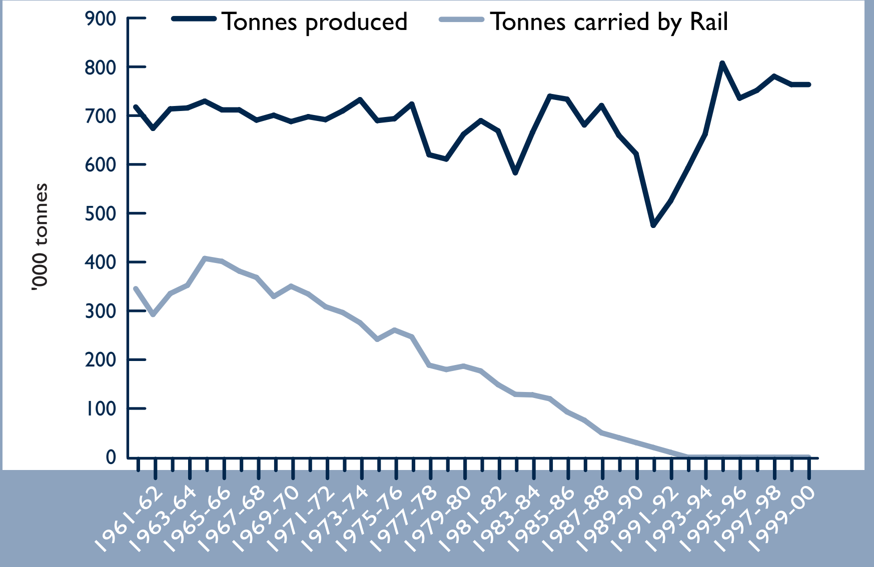
Sources: Appendix Tables VII.7 and VII.8.

FIGURE 7.58 VIC CEMENT PRODUCTION AND RAIL CARRIAGE



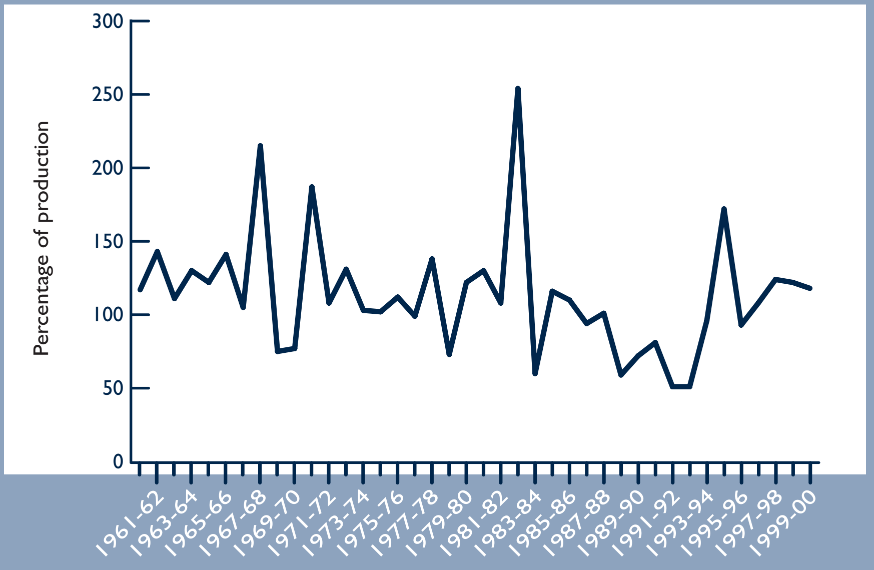
Sources: Appendix Tables VII.7 and VII.8.

FIGURE 7.59 VIC TIMBER PRODUCTION AND RAIL CARRIAGE



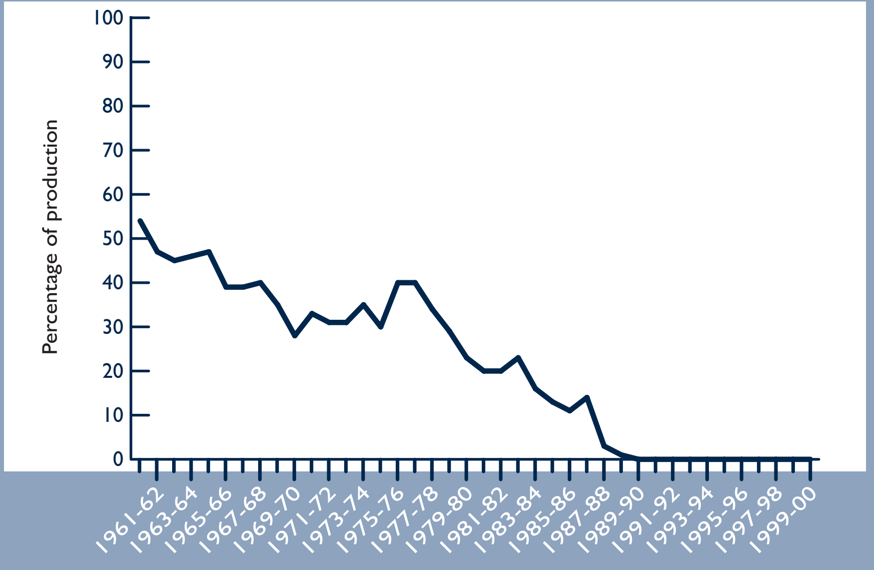
Sources: Appendix Tables VII.7 and VII.8.

FIGURE 7.60 VIC RAIL SHARE OF GRAINS



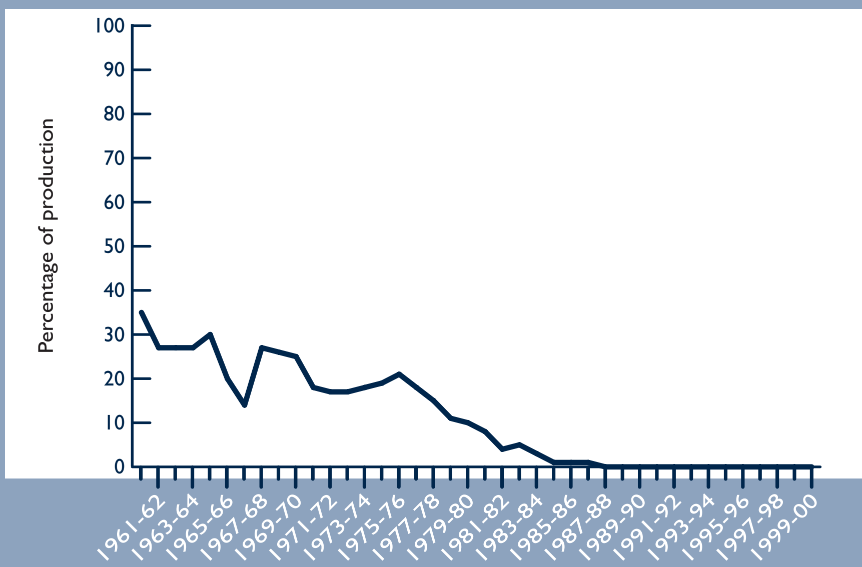
Sources: Appendix Tables VII.7 and VII.8.

FIGURE 7.61 VIC RAIL SHARE OF OTHER AGRICULTURE



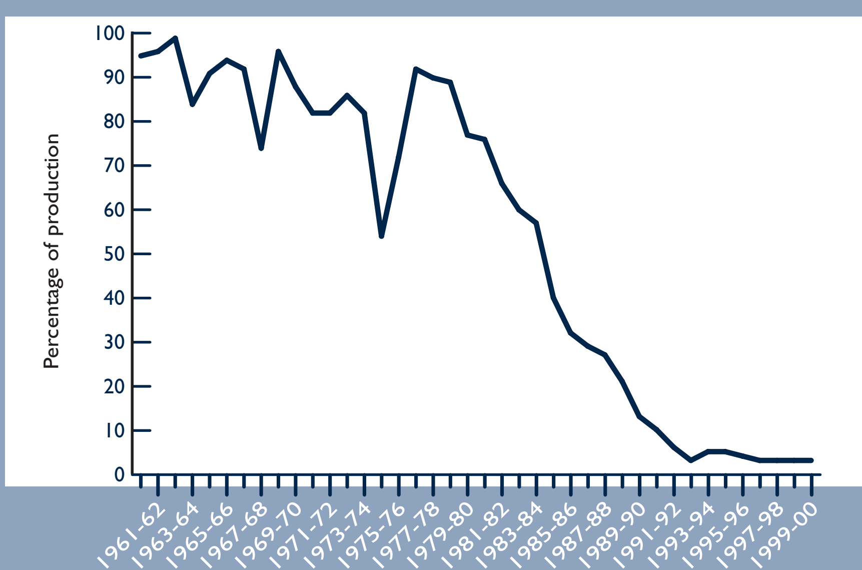
Sources: Appendix Tables VII.7 and VII.8.

FIGURE 7.62 VIC RAIL SHARE OF LIVESTOCK



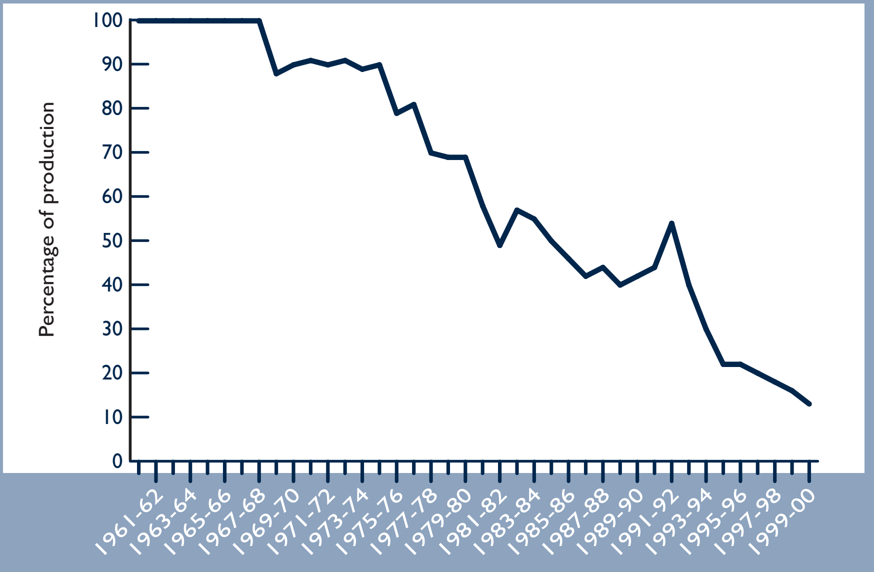
Sources: Appendix Tables VII.7 and VII.8.

FIGURE 7.63 VIC RAIL SHARE OF FERTILISERS



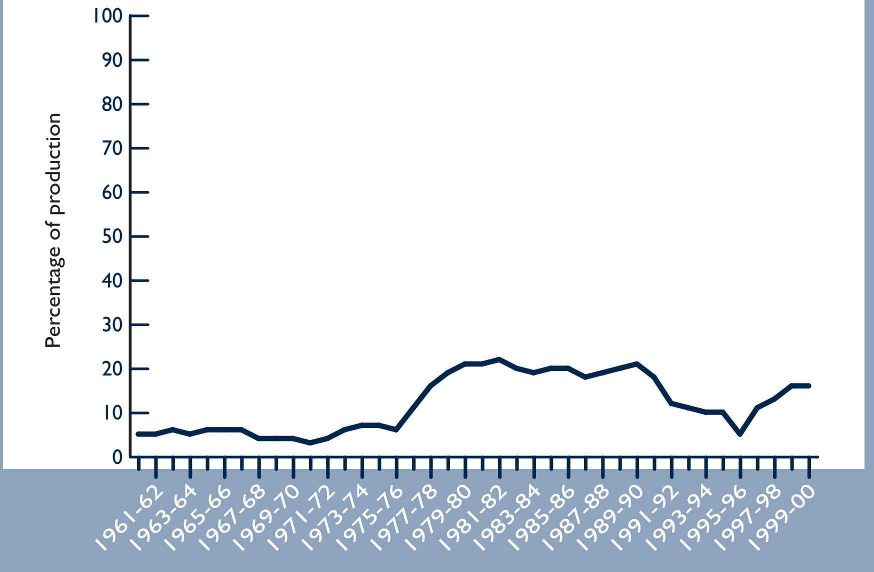
Sources: Appendix Tables VII.7 and VII.8.

FIGURE 7.64 VIC RAIL SHARE OF COAL



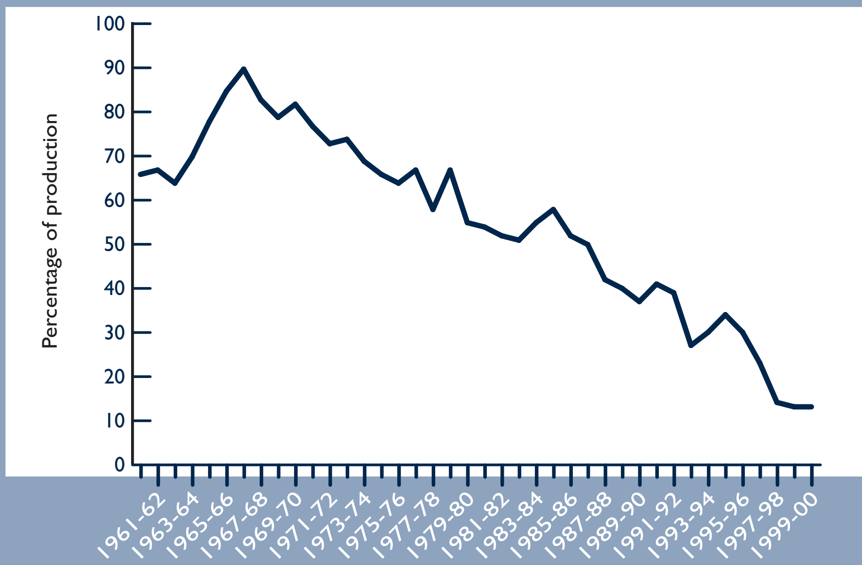
Sources: Appendix Tables VII.7 and VII.8.

FIGURE 7.65 VIC RAIL SHARE OF OTHER MINERALS



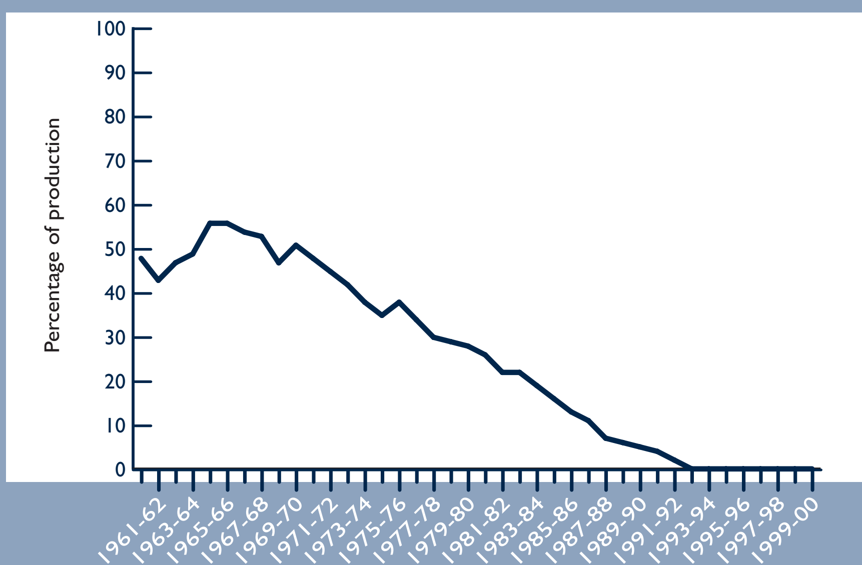
Sources: Appendix Tables VII.7 and VII.8.

FIGURE 7.66 VIC RAIL SHARE OF CEMENT



Sources: Appendix Tables VII.7 and VII.8.

FIGURE 7.67 VIC RAIL SHARE OF TIMBER



Sources: Appendix Tables VII.7 and VII.8.

Western Australia

The production and rail freight graphs—Figures 7.68 to 7.75 show that:

- All commodity production, except Timber, is increasing.
- The largest and fastest-growing production tonnages are in Other minerals and Coal, followed by Grains.
- Rail tonnages are increasing in Coal, Grains and Other minerals.

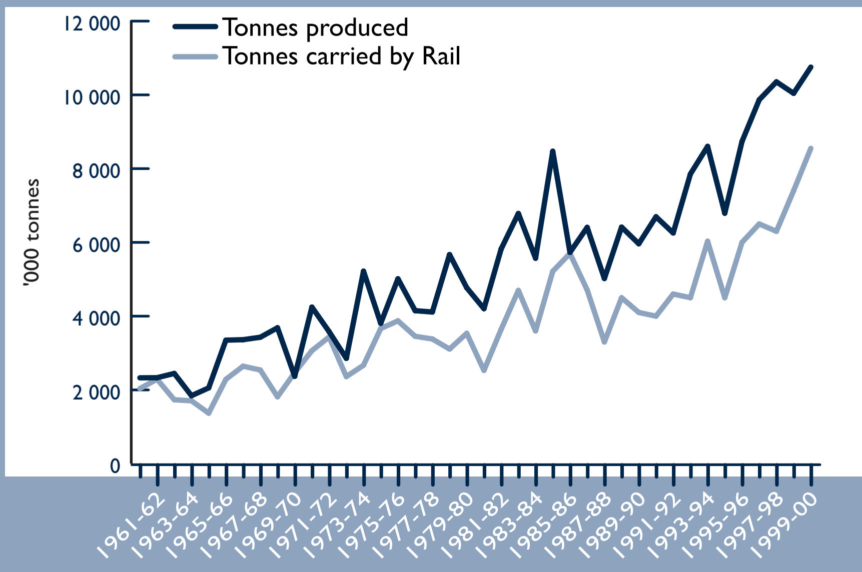
The rail mode share graphs—Figures 7.76 to 7.83—show that:

- Rail is maintaining its share of the carriage of a growing production in Other minerals only.
- In all other commodities, rail has either steadily lost mode share—sometimes purposefully, as the traffic becomes non-profitable—or maintained a relatively constant share.

The share graphs show that:

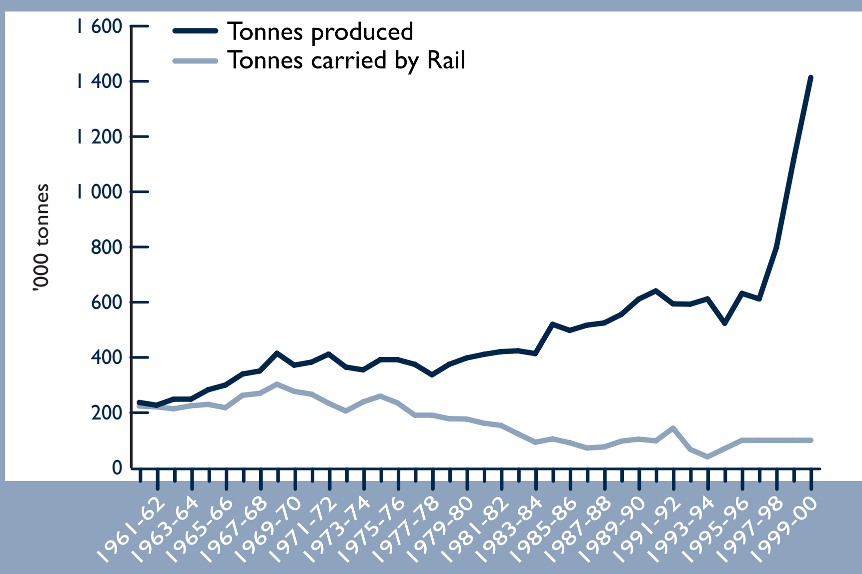
- Grain fluctuates with production but has decreased from 85 per cent rail to 70 per cent between 1960–61 and 1999–2000.
- Other agriculture has decreased consistently from 95 per cent to 10 per cent in 1999-00.
- Livestock has decreased from 65 per cent to no rail share between 1960–61 and 1999–2000.
- Fertiliser has decreased from 65 per cent rail to 10 per cent between 1960–61 and 1999–2000.
- Coal has fluctuated dramatically between 1960–61 and 1999–2000 and rail currently maintains a 45 per cent carriage share of coal production.
- Other minerals has fluctuated from 20 per cent rail to 55 per cent, between 1960–61 and 1999–2000.
- Cement has not been above 25 per cent between 1960–61 and 1999–2000 and rail currently carries less than five per cent of cement.
- Timber has steadily decreased from around 100 per cent in rail to 25 per cent between 1960–61 and 1999–2000.

FIGURE 7.68 WA GRAINS PRODUCTION AND RAIL CARRIAGE



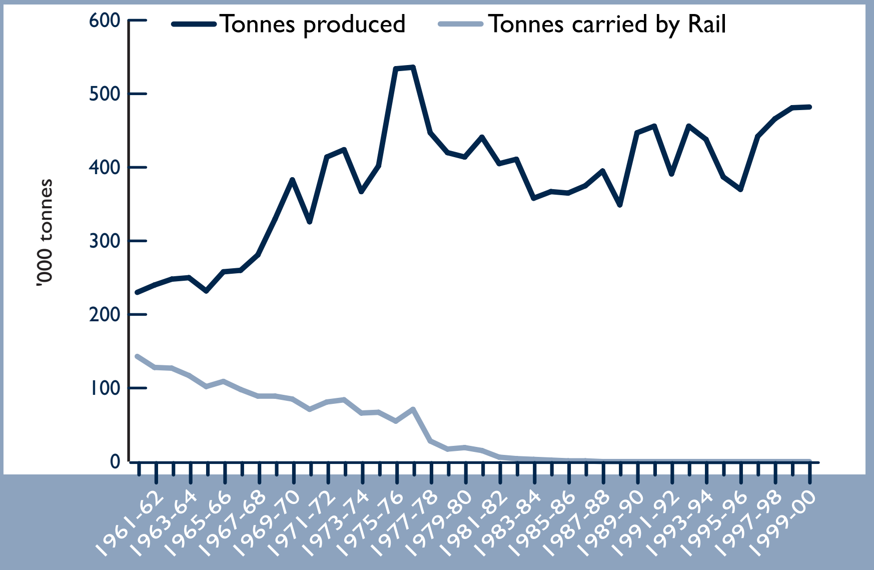
Sources: Appendix Tables VII.9 and VII.10.

FIGURE 7.69 OTHER AGRICULTURE PRODUCTION AND RAIL CARRIAGE—WA



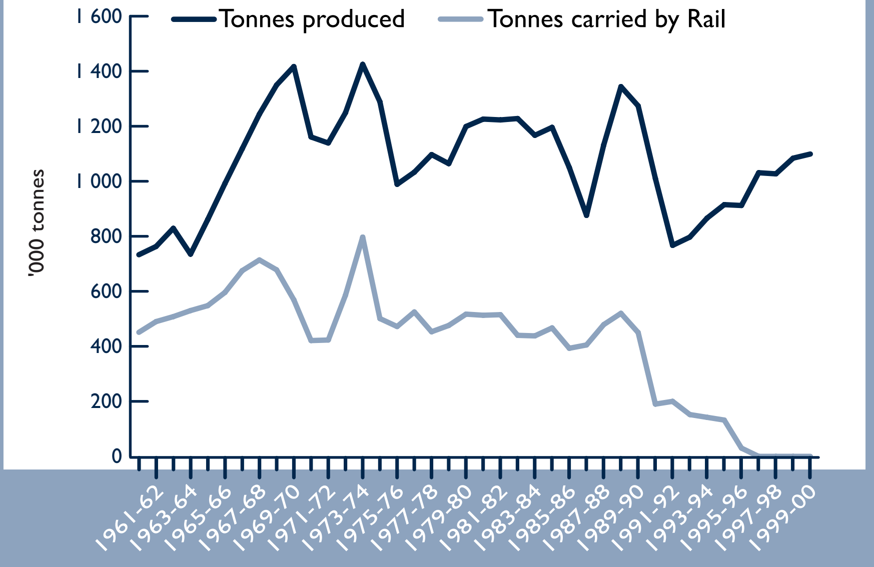
Sources: Appendix Tables VII.9 and VII.10.

FIGURE 7.70 WA LIVESTOCK PRODUCTION AND RAIL CARRIAGE



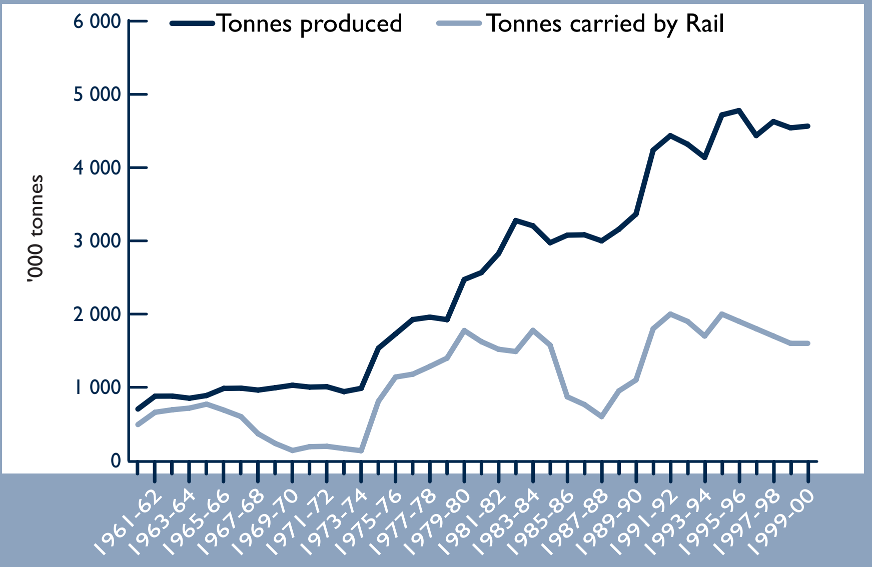
Sources: Appendix Tables VII.9 and VII.10.

FIGURE 7.71 WA FERTILISER PRODUCTION AND RAIL CARRIAGE



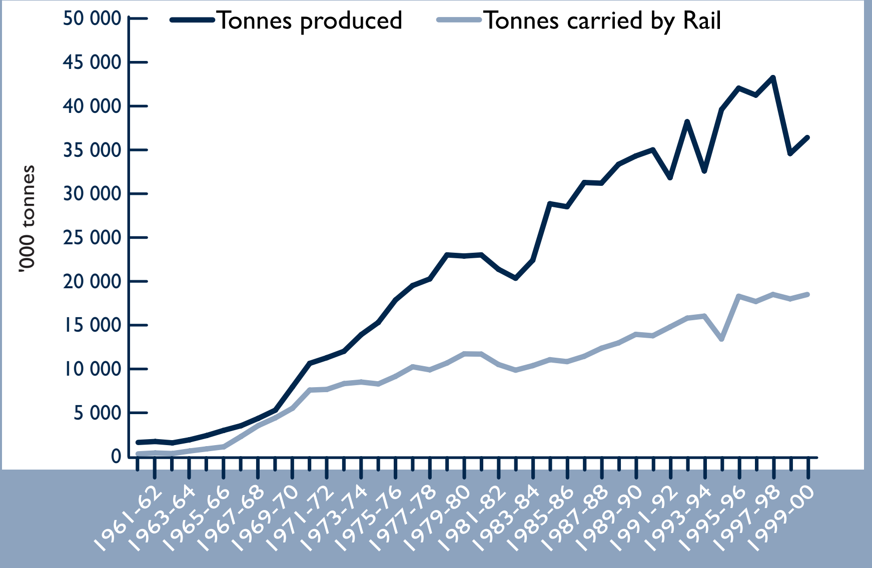
Sources: Appendix Tables VII.9 and VII.10.

FIGURE 7.72 WA COAL PRODUCTION AND RAIL CARRIAGE



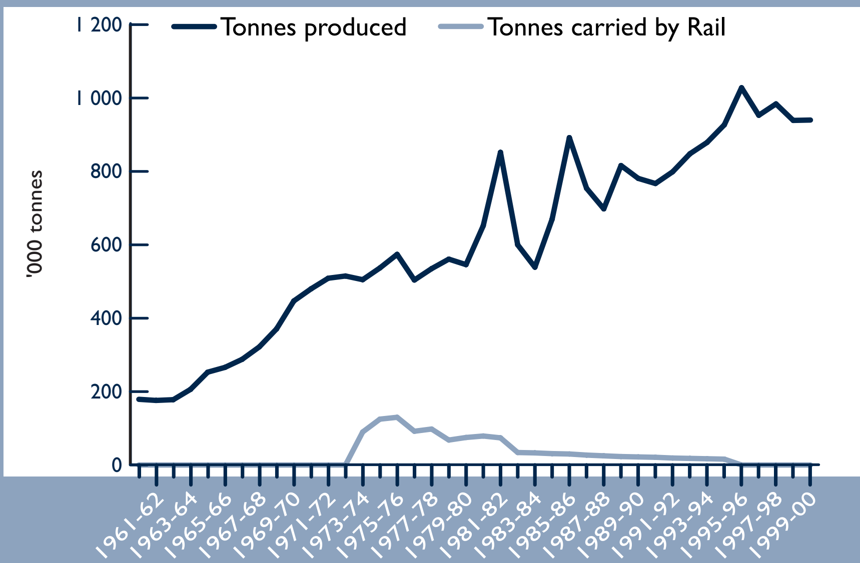
Sources: Appendix Tables VII.9 and VII.10.

FIGURE 7.73 OTHER MINERALS PRODUCTION AND RAIL CARRIAGE—WA



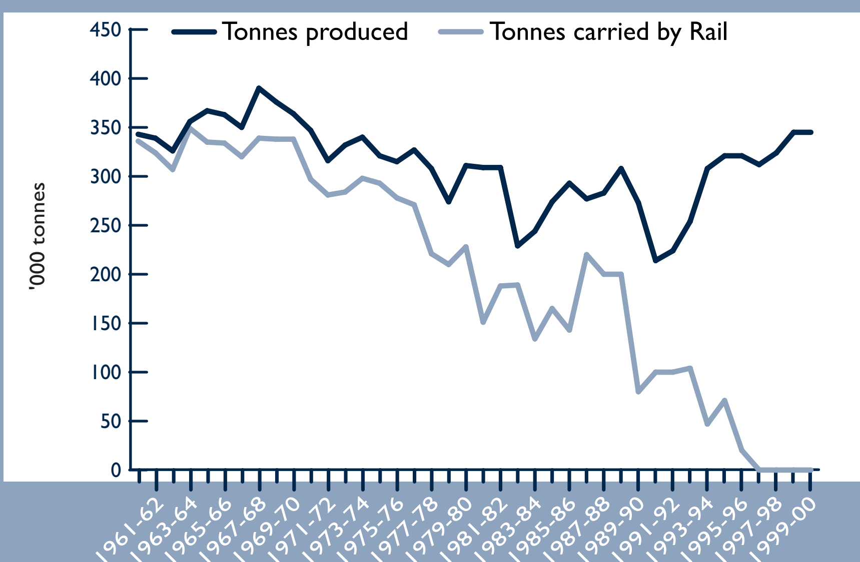
Sources: Appendix Tables VII.9 and VII.10.

FIGURE 7.74 WA CEMENT PRODUCTION AND RAIL CARRIAGE



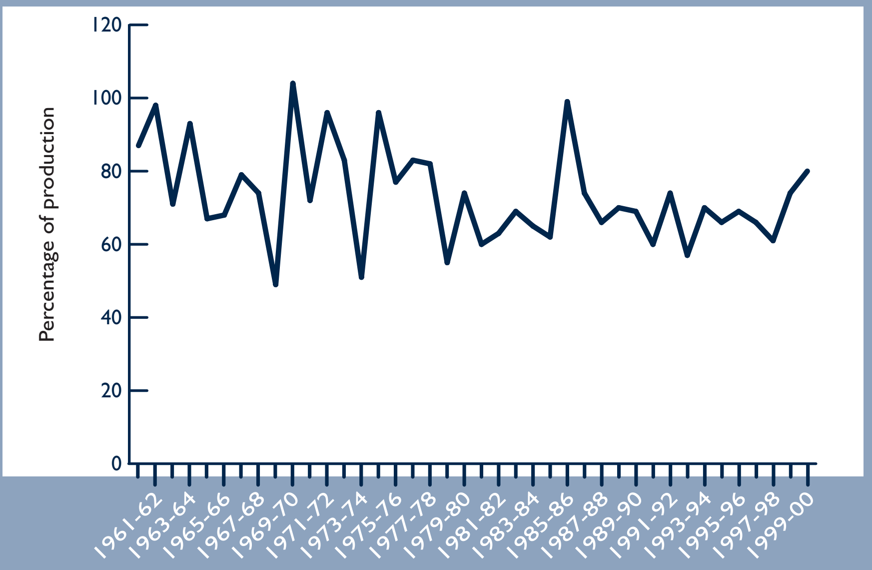
Sources: Appendix Tables VII.9 and VII.10.

FIGURE 7.75 WA TIMBER PRODUCTION AND RAIL CARRIAGE



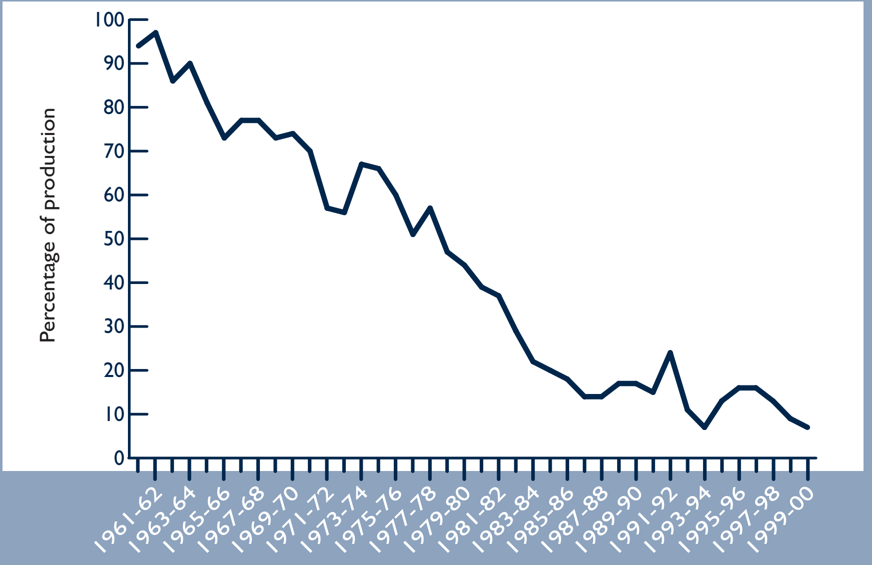
Sources: Appendix Tables VII.9 and VII.10.

FIGURE 7.76 WA RAIL SHARE OF GRAINS



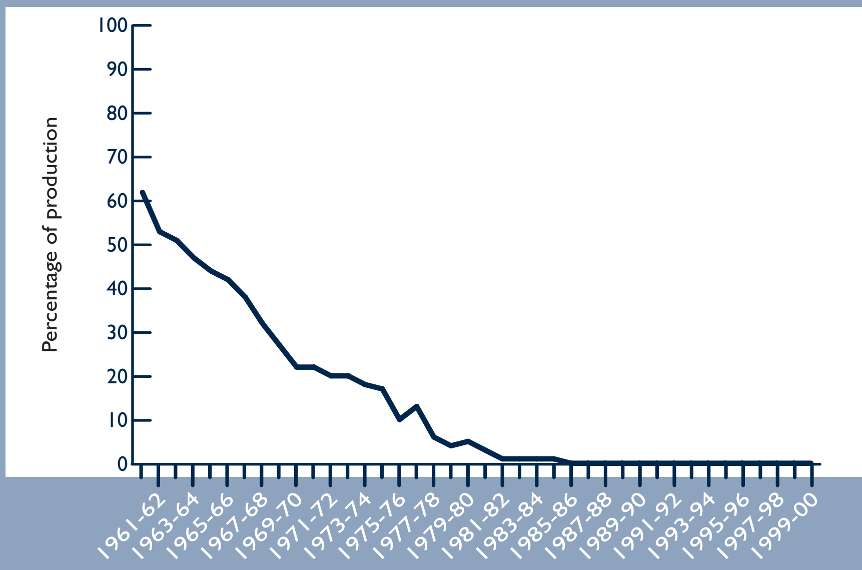
Sources: Appendix Tables VII.9 and VII.10.

FIGURE 7.77 WA RAIL SHARE OF OTHER AGRICULTURE



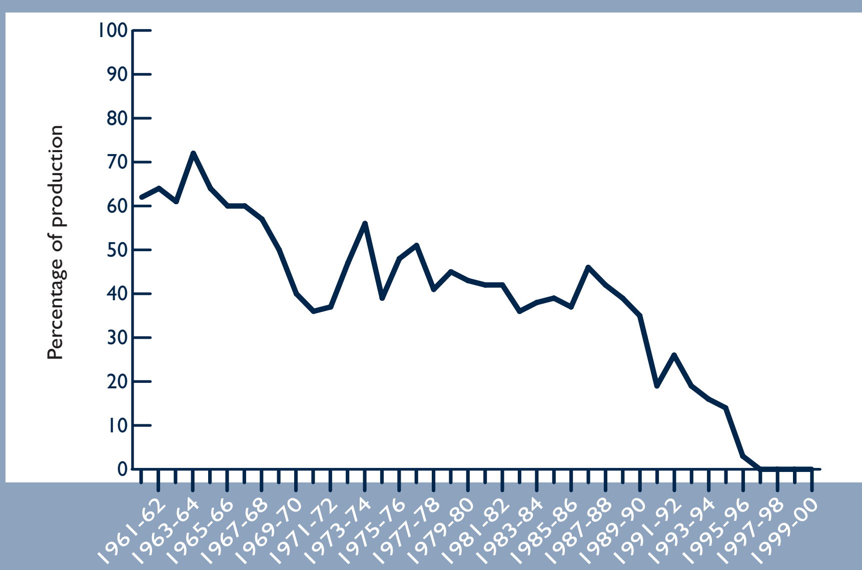
Sources: Appendix Tables VII.9 and VII.10.

FIGURE 7.78 WA RAIL SHARE OF LIVESTOCK



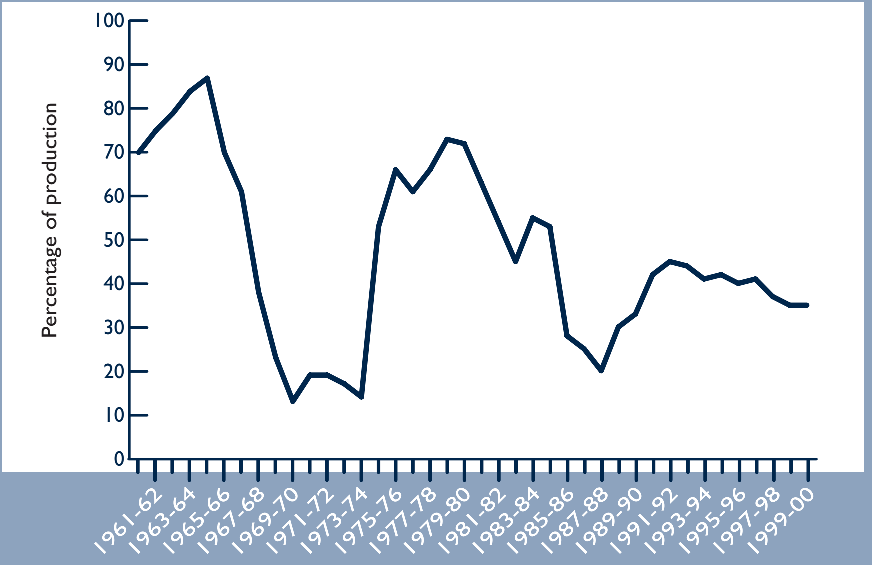
Sources: Appendix Tables VII.9 and VII.10.

FIGURE 7.79 WA RAIL SHARE OF FERTILISERS



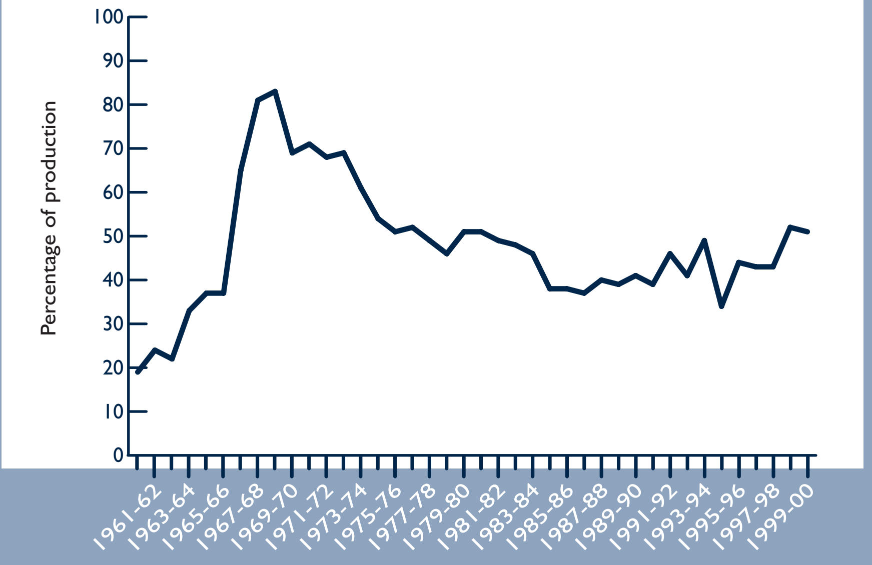
Sources: Appendix Tables VII.9 and VII.10.

FIGURE 7.80 WA RAIL SHARE OF COAL



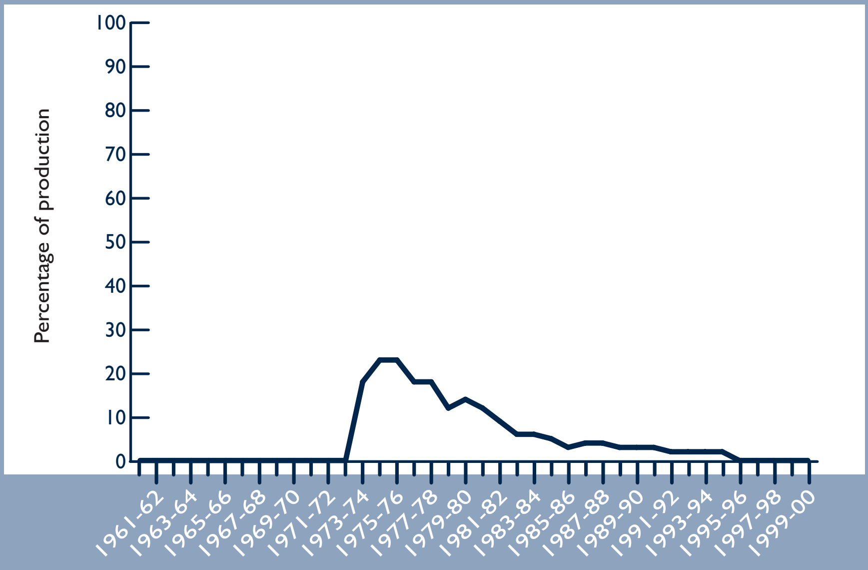
Sources: Appendix Tables VII.9 and VII.10.

FIGURE 7.81 WA RAIL SHARE OF OTHER MINERALS



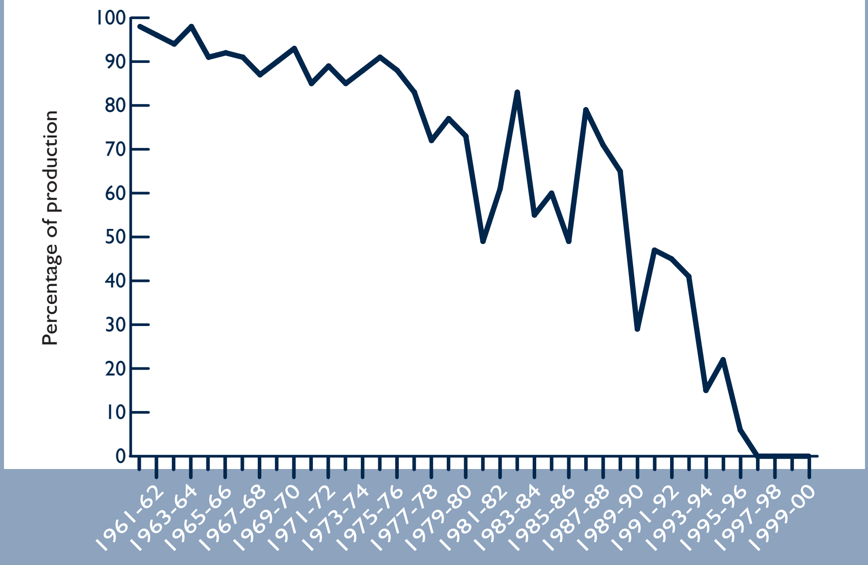
Sources: Appendix Tables VII.9 and VII.10.

FIGURE 7.82 WA RAIL SHARE OF CEMENT



Sources: Appendix Tables VII.9 and VII.10.

FIGURE 7.83 WA RAIL SHARE OF TIMBER



Sources: Appendix Tables VII.9 and VII.10.

South Australia

The production and rail freight graphs—Figures 7.84 to 7.91—show that:

- All commodity production, except Fertilisers, is increasing.
- The largest-growing production tonnage is in Other minerals. The fastest-growing production tonnage is in Other agriculture.
- Rail tonnages are increasing for Coal, Grains and Other minerals only.

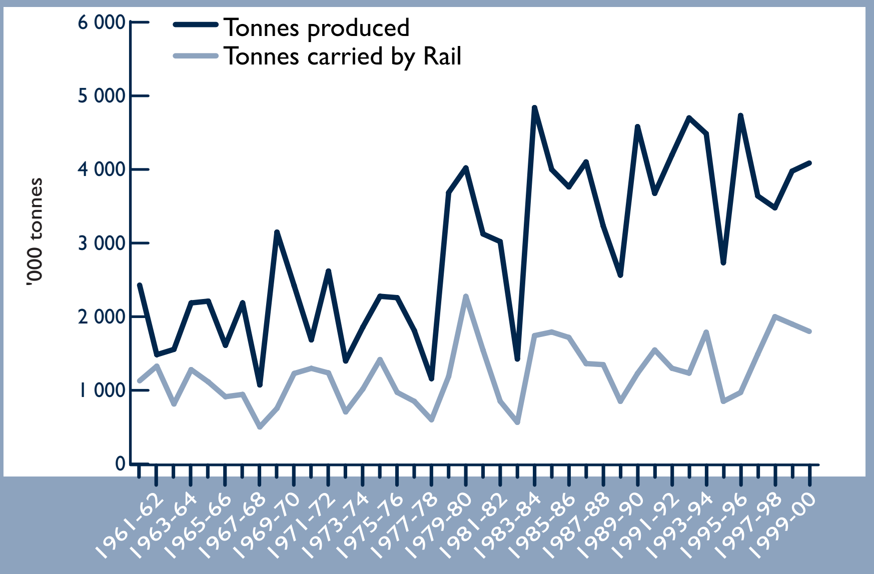
The rail mode share graphs—Figures 7.92 to 7.99—show that:

- In Coal and Other minerals rail is maintaining its share of the carriage of a growing production. Coal has decreased recently.
- In all other commodities, rail has either steadily lost mode share—sometimes purposefully, as the traffic becomes non-profitable—or maintained a constant share.

The share graphs individually show that:

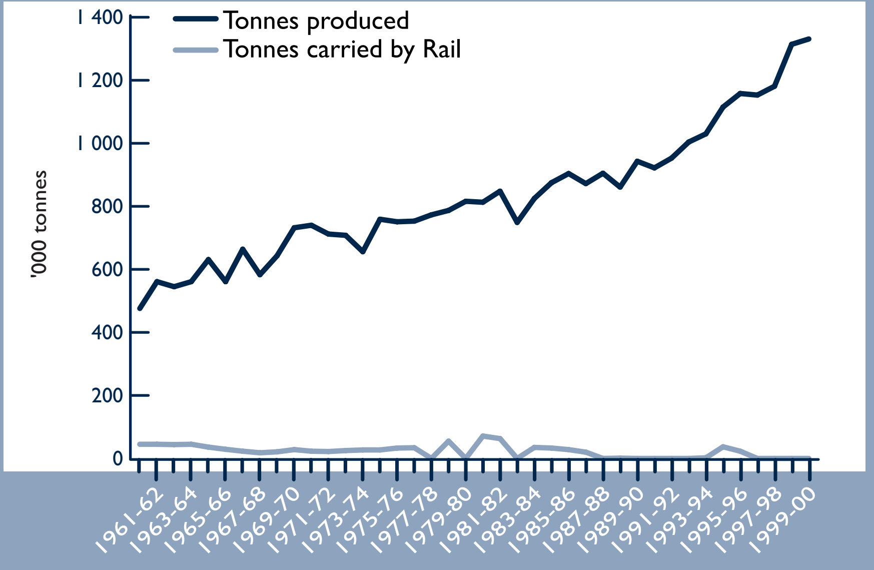
- Grain fluctuates with production but has decreased from 50 per cent rail to 45 per cent between 1960–61 and 1999–2000.
- Other agriculture has decreased from an initial 10 per cent to zero per cent between 1960–61 and 1999–2000.
- Livestock has decreased from 95 per cent rail to no share between 1960–61 and 1999–2000. The Livestock carriage figures may include some stock from New South Wales.
- Fertiliser has fluctuated markedly, but has decreased from 65 per cent rail to no share between 1960–61 and 1999–2000.
- Coal has followed production levels between 1960–61 and 1999–2000. Rail currently maintains a 90 per cent carriage share of coal production. As in the other states, coal production is growing and rail seems assured of the dominant share of carriage.
- Other minerals has increased slightly from 25 per cent rail to 30 per cent between 1960–61 and 1999–2000. Rail carriage may include some tonnages from New South Wales.
- Cement has decreased from 40 per cent rail to 30 per cent between 1960–61 and 1999–2000.
- Timber has remained at zero per cent for the 40 year survey period.

FIGURE 7.84 SA GRAINS PRODUCTION AND RAIL CARRIAGE



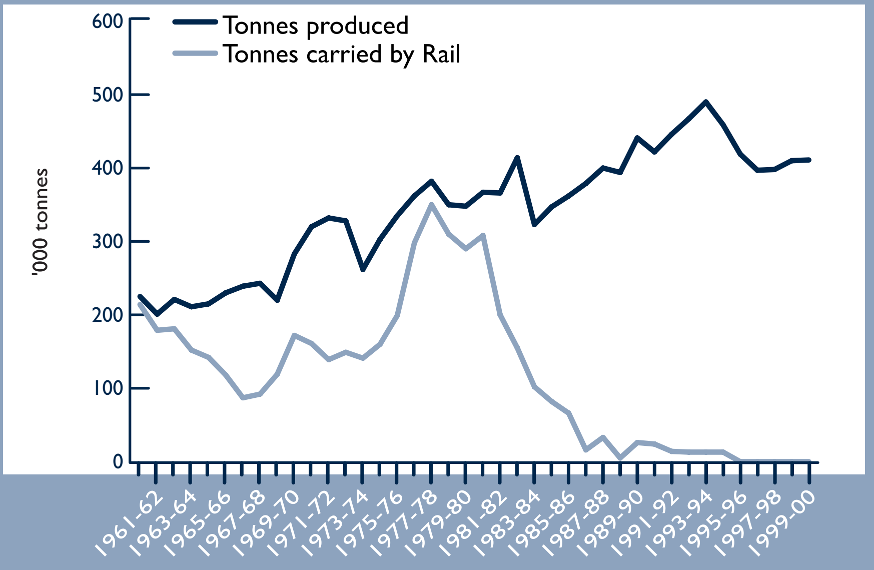
Sources: Appendix Tables VII.11 and VII.12.

FIGURE 7.85 OTHER AGRICULTURE PRODUCTION AND RAIL CARRIAGE—SA



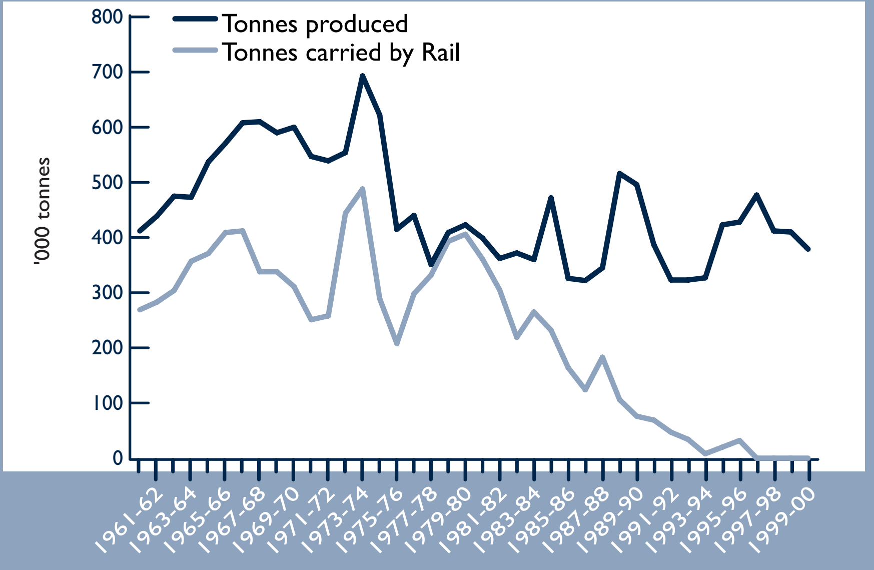
Sources: Appendix Tables VII.11 and VII.12.

FIGURE 7.86 SA LIVESTOCK PRODUCTION AND RAIL CARRIAGE



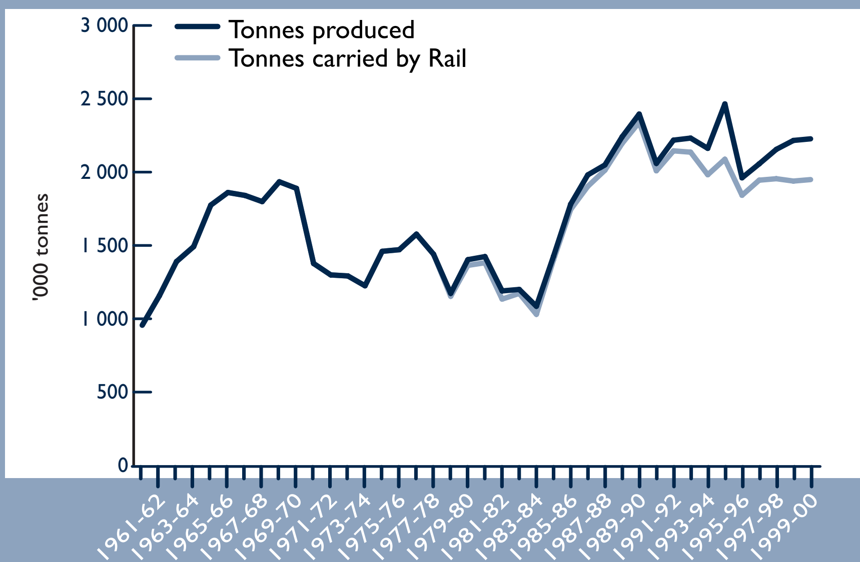
Sources: Appendix Tables VII.11 and VII.12.

FIGURE 7.87 SA FERTILISER PRODUCTION AND RAIL CARRIAGE



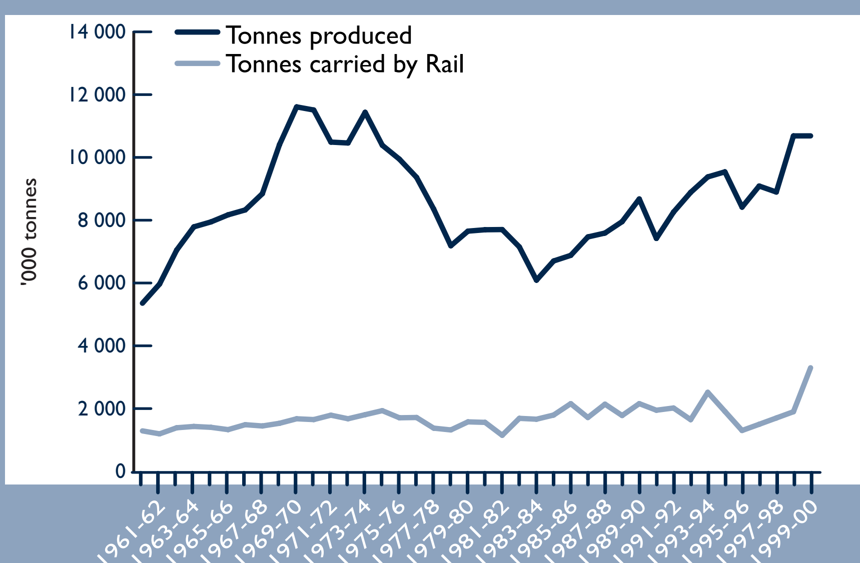
Sources: Appendix Tables VII.11 and VII.12.

FIGURE 7.88 SA COAL PRODUCTION AND RAIL CARRIAGE



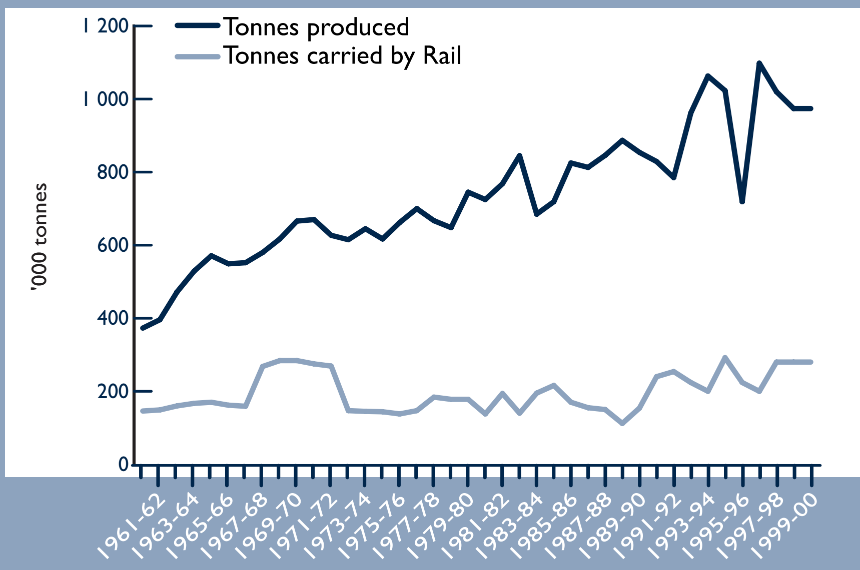
Sources: Appendix Tables VII.11 and VII.12.

FIGURE 7.89 OTHER MINERALS PRODUCTION AND RAIL CARRIAGE—SA



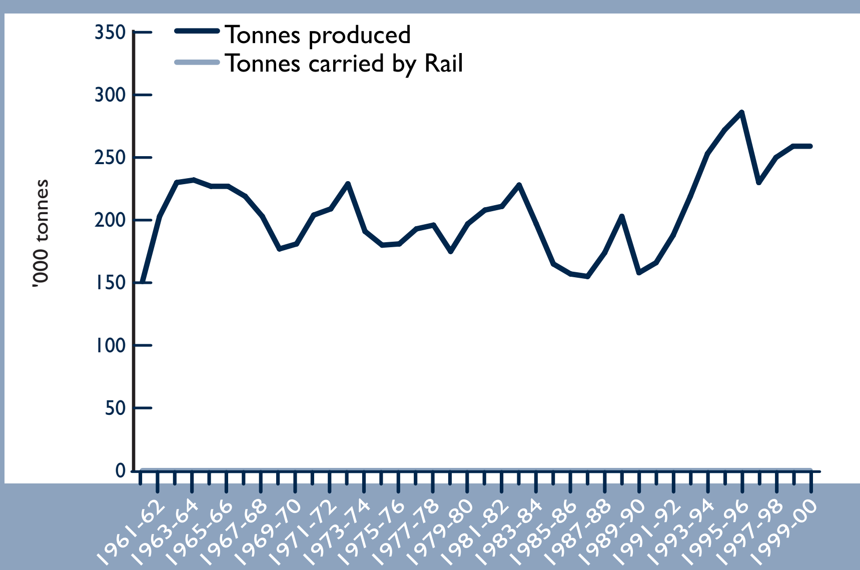
Sources: Appendix Tables VII.11 and VII.12.

FIGURE 7.90 SA CEMENT PRODUCTION AND RAIL CARRIAGE



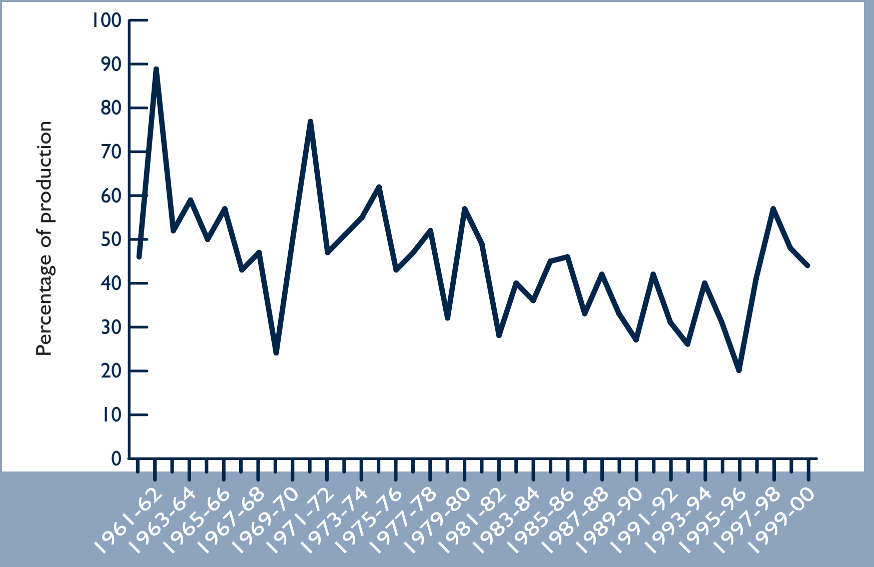
Sources: Appendix Tables VII.11 and VII.12.

FIGURE 7.91 SA TIMBER PRODUCTION AND RAIL CARRIAGE



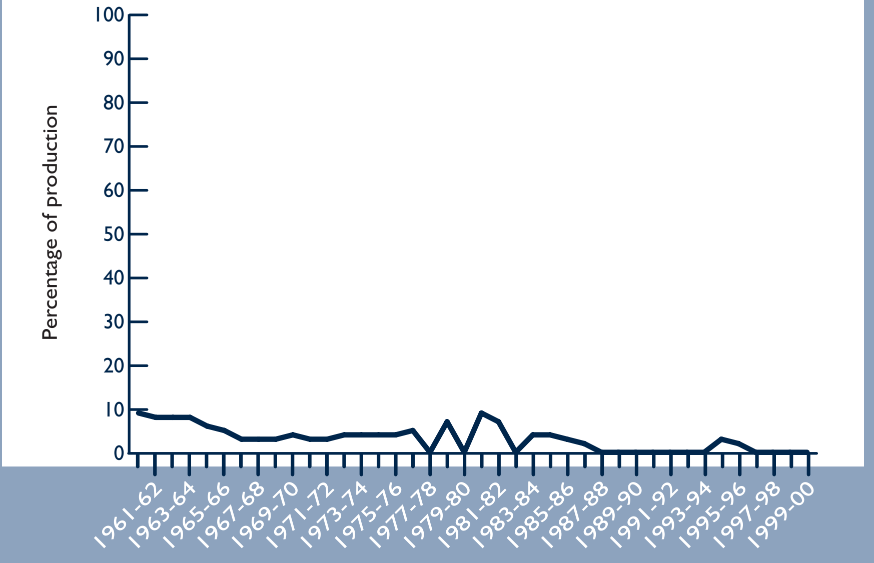
Sources: Appendix Tables VII.11 and VII.12.

FIGURE 7.92 SA RAIL SHARE OF GRAINS



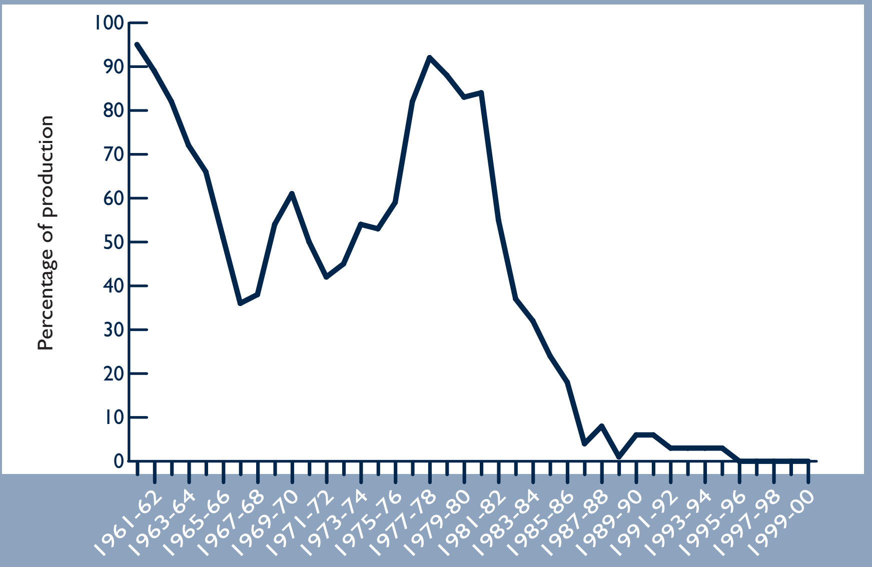
Sources: Appendix Tables VII.11 and VII.12.

FIGURE 7.93 OTHER AGRICULTURE RAIL SHARE—SA



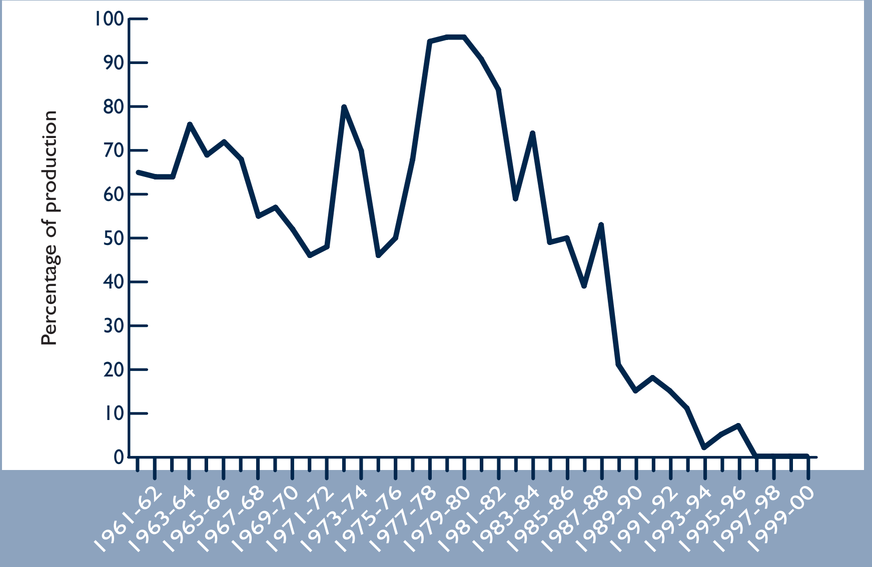
Sources: Appendix Tables VII.11 and VII.12.

FIGURE 7.94 SA RAIL SHARE OF LIVESTOCK



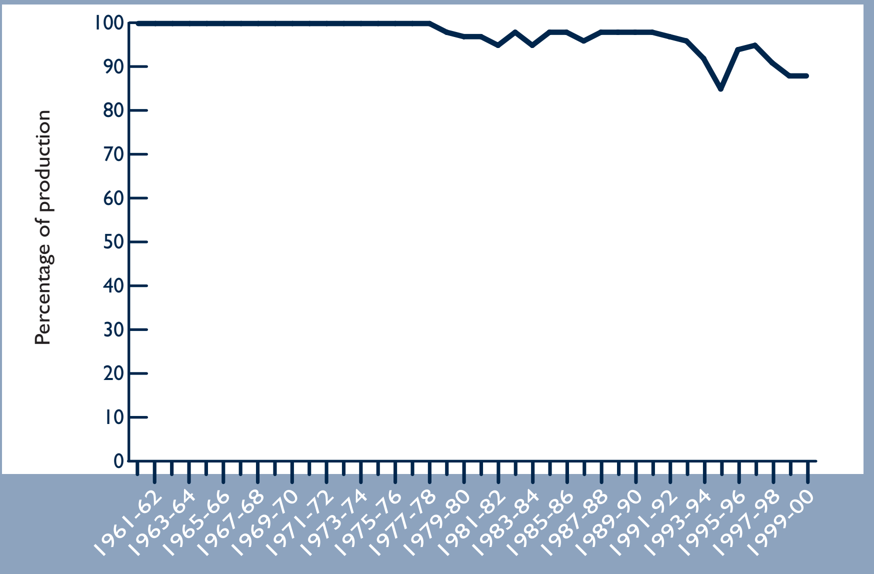
Sources: Appendix Tables VII.11 and VII.12.

FIGURE 7.95 SA RAIL SHARE OF FERTILISER



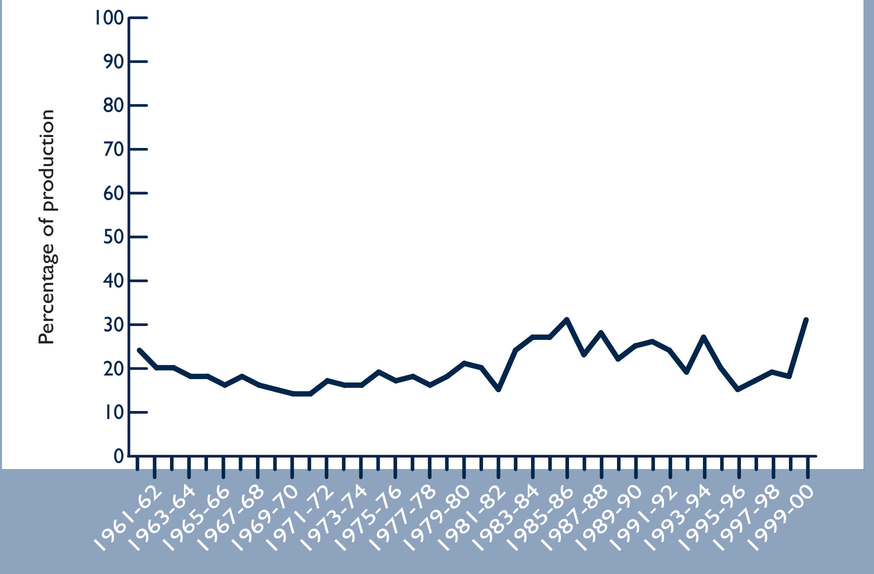
Sources: Appendix Tables VII.11 and VII.12.

FIGURE 7.96 SA RAIL SHARE OF COAL



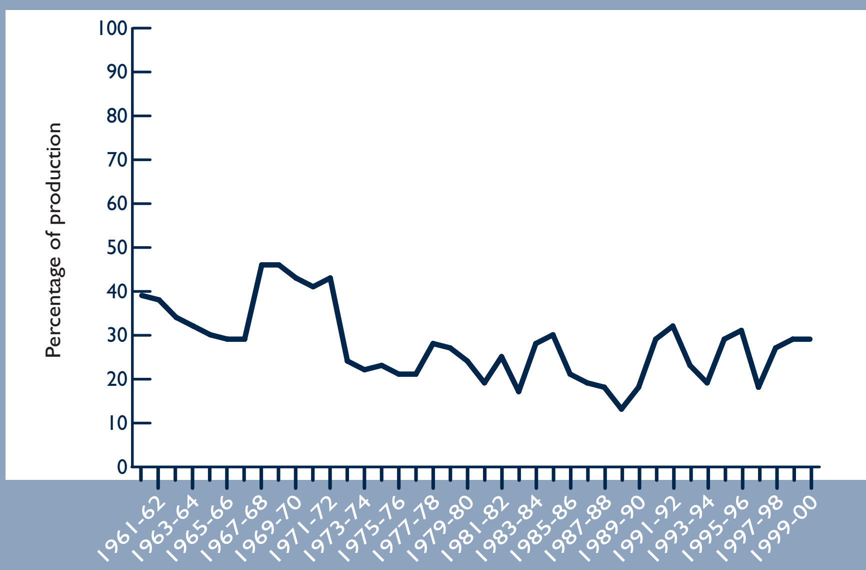
Sources: Appendix Tables VII.11 and VII.12.

FIGURE 7.97 OTHER MINERALS RAIL SHARE—SA



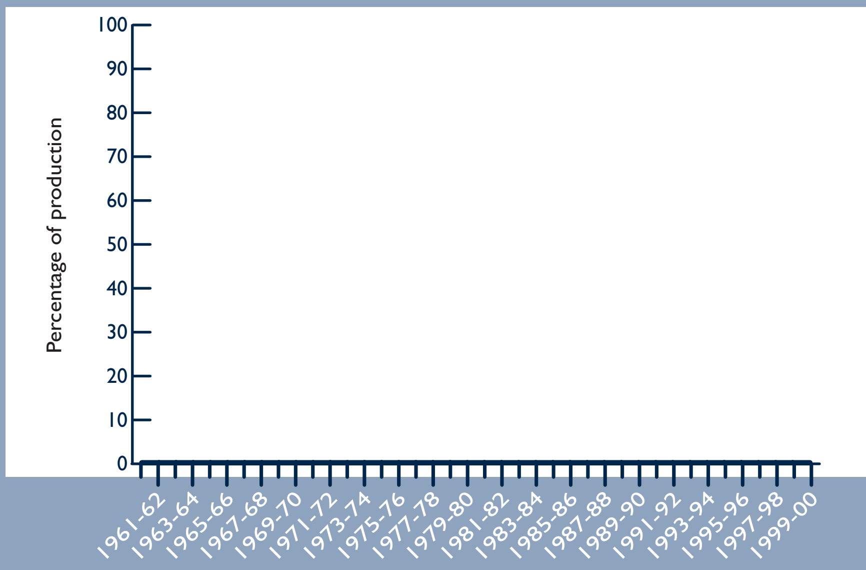
Sources: Appendix Tables VII.11 and VII.12.

FIGURE 7.98 SA RAIL SHARE OF CEMENT



Sources: Appendix Tables VII.11 and VII.12.

FIGURE 7.99 SA RAIL SHARE OF TIMBER



Sources: Appendix Tables VII.11 and VII.12.

Tasmania

The production and rail freight graphs—Figures 7.100 to 7.107—show that:

- All commodity production, except Timber, is increasing.
- The largest and fastest-growing production tonnage is in Other minerals.
- Rail tonnages are increasing for Coal, Other minerals and Cement.

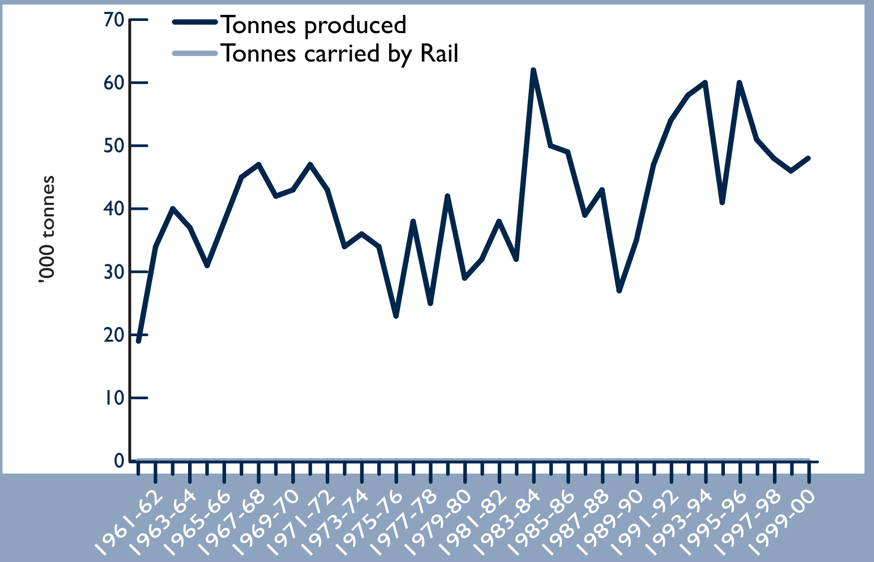
The rail mode share graphs—Figures 7.108 to 7.115—show that:

- Rail is increasing its share of the carriage of a growing production only in Other minerals.
- In all other commodities, rail has either steadily lost mode share—sometimes purposefully, as the traffic becomes non-profitable—or maintained a constant share.

The share graphs show that:

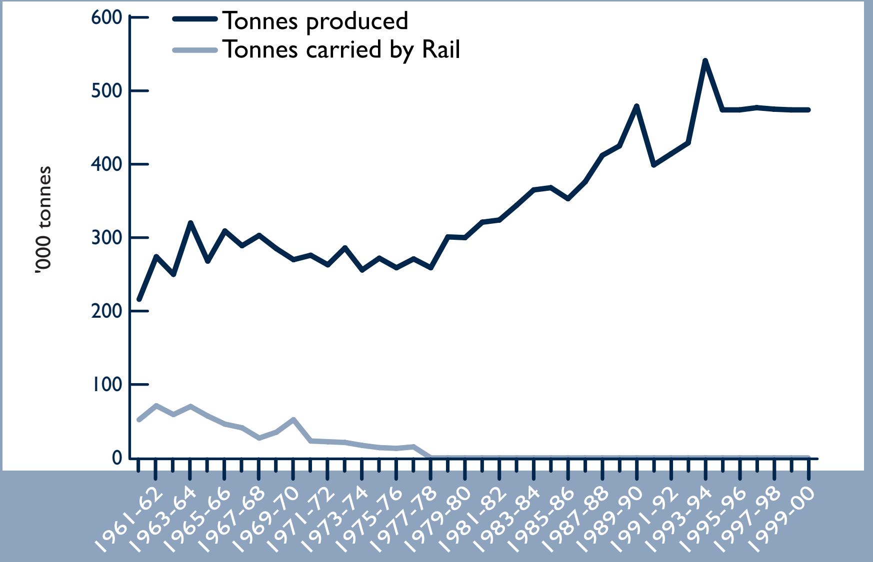
- Grain has remained at zero per cent rail share between 1960–61 and 1999–2000.
- Other agriculture has decreased from 25 per cent rail in 1960–61 to zero per cent from 1977–78 on.
- Livestock has decreased from 70 per cent rail in 1960–61 to have no share from 1978–79 on.
- Fertiliser has decreased from 95 per cent rail to no share between 1960–61 and 1999–2000.
- Coal has decreased from 100 per cent rail to 65 per cent between 1960–61 and 1999–2000.
- Other minerals has increased from below five per cent rail to just below 15 per cent between 1960–61 and 1999–2000.
- Cement has decreased from 85 per cent rail to 80 per cent between 1960–61 and 1999–2000.
- Timber has decreased from 90 per cent to 35 per cent between 1960–61 and 1999–2000.

FIGURE 7.100 TAS GRAINS PRODUCTION AND RAIL CARRIAGE



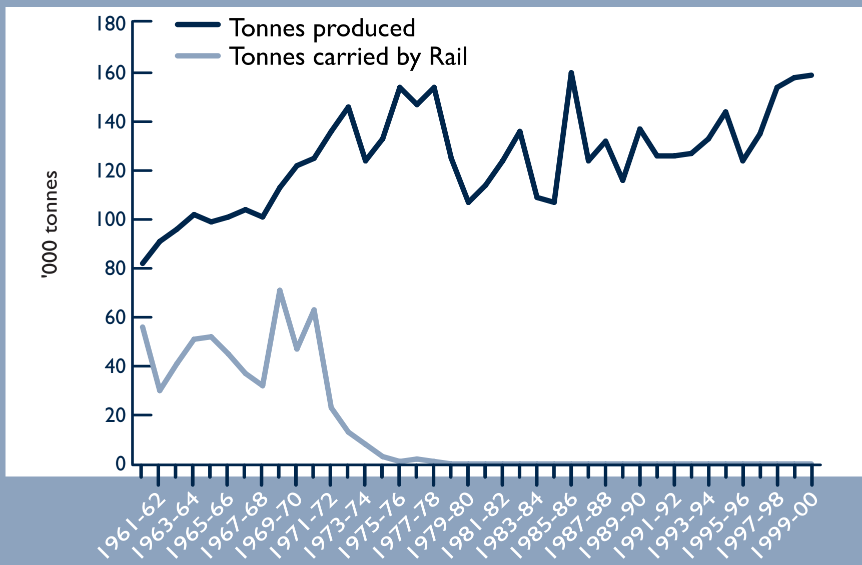
Sources: Appendix Tables VII.11 and VII.12.

FIGURE 7.101 OTHER AGRICULTURE PRODUCTION AND RAIL CARRIAGE—TAS



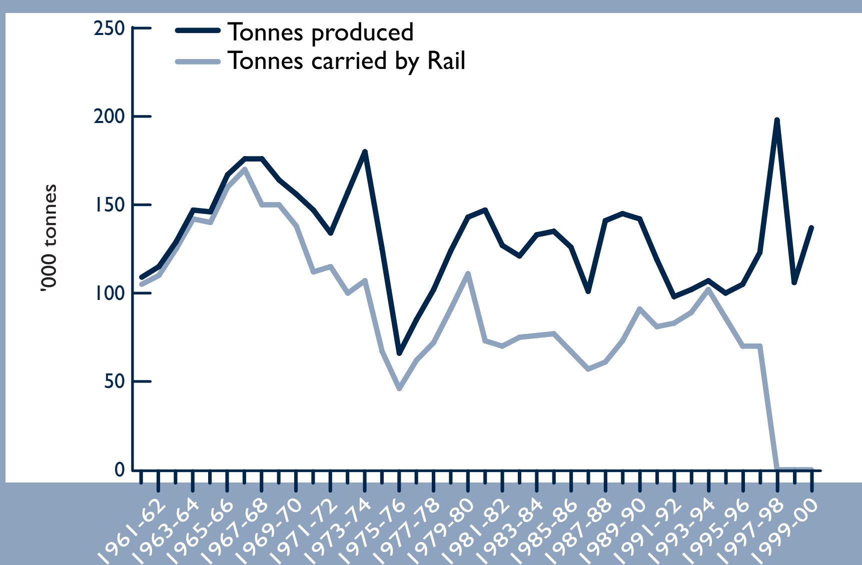
Sources: Appendix Tables VII.11 and VII.12.

FIGURE 7.102 TAS LIVESTOCK PRODUCTION AND RAIL CARRIAGE



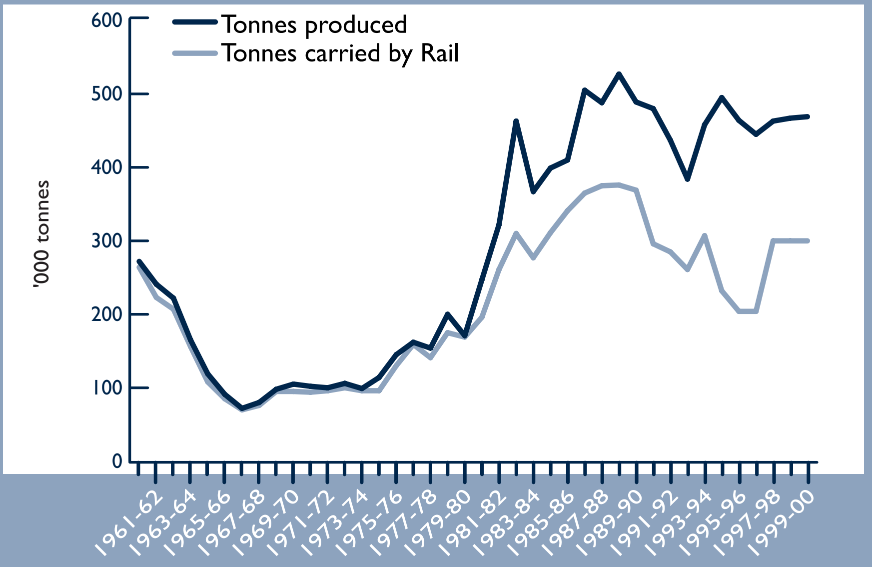
Sources: Appendix Tables VII.13 and VII.14.

FIGURE 7.103 TAS FERTILISER PRODUCTION AND RAIL CARRIAGE



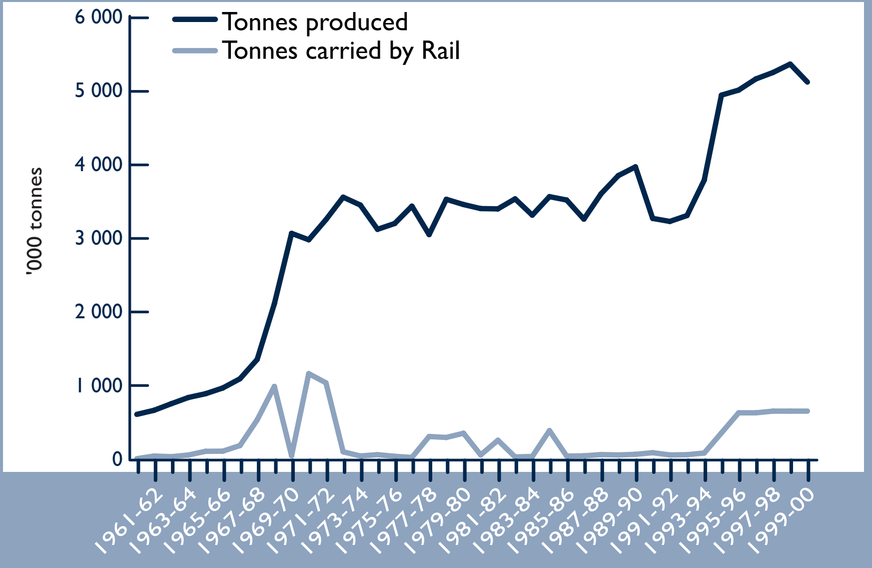
Sources: Appendix Tables VII.13 and VII.14.

FIGURE 7.104 TAS COAL PRODUCTION AND RAIL CARRIAGE



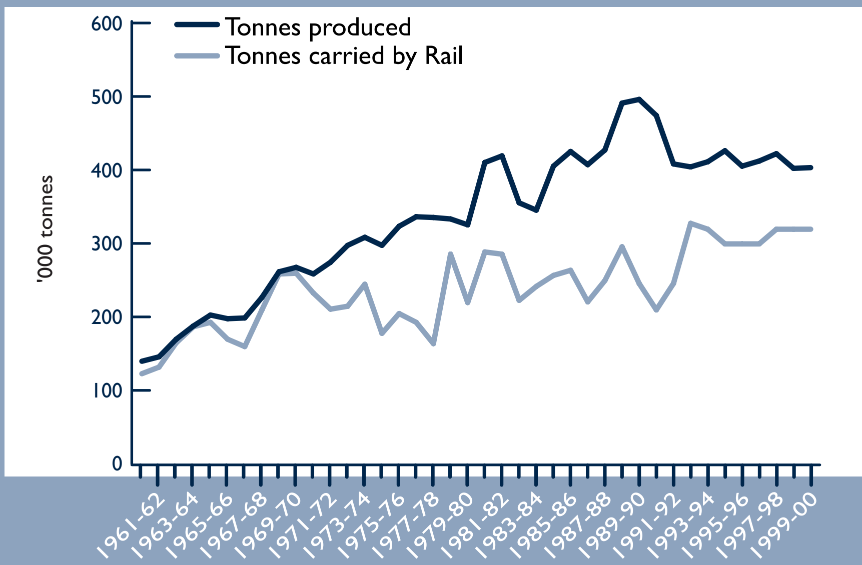
Sources: Appendix Tables VII.13 and VII.14.

FIGURE 7.105 OTHER MINERALS PRODUCTION AND RAIL CARRIAGE—TAS



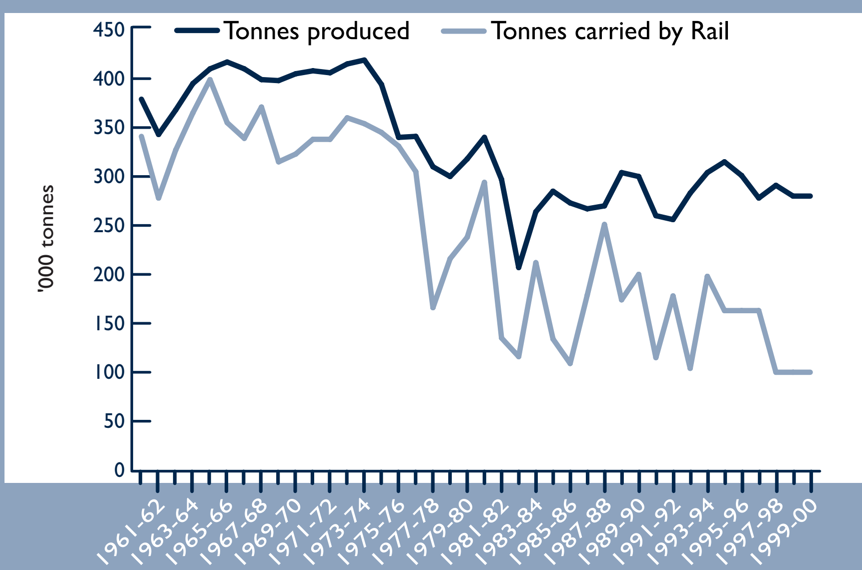
Sources: Appendix Tables VII.13 and VII.14.

FIGURE 7.106 TAS CEMENT PRODUCTION AND RAIL CARRIAGE



Sources: Appendix Tables VII.13 and VII.14.

FIGURE 7.107 TAS TIMBER PRODUCTION AND RAIL CARRIAGE

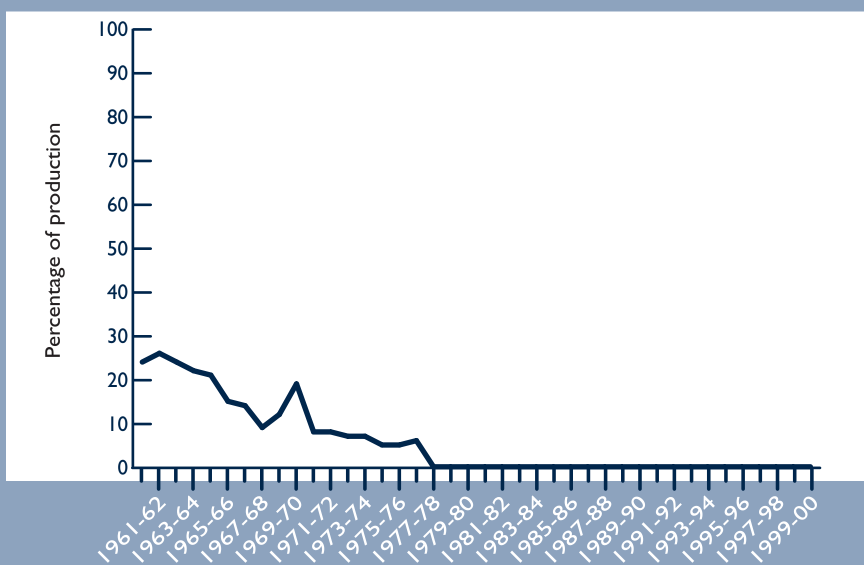


Sources: Appendix Tables VII.13 and VII.14.

FIGURE 7.108 TAS RAIL SHARE OF GRAINS

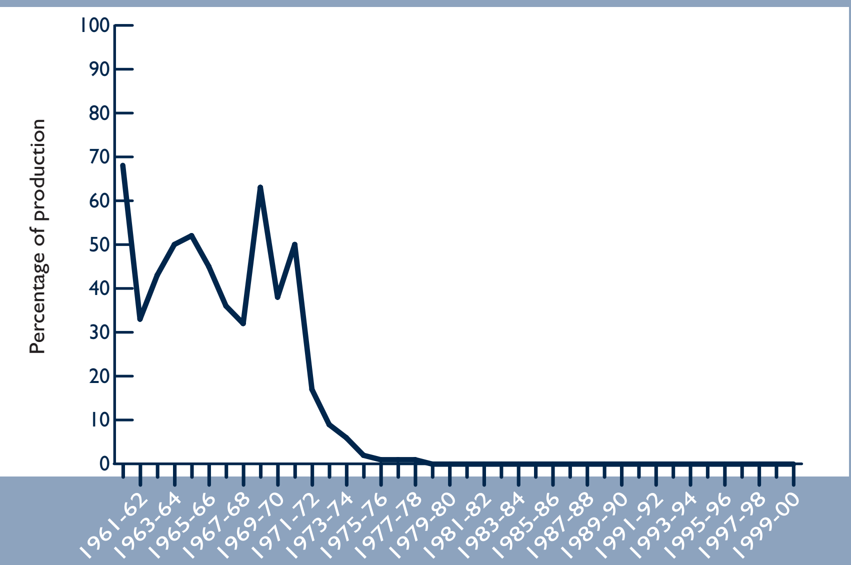
Sources: Appendix Tables VII.13 and VII.14.

FIGURE 7.109 TAS RAIL SHARE OF OTHER AGRICULTURE



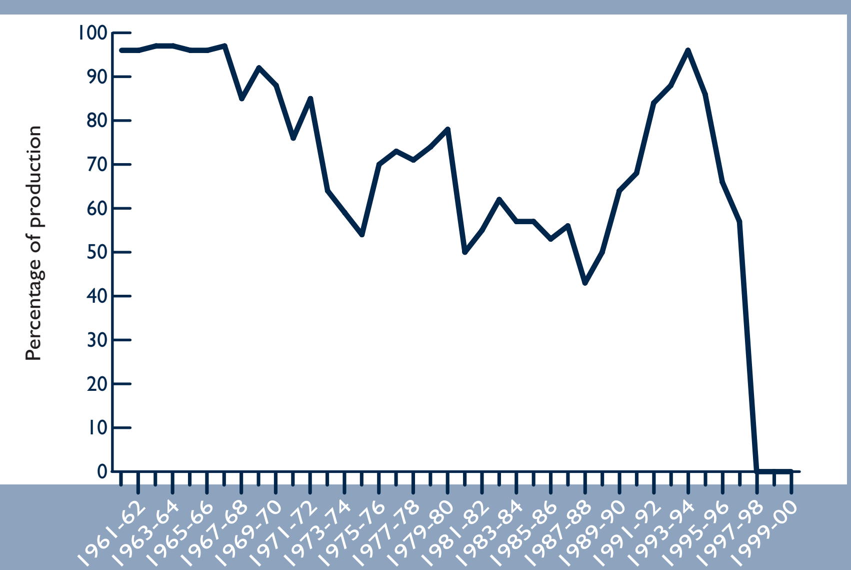
Sources: Appendix Tables VII.13 and VII.14.

FIGURE 7.110 TAS RAIL SHARE OF LIVESTOCK



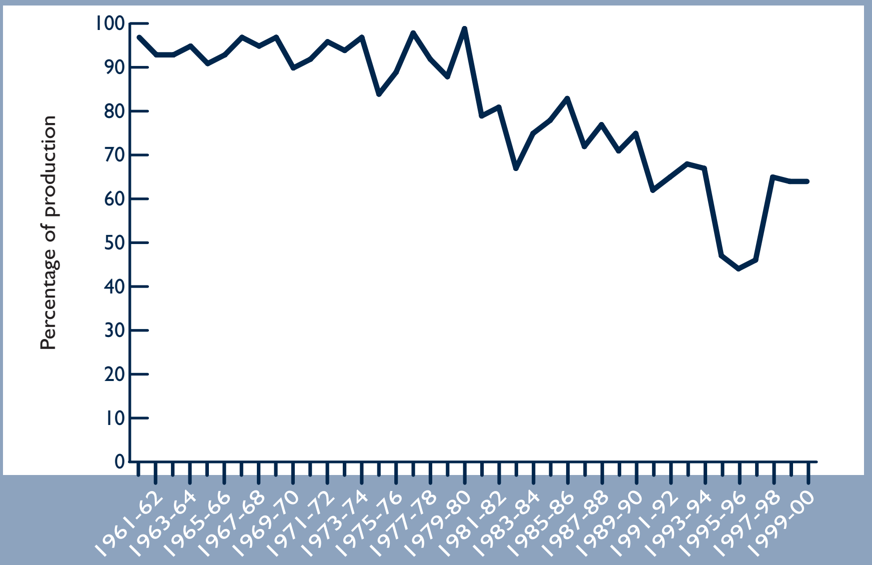
Sources: Appendix Tables VII.13 and VII.14.

FIGURE 7.111 TAS RAIL SHARE OF FERTILISER



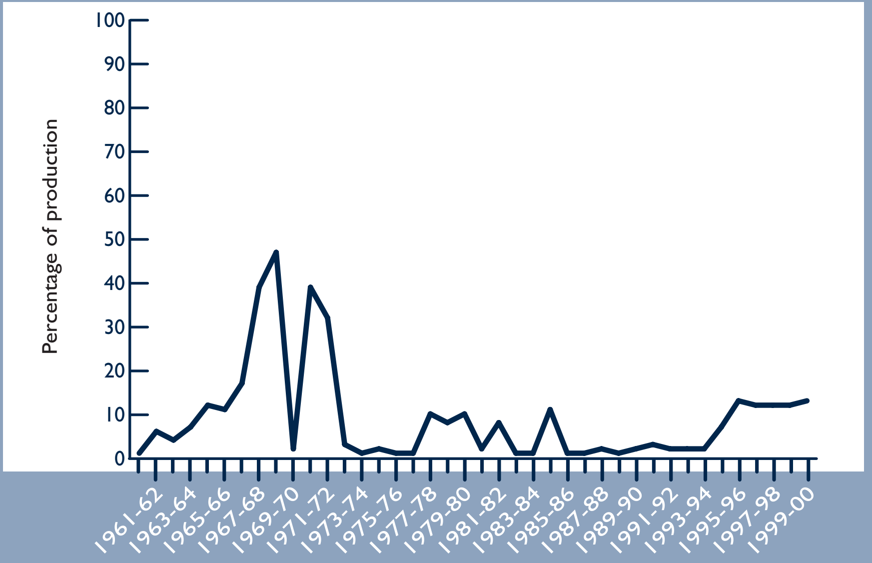
Sources: Appendix Tables VII.13 and VII.14.

FIGURE 7.112 TAS RAIL SHARE OF COAL



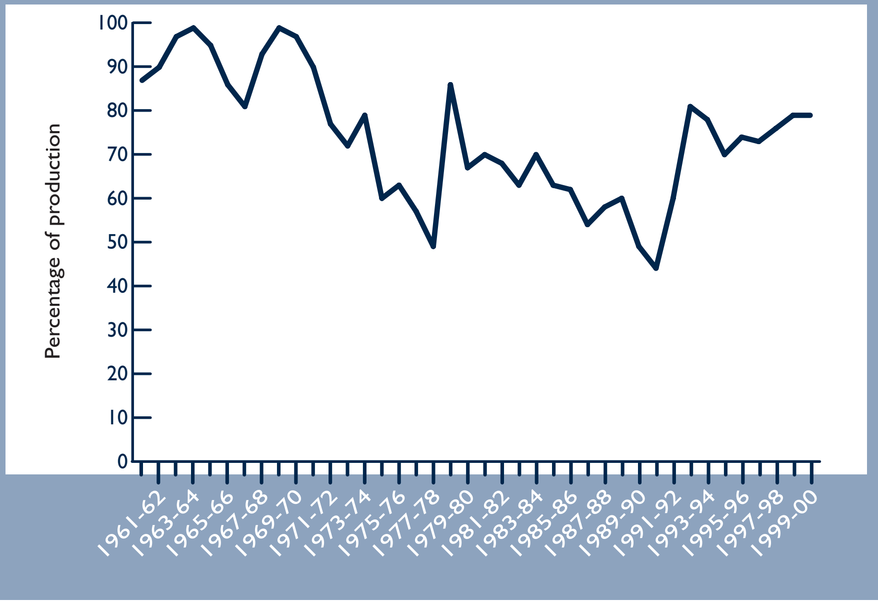
Sources: Appendix Tables VII.13 and VII.14.

FIGURE 7.113 TAS RAIL SHARE OF OTHER MINERALS



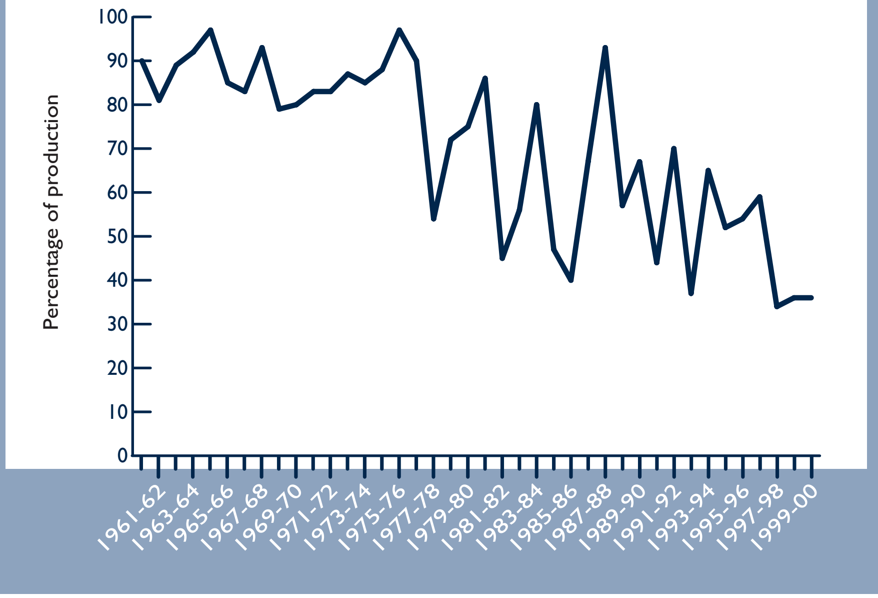
Sources: Appendix Tables VII.13 and VII.14.

FIGURE 7.114 TAS RAIL SHARE OF CEMENT



Sources: Appendix Tables VII.13 and VII.14.

FIGURE 7.115 TAS RAIL SHARE OF TIMBER



Sources: Appendix Tables VII.13 and VII.14.

7.6 COMMODITY LEVEL

Grains

Grains production is extremely variable from year-to-year. This variability is reflected in the levels of carriage by the rail systems. Nationally, trend production is growing steadily. Rail's trend carriage level is also increasing steadily, but at a slower rate than production. This has resulted in a shrinking mode share. At the state level, there is no rail carriage of grain in Tasmania. Victoria shows a slightly decreasing mode share. In South Australia and Western Australia, rail's share of grain carriage is also decreasing slightly. The New South Wales and Queensland rail systems appear to be holding a constant share of grains carriage. Grain production is increasing in every state.

Other agriculture

Nationally, other agriculture production levels have increased consistently. Rail tonnages carried have remained flat between 1960–61 and 1999–2000, resulting in decreasing mode share. New South Wales is the only state where tonnes carried by rail over the survey period have increased. But rail's mode share has decreased despite this. Rail's mode share has decreased in all other states. Western Australia is the only state to have had a large mode share in the past. All other states carried minimal shares during that time period.

Livestock

Nationally livestock production has increased steadily. But both rail tonnes carried and rail mode share have decreased steadily. Livestock production increased in all states. No state shows an increase in tonnes carried by rail over the survey period. Thus rail's mode share has decreased in every state. Its carriage share of livestock production is now minimal or zero.

Fertiliser

Despite some erratic fluctuations, fertiliser production has also increased nationally. Both rail tonnes carried and rail mode share have decreased steadily around Australia. Fertiliser production has increased in all states, except South Australia and New South Wales. Rail tonnes carried, and rail mode share, have decreased in every state.

Coal

Coal has the greatest production levels and largest carriage by the public-access rail systems in Australia. Nationally, production, carriage and mode share have all increased. Coal production and carriage is dominated by New South Wales and Queensland, where both production and rail carriage have increased. Queensland's mode share has increased and New South Wales' mode share has remained constant. Victorian coal production is mainly brown coal which is burnt onsite. Victorian rail carriage of coal is mainly brown coal briquettes. Rail's mode share in Western Australia, Tasmania and South Australia—which account for a small share of coal production and movement—has decreased. Coal is an important commodity for the public-access rail system and one where rail seems to be assured of maintaining a significant mode share.

Other minerals

Nationally, the production of other minerals has grown considerably. Comparatively, rail tonnages have increased at a slightly lower rate. Mode share has remained relatively constant over the last forty years. Queensland shows a rise in production as well as a rise in rail tonnages. This has resulted in an eventual increase in mode share. Production and rail carriage are increasing in New South Wales but rail's mode share remains constant. Similarly, Western Australia shows a rise in both production and tonnes carried. But rail's mode share has decreased for twenty years and, in the last 10 years, has been relatively flat. Production is increasing in all other states but rail tonnages remain relatively flat and mode shares have decreased slightly.

Cement

Australian cement production is increasing at a fairly constant rate. Rail carriage, however, has remained relatively flat over the last 40 years. Consequently, rail's mode share has decreased over the survey period. Cement production has increased in each state. Rail carriage of cement has increased in Tasmania, South Australia and Queensland. Rail tonnages in all other states remain relatively constant. This has resulted in rail's mode share decreasing in all states except Tasmania, South Australia and Queensland.

Timber

Nationally, timber production has remained quite stable over the last 40 years. Rail's mode share has decreased. Timber production is relatively flat, or decreasing slightly, in all states. Rail tonnes carried have decreased for every state over the 40 years. Thus rail's mode share for timber carriage has decreased in all states.

7.7 CONCLUSION

Rail in most states is maintaining or increasing mode share only in coal, other minerals and/or grain. These are the biggest and some of the fastest growing commodity groups.

In the carriage of almost all other commodities rail is losing or has lost mode share to other modes (mostly to road). Quite often this is because the task involves dispersed origins and destinations, thus suiting road as the mode of carriage.

CHAPTER 8

FREIGHT RATES IN AUSTRALIA

Interstate, non-bulk freight transport services are provided by four modes of transport:

- road
- rail
- coastal shipping
- air.

Most of the interstate non-bulk freight task—especially on shorter-distance routes—is completed by road. Rail is an important player on long-distance routes between Perth and the eastern states. Coastal shipping is an important link between Tasmania and the mainland. Air, on the other hand, carries a very small fraction of the total interstate non-bulk freight task by weight but has a significant share of the task by value.

BTRE has recently published long-time series of freight rates for the four interstate modes (BTRE 2002a). This Chapter repeats the findings in that publication. Appendix 10 gives the source and methodological details. The estimates of interstate non-bulk freight rates that have been derived show that, in real terms, it has never been cheaper to ship goods around Australia.

Road and rail are the main modes used for interstate shipments of non-bulk goods. Real freight rates for road and rail have decreased substantially throughout the last 35 years—see Figures 8.1 and 8.2 and Table 8.1.

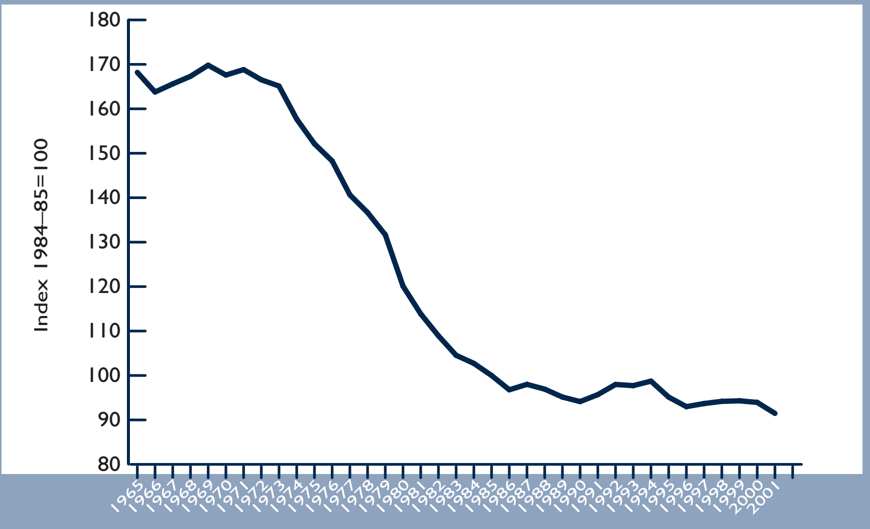
Real road freight rates have almost halved since 1965, in response to much better highways and the change to bigger and more efficient vehicles. For example, in the 1960s there were still large numbers of small rigid trucks running between Melbourne and Sydney. The shift to six-axle articulated trucks in the 1970s had a huge impact on efficiencies. Similarly, in the late 1970s, the driving time from Sydney to Canberra was five hours over a dangerous road. Today, it is three hours on a very safe road.

TABLE 8.1 NOMINAL AND REAL FREIGHT RATES

Year	Air (Tasmania)	Road	Rail (Perth)	Shipping (Tasmania)	Shipping (Perth)	CPI	Air	Road	Rail	Shipping	Shipping
	(cents per net tonne–kilometres)					(1990=100)	(1985=100)				(1990=100)
1964–65	14.36	1.17	0.93	0.88	–	14.63	84.5	168.20	127.40	41.83	–
1965–66	14.71	1.17	0.97	0.91	–	15.12	83.8	163.78	128.25	41.90	–
1966–67	15.00	1.22	1.00	0.97	–	15.51	83.3	165.61	128.12	43.73	–
1967–68	15.00	1.27	1.00	1.02	–	16.00	80.7	167.31	124.93	44.22	–
1968–69	15.00	1.33	1.02	1.05	–	16.49	78.4	169.81	123.91	44.35	–
1969–70	15.00	1.36	1.05	1.13	–	17.07	75.7	167.60	122.20	46.22	–
1970–71	16.51	1.44	1.11	1.25	–	17.95	79.2	168.82	123.28	48.59	–
1971–72	17.23	1.51	1.15	1.33	–	19.12	77.6	166.53	119.75	48.63	–
1972–73	17.23	1.62	1.12	1.47	–	20.68	71.7	165.12	108.14	49.61	–
1973–74	19.38	1.77	1.15	1.59	–	23.71	70.4	157.68	96.70	46.81	–
1974–75	21.53	2.00	1.29	1.76	–	27.71	66.9	152.13	93.14	44.22	–
1975–76	26.56	2.18	1.54	2.44	–	31.02	73.7	148.27	98.84	54.78	–
1976–77	26.56	2.35	1.73	3.81	–	35.22	64.9	140.64	98.03	75.44	–
1977–78	27.99	2.46	2.07	4.57	–	38.05	63.4	136.67	108.48	83.60	–
1978–79	32.30	2.58	2.15	4.97	–	41.37	67.2	131.66	103.67	83.65	–
1979–80	39.48	2.61	2.34	6.16	–	45.85	74.1	120.11	101.85	93.64	–
1980–81	47.37	2.69	2.61	7.25	–	49.85	81.8	113.87	104.53	101.38	–
1981–82	59.22	2.85	2.88	8.55	–	55.22	92.3	108.93	104.15	107.89	–
1982–83	63.17	3.04	3.02	9.56	–	61.37	88.6	104.54	98.17	108.49	–
1983–84	71.06	3.10	3.25	9.76	–	63.80	95.9	102.72	101.67	106.56	–
1984–85	78.96	3.22	3.41	9.76	–	68.00	100.0	100.00	100.00	100.00	–
1985–86	86.85	3.38	3.35	9.72	–	73.76	101.4	96.78	90.67	91.79	–
1986–87	90.80	3.74	3.46	9.64	–	80.59	97.0	98.00	85.77	83.31	–
1987–88	95.93	3.96	3.30	10.08	–	86.34	95.7	96.63	76.36	81.32	–
1988–89	95.93	4.19	3.53	10.24	–	92.88	88.9	95.15	75.73	76.83	–
1989–90	104.62	4.46	3.48	10.05	2.54	100.00	90.1	94.13	69.52	70.03	70.00
1990–91	118.44	4.69	3.53	10.94	2.54	103.41	98.6	95.69	68.19	73.71	67.69
1991–92	114.49	4.86	3.42	10.80	2.47	104.68	94.2	97.98	65.09	71.90	65.03
1992–93	114.49	4.94	3.24	10.71	2.45	106.63	92.5	97.72	60.60	69.98	63.32
1993–94	114.49	5.07	3.18	10.98	2.39	108.49	90.9	98.73	58.56	70.50	60.71
1994–95	114.49	5.11	2.89	11.11	2.35	113.37	87.0	95.13	50.79	68.28	57.13
1995–96	102.25	5.15	2.81	11.11	2.30	116.88	75.3	92.99	48.05	66.23	54.23
1996–97	102.25	5.21	2.78	12.34	2.24	117.27	75.1	93.69	47.27	73.34	52.64
1997–98	102.25	5.27	2.73	13.24	2.18	118.05	74.6	94.18	46.21	78.12	50.89
1998–99	102.25	5.33	2.76	11.90	2.13	119.32	73.8	94.30	46.18	69.46	49.20
1999–00	102.25	5.48	2.84	11.81	2.08	123.12	71.5	93.94	46.01	66.80	46.56
2000–01	111.73	5.66	2.75	12.54	2.08	130.54	73.7	91.47	42.01	66.94	43.91

Source: *BTRE (2002a).*

FIGURE 8.1 REAL ROAD FREIGHT RATES



Source: *Table 8.1.*

FIGURE 8.2 REAL RAIL FREIGHT RATES

Source: *Table 8.1.*

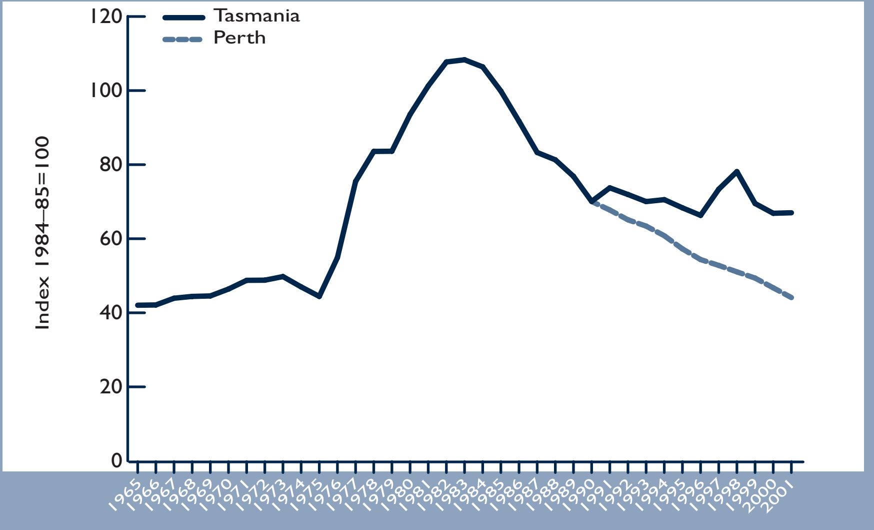
Real rail freight rates have fallen 70 per cent since 1965. Track improvements, more efficient engines and rolling stock, and containerisation have essentially revolutionised the handling of non-bulk freight by the railways. In addition, reforms introduced since the late 1980s have made interstate rail much 'leaner and meaner'.

The rate at which real freight rates have decreased has moderated—for road since the mid-1980s and for rail since the mid-1990s. The earlier rapid decreases were associated with major changes that may not be repeated.

However, the BTRE expects that real interstate non-bulk freight rates will continue to decrease in the order of 0.5 per cent per year over the coming decades. These decreases will be associated with the continuing development of more efficient vehicles and supply chain management measures.

Figure 8.3 and Table 8.1 show real freight rates for non-bulk coastal shipping. The main shipping freight rates series is based on rates from Tasmania—the Tasmanian trade constitutes one-third of Australian's non-bulk coastal shipping task. Since the 1980s, real shipping rates to Tasmania have decreased, but they are still above pre-1976 levels. Before 1976, north-bound rates were subsidised directly by government. There has been a much greater use of the single and continuous voyage

FIGURE 8.3 REAL COASTAL SHIPPING FREIGHT RATES



Source: Table 8.1.

permit system in the 1990s. This has not affected rates on the Tasmanian route, but does appear to have affected routes such as those to and from Perth, where international competition has been most evident. Real coastal shipping rates to and from Perth have dropped by 40 per cent since 1990. Between 1995 and 2001 coastal shipping on the route lifted its mode share from seven to 12 per cent.

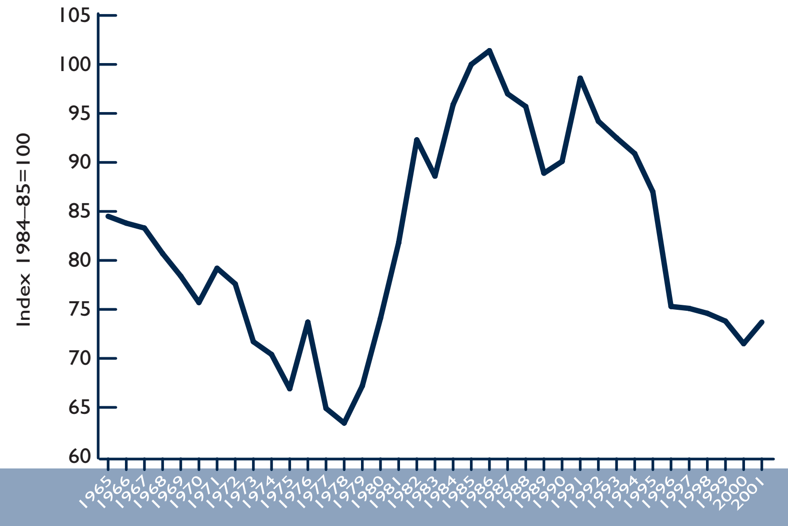
Figure 8.4 and Table 8.1 show real air freight rates, which have been making some fairly wide swings around a basically flat trend. However, following a period of high rates in the 1980s, real air rates in the 1990s have decreased.

Large decreases in real freight rates—especially for road and rail—have had, and will continue to have, major impacts on Australia.

Falling freight rates, when combined with economic growth, result in very high growth rates for freight transport. For example, the BTRE estimates that interstate freight will double in 20 years' time. Notwithstanding some offsetting effects from improvements in vehicles and road technology, this has major implications for infrastructure planning needs.

Freight rates are important for the logistics industry, with transport costs comprising 40 per cent of their value-added. The logistics industry,

FIGURE 8.4 REAL AIR FREIGHT RATES



Source: Table 8.1.

which comprises nine per cent of gross domestic product, is important to the economy as a whole (BTRE 2001). Thus, reduced freight rates are important because they enable greater specialisation in regional production and a more efficient logistics industry. This ultimately feeds through to a stronger economy, to lower prices, and more choice for Australian consumers.

8.1 CONCLUSION

There have been huge falls in real freight rates in past decades, especially in surface transport (road and rail).

These reductions have contributed to the rapid growth in freight volumes, and to growth in the wider economy.

CHAPTER 9

THE ROAD FREIGHT INDUSTRY IN AUSTRALIA

9.1 INTRODUCTION

The road freight industry is important to the Australian economy. Road freight contributed about 1.8 per cent of gross domestic products (GDP) in 1999–00. That is almost half the total contribution of freight transport to GDP (BTRE 2001).

However, accurate measures of road freight's importance are typically difficult to obtain. Trucking is under-represent in GDP estimates. This is because the value added by in-house truck fleets of companies in other industries—for example, mining, retail and construction—is not accounted for within the road freight transport industry.

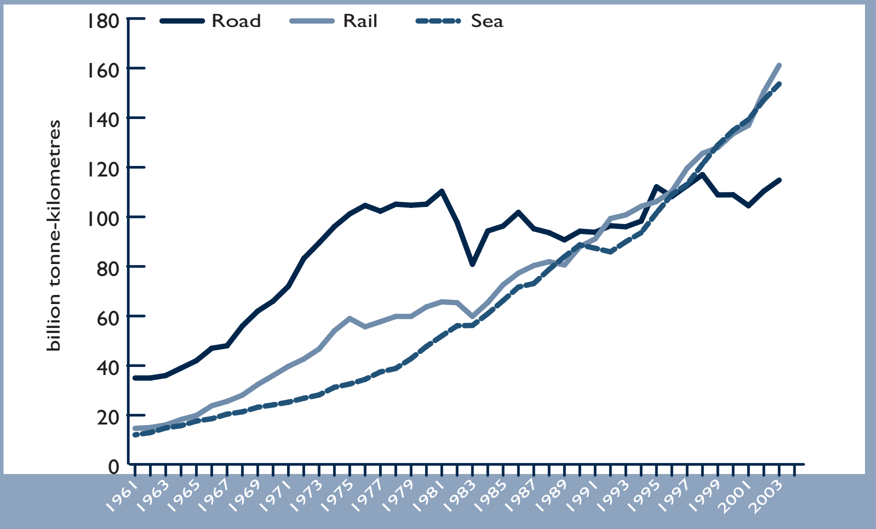
9.2 HISTORIC GROWTH

Physical estimates—in tonne–kilometres— of the Australian freight task have the disadvantage of underestimating the importance of the air freight industry. However, tonne–kilometre estimates can accurately show prevailing trends. Figure 9.1 shows tonne–kilometre estimates of the Australian freight task since 1971—details are given in Chapter 1, Table 1.4. Figure 9.1 shows that road freight has grown more rapidly than sea and rail freight traffic. By 2000, road, rail and coastal shipping each accounted for about one-third of the Australian domestic freight task—by tonne–kilometres performed.

Compared to our modest population growth over the same period, the growth in rail and road transport may seem excessive, and unsustainable. But our ever-improving wealth and living standards—coupled with new technologies, improving labour efficiency and ever-expanding world markets—suggest little that would significantly dampen growth prospects over coming decades.

Rail and sea are heavy carriers of bulk commodities from the mines and farms to the ports and cities of Australia. Road carries primarily non-bulk freight. It is pre-eminent in urban, interurban, urban-to-hinterland and local rural freight traffic.

FIGURE 9.1 AGGREGATE FREIGHT TASK

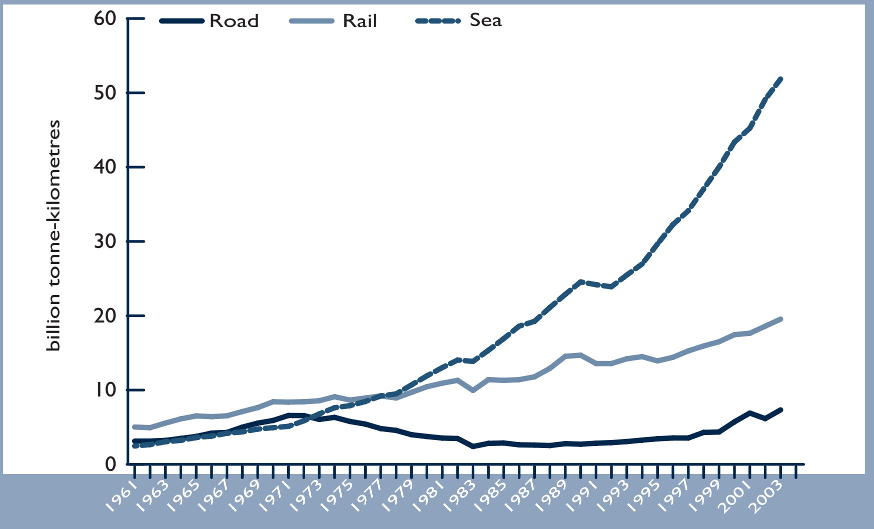


Sources: BTRE (2002), BTRE estimates.

The main area of competition between modes is in the interstate carriage of non-bulk freight. Road has been steadily gaining market share from rail on these routes—see Figure 9.2. There are possibilities for rail and sea to gain mode share on the interstate, especially intercapital, routes. However, the intercapital road freight task accounts for only about 15 per cent of the total road task. So in terms of the road freight industry in its entirety, the possibilities for substituting rail for road are clearly limited.

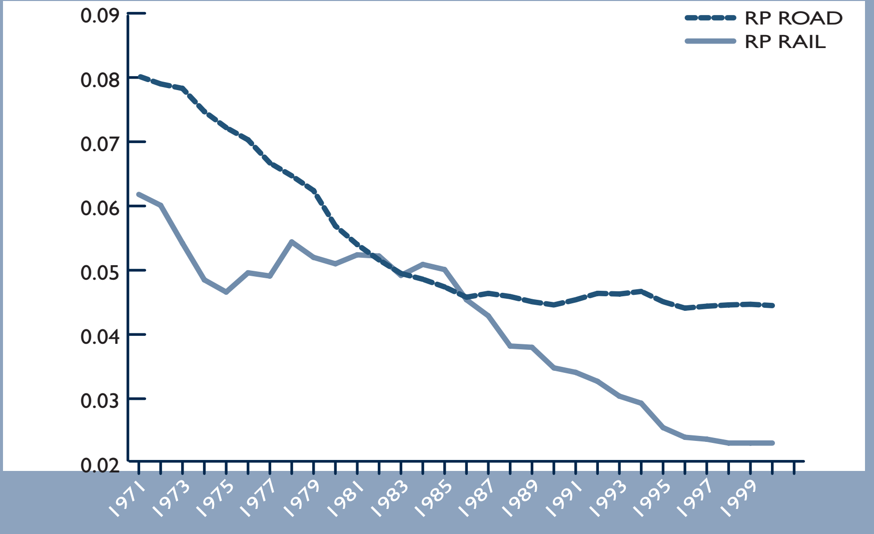
Over the last 30 years, locomotive and truck designs have become more efficient with lower operating and maintenance costs and longer lives. However, the extent to which these improvements have reduced land-based freight rates during that time is unclear. Commonwealth and state efforts in developing National Highways, roads of national importance and the interstate rail network have led to reduced travelling time and operating costs, and hence lower freight rates. The decrease in freight rates for road and rail is shown in Figure 9.3. Regardless of why freight rates were reduced, cheaper freight enables businesses to use more transport as a factor of production. This reduces product costs and supports the expansion of manufacturing. Therefore, freight growth is considerably more than the changes in freight rates might suggest.

FIGURE 9.2 INTERSTATE NON-BULK FREIGHT TASK



Source: Table 5.1.

FIGURE 9.3 REAL ROAD AND RAIL FREIGHT RATES

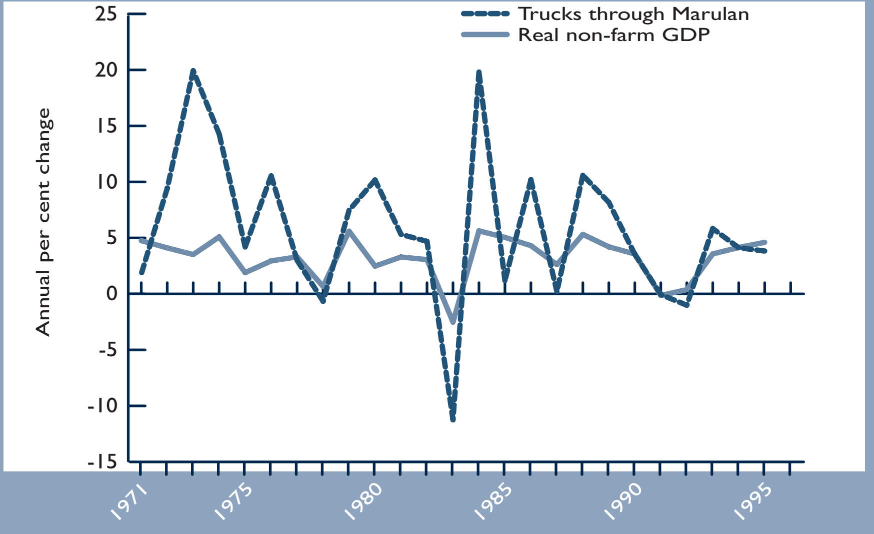


Source: BTRE (2002a).

In fact, growth in total road tonne–kilometre over the past 30 years has been extremely rapid. During that time, it was often twice the growth rate of the national economy—that is, road freight growth of about seven per cent per year compared with GDP growth of about 3.5 per cent. However, this supernormal growth was associated with a period in which road freight rates halved in real terms. Since 1985, freight growth rates have fallen and became more comparable with the economic growth rate.

During the recession of the early 1990s road freight traffic actually decreased —for the first time since 1965. Growth in road freight since the recession has been of the order of three to four per cent per year. This more closely matches the rate of economic growth. In the absence of any major falls in future real road freight rates, this closer relationship between road freight activity and general economic activity is likely to continue. Figure 9.4 shows that the relationship between trucking and the economy is indeed close. The change in the number of trucks passing Marulan on the Hume highway bears a fairly close relationship to the rate of growth in the economy.

FIGURE 9.4 TRUCKING AND NON-FARM GDP



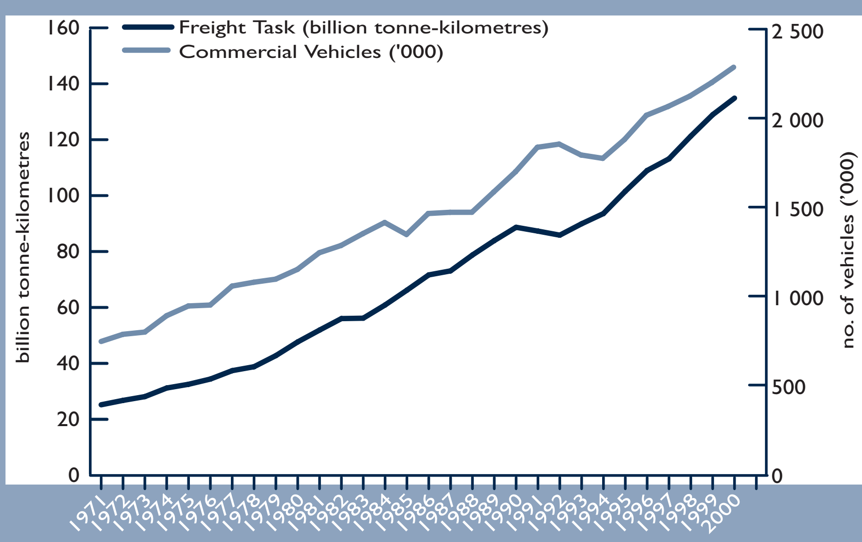
Source: Chapter 2.

9.3 STRUCTURAL CHANGE IN THE ROAD FREIGHT INDUSTRY

The rapid growth in the road freight task in the last 30 years has been accomplished by shifting tonnages toward the larger trucks. Figure 9.5 shows freight demand alongside the number of commercial vehicles used in satisfying that demand. The total number of trucks has been growing much less rapidly than tonne–kilometres—3.9 per cent per year compared with six per cent respectively. The growth in heavy vehicle numbers is even less at 1.2 per cent per year. Yet these vehicles continue to carry about 95 per cent of the total freight task.

Figure 9.5 and 9.6 show that much of the growth has been accommodated by growth in the capacity of articulated trucks. Higher axle load limits and the introduction of B-doubles have contributed to this growth. Articulated trucks carry 71 per cent of the load nationally. Even in the city, articulated trucks account for over 48 per cent of the urban freight transport task—in tonne–kilometres.

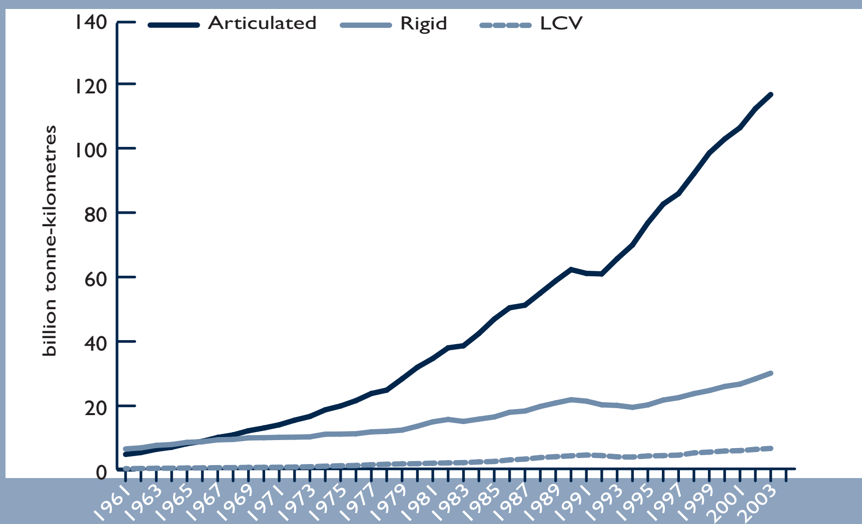
FIGURE 9.5 NUMBER OF COMMERCIAL VEHICLES AND FREIGHT TASK, AUSTRALIA



Sources: BTRE (2002b), BTRE estimates.

In terms of the number of commercial vehicles on the road, however, it is the light commercial vehicles that are both the most numerous and the fastest-growing category. The increasing relative importance of the service sector of the economy means that this trend is likely to continue.

FIGURE 9.6 ROAD FREIGHT TASK BY TYPE OF TRUCK



Sources: BTRE (2002b), BTRE estimates.

With the growth in personal incomes and e-commerce, there is likely to be a concomitant substitution of home delivered services for work previously performed by households. Examples of this include lawnmowing, take-away food, and internet shopping. This means that more light commercial vehicles will be driving around already congested urban areas to deliver these goods and services. The increased traffic levels and motor vehicle-related pollution could potentially become a significant issue.

9.4 SHORT-TERM DYNAMICS OF THE AUSTRALIAN TRUCKING INDUSTRY

In the trucking industry, demand represents tonne–kilometres performed. Supply is the carrying capacity of the Australian truck fleet when operating a 'normal' number of kilometres per year. Over the long-term, they move together.

However, fluctuations in industry conditions can arise from short-term imbalances in supply and demand. The lag in supply response allows first undersupply, and then oversupply, to develop. This results in rising and falling real freight rates respectively. Of course the words 'under' and 'over' are relative; relative in this case to the gap between the carrying capacity of the fleet and demand levels. This gap can be thought of as representing an arbitrary measure of excess capacity in the industry. The level of excess capacity in articulated trucking has a fairly close inverse correlation with change in real road freight rates. Excess capacity can arise when demand falls away unexpectedly—as in a recession—or when supply surges ahead of demand growth. This happens when investment in new trucks is accelerated by low interest rates or investment incentives.

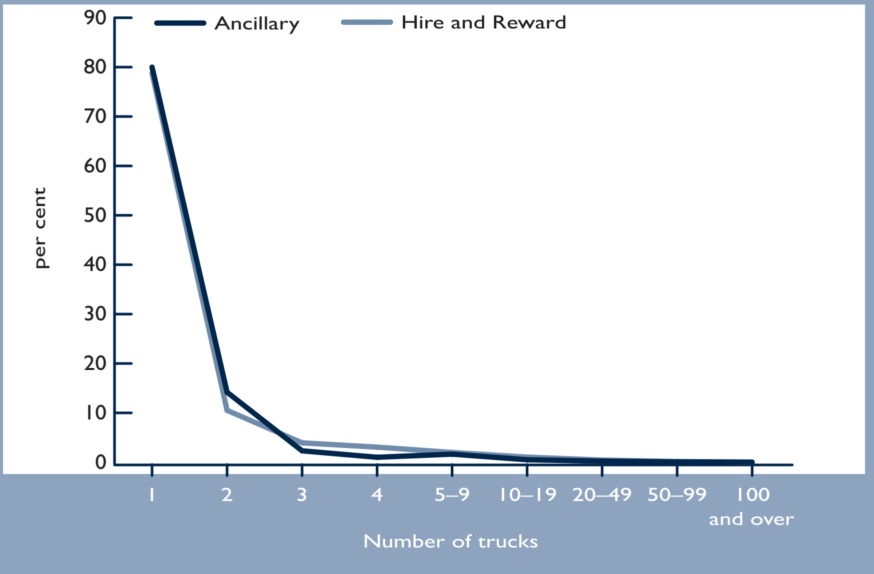
However, changes in real road freight rates continually move the industry back towards its long-run equilibrium with demand. This suggests a highly competitive industry, with few barriers to entry. And this is supported by current analysis, as indicated in BTRE (2003), which finds:

> NRTC (1998) provided estimates of the total number of establishments in both ancillary and hire & reward sectors of the road freight industry for 1994/95. Altogether there were about 210 000 trucking establishments in operation, of which 21 per cent belonged to the hire & reward sector and 79 per cent to the ancillary sector.

Estimation by NRTC (1998) of the distribution of trucking businesses within the ancillary sector for 1994/95 was largely based on the proportions derived from BTE's 1982/83 survey results. Nearly two-thirds of the ancillary operators were in the agricultural sector.

The road freight industry is dominated by small establishments with one or two trucks (over 90 per cent in 1995). This is true for both hire & reward and ancillary sectors (Figure 9.7).

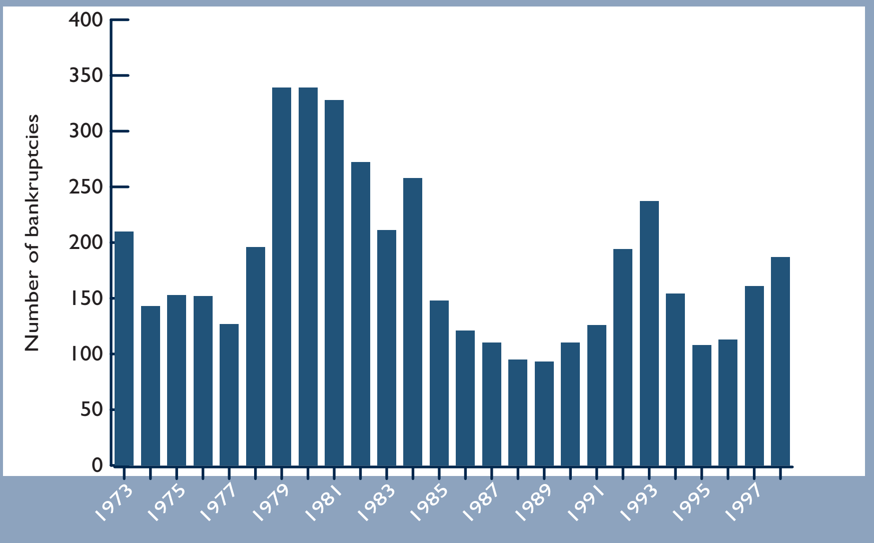
FIGURE 9.7 PROPORTION OF BUSINESS ESTABLISHMENTS BY FLEET SIZE (1995): HIRE & REWARD ANCILLARY



Source: Data from National Road Transport Commission (NRTC) (1998).

The bureau (BTRE 2003) further estimates that industry concentration is low. Based on sales, the top four firms account for only 15 per cent of the market. Gross profit margins are estimated at less than seven per cent. Despite this highly competitive environment, the number of bankruptcies in road transport seems quite low—see Figure 9.8—compared with the more than 200 000 trucking establishments.

FIGURE 9.8 BUSINESS BANKRUPTCIES IN ROAD TRANSPORT (1973–1998)



Note: Business bankruptcy refers to an individual's bankruptcy which is directly related to his or her proprietary interest in a business.

Source: BTRE (2003).

9.5 FUTURE GROWTH OF AUSTRALIAN ROAD FREIGHT

Research presented in Chapter 2 found an income elasticity for total Australian road freight of about 1.24 and a price elasticity of about -0.86. On this basis, and assuming a business as usual scenario, road freight tonne–kilometres in Australia are projected to grow by about four per cent per year over the next 20 years under a 'business as usual' scenario—see Figure 2.10.

The size of large trucks is likely to continue to increase. However, these increases will be moderate in comparison to the growth in the average size of trucks achieved during the 1970s and 1980s by the switch to articulated trucks.

In making projections for future fuel use, the BTRE has assumed fairly substantial further decreases in fuel intensities—that is, litres/100 kilometres—over the extended 20 year period. The assumptions used by the BTRE—and those of several other Australian forecasters—are shown in Table 9.1.

TABLE 9.1 GROWTH IN FUEL USE BY RIGID AND ARTICULATED TRUCKS, 1995 TO 2000

(annual percentage change)

Component	AIP	ABARE	NIEIR	BTRE (2000–05)
Number of trucks				
Rigid	n.a.	2.0	1.9	1.4
Articulated	n.a.	1.3	1.5	2.2
Average VKT				
Rigid	n.a.	0.5	1.1	0.0
Articulated	n.a.	0.4	1.1	1.0
Total VKT				
Rigid	n.a.	2.5	2.9	1.4
Articulated	n.a.	1.7	2.6	3.2
Fuel intensity				
Rigid	n.a.	-0.3	-0.4	0.0
Articulated	n.a.	-0.2	-0.5	0.0
Total fuel use	3.6[a]			
Rigid	n.a.	2.2	2.5	1.4
Articulated	n.a.	1.5	2.1	3.2

AIP Australian Institute of Petroleum.
ABARE Australian Bureau of Agricultural and Resource Economics.
NIEIR National Institute of Economic and Industry Research.
n.a. not available.
VKT vehicle kilometres travelled.
a. Includes light commercial vehicles.
NIEIR forecasts are for 1993–94 to 1998–99.
Fuel intensity is typically measured in litres per 100 kilometres travelled.
Sources: Bush et al. (1993, p.65), NIEIR (1994, pp. 3.31 to 3.38), AIP (1994, p.7), BTCE estimates.

Table 1.4 in Chapter 1 presents details of the assumed increases in vehicle kilometres travelled by vehicle type. Articulated truck travel, in both urban and non-urban areas, is likely to grow by about 50 per cent between 2003 and 2015. The same increase for light commercial vehicles is likely in non-urban areas. However, in urban areas the increase is likely to be 63 per cent.

In urban areas, light commercial vehicles will meet the ever-growing demand for goods and services, compounded by ever-growing population densities.

The BTRE has not taken explicit account of increases in congestion in Australia's cities or on its highways. Regardless of how road authorities handle congestion, more travel, especially by light commercial vehicles, seems inevitable. Longer peak periods and more off-peak travel are likely in large urban areas. This could be to avoid congestion tolls, or to avoid delays in ever-longer queues—if congestion tolling continues to be deferred.

9.6 POLICY ISSUES IN THE AUSTRALIAN ROAD FREIGHT INDUSTRY

Future developments in the Australian road freight industry will generate policy responses in several areas. These areas include:

- regulation
- congestion
- safety
- greenhouse gas emissions
- local pollution.

Operational regulation of the trucking industry involves predominantly state and local governments. Previous state regulations restricting the carriage of coal, grain, minerals and other commodities to rail transport are being progressively eased. Current regulations govern sizes of trucks and allowed areas of operation. These are likely to be fairly regularly reviewed over the coming decades, as changes in traffic levels and truck configurations pose new issues for policy makers. There are likely to be significant increases in the numbers of trucks (especially large trucks—see Appendix Tables VIII.3 and VIII.4) over the next 20 years—on both urban roads and rural highways. Increasing congestion is liable to increase the competition for road space between cars and trucks. Trucking is an integral part of our economy, and must continue to be seen to pay its way[1], in order to pre-empt pressure for over–regulation. This would adversely affect the nation as a whole.

Local government regulation of trucking is likely to become more of an issue in the future. There is a trend in some states for devolution of regulatory powers over trucking from State to local government . These issues for trucks operating over many local government areas. In addition, there is a temptation for local government to adopt a 'not in my backyard' attitude to trucking. Issues of access, parking facilities and hours of operation, will be exacerbated by the growth likely to occur in the industry over the next 20 years. The pressures to find workable regulations for the industry will increase.

Congestion, especially in urban areas, will be a continuing problem over the next 20 years. The growth in vehicle kilometres travelled by cars will be of the order of 1.3 per cent per year. This is expected to increase by one third in 20 years. Vehicle kilometres travelled by commercial vehicles are likely to increase by about three per cent per year and to

1 Economically, environmental and socially, perhaps encapsulated by 'sustainability'.

almost double in 20 years. Trucks will make up an increasing proportion of an increasingly congested traffic stream. As such, they will not escape the effects of measures aimed at congestion. In fact, the industry will be required to participate in the formulation of policies to deal with congestion. This participation will involve consideration of supply and demand issues. Supply is the provision of infrastructure while demand includes pricing, operational restrictions and the location of industrial and residential zones.

Safety and vehicle condition are likely to be areas that will generate policy initiatives affecting trucking. An accident between a light vehicle and a heavy vehicle is more likely to result in fatalities than an accident between two light vehicles. With trucks making up an increasing proportion of the traffic stream, issues associated with ensuring their safe operation on Australia's roads will become more important. These issues include driver training and the mechanical fitness of vehicles.

With global warming likely to become a more significant world issue over the next 20 years, the attempts to control greenhouse gas emissions will inevitably involve trucking. In fact, trucking is one of the major transport sector growth areas foreseen for greenhouse gases over the next two decades—the other being aviation. The trucking and aviation industries are therefore likely to be heavily involved in policies aimed at reducing greenhouse gas emissions from Australian transport.

Local pollution by trucks may also be an issue of growing importance. Particulates are a visible and fairly dangerous emission that will increasingly be the subject of regulation. Other emissions from trucks, for example fumes and noise, will also attract attention if growing truck volumes seem unjustified.

There is pressure for governments to openly and transparently identify the costs to society as a whole of road use—by all types of vehicles, in various places, at various times. Only then will the community support efforts to balance those impacts with regulations or to charge for that use. Travel on Australia's road will be shared efficiently among competing users when regulations and charges reflects the costs of road use. And provided pricing for freight and passenger travel by other modes is equally rigorous, only then will Australia have the right amount of road travel. Anything less will reduce our national prosperity.

9.7 CONCLUSION

The Australian road freight industry in the last two decades has been characterised by rapid growth. This is likely to continue in the next two decades—albeit at a somewhat slower rate. The industry's close link to the economy's growth will ensure that issues affecting the Australian economy find their counterpart in the road freight industry.

The pace of structural change in the industry has been, and is likely to continue to be, as rapid as its overall growth. During the next two decades, trucks will comprise a growing proportion of the traffic stream. There will be more larger trucks with more varied trailer combinations. In addition, the light commercial vehicle sector of the industry should show rapid growth. This growth should be in line with fast growth in the service sector of the economy.

This rapid growth and structural change provides a backdrop to the policy issues that government will face over the next 20 years. Pre-eminent among these issues will be those involving regulation, congestion, safety, greenhouse emissions, local pollution and equity. Perhaps most importantly of all will be the policy considerations about economically efficient charges.

CHAPTER 10

FREIGHTSIM

10.1 BACKGROUND AND PROJECT ORIGINS

During recent decades the strategic transport modelling capability of many road agencies has not kept pace with need. While some advances have been made in analyses of urban networks, little progress has been made in modelling the freight tasks of the rural networks. At the same time there has been a strong movement towards allocating transport funds to the rural network on the basis of the transport task carried by the strategic interregional freight corridors. Risk management, and its treatment of future uncertainty, has also achieved a more prominent position in program and policy development. Together, these changes have emphasised the need for an improved capability for modelling interregional transport—especially for alternative future scenarios of regional development.

Austroads members recognised the need for improved interregional transport modelling, and in June 2001 contracted the Bureau of Transport and Regional Economics (BTRE) to undertake this project. With Austroads agreement, the BTRE subcontracted FDF Pty Ltd to complete a substantial component of the project on the basis of the ongoing arrangements for intellectual property ownership noted below.

This chapter describes the structure and capabilities of the model, *FreightSim*, that resulted from that work. This chapter is a summary of a resulting Austroads report (Austroads 2003).

10.2 FREIGHTSIM MODEL CAPACITY

Fundamentally, *FreightSim* is a flexible model. It relies upon, and encourages input to be provided by, a user knowledgeable in the freight tasks, the strategic transport networks, the regions and the commodities that are being modelled. It is not a 'black box' technology. Rather, it relies on simple logical algorithms with input parameters chosen by the user. This facilitates user understanding of the output and the testing of alternative scenarios.

The first important capability of *FreightSim* is its ability to estimate base-year freight flows—1998–99. *FreightSim* covers 132 regions—matching the ABS Statistical Sub–Divisions—16 commodity groupings and six modes. The regions are distributed across the Australian mainland and Tasmania.

There is one commodity category for non-bulk goods and 15 bulk commodity categories. The bulk commodity groups are listed in a subsequent section of this chapter.

The second capability of *FreightSim* is basecase forecasting of interregional freight flows. For each commodity, the model allows detailed 20-year horizon basecase forecasting of each region's production, imports, consumption and exports. It also enables the resulting freight flows to be depicted between all regions by mode.

The third capability provided by the model is the ability to make changes to the basecase assumptions. For example, the assumed rates of economic growth over the 20 year forecast horizon can be reset by the analyst. Many other 'general' model parameters can also be reset.

The fourth capability of *FreightSim* is its ability to serve as a sketch-planning tool for examining the freight transport implications of economic development scenarios. For example, it enables examination of questions such as 'What would be the freight task impact of a switch from production of wool to wheat in the wheat–sheep zone of Australia?', or 'What are the freight implications of high population growth on the New South Wales North Coast?' These are the types of questions to which answers can now be logically devised using *FreightSim*. An advantage of the model in such sketch-planning is that it enables examination of possible changes, or development, of the economic geography. The examination of specific charges is done within a framework that is addressing, in parallel, forecasts of the balance of the system traffic.

Thus *FreightSim* offers four important features to Australian Government and state planning bodies. It provides:

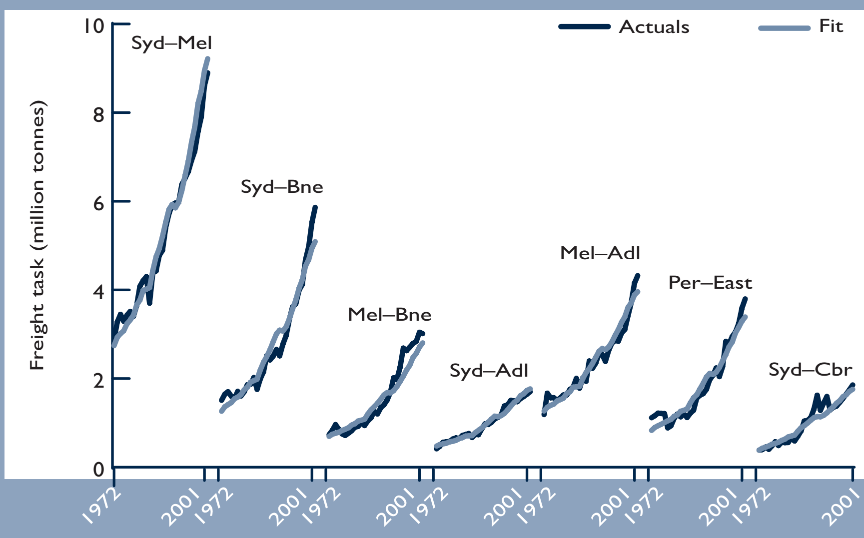
1. a detailed base-year estimate of freight flows between Australian regions
2. best-guess 20-year forecasts of how these flows will develop over time
3. the ability to make changes to 'general' basecase assumptions
4. a systematic framework for sketch planning analysis of the impacts of specific changes to regional economies or to the freight system.

The following sections describe the model's capabilities in forecasting basecase and scenario freight transport. *FreightSim* uses different modules for bulk and non-bulk freight commodity classes. Accordingly, the applied methods are described separately. Non-bulk commodities include manufactured products—also termed transformed or value-added products. The bulk commodities are itemised later in this document.

10.3 BASECASE FORECASTING—NON-BULK FREIGHT

The module for non-bulk freight forecasting uses a gravity model. This reflects the assumption that the volume of non-bulk freight moving between any two regions is slightly more than proportional to the combined gross domestic product of the regions. The gross domestic product is taken as regional population times national-level gross domestic product per person. Non-bulk freight also increases as real freight rates decrease. Figure 10.1 shows the fit of the gravity model to 30 years traffic on the seven major intercity corridors in Australia.

FIGURE 10.1 GRAVITY MODEL RESULTS FOR SEVEN MAJOR INTERCITY CORRIDORS



This gravity model has been generalised in *FreightSim* to predict the growth of non-bulk freight between all 132 regions. The basic assumptions underlying the best guess basecase forecasts produced by *FreightSim* are:

1. population growth—and distribution across regions—reflects the current median ABS forecast. Australia's population is forecast to increase from 19.20 million in 2000 to 22.78 million in 2020 (ABS 2001)

2. the rate of growth of Australia's gross domestic product is forecast to progressively reduce from around 3.75 per cent per annum this financial year, to around 2.1 per cent in the year 2020 (Henry 2002)
3. real freight rates—averaged across modes—are assumed to fall by 0.5 per cent per annum to year 2020 (BTRE 2002b).

Using these assumptions, *FreightSim* produces forecasts of non-bulk freight flows between regions. Tables 10.1 to 10.3 show the year 2000 matrix of flows, the year 2020 matrix, and the computed percentage growth over the next 20 years—where 100 per cent equals a doubling.

TABLE 10.1 NON-BULK FREIGHT FLOW ESTIMATES, YEAR 2000

(kilotonnes)

Origin	Destination								Total
	ACT	NSW	Vic	Qld	SA	WA	Tas	NT	
ACT	335	97	3	1					437
NSW	579	22 863	2 398	1 557	681	576	4	48	28 707
VIC	3	2 191	20 212	1 434	2 106	1 371	590	92	28 000
QLD	2	1 229	623	12 857	98	106		23	14 937
SA		581	1 408	143	6 342	562		110	9 147
WA		249	378	167	260	7 361	1	12	8 427
TAS		1	859	0	1	3	3 409		4 273
NT		12	10	8	88	6		667	792
Total	**920**	**27 223**	**25 892**	**16 168**	**9 577**	**9 985**	**4 005**	**951**	**94 719**

Note: Tables 10.1, 10.2 and 10.3 present uplifted tonnages for all (domestic) modes.

TABLE 10.2 NON-BULK FREIGHT FLOW FORECASTS, YEAR 2020

(kilotonnes)

Origin	Destination								Total
	ACT	NSW	Vic	Qld	SA	WA	Tas	NT	
ACT	564	287	6	2					858
NSW	1 097	41 244	4 218	3 048	1 225	1 110	7	97	52 047
VIC	6	4 100	35 388	2 722	3 688	2 595	860	179	49 538
QLD	4	2 592	1 168	26 866	178	236		52	31 096
SA		941	2 359	244	10 219	954		189	14 907
WA		528	772	358	468	15 049	1	25	17 202
TAS		2	1 215	1	1	5	4 766		5 989
NT		25	20	19	161	13		1304	1 543
Total	**1 671**	**49 720**	**45 146**	**33 260**	**15 940**	**19 963**	**5 634**	**1 845**	**173 179**

TABLE 10.3 PERCENTAGE CHANGE IN NON-BULK FREIGHT FLOWS, 2000–20

(per cent)

Origin	Destination								Total
	ACT	NSW	Vic	Qld	SA	WA	Tas	NT	
ACT	68	195	77	77					97
NSW	89	80	76	96	80	93	55	102	81
VIC	90	87	75	90	75	89	46	94	77
QLD	90	111	87	109	82	124		128	108
SA		62	68	71	61	70		72	63
WA		112	104	115	80	104	57	111	104
TAS		53	41	48	35	48	40		40
NT		105	99	146	82	115		95	95
Total	**82**	**83**	**74**	**106**	**66**	**100**	**41**	**94**	**83**

Table 10.3 (last column, last row) indicates that non-bulk freight tonnages are forecast to grow under basecase assumptions by 83 percent over the 20 years. Queensland and West Australia are forecast to have the fastest growth in non-bulk tonnages. Tasmania and South Australia are forecast to have the slowest growth. Although Tables 10.1 to 10.3 focus on states, *FreightSim* provides forecasts for each of the 132 regions. Note that the units are tonnes uplifted, not tonne–kilometres.

After the total flows of non-bulk freight between regions have been calculated, the model splits these into modal flows. The existing mode split is specified in the base year dataset. For the forecasts, these mode splits have been gradually altered according to historical business-as-usual trends. These trends reflect road increasing its mode share. The *FreightSim* basecase forecasts of mode share also reflect this.

For example, Table 10.4 shows the forecast percentage change in road freight flows over the 20 years of the forecast period. Comparing Tables 10.3 and 10.4 shows that although total flows of non-bulk freight increase by 83 per cent, non-bulk road freight flows increase by 98 per cent. The comparison for interstate flows shows an even greater relative role for the road mode compared with rail.

Table 10.5 shows a condensed version of the year 2000 grain flows matrix.

TABLE 10.4 PERCENTAGE CHANGE IN NON-BULK ROAD FREIGHT FLOWS, 2000–20

(per cent)

Origin	Destination								Total
	ACT	NSW	Vic	Qld	SA	WA	Tas	NT	
ACT	68	192							95
NSW	92	88	137	164	113	120		111	95
VIC		143	80	105	246	153		112	93
QLD	90	221	96	128	82	125		126	132
SA		71	243	72	62	129		133	76
WA		125	145	131	129	114		183	115
TAS							52		52
NT		112	110	146	82	189		125	125
Total	**83**	**96**	**89**	**128**	**86**	**116**	**52**	**124**	**98**

TABLE 10.5 *FREIGHTSIM* YEAR 2000 GRAIN FLOW MATRIX

(kilotonne)

Origin	Destination										Total
	ACT	NSW	Vic	Qld	SA	WA	Tas	NT	To consumption	To export	
From prod	0	13 377	3 365	4 455	6 394	12 284	74	13			39 962
From import		30	4	8	0	1		0			44
ACT	0								93		93
NSW	93	19 660	1 456	69	89	9	31		7 919	3 686	33 011
VIC		16	6 633	3	13	31			2 389	2 510	11 595
QLD		27	80	6 857					2 553	1 651	11 168
SA			58		12 493				2 384	4 049	18 984
WA				0		23 463	2		2 254	10 067	35 787
TAS							161		106	2	269
NT								6		13	18
Total	**93**	**33 110**	**11 595**	**11 393**	**18 989**	**35 787**	**269**	**18**	**17 699**	**21 978**	**150 932**

Note: The above table presents uplifted tonnages for all modes—one tonne of grain moved by truck to the rail-head and then by train to the port is summed as two uplifted tonnes.

While assumptions about mode share trends are embedded in the *FreightSim* basecase, its construction allows for the parameter values to be changed by the user to reflect other judgements.

When the mode split has been characterised, the flows calculated by *FreightSim* can be assigned to the road and rail networks, and the traffic flow implications derived. *FreightSim* can then be applied to answer questions such as 'How much interregional road freight is currently passing Yass on the Hume Highway?', 'What will this increase to in the year 2020?'

The model also produces estimates of tonnages of non-bulk commodity imports and exports. These are strongly correlated with the *FreightSim* input assumptions.

The import, and especially export, forecasts for the bulk commodities reflect an entirely different modelling paradigm. It is described in the following section.

10.4 BASECASE FORECASTING—BULK FREIGHT

There are 15 bulk commodity groups in *FreightSim*. They are:

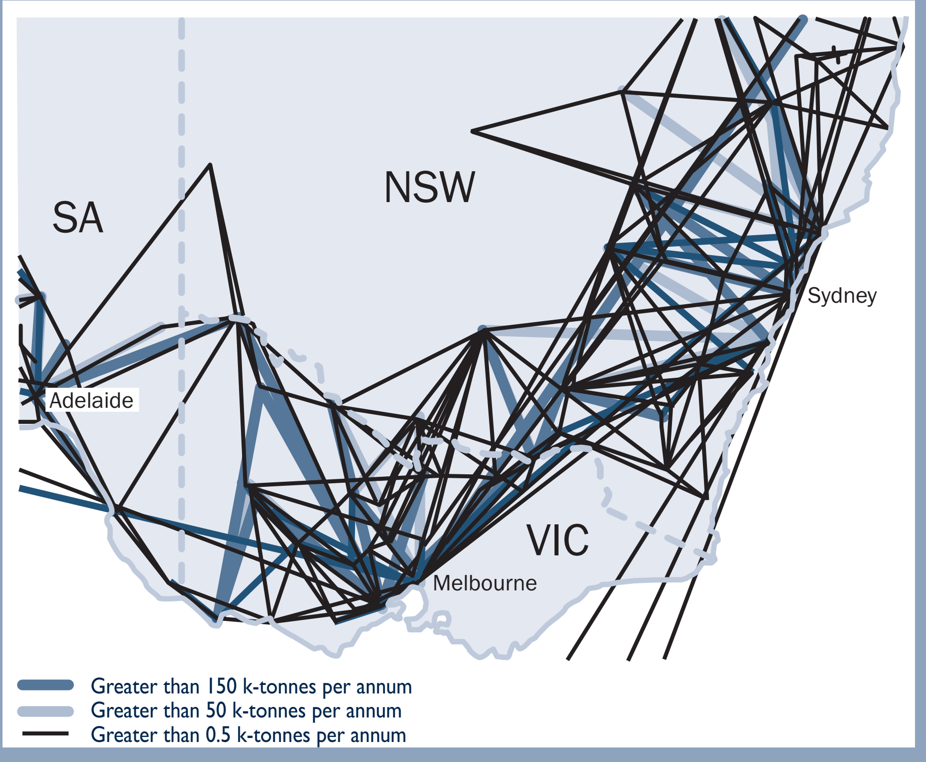
1. Grains and oilseeds
2. Sheep (live)
3. Cattle (live)
4. Meat
5. Other agriculture
6. Coal and coke
7. Metallic minerals
8. Non-metallic minerals
9. Oil and petroleum products
10. Gas
11. Steel and metals
12. Fertilisers
13. Cement
14. Timber
15. Other bulk.

Each of the above categories can be further subdivided and addressed in *FreightSim*.

In contrast with the non-bulk module—where a gravity model is used to factor up the flows directly—the bulk commodities module calculates flows from fundamental inputs. For each region, for the commodity at issue, production, imports and consumption are specified. The consumption freight mass flow is satisfied in *FreightSim* according to past flow patterns, and adjusted into the future, as appropriate. Any surplus—of production plus imports less consumption—is then allocated to ports for export using past mode-specific export path patterns and past port-use patterns.

The basecase module for grains and oilseeds illustrates how the bulk matrixes are specified and handled in *FreightSim*. Figure 10.2 shows the major grain flows in South Eastern Australia, mapped from the *FreightSim* base year dataset.

FIGURE 10.2 FREIGHTSIM YEAR 2000 GRAIN FLOWS—MOVED BY ALL MODES



Note: Legend for the above flows: Blue greater than (GT) 150 kilo tonnes per annum, Red GT 50, Green GT 25, Grey GT 0.5 kilotonnes per annum.

The first step in projecting this matrix into the future is to specify each region's forecast grain production. Basecase regional grain production forecasts are provided with the model. These are drawn from CSIRO 2002.

Next, consumption is forecast. *FreightSim* does this by assuming consumption in each region is adjusted for the relevant state population growth or decrease. This basecase assumption can be adjusted into the future, as appropriate. Imports at each port are assumed to increase in line with demand in the port's hinterland regions. Again a simple assumption of unchanged per capita import demand—for the hinterland—is made. It is noted here that—other than for petroleum products and fertilisers—the imports of most bulk commodities are minimal.

Results from the bulk commodities module, for the basecase year 2020 forecast grain flows matrix, are summarised in Table 10.6.

TABLE 10.6 *FREIGHTSIM* BASECASE YEAR 2020 FORECAST GRAIN FLOW MATRIX

(kilotonne)

Origin	Destination										Total
	ACT	NSW	Vic	Qld	SA	WA	Tas	NT	To consumption	To export	
From prod	0	16 888	4 387	5 527	8 088	14 621	77	15			49 602
From import		35	5	10	0	1		0			51
ACT	0								130		130
NSW	130	25 781	1 948	269	95	10	30		9 226	4 793	42 284
VIC		20	9149	3	14	39			2 704	3 723	15 652
QLD		30	95	9 004					3 398	2 114	14 641
SA			73		16 608				2 484	5 600	24 764
WA				0		28 866	2		2 911	11 754	43 534
TAS							170		100	10	279
NT								7		15	21
Total	**130**	**42 753**	**15 656**	**14 814**	**24 806**	**43 537**	**279**	**21**	**20 953**	**28 009**	**190 958**

Table 10.7 presents the percentage change in grain flows. As can be seen, the total grain flows are forecast to rise by 27 percent—bottom row, last column. This is slightly greater than the 24 per cent total grain production increase—top row, last column.

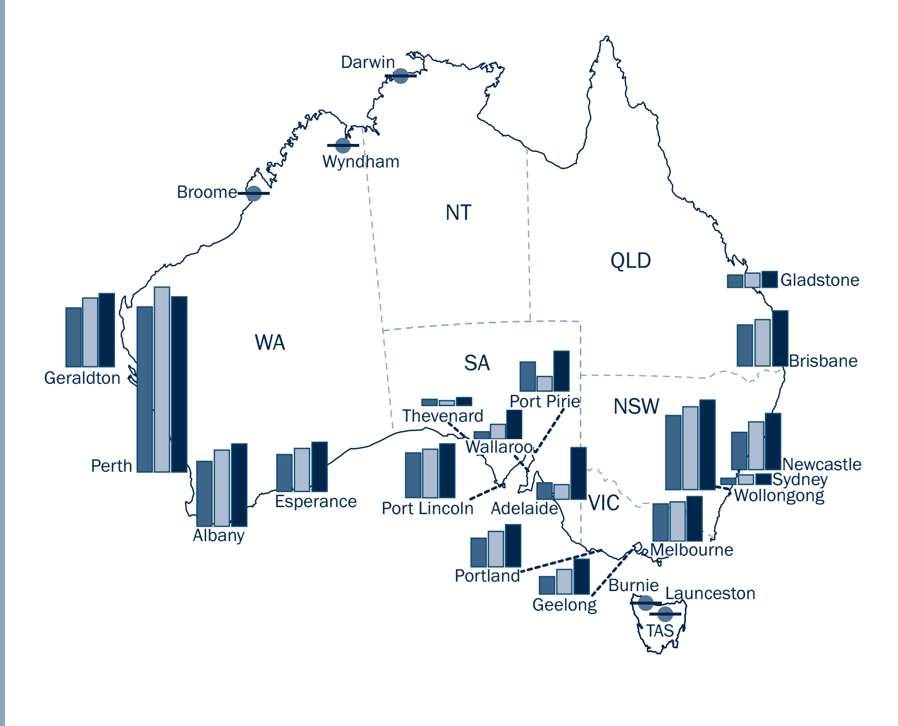
TABLE 10.7 FORECAST PERCENT CHANGE IN GRAIN FLOWS, 2000–20

Origin	Destination										Total
	ACT	NSW	Vic	Qld	SA	WA	Tas	NT	To consumption	To export	
From prod	12	26	30	24	26	19	4	13			24
From import		15	17	22	50	14					17
ACT	17								40		40
NSW	40	31	34	289	8	18	-3		17	30	28
VIC		22	38	27	8	23			13	48	35
QLD		12	18	31					33	28	31
SA			25		33				4	38	30
WA				20		23	-3		29	17	22
TAS							6		-5	380	4
NT								18		13	14
Total	**40**	**29**	**35**	**30**	**31**	**22**	**4**	**14**	**18**	**27**	**27**

The forecast total flows in Table 10.6 are allocated to modes using basecase historical trends, as in the non-bulk module—see Chapter 7. These trends reflect rail maintaining its mode share in grains transport. Thus, the road and rail tasks in the basecase grains forecasts increase by approximately the same percentages as in Table 7. Again, *FreightSim* is designed so that this assumption—and any of the others discussed above—can be easily changed and the impact revealed.

The resulting growth in export grain flows through the major ports is shown in Figure 10.3.

FIGURE 10.3 BASECASE FORECASTS OF EXPORTS OF GRAIN BY PORT, 2000, 2010 & 2020



Note: The vertical bars show grain export tonnages for the years 2000, 2010 & 2020 for each major grain export port.

The differences in the growth rate between ports is a function of the various basecase assumptions—principally those that specify grain production and grain consumption in the regions forming each port's hinterland. Reductions in the growth of grain exports will be due to falling production and/or rising domestic consumption.

Consistent with other aspects of the use of the model, the analyst may wish to consider other assumptions about regional grain production.

When the analyst chooses to make substantial changes to fundamental assumptions, the situation being analysed can be considered to be a new future scenario. Such scenario analysis capability is a powerful aspect of *FreightSim* and can be carried out for bulk and non-bulk freights.

FreightSim aims to be a sketch-planning tool that allows the analyst to make specific changes to the input data and/or to the model's parameter values. These assumptions are then processed within the context of a systematic model. The implications can then be readily identified.

10.5 SCENARIO FORECASTING—NON-BULK FREIGHT

Scenario forecasting may consider a question such as 'What would happen to non-bulk freight flow patterns, if there was to be a major population shift to the North Coast of New South Wales—to Coffs Harbour and Port Macquarie—such that it equalled the population growth otherwise forecast for Sydney over the next 20 years?' While such a 'New Gold Coast' scenario is admittedly extreme, it is ideal for illustrating *FreightSim's* flexibility in predicting the effects of radically different patterns of economic development. Table 10.8 outlines the population shifts for this scenario.

TABLE 10.8 POSSIBLE POPULATION CHANGE USED IN THE MODELLING

Location	Population year 2000	Projected population year 2020	New Gold Coast scenario year 2020	Difference
Sydney	4 077 000	4 942 000	4 077 000	-865 000
Port Macquarie	63 000	80 000	512 000	+432 000
Coffs Harbour	61 000	75 000	508 000	+433 000

Source: for population 2000 and 2020: ABS (2001).

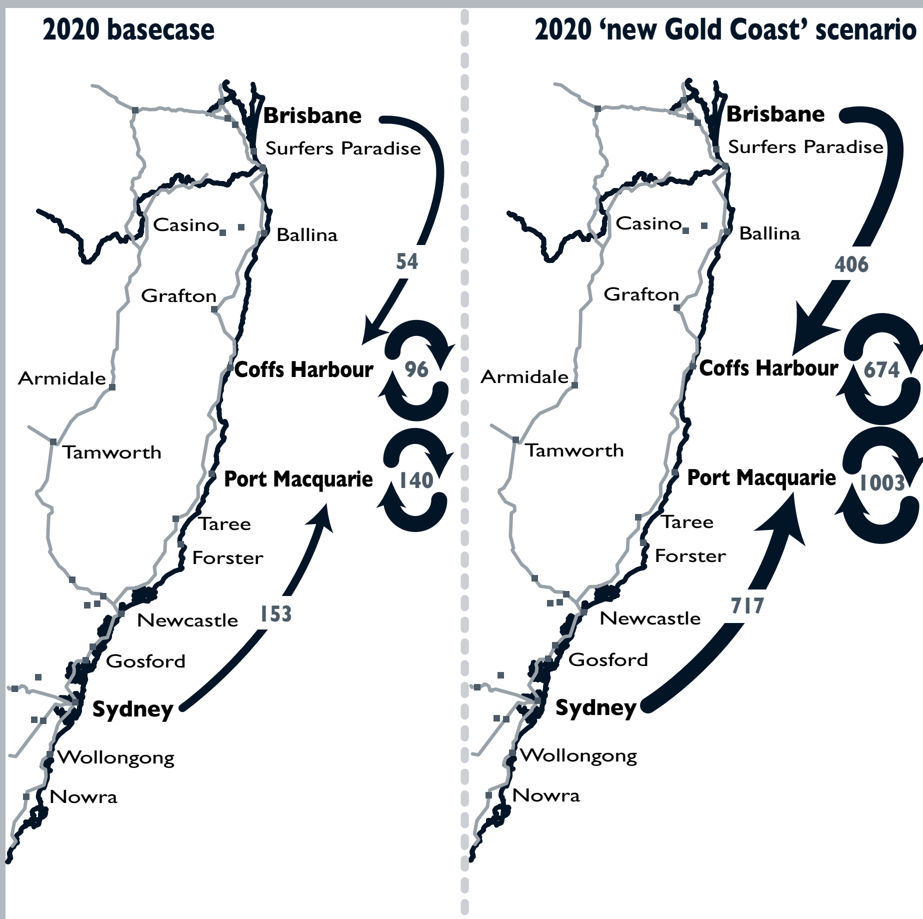
Figure 10.4 shows the significant year 2020 non-bulk freight flows, moved by road, for both the basecase and the scenario forecasts respectively.

The most obvious difference is in shipments to and from the scenario 'New Gold Coast' regions. The North Coast New South Wales growth cities make a much greater call on other regions to supply goods for the dramatically increased population.

Other changes include some thinning of flows from other regions to and from Sydney. Its population in 2020 is now significantly lower than was forecast for the basecase. Some of the flows from Brisbane, previously destined for Sydney, are diverted to the growth regions. Imports for the growth cities enter through Sydney or Brisbane and are moved by road and rail to the North Coast.

The discussion above addresses only the non-bulk freight movement changes. The North Coast New South Wales growth scenario will also produce new and increased freight movements for the bulk commodities. These can also be estimated using *FreightSim*.

FIGURE 10.4 NON-BULK FREIGHT FLOWS FOR THE YEAR 2020 BASECASE AND THE YEAR 2020 NEW GOLD COAST SCENARIO (KILOTONNES)



Note: The 2020 basecase is shown on the left—with 2020 'New Gold Coast' scenario on the right.

10.6 SCENARIO FORECASTING—BULK FREIGHT

In a similar way, the scenario analysis may consider a question such as 'What would be the effect on grain transport, if grain production in some regions is lower in the next 20 years than assumed by the CSIRO in its basecase grain forecasts?' To examine the effect of this on grain transport, assume that production in the Murray–Darling River region declines, at a rate of one per cent each year from the basecase forecast, between 2000 and 2020. The affected regions are shown in Figure 10.5.

FIGURE 10.5 REGIONS ASSUMED TO HAVE REDUCED GRAIN PRODUCTION

Note: This scenario covers the regions: 257 Upper Darling, 263 Lachlan, 271 Central Murrumbidgee, 272 Lower Murrumbidgee, 275 Albury, 276 Upper Murray, 277 Central Murray, 278 Murray-Darling, 281 Far West, 341 Mildura, 342 West Mallee, 343 East Mallee, 356 North Loddon, 362 North Goulburn, 375 Wodonga, 541 Riverland, 545 Murray Mallee. The above map shows the location of these regions.

Note: This scenario covers the regions: 257 Upper Darling, 263 Lachlan, 271 Central Murrumbidgee, 272 Lower Murrumbidgee, 275 Albury, 276 Upper Murray, 277 Central Murray, 278 Murray-Darling, 281 Far West, 341 Mildura, 342 West Mallee, 343 East Mallee, 356 North Loddon, 362 North Goulburn, 375 Wodonga, 541 Riverland, 545 Murray Mallee. The above map shows the location of these regions.

The resulting forecast changes from the year 2020 basecase grain exports from South–East Australian ports are given in Table 10.9.

The above table shows that Wollongong, the primary New South Wales port for Riverina grain, and Melbourne—Australia's major rice exporting port—would both face the largest potential decline in the tonnage of grain exported. With this scenario rail and road grain flows in New South Wales and Victoria are forecast to decline by roughly similar percentage amounts.

Table 10.9 also illustrates a multiplier effect. For example, a 20 per cent reduction in grain production translates into a 64 per cent reduction in grain delivery at the Port of Melbourne. This highlights the implications for exports, for the transport services task, and ultimately, for the provision of transport infrastructure.

TABLE 10.9 GRAIN EXPORTS UNDER A REDUCED PRODUCTION SCENARIO

(kilotonne)

	Projected exports—basecase estimate (Year)			Projected exports—under a reduced production scenario (Year)			Percentage change (Year)		
Port	2000	2010	2020	2000	2010	2020	2000	2010	2020
Sydney	215	299	345	215	271	228		-9%	-34%
Newcastle	1209	1489	1685	1209	1466	1572		-2%	-7%
Wollongong	2263	2533	2763	2263	2377	2171		-6%	-21%
Melbourne	576	836	1084	576	471	389		-44%	-64%
Geelong	1121	1255	1358	1121	1231	1276		-2%	-6%
Portland	813	1080	1281	813	1000	1118		-7%	-13%
Brisbane	1281	1489	1667	1281	1479	1653		-1%	-1%
Gladstone	369	416	447	369	416	447			
Adelaide	1267	1442	1607	1267	1326	1326		-8%	-17%
Wallaroo	946	1133	1304	946	1133	1304			
Port Lincoln	1381	1500	1676	1381	1498	1670			
Thevenard	179	205	255	179	205	255			

The disaggregated level of information available from *FreightSim* analyses allows detailed examination of the effects of diverse scenarios on network flows.

10.7 CONCLUSION

FreightSim provides base-year estimates of freight flows between Australian regions. The *FreightSim* software also provides a powerful means of forecasting future changes in interregional freight flows.

Further, it is quite straightforward for the analyst to reconfigure the model. This means that the model can be used for either strategic and/or regional transport planning, or for analysing the freight task arising from any particular commodity or commodity grouping. It can be updated as new data becomes available, and it can be used to test various growth and regional development scenarios.

It is expected that *FreightSim* will provide a significant input into the process of providing reliable estimates of the future regional transport task.

CHAPTER 11

AN URBAN FREIGHT POLICY MODEL

11.1 DESCRIPTION OF THE URBAN FREIGHT MODEL

Road freight activity in Australian cities is growing more rapidly than passenger traffic, and although passenger traffic per person is expected to plateau at some point in the future, there is no sign of that happening for urban freight activity. As a result, the environmental impacts of urban freight traffic, especially in terms of greenhouse gas (GHG) and other air pollution, are of increasing interest to the community. In view of this, BTRE, on behalf of the Australian Greenhouse Office (AGO), commissioned a study to investigate the sensitivity of urban freight patterns to a range of transport outcome scenarios aimed at reducing GHG emissions. This chapter is a summary of the resulting BTRE report (BTRE 2004).

While the study aimed to provide results generally applicable to all Australian urban areas, Greater Sydney was used as a case study, to build on the data and models held by the Transport and Population Data Centre (TPDC) of Transport NSW. The TPDC Commercial Transport Study (CTS) has developed methodologies to derive freight traffic due to total requirements for freight and relative requirements for categories of goods from actual or forecasted commodity flows and associated information. This provides one of the most detailed estimations of the impacts of urban freight flows on the road network available anywhere in the world. In essence, the model links the demand for different commodities to be moved from A to B with the usual ways and means of getting the freight there. Such models are potentially powerful in predicting expected traffic on the network due to changes in the needs for different types of freight.

GHG emissions due to urban freight depend upon the fuel use by freight vehicles. This in turn depends upon vehicle technologies, and fuel, plus travel speed and flow, hence prevailing traffic. It also depends on the numbers of trips required, the loading of vehicles and the location of the industry and business dispatching or receiving freight together with the transport infrastructure, predominantly roads, linking freight origins and destinations. Potential scenarios expected to produce positive GHG

TABLE 11.1 INFLUENCE ON URBAN FREIGHT GHG EMISSIONS

Category	Influences
VEHICLE	The type of fuel, efficiency of motors, and influences such as vehicle weight, aerodynamic properties and driving style all influence emissions.
TRAFFIC	Emissions vary with speed and differ between free flow and congested conditions, thus are affected by prevailing traffic conditions.
VEHICLE MOVEMENT	Emissions depend on numbers of trips, total trip distances, loading of vehicles and size of the vehicle used for the task.
INFRASTRUCTURE AND LAND USE	Land use governing the location of industries and business and their distances from suppliers and customers influence trip lengths, hence fuel use and emissions as does new infrastructure to provide better connectivity.

emission outcomes may thus be conveniently divided into the categories shown in Table 11.1.

A wide range of potential measures in these categories was identified, a modelling framework was developed and a set of scenarios for modelling was selected. The relative impacts of scenarios on vehicle emissions were then modelled. The models took into account the basic factors affecting the pattern of urban freight traffic activity, the rate of emissions under different traffic conditions, and the resulting impacts in terms of patterns of emissions in different parts of cities (emissions on short links in the network).

A literature search and advice from experts were used to develop a qualitative understanding of the urban freight task. This was then turned into quantitative estimates of how the patterns of freight vehicles trips by Articulated Trucks, Rigid Trucks and Light Commercial Vehicles would change under different scenarios. The freight vehicle trips were then combined with the traffic from passenger vehicles. This produces a complete picture of travel distance and time for each type of vehicle, within time of day periods to allow for differences in traffic volumes. More details are available in Technical Paper 2 (Smith and Kilsby 2003)

Next the modelling estimated first fuel use, then resulting GHG and other emissions (as shown in Table 11.2) for each link in the road network. This needed to take into account the mix of traffic, an estimated distribution of fuel types, the speed of traffic and the loadings of vehicles. These latter processes required recalibration of European data such as speed and load curves to suit the Australian context. More details of emissions modelling and results are available in Technical Paper 3

TABLE 11.2 EMISSIONS MODELLED

Direct GHG		Air Pollutants	
CO_2	Carbon Dioxide	CO	Carbon Monoxide
CO_2e	Carbon Dioxide Equivalents	VOC	Volatile Organic Compounds
CH_4	Methane	NO_x	Oxides of Nitrogen
N_2O	Nitrous Oxide	PM	Particulate Matter
		C_6H_6	Benzene
		C_4H_6	Butadiene
		SO_2	Sulphur Dioxide

(Zito and Taylor 2003). A Scenario Viewer was included in the package to allow examination of the study results at road network link level. Further information about the uses and features of the Scenario Viewer can be found in Technical Paper 4 (Marquez 2003).

The modelling was also extended to examine air pollution from transport sources. The link level emission results for each air pollutant were input into an air shed model of Sydney to estimate their spatial dispersion across the urban area throughout the day. The process used estimates of population whereabouts by time of day using data on household activity from the TPDC Household Survey. Relative impacts of the alternative GHG scenarios for urban freight on air quality were reported in terms of exposure of the population to air pollution in different parts of the city over a representative day. In view of the extensive output when the impacts of seven scenarios on exposure to four pollutants in different areas of the city are considered, only example results are presented here. Full detail of the results for each pollutant and each scenario can be found in Technical Paper 5 (Marquez and Smith 2003).

11.2 RESULTS FOR THE MODELLED SCENARIOS

The results of applying a scenario model to simulate the effects on greenhouse gas (GHG) emissions from trucking in Sydney of various abatement scenarios are presented. These include vehicle measures, traffic measures, vehicle movement measures and infrastructure and land use measures.

The model results are presented in terms of the effects of transport, emissions and air pollution.

Transport effects

The seven scenarios together with the methods used to test them are summarised in Table 11.3, together with the transport outcomes of the scenarios on average.

The scenarios are selected to represent generic outcomes and thus provide results for far more than seven separate scenarios. For example, congestion might be reduced (scenario 2) by a range of means: improved public transport, parking restriction or even road charges.

For the base and each scenario: distance and speeds for the four vehicle types (passenger vehicles, light commercial vehicles, rigid trucks and articulated trucks) on the approximately 15 000 one way links on the transport network were then passed to an emissions model.

The strength of the network modelling approach lies in the estimating location of specific variations and variation by time of day.

TABLE 11.3 SCENARIOS, TRANSPORT MODEL APPROACHES AND SUMMARISED RESULTS

Scenario	Transport modelling approaches	Summary results
1. Improved fuel consumption	Use Base case: with emission model factors changed for trucks	Better truck fuel efficiency lowers truck fuel use
2. Lower congestion	15 per cent reduction in car use in AM and PM peaks	Reduces both peak VKT and VHT. The percentage reduction in VHT exceeds that of VKT and average travel speeds increase in peaks
3. Better traffic management	Volume-delay functions on aerial roads modified to increase speed at saturation by 3 kph and to add 5 per cent to capacity	Improvement of the performance of arterial roads improves traffic flow but the overall effect is small, because the better-performing roads tend to attract more traffic, which slows them down again
4. Logistic changes	Commercial vehicle trip matrices modified to give same quantity of goods being moved between same places but with higher load factors and some transfer of goods to larger vehicles	A move to higher load factors and load consolidation produces a large net decline in VKT by commercial vehicles and hence is likely to reduce emissions. There is very little change in operating speed, since VHT declines in roughly as VKT
5. Real-time traffic information	Volume-delay functions on major approaches to CBD and Parramatta and on major orbital routes modifies as per "better traffic management"	This increases the performance of the principal arterial and orbital routes. It has practically no effect on commercial vehicle VKT but VHT decreases slightly and hence higher operating speeds are achieved (for light CV's and rigid trucks)
6. Infrastructure improvement	Sydney Orbital route at freeway standard added to 1996 road network for Sydney	If trip patterns did not change, the Sydney Orbital would have encouraged longer but faster trips by both cars and commercial vehicle, with the result that VKT would go up, VHT would go down and the average travel speed would increase
7. Infrastructure improvement with land use change	Sydney Orbital route added; plus westward shift of employment assumed thus modified CV patterns	Relocation of some freight-generating employment from inner areas to western Sydney actually increased commercial vehicle activity

Emissions effect

The emission totals from all traffic over a 24-hour study period for each pollutant are presented in Figure 11.1.

Further, results that distinguish the impacts on freight emissions by freight vehicle type for each scenario are presented in Figure 11.2 to Figure 11.7.

Figure 11.2 indicates the GHG emissions performance of freight vehicles on the study network under different scenarios as a percentage of the base case. This figure presents a set of bar charts for each of the direct greenhouse gases and for total GHG emissions in CO_2 equivalents. Note in this and subsequent figures, scenario 1 (best fuel technology) is shown last.

The following results may be drawn from Figure 11.2:

- All of the scenarios, except for that of infrastructure improvements coupled with land use change through industry relocation, provide some positive benefit, in terms of GHG emissions. In the case of the

FIGURE 11.1 24-HOUR EMISSION TOTALS OF EACH POLLUTANT UNDER ALL SCENARIOS

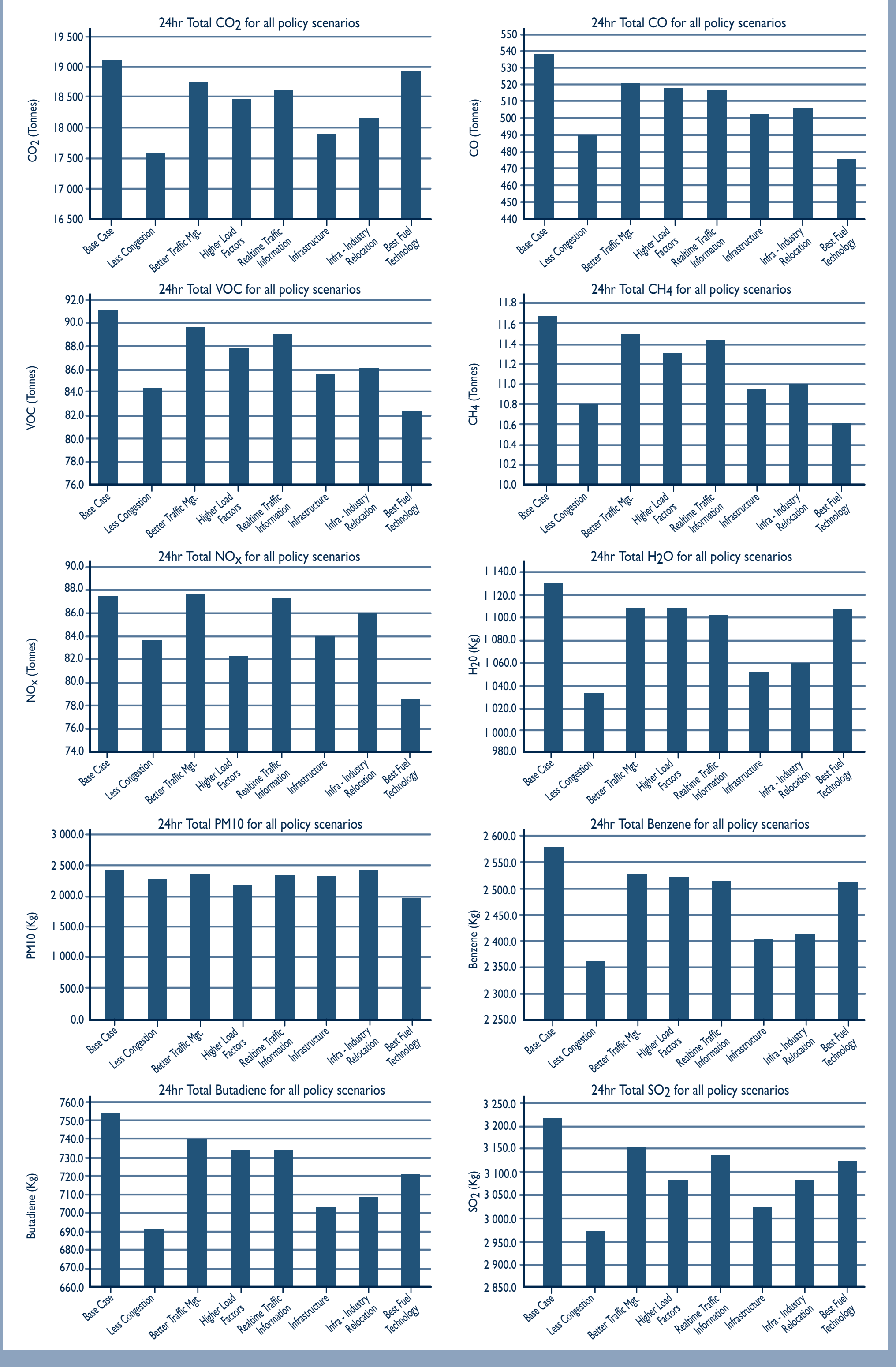
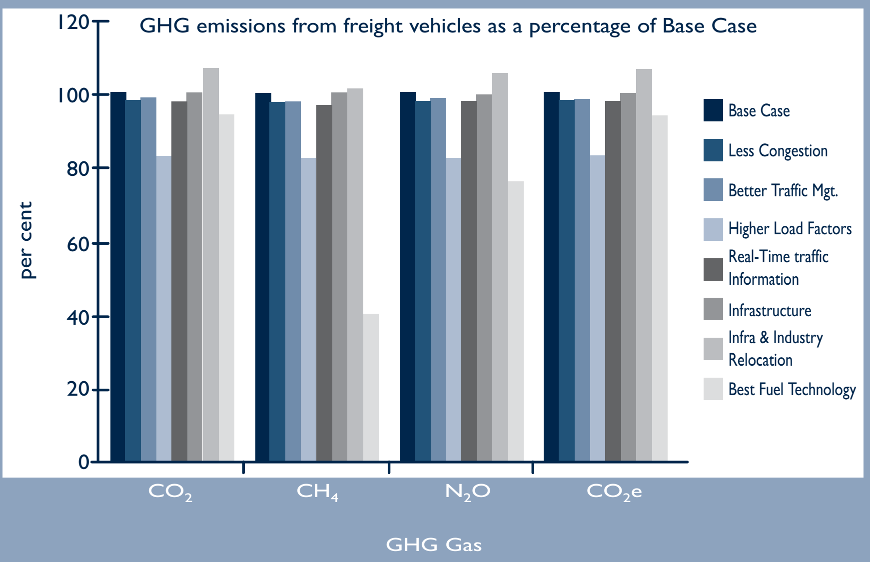


FIGURE 11.2 GHG EMISSIONS FROM FREIGHT VEHICLES BY SCENARIO



land use change scenario, as will be discussed later, there are specific reasons why no positive benefit to GHG emissions from freight transport was achieved, which could be overcome by complementary scenarios including other infrastructure improvements.

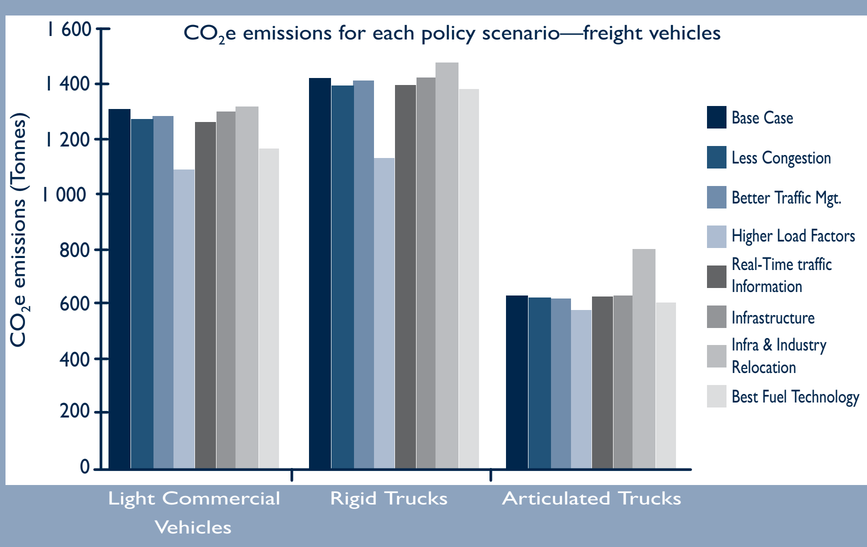
- The scenarios that has the largest positive effect on GHG emissions from freight transport is that of higher load factors for freight vehicles. This measure produced a reduction of about 17 per cent in total GHG emissions when compared to the base case.
- The application of best fuel technology was the second best scenario, and indeed this initiative produced the largest reductions in emissions of CH_4 and N_2O from urban freight.
- For all of the other scenarios producing reductions in GHG emissions from urban freight transport, the percentage reductions in total GHG emissions from freight transport were relatively small, of the order of three per cent or less. However in absolute terms of total quantities of GHG emissions the scenarios were still important.
- The scenario of infrastructure improvement coupled with industry relocation, for the case of the Sydney Orbital, led to an increase in overall GHG emissions from freight transport of about 6.5 per cent. This increase was almost entirely due to a singular effect, the doubling of the work tasks of articulated vehicles (as measured in terms of VKT

performed), which led to an increase of about one-third in GHG emissions from this vehicle class. The reason for this increase in vehicle work is the major role played by articulated vehicles in transporting commodities and goods between the port and the industrial complexes. The location of the port obviously remains fixed, whilst the industrial sites have shifted a considerable distance to the west. Modelling for this scenario reasonably assumed that the port-factory movements would continue to be made by road using the largest freight vehicles (i.e. articulated vehicles), as no alternative transport mode was available. Complementary measures, such as constructing new railway infrastructure, to provide a direct connection to the port, would mitigate GHG emissions from this particular freight task.

The total picture of GHG emissions on the study area network, from all transport sources including passenger vehicles, is provided in Figure 11.3. This chart is similar to Figure 11.2, but shows the relative GHG emissions performance of each scenario including emissions from private vehicles.

Figure 11.3 shows that all of the scenarios have positive effects on GHG emissions when total emissions from all road transport sources are considered. This includes the scenario with industry relocation and infrastructure provision, which yields a total GHG emissions reduction

FIGURE 11.3 GHG EMISSIONS FROM ALL VEHICLES BY SCENARIO



of five per cent. The reductions in GHG emissions from private vehicle travel outweigh the increased emissions from the freight vehicles.

The scenario with the greatest effect on total GHG emissions from transport is that of reduced peak period traffic congestion. The 20 per cent reduction in private vehicle trips assumed under this scenario leads to an overall decrease of around 8 per cent in total GHG emissions. The decrease in GHG emissions from freight vehicles in this case is around 2.3 per cent, indicating that the substantial benefit comes from reductions in the GHG emissions of private cars.

The infrastructure improvement scenario (without industry relocation) provided the second best result in terms of total GHG emissions (6.2 per cent). The benefit is derived from free flowing traffic. However it is important to remember that such an effect will only apply if the new infrastructure does not induce extra passenger vehicle trips. We believe evidence from the literature supports our assumption that the new infrastructure will not induce extra freight trips but that assumption would not hold for passenger trips, although as numbers of the links on the Sydney orbital are, or will be, subject to tolling, induced demand could be dampened.

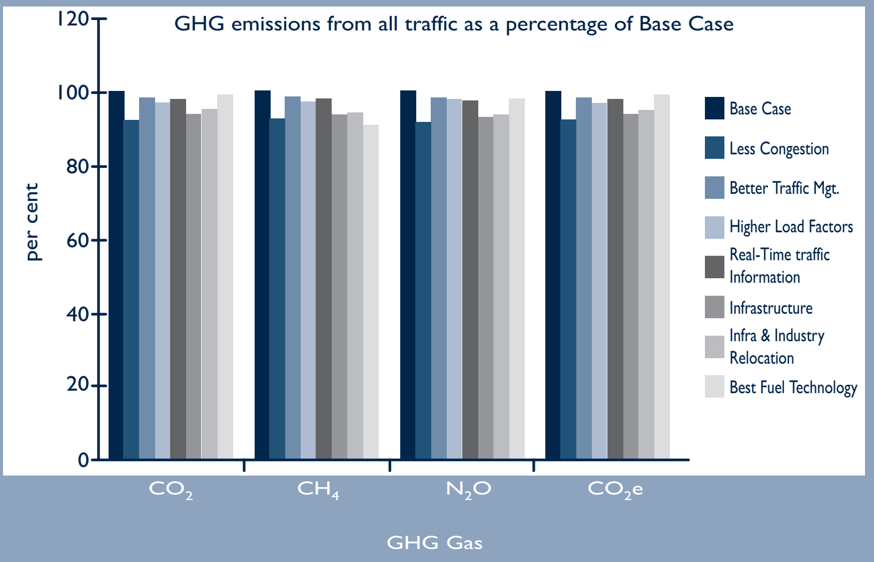
The other scenarios affecting general traffic activity (i.e. better traffic management and real time traffic information) led to reductions in total GHG emissions of about two per cent.

The freight transport-specific scenarios of higher load factors and best fuel technology found to offer the most promise in reducing GHG emissions from freight vehicles provided reductions in the total GHG emissions of 3.3 per cent and 1.1 per cent respectively, because these measures were solely targeted at urban freight transport. Private vehicle emissions were not directly affected by these scenarios except at the margin—higher load factors mean slightly fewer freight vehicles on the road.

The modelling results also permit a more detailed view of the emissions impacts on each vehicle class under each scenario. For the case of the total GHG emissions (measured in terms of CO_2 equivalents), Figure 11.4 shows the overall emissions impacts for each freight vehicle class.

This figure indicates that the different scenarios can have different effects on the freight vehicle classes. Higher load factors have most effects (both absolutely and proportionately) on the GHG emissions performance of light commercial vehicles and rigid trucks. The impact of this scenario on articulated trucks is much less, probably reflecting the more specialised freight tasks undertaken by this vehicle type in urban areas. Similarly, best fuel technology has most effect on the emissions performance of light commercial vehicles, the freight vehicle class known to be growing in importance in urban freight.

FIGURE 11.4 TOTAL MODELLED CO_2e EMISSIONS (in Tonnes per day) FOR EACH FREIGHT VEHICLE TYPE UNDER THE DIFFERENT POLICY SCENARIOS



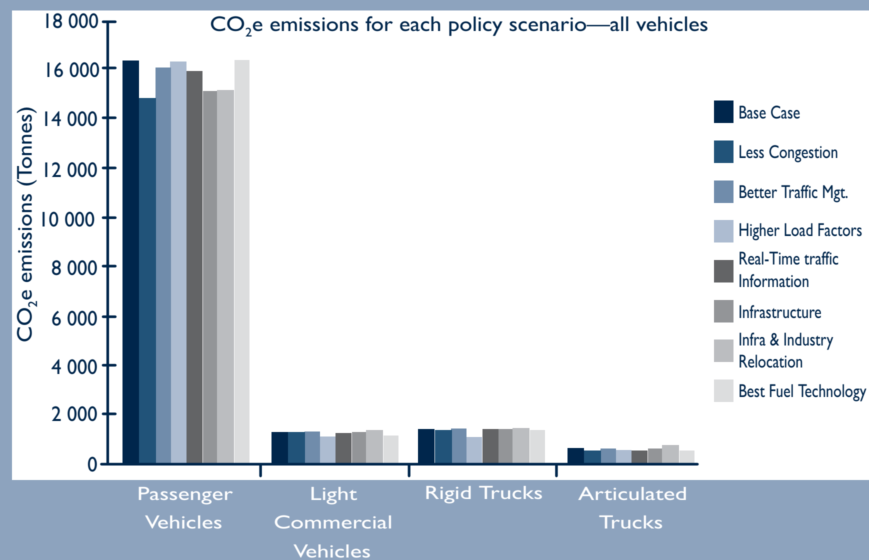
The impact on GHG emissions from articulated vehicles in the scenario with industry relocation following the construction of the Sydney Orbital is also clearly apparent, whilst this scenario has only a small effect for the other freight vehicle classes. We note again that while the size of this impact may be overestimated, due to modelling simplification in moving only manufacturing west, the direction of the impact is likely to be correct.

The other scenarios show slight decreases in total GHG emissions for all freight vehicles.

Context is again important when examining these results and the emissions performance of private vehicles under the same scenarios also needs to be considered. Figure 11.5 provides a similar chart to Figure 11.4, but with the inclusion (in absolute terms) of the total GHG emissions from private vehicles and freight vehicles. The data for freight vehicles are exactly the same as those in Figure 11.4, but the scale of the plot is changed because of the inclusion of the emissions from private vehicles. Private vehicle CO_2e emissions are just over four times the total CO_2e emissions from all freight vehicles.

Overall, the ‘reduced congestion’ scenario has the most impact on reducing CO_2e emissions because this has a major effect on the emissions from private vehicles. All of the scenarios have positive effects on GHG emissions, with the two infrastructure improvement scenarios having the next best effects again due to improvements in private vehicle emissions. 'Better traffic management' also provided a noticeable effect on private vehicle emissions, more so proportionately than for freight vehicles. 'Best fuel technology' was applied to freight vehicles only and higher loads factors/ larger vehicles had only a small effect due to reduced freight vehicle numbers in the traffic stream.

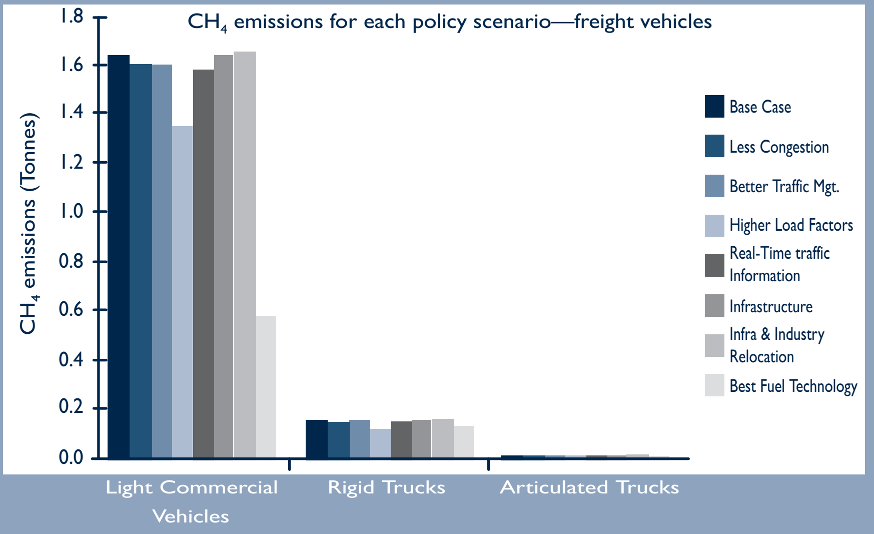
FIGURE 11.5 TOTAL MODELLED CO_2e EMISSIONS (in Tonnes per day) FOR ALL VEHICLE TYPES UNDER THE DIFFERENT POLICY SCENARIOS



In terms of the individual greenhouse gases, CO_2 emissions performance was virtually the same as that for CO_2e, not unexpectedly given that CO_2 is the dominant component of CO_2e. 'Higher load factors" reduced CO_2e emissions from freight vehicles by 17.0 per cent, with a 16.6 per cent reduction for LCVs, 20.6 per cent reduction for RTs, and 9.2 per cent for ATs. The corresponding reductions from 'best fuel technology' were, respectively, 6.3, 10.8, 3.2 and 4.2 per cent. The emissions performances for the other components of CO_2e, i.e. CH_4 and N_2O, are worthy of some attention because there are some relative differences in outcomes for the different freight vehicle classes.

Figure 11.6 shows the emissions of methane (CH_4) for freight vehicles under the different scenarios. Methane emissions from freight vehicles are dominated by the LCVs (Figure 11.6). The 'best fuel technology' scenario achieved a significant reduction in CH_4 emissions from this vehicle class (64.5 per cent) and therefore from freight vehicles generally (60 per cent). 'Higher load factors' has the second best impact, 17.6 per cent reduction in CH_4 emissions from LCVs, 17.8 per cent from all freight vehicles. All but one of the other scenarios offered small reductions in CH_4 emissions, of the order of 1–4 per cent. The exception was the 'infrastructure and

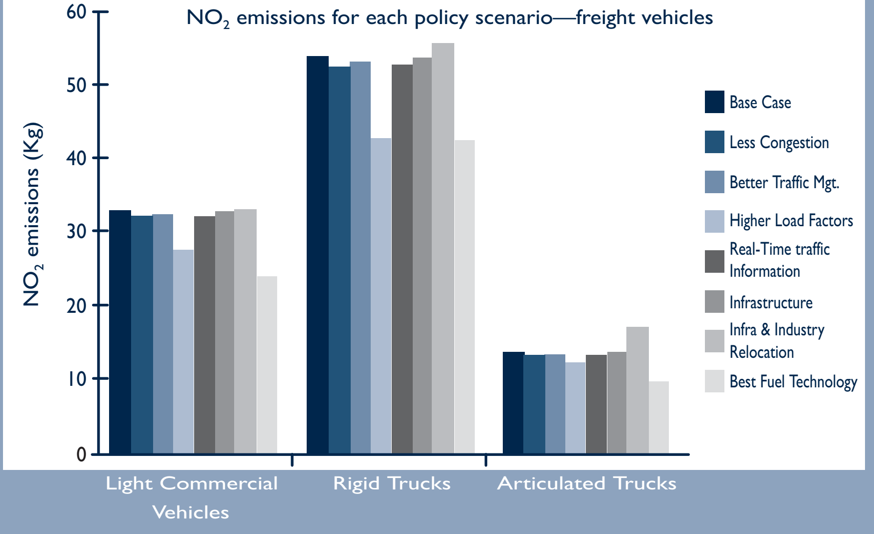
FIGURE 11.6 TOTAL MODELLED CH_4 EMISSIONS (in Tonnes per day) FOR ALL VEHICLE TYPES UNDER THE DIFFERENT POLICY SCENARIOS



industry relocation' scenario, which for the modelled case yielded a small increase (1.4 per cent for all freight vehicles).

For the N_2O emissions, the rigid truck class was the largest contributor amongst the freight vehicles (Figure 11.7). 'Higher load factors' and

FIGURE 11.7 TOTAL MODELLED N_2O EMISSIONS (in Tonnes per day) FOR ALL VEHICLE TYPES UNDER THE DIFFERENT POLICY SCENARIOS



'better fuel technology' had roughly equal impacts on N_2O emissions from RTs (20.7 per cent and 21.0 per cent respectively), but over all of the freight vehicles 'higher load factors' reduced N_2O emissions by 17.7 per cent whilst 'best fuel technology' reduced them by 24.0 per cent.

The importance of the spatial location of emissions is shown in the next section, where the dispersion of the air pollutant emission is modelled and the effects of scenarios on population exposure to pollution are estimated.

Air pollution impacts

The outcomes of the modelling study with respect to air quality emissions generally follow the results found for the greenhouse gas emissions. Figures 11.8 and 11.9 provide similar plots for air quality emissions to those of Figures 11.2 and 11.3, for the GHG.

The relative performance of each scenario on the air quality emissions from freight vehicles only showed that the best performing scenario was 'best fuel technology' for all except SO_2 emissions (Figure 11.8). 'Higher load factors' is the next best performing scenario, except for SO_2 where it outperforms 'best fuel technology'. All other scenarios offer small reductions in air quality emissions, except for 'infrastructure improvement with industry relocation'.

FIGURE 11.8 AIR QUALITY EMISSIONS FROM FREIGHT VEHICLES FOR EACH SCENARIO

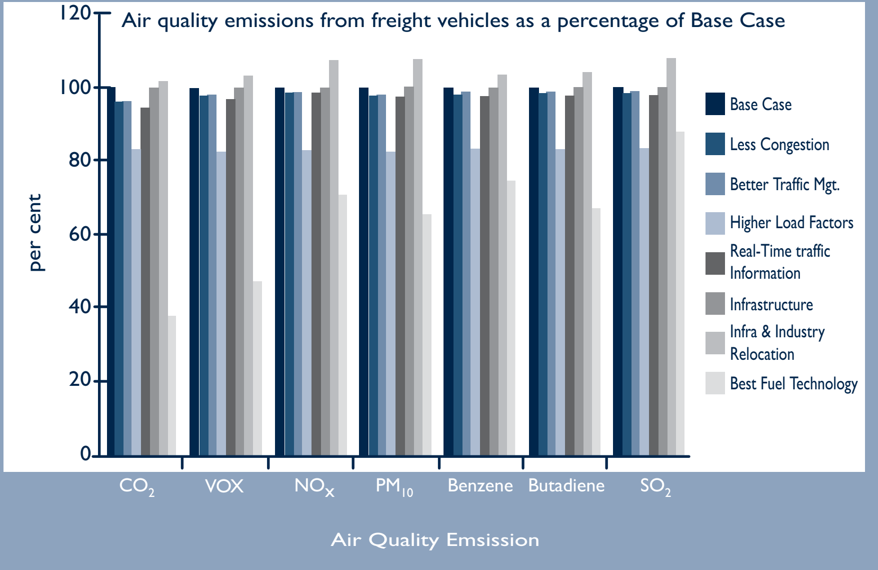


FIGURE 11.9 AIR QUALITY EMISSIONS FROM ALL VEHICLES FOR EACH SCENARIO

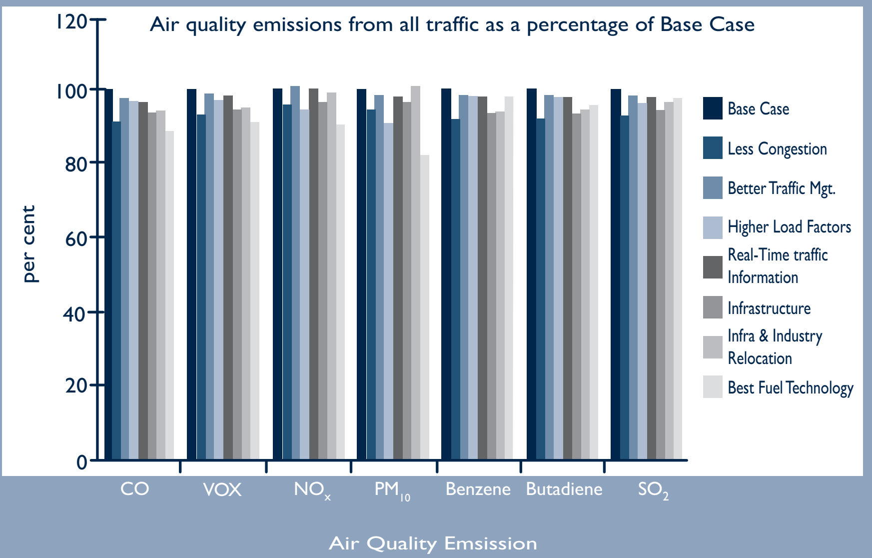


Figure 11.9 shows the relative performance of each scenario in terms of total air quality emissions from road transport, including both freight vehicles and private vehicles. 'Reduced peak period traffic congestion' is the scenario offering the best reductions in air quality emissions, as it was for the greenhouse gases. All other scenarios lead to small reductions in these emissions, except for emissions of NO_x and PM_{10} under the scenario of 'infrastructure improvement with industry relocation'. These two pollutants increase slightly under this scenario.

When PM_{10} emissions from all vehicles, including private vehicles are considered, the best performing scenario was 'best fuel technology' (total reduction 18.2 per cent compared to a total reduction of 5.7 per cent for 'less traffic congestion'), a reflection of the domination of this emission by freight vehicles (Figure 11.10). 'Higher load factors' lead to a 9.6 per cent reduction in PM_{10} emissions across the entire vehicle fleet. Remember that 'best fuel technology' and 'higher load factors' are scenarios that apply to the freight vehicle fleet and not to the private vehicle fleet.

The other air quality pollutant to which freight vehicles make larger contributions is NO_x. Figure 11.11 shows that 'best fuel technology' and 'higher load factors' are again the scenarios of most interest in terms of reductions in NO_x emissions from freight vehicles (with reductions of 29.4 per cent and 17.5 per cent respectively, for freight

FIGURE 11.10 TOTAL MODELLED PM10 EMISSIONS (in kg per day) FOR EACH VEHICLE TYPE UNDER THE DIFFERENT POLICY SCENARIOS

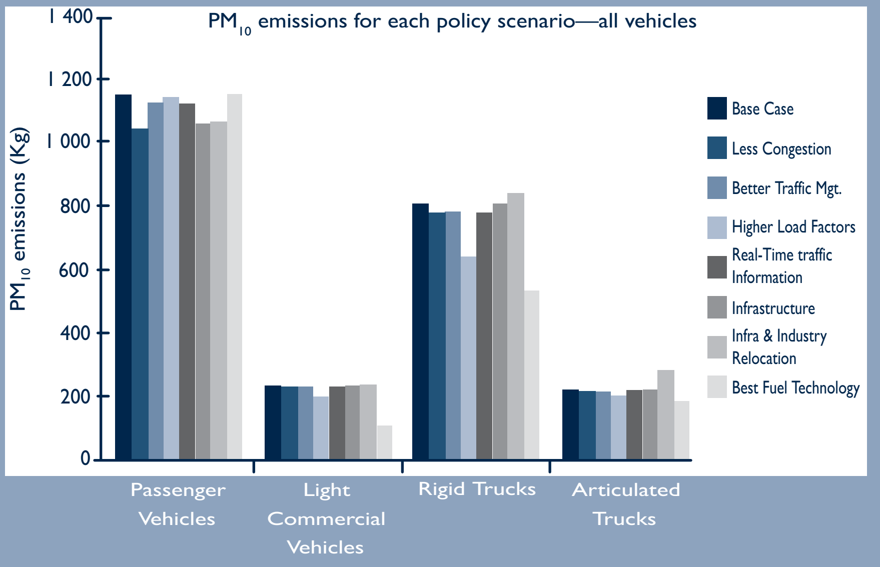
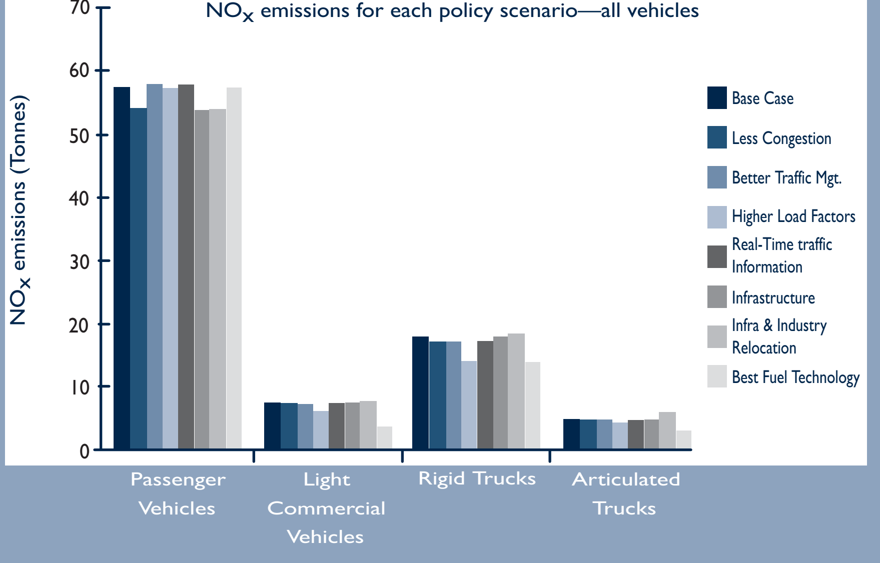


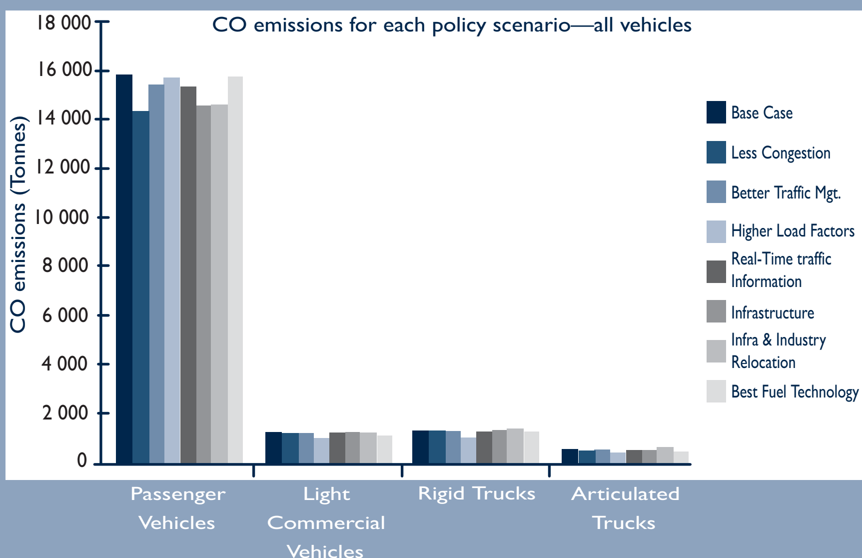
FIGURE 11.11 TOTAL MODELLED NO_X EMISSIONS (in tonnes per day) FOR EACH VEHICLE TYPE UNDER THE DIFFERENT POLICY SCENARIOS



vehicles). 'Less traffic congestion' has an overall impact of a decrease in NO_x emissions of 4.4 per cent, just less than the total decrease in NO_x emissions of 10.1 per cent from 'best fuel technology'. This indicates the importance of freight vehicles as a source of this emission

Figure 11.12 shows CO emissions for comparison. As can be seen freight vehicles are less important as a source of CO.

FIGURE 11.12 TOTAL MODELLED CO EMISSIONS (in tonnes per day) FOR ALL VEHICLE TYPES UNDER THE DIFFERENT POLICY SCENARIOS



Figures 11.13 and 11.14 show respectively percentage change in the peak concentrations of NO_2 and PM_{10} compared to the base case by location for the different scenarios for four example Statistical Sub-Divisions of Sydney. Figure 11.13 shows four example SSDs: Inner Sydney, Eastern Suburbs, St George-Sutherland and Canterbury Bankstown selected from areas having high peak concentration of NO_2.

Figure 11.14 shows four example SSDs: Inner Sydney, Inner Western Sydney, Canterbury-Bankstown and Central Western Sydney selected from areas having high peak concentration of PM_{10}.

These figures show that there will be no one best scenario for all areas. Despite all caveats about the representativeness of our exposure estimates, it could be expected that differences in scenario impacts in different parts of the greater urban area will apply.

FIGURE 11.13 PER CENT CHANGE IN PEAK NO_2 CONCENTRATION BY BY SCENARIOS FOR 4 SSDs

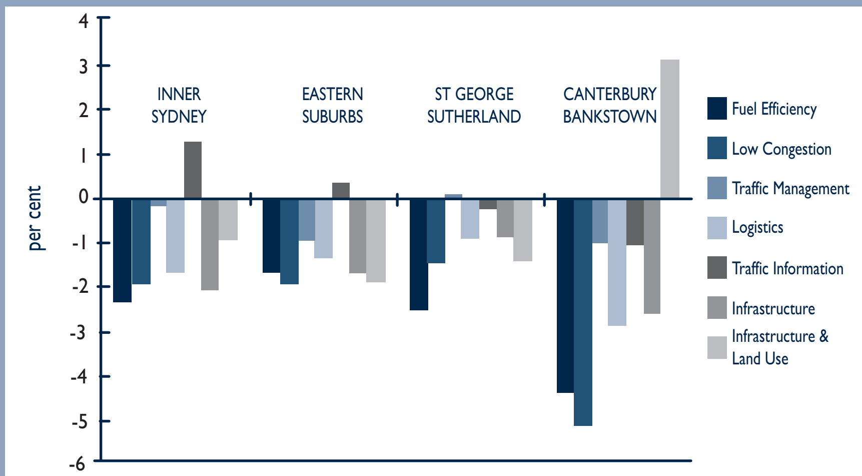
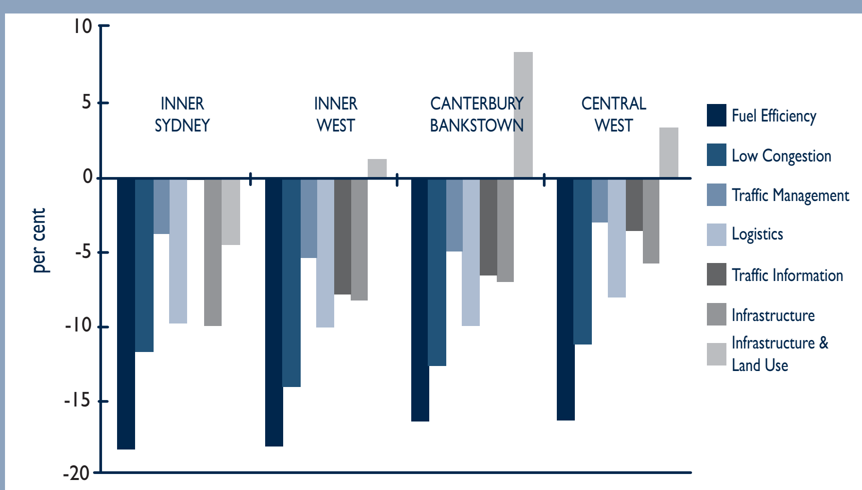


FIGURE 11.14 PER CENT CHANGE IN PEAK PM_{10} CONCENTRATION BY BY SCENARIOS FOR 4 SSDs



11.3 CONCLUSION

Relative Impacts of Scenarios on Urban Freight Emissions: While all but one tested scenario produced some improvements in GHG emissions, the scenarios that had the greatest impact in reducing GHG emissions from freight transport were ‘higher load factors’ and ‘best fuel technology’. These two scenarios also lead to the best performances in the air quality emissions.

Impacts on Total Fleet Emissions: In terms of total GHG emissions from road transport, the scenario leading to the largest overall reductions in GHG was that of ‘less peak period traffic congestion’. This scenario was proposed as a means of improving the emissions performance of freight vehicles. There is measurable reduction of GHG from free flowing freight traffic but the major reduction stems from less passenger vehicles. Note that the assumed 15 per cent reduction in peak hour traffic may be assisted by incentives to shift some travel from the peaks. Peak road use pricing might possibly produce such a shift.

Variability with Location and Time of Day: The study showed that the impacts of scenarios vary with location and with time of day. Such variation is clearly important for air quality outcomes since the location of emissions in part determines location of air pollutant concentrations and hence population exposure. However it can also be important for GHG. Location of measures, such as new traffic management measures or new infrastructure will help determine the total GHG impact of the initiative. Similarly targeting time of day initiatives can result in more GHG savings.

APPENDIX I

FREIGHT TASK TRENDS DATASET SOURCES

I.1 ROAD

Total Road Freight—historical and projections—was taken from Table 2.8 in Chapter 2.

Urban road freight was first taken from Urban Adjusted Total figures derived in the same manner as explained in Appendix II. A regression was run against gross domestic product and real road freight rates to get a predicted series. Using the assumptions in Appendix II on gross domestic product and real road freight rates, a series for both historical and projected figures was obtained.

Non-urban road freight was the difference between Urban and Total Road Freight.

The bulk and non-bulk split was done with a simple 30 per cent bulk, 70 per cent non-bulk split, on the basis of early Bureau of Transport Economics studies on the highways, and more recently the ABS Freight Movements Survey in 2000–01.

The historical road freight by vehicle type figures are a trend time-series based on Table 2.7 in Chapter 2. The projected figures are from Table II.6 in BTRE Report 107 (BTRE 2002b), with the projected shares by vehicle type multiplied by the revised total road freight figures from Table 2.9 in Chapter 2.

The Total Interstate Road Freight series was taken directly from Chapter 5. Non-bulk interstate road freight was assumed to be 95 per cent of the total interstate road freight. The bulk interstate road freight was the difference between the non-bulk interstate and total interstate figures.

I.2 RAIL

The public rail—bulk and non-bulk—and private rail freight figures all came directly from Table IV.7 in BTRE Report 107 (BTRE 2002b). Pre-1982 figures draw on annual reports from the then-government rail systems.

Total interstate non-bulk rail comes straight from Chapter 5. The non-bulk figures are assumed to be 77.8 per cent of total interstate freight. The 77.8 per cent comes from the latest Australasian Railway Association figures on non-bulk interstate freight (ARA 2004).

The bulk interstate rail freight is simply the difference between non-bulk interstate freight and total interstate freight.

I.3 SHIPPING

Shipping is based on previous Task Trends figures with updates made from the Coastal Shipping Database from 2000 onwards. Bulk and Total figures were updated from the Coastal Shipping database for the years 2000–2002.

Non-bulk for these years was the difference between the two updated figures.

Bulk and non-bulk shipping projections were from BTRE Report 107 (BTRE 2002b). Non-bulk figures were re-estimated based on the latest 2003 non-bulk data. The total projected shipping figure was the sum of the bulk and non-bulk projections.

The interstate non-bulk shipping figures were taken directly from Chapter 5. The total IS figures were updated from the Coastal Shipping database for the years 2000–2002. Previous years' total figures were from the previous version of the Task Trends dataset.

Interstate bulk figures were the difference between total and non-bulk interstate figures. Projected interstate non-bulk figures were from Chapter 5. Projected interstate bulk figures were assumed to be 75 per cent of the total bulk shipping figures. The total interstate shipping figures were the sum of the interstate bulk and non-bulk figures.

I.4 AIR

The total non-bulk air figures came from the Aviation Statistics collection of the BTRE.

Projections were based on a simple three per cent growth assumption.

Interstate non-bulk freight was assumed to be 95 per cent of total non-bulk air freight.

APPENDIX II

EXTENDING THE MEASUREMENT OF ROAD FREIGHT GROWTH

Chapter 2 detailed the methods used to adjust the Survey of Motor Vehicle Use (the survey) road freight time series for Australia.

Appendix II looks at how that measurement can be extended, specifically to series for the freight tasks by:

- state of operation
- interstate by state of operation
- capital city
- rest of state.

To do this it is necessary to start at the second item above—interstate by state of operation. This is because, prior to 1985, the survey only provides estimates of freight by state of registration. One must calculate the interstate task by state of operation and net it out of the by state of registration figures to derive by state of operation task figures for the early years.

Once this is done, the basic method for getting the final adjusted estimates for each level of measurement consists of six basic steps:

1. adjust the Australia-level aggregate for survey years using the methods derived in Chapter 2
2. run a regression of the adjusted survey data, with straight line interpolation, against income—and freight rates where applicable—to generate a final adjusted national estimate that varies over the economic cycle
3. calculate 'raw' state or city shares from the unadjusted freight task data for survey years
4. smooth these shares to a believable trend, not worrying if the total goes above or below 100 per cent
5. interpolate these shares between survey years and normalise to add to 100 per cent, giving the final share estimates

6. multiply the final share estimate by the final adjusted national series from the regression of the adjusted survey data to give a 33-year time series for each state or capital city or rest of state.

But, as has been said, before this process for each measurement level can be started, it is necessary to extend the interstate by state of operation' series from 1985 back to 1971.

This is because, before 1985, only data on the freight task by state of registration is available. The estimate of the road freight task by state of vehicle registration shows a much higher proportion of the freight task undertaken by Victorian, Queensland and Western Australian registered freight vehicles. This is in contrast to the estimates of road freight by state of registration. That data reflects the fact that a significant proportion of the interstate freight task carried by Victorian and Queensland registered trucks takes place on New South Wales roads.

Estimation for the early Survey of Motor Vehicle (SMVU) Use survey years of annual road freight movements by state of operation was thus a two-stage process. Step one involved estimating Interstate road freight movements by state of operation for each year of the survey. Step two involved netting this out of the by state of vehicle registration figures to obtain by state of operation estimates. These estimates were also derived for 1985, 1991 and 1995 to check on the accuracy of the estimation process.

II.1 ESTIMATION OF THE INTERSTATE ROAD FREIGHT TASK BY STATE OF OPERATION

Estimates of raw interstate road freight movement by state of operation for 1971 to 1985 were derived using a simple gravity model and rules of thumb about the proportion of travel undertaken within each state. The gravity model assignment method apportions total interstate road freight using the product of scaled populations[1] and the inverse of distance as the measure of relative attraction. It was assumed that all interstate freight movements originated from the state of vehicle registration. Though this assumption may not be realistic, the BTRE had no information on the origin of interstate freight carried by road freight vehicles.

The share of freight destined for each state was estimated from the weighting function, equation II.1.

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1 While state population has been used as a measure of freight attraction between states, the BTRE is aware that some measure of economic activity may be a better proxy for attraction. The BTRE did not undertake analysis, as the methods used here are only to derive indicative indicators of interstate freight moved within each state, and use the state share trends and the estimates of total road freight to estimate road freight movements within each state of operation.

$$w_{ij} = \frac{(P_i \cdot P_j)^{\beta}}{d_{ij}^{\gamma}} \tag{II.1}$$

where

w_{ij} = weighting factors for the proportion of freight carried by vehicles from state i to state j;

P_i = total population of state i;

d_{ij} = road distance between capital cities in each state i and j

β, γ = parameters.

The weighting factors, wij, were weighted by the proportion of interstate vehicle travel undertaken within each state, producing a multidimensional array of factors. The multidimensional array was subsequently applied to estimates of total interstate freight by state of vehicle registration to derive estimates of freight carried within each state, $F_{\bullet\bullet k}$.

$$F_{\bullet\bullet k} = \sum_i \left\{ \sum_j F_i \frac{w_{ij}}{\sum_j w_{ij}} \frac{T_{ijk}}{\sum_k T_{ijk}} \right\} \tag{II.2}$$

where

$F_{\bullet\bullet k}$ = total interstate freight carried within state k.

F_i = total interstate freight carried by vehicles registered within state i.

T_{ijk} = proportion of travel of freight vehicle movements from state i to state j undertaken within state k.

Estimation of the $F_{\bullet\bullet k}$ was an iterative procedure. It was undertaken through adjusting the parameters β and γ until the difference between the estimates for 1988 and 1995 estimates of total road freight within each state of operation was sufficiently small. In the event, total freight movements to and from the ACT were found to be too large and the ACT population was scaled down by a factor of 10. The final values of β and γ used in the modelling were: $\beta = 0.75$ and $\gamma = 1.0$.

2 Perl (Practical Extraction and Reporting Language) is an interpreted high-level programming language. The language is flexible enough to be used for a wide range of tasks. The following script requires that the PDL module be installed (this script was run with PDL 2.005-4). Perl and the PDL module are open source software. Binary versions of Perl are freely available for Unix (and Unix-like) and Microsoft operating systems.

The gravity-model-based estimates of road freight by state of operation were estimated using a simple *Perl*[2] script program.

Table II.1 lists the raw interstate road freight data by state of vehicle registration.

TABLE II.1 INTERSTATE TONNE–KILOMETRE BY STATE OF REGISTRATION—ALL COMMERCIAL VEHICLES

(million tonne–kilometres)

	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	AUST
1971	1 466.2	1 464.8	478.1	939.0	37.0	7.5	43.9	0.0	4 436.4
1976	1 968.9	1 859.3	530.5	3 648.6	71.4	8.9	34.4	41.9	8 164.0
1979	2 449.9	2 893.2	1 002.3	2 407.1	190.4	3.6	211.5	208.4	9 366.5
1982	3 206.0	4 224.4	1 148.5	2 547.4	479.2	53.0	246.7	283.3	12 188.5
1985	4 141.4	5 412.8	1 565.5	2 864.2	825.4	6.9	710.9	168.5	15 695.7

Source: ABS Survey of Motor Vehicle Use.

Table II.2 provides gravity-model-based raw estimates of interstate road freight movements by state of operation, together with actual raw ABS estimates from 1988 onwards. These two sets of raw estimates by state of operation will then form the basis for final adjusted estimates of interstate road freight by state of operation.

Having derived a full set of 1970–71 to 2002–03 raw estimates of interstate road freight by state of operation, we return to our six-step method for turning this into a final adjusted set of estimates by state.

The first step is to adjust the Australia level aggregate for interstate road freight in a manner similar to that used for total Australian freight. Table II.3 shows the mechanism for adjusting aggregate interstate tonne–kilometres. It is done by vehicle type, multiplying by the ratio of adjusted to raw tonne–kilometres by vehicle type of the Australia-level

TABLE II.2 INTERSTATE FREIGHT BY STATE OF OPERATION—RAW ESTIMATES

(million tonne–kilometres)

	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	AUST
1971	1 809	1 359	493	541	128	46	22	38	4 436
1976	3 246	2 986	730	700	319	71	51	61	8 164
1979	4 048	2 689	941	1 161	305	89	56	78	9 367
1982	5 277	3 212	1 282	1 742	375	120	77	102	12 187
1985	6 586	3 907	1 740	2 566	503	152	108	136	15 698
1988	8 706	3 731	1 605	2 490	557	162	124	116	17 491
1991	9 395	3 496	1 665	2 937	590	174	131	110	18 498
1995	13 440	4 847	3 320	3 724	1 791	27	626	182	27 957
1998	13 544	4 631	2 275	3 417	2 459	471	316	131	27 244
1999	15 038	5 361	4 190	3 845	2 466	4	1041	136	32 081
2000	18 117	4 904	4 658	4 500	1 403	2	1143	204	34 931
2001	18 335	5 118	3 285	4 333	1 478	37	657	197	33 440
2002	18 999	5 986	4 220	3 710	1 206	58	1277	147	35 603
2003	22 242	6 901	4 573	4 209	1 187	130	481	220	39 943

Sources: ABS Survey of Motor Vehicle Use, BTRE estimates.

TABLE II.3 INTERSTATE FREIGHT—ADJUSTED TOTAL

	LCV raw	LCV ratio	LCV adj	LCV final	Rigid raw	Rigid ratio	Rigid adj	Rigid final	Artic raw	Artic ratio	Artic adj	Artic final	Total raw	Total adj	Total IS[a]
1971	14	0.9211	13	13	427	0.9341	399	399	4 000	0.9056	3 622	3 485	4 441	3 897	5 455
1976	41	0.9647	40	40	477	0.9284	443	443	7 645	0.8882	6 790	6 533	8 164	7 016	9 822
1979	24	0.9500	22	50	494	1.0273	508	508	8 849	0.9012	7 974	7 672	9 366	8 230	11 522
1982	26	0.9500	25	60	588	0.9895	582	582	11 574	0.9234	10 688	10 283	12 189	10 925	15 295
1985	151	0.8696	131	70	683	0.9328	637	637	14 862	0.8834	13 129	12 631	15 696	13 338	18 673
1988	97	0.7806	76	76	617	0.8638	533	750	16 777	0.9089	15 248	14 670	17 490	15 495	21 693
1991	87	0.8551	74	74	705	1.0173	717	900	17 706	0.9046	16 017	15 410	18 497	16 384	22 938
1995	166	1.0501	174	85	1 166	0.8814	1 028	1 028	26 625	0.8703	23 171	22 293	27 957	23 406	32 768
1998	96	1.1767	113	113	1 112	1.0435	1 160	1 160	27 243	1.0377	28 269	27 198	28 451	28 471	39 859
1999	103	1.1047	114	114	633	1.0429	660	1 200	31 345	0.9752	30 569	29 410	32 081	30 724	43 014
2000	100	1.0501	105	140	1 492	1.0341	1 543	1 300	33 339	0.9937	33 128	31 872	34 931	33 312	46 637
2001	154	1.0804	166	166	1 511	1.0752	1 625	1 400	31 775	1.0441	33 176	33 176	33 440	34 743	48 640
2002	281	1.1520	324	166	975	1.0021	977	1 500	34 347	1.0496	36 052	36 052	35 603	37 718	52 805
2003	163	1.0110	165	165	2 062	0.9913	2 044	1 600	37 718	1.0092	38 065	38 065	39 943	39 829	55 761

Note: The 0.9387 factor for IS Artics, before 2001 comes from regressions on GDP and freight rates to 2000, and the predicted change to 2001.
a. Adjustment for ABS definition (which cuts out task done in state of origin).
Sources: ABS Survey of Motor Vehicle Use, BTRE estimates.

adjustment. Then a final adjustment is made for each vehicle type that seeks to smooth the series. The changes are shown in bold.

The articulated truck series pre-2001 is adjusted by a further factor of 0.9387. This is based on regressions to 2000 of the artic related interstate series on GDP and rates, and the predicted change to 2001. Finally, the adjusted aggregate is increased by 40 per cent, to account for the portion of interstate trips done within the state of origin—which the ABS does not count as interstate.

The second step in deriving estimates of interstate freight by state of operation is to use the regression equation of total interstate against GDP and real road freight rates on the adjusted interstate series interpolated between survey years. This generates a final adjusted Australia-level estimate of interstate freight tonne–kilometres that varies over the economic cycle. These figures are presented in Table II.7 later, while the details of the regression are given in Chapter 5.

Next we calculate the raw survey state shares of interstate freight from Table II.2. These are shown in Table II.4.

TABLE II.4 SHARE OF INTERSTATE FREIGHT BY STATE OF OPERATION—RAW

	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	AUST
1971	0.4078	0.3064	0.1111	0.1220	0.0289	0.0104	0.0050	0.0086	1.0000
1976	0.3976	0.3658	0.0894	0.0857	0.0391	0.0087	0.0062	0.0075	1.0000
1979	0.4322	0.2871	0.1005	0.1239	0.0326	0.0095	0.0060	0.0083	1.0000
1982	0.4330	0.2636	0.1052	0.1429	0.0308	0.0098	0.0063	0.0084	1.0000
1985	0.4195	0.2489	0.1108	0.1635	0.0320	0.0097	0.0069	0.0087	1.0000
1988	0.4977	0.2133	0.0918	0.1424	0.0318	0.0093	0.0071	0.0066	1.0000
1991	0.5079	0.1890	0.0900	0.1588	0.0319	0.0094	0.0071	0.0059	1.0000
1995	0.4807	0.1734	0.1188	0.1332	0.0641	0.0010	0.0224	0.0065	1.0000
1998	0.4971	0.1700	0.0835	0.1254	0.0903	0.0173	0.0116	0.0048	1.0000
1999	0.4688	0.1671	0.1306	0.1199	0.0769	0.0001	0.0324	0.0042	1.0000
2000	0.5187	0.1404	0.1333	0.1288	0.0402	0.0001	0.0327	0.0058	1.0000
2001	0.5483	0.1531	0.0982	0.1296	0.0442	0.0011	0.0196	0.0059	1.0000
2002	0.5336	0.1681	0.1185	0.1042	0.0339	0.0016	0.0359	0.0041	1.0000
2003	0.5568	0.1728	0.1145	0.1054	0.0297	0.0033	0.0120	0.0055	1.0000

Sources: ABS Survey of Motor Vehicle Use, BTRE estimates.

Then these shares to a believable trend are smoothed, not worrying if the total share goes above or below 1.0. These shares are shown in Table II.5. The changes are shown shaded.

Then these shares are interpolated between survey years, and normalised to add to 1.0. This is shown in Table II.6.

Finally, these shares are multiplied by the adjusted Australia-level interstate tonne–kilometres from the second step above—shown as the last column in Table II.7—to get the final interstate freight by state of operation series. These are shown in Table II.7.

TABLE II.5 INTERSTATE SHARE BY STATE OF OPERATION—SMOOTHED

	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	AUST
1971	0.4078	0.3064	0.1111	0.1220	0.0289	0.0104	0.0050	0.0061	0.9976
1976	**0.4200**	**0.2967**	**0.1058**	**0.1230**	0.0391	0.0087	0.0062	**0.0060**	1.0055
1979	0.4322	0.2871	0.1005	0.1239	0.0326	0.0095	0.0060	0.0059	0.9976
1982	0.4330	0.2636	0.1052	0.1429	0.0308	0.0098	0.0063	0.0060	0.9976
1985	**0.4654**	**0.2384**	**0.0985**	**0.1426**	0.0320	0.0097	0.0069	**0.0057**	0.9993
1988	0.4977	0.2133	0.0918	0.1424	0.0318	0.0093	**0.0106**	0.0047	1.0016
1991	0.5079	0.1890	0.1053	**0.1378**	0.0319	0.0094	**0.0143**	0.0042	0.9998
1995	0.4807	0.1734	0.1188	0.1332	**0.0400**	0.0010	**0.0193**	**0.0043**	0.9706
1998	0.4971	0.1700	**0.1185**	0.1254	**0.0400**	**0.0010**	**0.0230**	**0.0043**	0.9793
1999	**0.5187**	**0.1685**	**0.1185**	0.1199	**0.0400**	**0.0010**	**0.0235**	**0.0043**	0.9943
2000	0.5187	**0.1685**	**0.1185**	**0.1146**	**0.0380**	**0.0010**	**0.0240**	0.0042	0.9875
2001	**0.5261**	**0.1685**	**0.1185**	**0.1094**	**0.0359**	0.0011	**0.0245**	0.0042	0.9883
2002	0.5336	0.1681	0.1185	0.1042	0.0339	0.0016	**0.0250**	**0.0041**	0.9891
2003	0.5568	0.1728	0.1145	0.1054	0.0297	**0.0016**	0.0120	0.0039	0.9968

Source: *BTRE estimates.*

TABLE II.6 INTERSTATE SHARE BY STATE OF OPERATION—INTERPOLATED AND NORMALISED

	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	AUST
1971	0.4088	0.3071	0.1114	0.1223	0.0289	0.0104	0.0050	0.0061	1.0000
1972	0.4106	0.3047	0.1102	0.1223	0.0309	0.0100	0.0052	0.0061	1.0000
1973	0.4124	0.3023	0.1089	0.1223	0.0329	0.0097	0.0055	0.0061	1.0000
1974	0.4141	0.2999	0.1077	0.1223	0.0349	0.0093	0.0057	0.0060	1.0000
1975	0.4159	0.2975	0.1065	0.1223	0.0369	0.0090	0.0060	0.0060	1.0000
1976	0.4177	0.2951	0.1052	0.1223	0.0389	0.0086	0.0062	0.0060	1.0000
1977	0.4229	0.2927	0.1037	0.1229	0.0368	0.0089	0.0061	0.0060	1.0000
1978	0.4280	0.2902	0.1022	0.1236	0.0347	0.0092	0.0061	0.0060	1.0000
1979	0.4332	0.2878	0.1007	0.1242	0.0326	0.0095	0.0060	0.0060	1.0000
1980	0.4335	0.2799	0.1023	0.1306	0.0320	0.0096	0.0061	0.0060	1.0000
1981	0.4338	0.2720	0.1039	0.1369	0.0314	0.0098	0.0062	0.0060	1.0000
1982	0.4340	0.2642	0.1054	0.1433	0.0308	0.0099	0.0063	0.0060	1.0000
1983	0.4446	0.2557	0.1031	0.1431	0.0313	0.0098	0.0065	0.0059	1.0000
1984	0.4552	0.2471	0.1008	0.1429	0.0317	0.0098	0.0067	0.0058	1.0000
1985	0.4657	0.2386	0.0986	0.1428	0.0321	0.0097	0.0069	0.0057	1.0000
1986	0.4761	0.2301	0.0962	0.1425	0.0320	0.0095	0.0081	0.0054	1.0000
1987	0.4865	0.2215	0.0939	0.1423	0.0319	0.0094	0.0094	0.0051	1.0000
1988	0.4969	0.2130	0.0916	0.1421	0.0318	0.0092	0.0106	0.0047	1.0000
1989	0.5006	0.2050	0.0962	0.1407	0.0318	0.0093	0.0118	0.0046	1.0000
1990	0.5043	0.1970	0.1007	0.1393	0.0319	0.0094	0.0131	0.0044	1.0000
1991	0.5080	0.1890	0.1053	0.1378	0.0319	0.0094	0.0143	0.0042	1.0000
1992	0.5048	0.1864	0.1095	0.1377	0.0342	0.0073	0.0157	0.0043	1.0000
1993	0.5016	0.1838	0.1138	0.1375	0.0366	0.0052	0.0171	0.0043	1.0000
1994	0.4985	0.1812	0.1181	0.1374	0.0389	0.0031	0.0185	0.0044	1.0000
1995	0.4953	0.1786	0.1223	0.1372	0.0412	0.0010	0.0199	0.0044	1.0000
1996	0.4994	0.1769	0.1219	0.1342	0.0411	0.0010	0.0211	0.0044	1.0000
1997	0.5035	0.1753	0.1215	0.1311	0.0410	0.0010	0.0223	0.0044	1.0000
1998	0.5076	0.1736	0.1210	0.1281	0.0408	0.0010	0.0235	0.0044	1.0000
1999	0.5217	0.1695	0.1192	0.1205	0.0402	0.0010	0.0236	0.0043	1.0000
2000	0.5252	0.1706	0.1200	0.1161	0.0385	0.0010	0.0243	0.0042	1.0000
2001	0.5324	0.1705	0.1199	0.1107	0.0364	0.0011	0.0248	0.0043	1.0000
2002	0.5395	0.1700	0.1198	0.1054	0.0342	0.0016	0.0253	0.0041	1.0000
2003	0.5586	0.1733	0.1149	0.1057	0.0298	0.0016	0.0121	0.0039	1.0000

Source: *BTRE estimates.*

TABLE II.7 INTERSTATE FREIGHT BY STATE OF OPERATION—FINAL

(billion tonne–kilometres)

	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	AUST
1971	2.248	1.689	0.613	0.672	0.159	0.057	0.027	0.034	5.500
1972	2.587	1.920	0.694	0.770	0.195	0.063	0.033	0.038	6.300
1973	3.010	2.207	0.795	0.893	0.240	0.071	0.040	0.044	7.300
1974	3.396	2.459	0.883	1.003	0.286	0.077	0.047	0.049	8.200
1975	3.535	2.529	0.905	1.039	0.313	0.076	0.051	0.051	8.500
1976	3.801	2.685	0.958	1.113	0.354	0.079	0.057	0.054	9.100
1977	4.186	2.897	1.027	1.217	0.364	0.089	0.061	0.059	9.900
1978	4.366	2.960	1.043	1.261	0.354	0.094	0.062	0.061	10.200
1979	4.982	3.309	1.158	1.429	0.375	0.110	0.069	0.069	11.500
1980	5.548	3.583	1.309	1.672	0.410	0.123	0.078	0.076	12.800
1981	6.073	3.809	1.454	1.917	0.440	0.137	0.087	0.084	14.000
1982	6.554	3.989	1.592	2.164	0.466	0.149	0.096	0.090	15.100
1983	6.625	3.809	1.537	2.132	0.466	0.146	0.097	0.088	14.900
1984	7.510	4.078	1.664	2.358	0.522	0.161	0.111	0.096	16.500
1985	8.476	4.343	1.794	2.598	0.584	0.176	0.125	0.104	18.200
1986	9.523	4.601	1.925	2.851	0.640	0.191	0.162	0.108	20.000
1987	10.071	4.585	1.944	2.946	0.660	0.194	0.194	0.105	20.700
1988	11.281	4.834	2.080	3.226	0.722	0.210	0.240	0.107	22.700
1989	12.315	5.043	2.366	3.461	0.783	0.229	0.291	0.112	24.600
1990	13.314	5.201	2.659	3.676	0.841	0.247	0.345	0.116	26.400
1991	13.208	4.915	2.737	3.583	0.829	0.245	0.372	0.110	26.000
1992	12.974	4.791	2.815	3.538	0.880	0.188	0.403	0.110	25.700
1993	13.745	5.037	3.119	3.768	1.002	0.143	0.468	0.119	27.400
1994	14.456	5.256	3.424	3.984	1.128	0.090	0.536	0.127	29.000
1995	15.800	5.698	3.903	4.378	1.315	0.032	0.634	0.141	31.900
1996	17.329	6.140	4.230	4.656	1.426	0.035	0.732	0.153	34.700
1997	18.479	6.432	4.457	4.812	1.503	0.037	0.818	0.161	36.700
1998	20.234	6.918	4.823	5.105	1.628	0.041	0.936	0.174	39.859
1999	22.438	7.289	5.126	5.185	1.730	0.043	1.017	0.185	43.014
2000	24.496	7.958	5.597	5.414	1.795	0.047	1.134	0.197	46.637
2001	25.894	8.293	5.832	5.385	1.769	0.054	1.206	0.207	48.640
2002	28.490	8.976	6.328	5.563	1.808	0.087	1.335	0.217	52.805
2003	31.151	9.665	6.405	5.895	1.662	0.090	0.674	0.220	55.761

Source: BTRE estimates.

II.2 ESTIMATING THE FREIGHT TASK BY STATE OF OPERATION

As with the interstate task, estimating the state task has to start with the 1970–71 to 1984–85 survey years, where estimates of the task by state of operation are missing.

Table II.8 gives the survey figures for the task by state of registration.

TABLE II.8 TOTAL ROAD FREIGHT ACTIVITY BY STATE OF REGISTRATION— ALL COMMERCIAL VEHICLES

(million tonne-kilometres)

	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	AUST
1971	9481.1	6 681.5	2 911.0	3 219.2	3 136.3	672.1	568.4	na	26 670
1976	12 296.8	8 149.5	3 862.6	6 967.7	3 710.6	1 095.4	432.8	186.9	36 702
1979	16 456.1	11 482.0	6 589.8	6 253.2	4 651.9	1 407.4	946.3	340.3	48 127
1982	20 384.0	13 781.5	8 852.9	6 305.4	6 365.8	1 512.6	1 757.1	407.0	59 366
1985	23 950.5	17 611.6	11 057.9	8 017.3	8 254.6	1 877.9	3 176.7	353.5	74 300

na not available.

Source: ABS Survey of Motor Vehicle Use.

The next step is to subtract the survey estimates of interstate freight by state of registration—Table II.1. Then the gravity model estimates of interstate freight by state of operation are added back in—Table II.2. This gives the raw estimate of freight by state of operation. For example, for New South Wales in 1970–71, one takes freight by state of registration of 9 481 from Table II.8, subtracts interstate freight by state of registration of 1 466 from Table II.1 and adds back in the interstate freight by state of operation of 1 809 from Table II.2. This gives the raw estimate of freight task by state of operation for New South Wales in 1970–71 of 9 824—in Table II.9 following.

TABLE II.9 FREIGHT BY STATE OF OPERATION—RAW

(million tonne–kilometres)

	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	AUST
1971	9 825	6 576	2 926	2 821	3 227	711	547	136	26 767
1976	13 575	9 276	4 063	4 019	3 958	1 158	449	206	36 702
1979	18 055	11 277	6 529	5 007	4 766	1 493	791	209	48 127
1982	22 456	12 769	8 987	5 500	6 262	1 579	1 588	226	59 366
1985	26 394	16 105	11 232	7 719	7 932	2 023	2 574	321	74 300
1988	29 546	20 290	12 490	7 498	10 556	2 485	2 268	396	85 529
1991	29 009	19 257	16 000	7 699	10 856	2 453	2 532	399	88 205
1995	37 003	25 516	22 479	11 328	16 297	2 812	3 328	463	119 226
1998	37 434	26 917	19 715	9 786	16 877	2 487	2 630	302	116 148
1999	42 820	27 510	24 763	10 948	17 664	2 116	3 719	334	129 874
2000	45 250	28 671	25 711	12 838	15 769	2 457	3 244	438	134 378
2001	44 874	30 466	24 457	11 677	15 268	2 646	2 610	425	132 423
2002	46 715	29 817	29 466	11 855	16 800	2 727	3 206	353	140 939
2003	50 022	34 592	29 471	13 085	19 674	2 753	2 709	472	152 778

Sources: ABS Survey of Motor Vehicle Use, BTRE estimates.

Table II.9 also gives the raw ABS survey estimates of freight task by state of operation for the survey years from 1987–88 to 2002–03.

Once the raw estimates have been derived, the six-step procedure can again be followed.

The first two steps for the Australian aggregate freight task were performed in Chapter 2. The results are given again in Table II.13, last column.

The third and subsequent steps are as follows:

- Using the raw estimates of Table II.9, one can then then generate raw shares by state of operation. These are given in Table II.10.

TABLE II.10 FREIGHT SHARE BY STATE OF OPERATION—RAW—SURVEY YEARS

	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	AUST
1971	0.3670	0.2457	0.1093	0.1054	0.1206	0.0266	0.0204	0.0051	1.0000
1976	0.3699	0.2527	0.1107	0.1095	0.1078	0.0315	0.0122	0.0056	1.0000
1979	0.3751	0.2343	0.1357	0.1040	0.0990	0.0310	0.0164	0.0044	1.0000
1982	0.3783	0.2151	0.1514	0.0927	0.1055	0.0266	0.0267	0.0038	1.0000
1985	0.3552	0.2168	0.1512	0.1039	0.1068	0.0272	0.0346	0.0043	1.0000
1988	0.3454	0.2372	0.1460	0.0877	0.1234	0.0291	0.0265	0.0046	1.0000
1991	0.3289	0.2183	0.1814	0.0873	0.1231	0.0278	0.0287	0.0045	1.0000
1995	0.3104	0.2140	0.1885	0.0950	0.1367	0.0236	0.0279	0.0039	1.0000
1998	0.3223	0.2317	0.1697	0.0843	0.1453	0.0214	0.0226	0.0026	1.0000
1999	0.3297	0.2118	0.1907	0.0843	0.1360	0.0163	0.0286	0.0026	1.0000
2000	0.3367	0.2134	0.1913	0.0955	0.1173	0.0183	0.0241	0.0033	1.0000
2001	0.3389	0.2301	0.1847	0.0882	0.1153	0.0200	0.0197	0.0032	1.0000
2002	0.3315	0.2116	0.2091	0.0841	0.1192	0.0193	0.0227	0.0025	1.0000
2003	0.3274	0.2264	0.1929	0.0856	0.1288	0.0180	0.0177	0.0031	1.0000

Sources: ABS Survey of Motor Vehicle Use, BTRE estimates.

- These shares are then smoothed to trends, not worrying if the total share goes above or below 1.0. These shares are shown in Table II.11. The changes are shown bolded.

TABLE II.11 FREIGHT SHARE BY STATE OF OPERATION—SMOOTHED—SURVEY YEARS

	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	AUST
1971	0.3670	0.2457	0.1093	0.1054	0.1206	0.0266	0.0204	0.0056	1.0005
1976	0.3699	0.2527	0.1107	0.1095	0.1078	0.0266	0.0240	0.0056	1.0068
1979	0.3751	0.2343	0.1357	0.1040	**0.1067**	**0.0266**	**0.0240**	**0.0050**	1.0114
1982	**0.3652**	**0.2255**	**0.1434**	**0.1040**	0.1055	0.0266	**0.0240**	**0.0050**	0.9992
1985	0.3552	0.2168	0.1512	0.1039	0.1068	**0.0266**	**0.0240**	**0.0050**	0.9894
1988	0.3454	**0.2175**	**0.1663**	**0.0956**	0.1234	**0.0240**	**0.0240**	0.0046	1.0009
1991	0.3289	0.2183	0.1814	0.0873	0.1231	**0.0220**	**0.0240**	0.0045	0.9895
1995	0.3230	0.2140	0.1885	**0.0858**	**0.1200**	**0.0200**	**0.0238**	0.0039	0.9790
1998	0.3223	**0.2129**	**0.1896**	0.0843	**0.1200**	**0.0190**	0.0226	0.0034	0.9741
1999	**0.3262**	0.2118	0.1907	0.0843	**0.1200**	**0.0188**	**0.0227**	**0.0033**	0.9778
2000	**0.3262**	0.2134	0.1913	**0.0842**	**0.1200**	**0.0186**	**0.0227**	0.0033	0.9797
2001	**0.3262**	**0.2125**	**0.1921**	**0.0842**	**0.1200**	**0.0184**	**0.0227**	0.0032	0.9793
2002	**0.3262**	0.2116	**0.1921**	0.0841	**0.1200**	**0.0182**	0.0227	**0.0032**	0.9781
2003	0.3274	0.2116	0.1929	0.0856	**0.1200**	0.0180	0.0177	0.0031	0.9764

Source: BTRE estimates.

- Then these shares are interpolated between survey years, and normalised to add to 1.0. This is shown in Table II.12.
- Finally, these shares are multiplied by the adjusted Australian-level total tonne-kilometres from Table 2.9 in Chapter 2—repeated as the last column in Table II.13—to give the final estimates of the freight tasks by state of operation. These are shown in Table II.13.

TABLE II.12 FREIGHT SHARE BY STATE OF OPERATION—INTERPOLATED AND NORMALISED

	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	AUST
1971	0.3668	0.2455	0.1093	0.1053	0.1205	0.0265	0.0204	0.0056	1.0000
1972	0.3669	0.2466	0.1094	0.1060	0.1178	0.0265	0.0211	0.0056	1.0000
1973	0.3670	0.2477	0.1095	0.1067	0.1151	0.0265	0.0218	0.0056	1.0000
1974	0.3671	0.2488	0.1097	0.1074	0.1125	0.0265	0.0225	0.0056	1.0000
1975	0.3672	0.2499	0.1098	0.1081	0.1098	0.0264	0.0232	0.0056	1.0000
1976	0.3673	0.2510	0.1099	0.1088	0.1071	0.0264	0.0238	0.0056	1.0000
1977	0.3685	0.2446	0.1180	0.1068	0.1066	0.0264	0.0238	0.0054	1.0000
1978	0.3697	0.2381	0.1261	0.1048	0.1060	0.0263	0.0238	0.0052	1.0000
1979	0.3709	0.2317	0.1341	0.1029	0.1055	0.0263	0.0237	0.0049	1.0000
1980	0.3691	0.2297	0.1373	0.1033	0.1055	0.0264	0.0238	0.0050	1.0000
1981	0.3673	0.2277	0.1404	0.1037	0.1055	0.0265	0.0239	0.0050	1.0000
1982	0.3655	0.2257	0.1435	0.1040	0.1056	0.0266	0.0240	0.0050	1.0000
1983	0.3633	0.2235	0.1466	0.1044	0.1063	0.0267	0.0241	0.0050	1.0000
1984	0.3612	0.2213	0.1497	0.1047	0.1071	0.0268	0.0242	0.0050	1.0000
1985	0.3590	0.2191	0.1528	0.1050	0.1079	0.0269	0.0243	0.0051	1.0000
1986	0.3544	0.2185	0.1572	0.1018	0.1130	0.0259	0.0242	0.0049	1.0000
1987	0.3498	0.2179	0.1617	0.0987	0.1182	0.0249	0.0241	0.0048	1.0000
1988	0.3451	0.2173	0.1661	0.0955	0.1233	0.0240	0.0240	0.0046	1.0000
1989	0.3397	0.2177	0.1712	0.0928	0.1232	0.0233	0.0240	0.0046	0.9965
1990	0.3343	0.2180	0.1763	0.0900	0.1232	0.0227	0.0240	0.0046	0.9930
1991	0.3289	0.2183	0.1814	0.0873	0.1231	0.0220	0.0240	0.0045	0.9895
1992	0.3291	0.2184	0.1842	0.0874	0.1230	0.0216	0.0241	0.0044	0.9921
1993	0.3294	0.2185	0.1870	0.0874	0.1228	0.0212	0.0242	0.0042	0.9947
1994	0.3297	0.2185	0.1898	0.0875	0.1227	0.0208	0.0242	0.0041	0.9974
1995	0.3299	0.2186	0.1926	0.0876	0.1226	0.0204	0.0243	0.0040	1.0000
1996	0.3302	0.2186	0.1933	0.0872	0.1228	0.0201	0.0240	0.0038	1.0000
1997	0.3305	0.2186	0.1940	0.0869	0.1230	0.0198	0.0236	0.0036	1.0000
1998	0.3309	0.2186	0.1946	0.0865	0.1232	0.0195	0.0232	0.0035	1.0000
1999	0.3336	0.2166	0.1950	0.0862	0.1227	0.0192	0.0232	0.0034	1.0000
2000	0.3330	0.2178	0.1953	0.0859	0.1225	0.0190	0.0232	0.0033	1.0000
2001	0.3331	0.2170	0.1962	0.0860	0.1225	0.0188	0.0232	0.0033	1.0000
2002	0.3335	0.2163	0.1964	0.0860	0.1227	0.0186	0.0233	0.0033	1.0000
2003	0.3353	0.2167	0.1976	0.0877	0.1229	0.0184	0.0182	0.0032	1.0000

Source: BTRE estimates.

TABLE II.13 FREIGHT TASK BY STATE OF OPERATION—FINAL

(billion tonne–kilometres)

	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	AUST
1971	9.269	6.204	2.760	2.661	3.044	0.671	0.516	0.141	25.27
1972	9.846	6.618	2.935	2.845	3.161	0.712	0.566	0.150	26.83
1973	10.343	6.981	3.086	3.007	3.245	0.747	0.614	0.158	28.18
1974	11.474	7.776	3.427	3.356	3.515	0.827	0.702	0.175	31.25
1975	11.969	8.145	3.578	3.522	3.578	0.862	0.754	0.182	32.59
1976	12.658	8.649	3.788	3.747	3.691	0.910	0.821	0.192	34.46
1977	13.807	9.163	4.421	4.001	3.992	0.988	0.892	0.201	37.46
1978	14.369	9.255	4.899	4.074	4.120	1.024	0.924	0.200	38.86
1979	15.889	9.925	5.746	4.406	4.518	1.127	1.017	0.212	42.84
1980	17.618	10.964	6.552	4.929	5.036	1.261	1.137	0.237	47.73
1981	19.085	11.832	7.295	5.386	5.483	1.378	1.243	0.259	51.96
1982	20.494	12.657	8.048	5.834	5.919	1.493	1.347	0.281	56.07
1983	20.423	12.563	8.241	5.866	5.978	1.501	1.355	0.282	56.21
1984	22.007	13.484	9.121	6.379	6.527	1.633	1.473	0.307	60.93
1985	23.776	14.507	10.118	6.953	7.145	1.780	1.606	0.335	66.22
1986	25.404	15.662	11.271	7.300	8.102	1.858	1.732	0.352	71.68
1987	25.577	15.935	11.823	7.215	8.641	1.824	1.760	0.349	73.12
1988	27.196	17.126	13.091	7.525	9.716	1.889	1.889	0.365	78.80
1989	28.518	18.272	14.373	7.787	10.344	1.958	2.013	0.386	83.65
1990	29.653	19.337	15.639	7.985	10.924	2.010	2.128	0.404	88.08
1991	28.724	19.068	15.843	7.623	10.750	1.921	2.096	0.395	86.42
1992	28.269	18.757	15.820	7.503	10.560	1.856	2.068	0.376	85.21
1993	29.633	19.653	16.822	7.867	11.049	1.908	2.173	0.382	89.49
1994	30.860	20.457	17.766	8.193	11.486	1.949	2.268	0.384	93.36
1995	33.510	22.203	19.561	8.898	12.450	2.075	2.469	0.403	101.57
1996	35.995	23.826	21.066	9.509	13.382	2.193	2.611	0.415	109.00
1997	37.410	24.738	21.951	9.831	13.919	2.242	2.671	0.413	113.17
1998	40.130	26.511	23.608	10.491	14.941	2.366	2.819	0.423	121.29
1999	43.011	27.930	25.141	11.115	15.823	2.479	2.993	0.435	128.93
2000	44.907	29.373	26.341	11.592	16.520	2.561	3.125	0.449	134.87
2001	46.381	30.209	27.314	11.972	17.062	2.616	3.228	0.456	139.24
2002	49.078	31.830	28.902	12.655	18.055	2.738	3.422	0.481	147.16
2003	51.514	33.292	30.350	13.475	18.880	2.832	2.790	0.486	153.62

Source: BTRE estimates.

II.3 ESTIMATING THE CAPITAL CITIES' ROAD FREIGHT TASKS

Estimating the city tasks again follows a six-step procedure.

- The first step is to adjust the Australian-level aggregate for the eight capital cities' freight task in a manner similar to that used for total Australian freight. Table II.14 shows the mechanism for adjusting aggregate capital city tonne-kilometres. It is done by vehicle type, multiplying by the ratio of adjusted to raw tonne–kilometres by vehicle type of the Australia-level adjustment. Then a final adjustment is made, for each vehicle type that seeks to smooth the series. The changes are shown shaded.
- The second step in deriving an estimate of capital city freight is to use the regression equation of total capital city freight against GDP and real road freight rates and the adjusted capital city series interpolated between survey years, to generate a final adjusted Australia-level estimate of capital city freight tonne–kilometres that varies over the economic cycle. These figures are presented in Table II.19, last column. Detail of the regression is given in Chapter 3.

TABLE II.14 ADJUSTMENTS TO EIGHT CAPITAL CITIES TOTAL ROAD FREIGHT—RAW

	LCV raw	LCV ratio	LCV adj	LCV final	Rigid raw	Rigid ratio	Rigid adj	Rigid final	Artic raw	Artic ratio	Artic adj	Artic final	Total raw	Total adj
1971	550	0.9211	506	506	4 730	0.9342	4 419	4 419	2 415	0.9056	2 187	2 187	7 695	7 112
1976	821	0.9647	792	792	5 387	0.9284	5 001	5 001	4 092	0.8882	3 635	3 635	10 300	9 428
1979	1 230	0.9500	1 168	1 168	5 830	1.0273	5 989	5 989	5 351	0.9012	4 822	4 822	12 410	11 979
1982	1 153	0.9500	1 096	1 096	6 987	0.9895	6 914	6 914	6 412	0.9234	5 921	5 921	14 553	13 931
1985	1 430	0.8696	1 243	1 243	7 839	0.9328	7 313	7 313	7 821	0.8834	6 909	6 909	17 090	15 465
1988	2 208	0.7806	1 724	1 724	10 367	0.8638	8 955	8 605	10 007	0.9089	9 095	7 997	22 582	18 325
1991	2 338	0.8551	1 999	1 999	9 541	1.0173	9 706	9 706	9 356	0.9046	8 463	8 463	21 234	20 168
1995	2 395	1.0501	2 515	2 515	10 872	0.8814	9 583	9 583	13 764	0.8703	11 979	11 979	27 031	24 076
1998	2 732	1.0000	2 732	2 600	10 129	1.0435	10 569	10 108	15 444	1.0377	16 026	14 510	28 305	27 218
1999	2 488	1.0000	2 488	2 655	10 197	1.0429	10 634	10 634	15 743	0.9752	15 353	14 813	28 428	28 102
2000	2 744	1.0000	2 744	2 682	11 559	1.0341	11 953	11 953	14 669	0.9937	14 576	15 104	28 972	29 740
2001	2 604	1.0804	2 813	2 880	11 531	1.0752	12 398	12 398	15 384	1.0000	15 384	15 282	29 519	30 559
2002	2 802	1.1000	3 082	3 082	13 651	1.0021	13 680	13 680	14 976	1.0000	14 976	15 459	31 429	32 221
2003	3 215	1.0110	3 250	3 250	13 380	0.9913	13 264	14 000	15 870	1.0092	16 016	16 016	32 465	33 266

Sources: ABS Survey of Motor Vehicle Use, BTRE estimates.

TABLE II.15 ROAD FREIGHT TKM BY CAPITAL CITIES—RAW

	SYD	MEL	BNE	ADL	PER	HOB	DRW	CBR	8 CAPS
1971	3 099	2 148	680	734	861	125	49	135	7 829
1976	3 664	2 787	1 039	1 330	1 077	191	68	145	10 300
1979	4 506	3 417	1 551	1 111	1 393	238	61	132	12 410
1982	5 401	3 749	2 143	1 041	1 649	263	182	124	14 553
1985	5 544	4 834	2 556	1 513	1 880	353	225	185	17 090
1988	7 741	6 928	2 798	1 631	2 505	490	263	226	22 582
1991	6 240	6 257	3 519	1 863	2 429	373	256	297	21 234
1995	8 689	8 319	4 151	1 668	3 123	540	260	280	27 030
1998	9 343	8 023	4 876	2 013	3 264	339	277	171	28 306
1999	9 159	8 843	4 751	1 659	3 243	278	298	198	28 429
2000	9 135	8 352	5 247	1 959	3 512	276	256	234	28 971
2001	9 316	8 929	5 177	1 659	3 625	375	209	228	29 518
2002	9 578	9 778	5 718	2 086	3 646	268	148	206	31 428
2003	10 043	9 940	5 525	2 472	3 747	307	179	252	32 465

Sources: ABS Survey of Motor Vehicle Use, BTRE estimates.

- Next one calculates the raw survey shares of capital city freight from Table II.15, which gives the raw ABS survey estimates of tonne–kilometres by city. These raw shares are shown in Table II.16

TABLE II.16 ROAD FREIGHT SHARE BY CAPITAL CITIES—RAW

	SYD	MEL	BNE	ADL	PER	HOB	DRW	CBR	8 CAPS
1971	0.3958	0.2743	0.0869	0.0937	0.1099	0.0160	0.0062	0.0172	1.0000
1976	0.3557	0.2705	0.1009	0.1291	0.1045	0.0185	0.0066	0.0141	1.0000
1979	0.3631	0.2754	0.1250	0.0896	0.1123	0.0191	0.0049	0.0106	1.0000
1982	0.3712	0.2576	0.1473	0.0715	0.1133	0.0181	0.0125	0.0085	1.0000
1985	0.3244	0.2829	0.1496	0.0885	0.1100	0.0207	0.0131	0.0108	1.0000
1988	0.3428	0.3068	0.1239	0.0722	0.1109	0.0217	0.0116	0.0100	1.0000
1991	0.2939	0.2947	0.1657	0.0877	0.1144	0.0176	0.0120	0.0140	1.0000
1995	0.3215	0.3078	0.1536	0.0617	0.1155	0.0200	0.0096	0.0104	1.0000
1998	0.3301	0.2834	0.1723	0.0711	0.1153	0.0120	0.0098	0.0060	1.0000
1999	0.3222	0.3111	0.1671	0.0584	0.1141	0.0098	0.0105	0.0070	1.0000
2000	0.3153	0.2883	0.1811	0.0676	0.1212	0.0095	0.0088	0.0081	1.0000
2001	0.3156	0.3025	0.1754	0.0562	0.1228	0.0127	0.0071	0.0077	1.0000
2002	0.3048	0.3111	0.1819	0.0664	0.1160	0.0085	0.0047	0.0066	1.0000
2003	0.3093	0.3062	0.1702	0.0761	0.1154	0.0095	0.0055	0.0078	1.0000

Sources: ABS Survey of Motor Vehicle Use, BTRE estimates.

- Then these shares are smoothed to a believable trend, not worrying if the total share goes above or below 1.0. These shares are shown in Table II.17, with the changes bolded.
- Then these shares are interpolated between survey years and normalised to add to 1.0. This is shown in Table II.18.
- Finally, these shares are multiplied by the adjusted Australia-level eight capital city tonne-kilometres from the second step above—shown as the last column in Table II.19—to get the final adjusted freight task by capital city series. These are shown in Table II.19.

TABLE II.17 ROAD FREIGHT SHARE BY CAPITAL CITIES—SMOOTHED

	SYD	MEL	BNE	ADL	PER	HOB	DRW	CBR	8 CAPS
1971	0.3958	0.2743	0.0869	0.0937	0.1099	0.0160	0.0062	**0.0141**	0.9969
1976	**0.3794**	**0.2748**	0.1009	**0.0916**	**0.1111**	0.0185	0.0066	0.0141	0.9971
1979	0.3631	0.2754	0.1250	0.0896	0.1123	0.0191	0.0049	**0.0140**	1.0034
1982	**0.3564**	**0.2791**	0.1473	0.0715	0.1133	0.0181	0.0125	**0.0140**	1.0122
1985	**0.3496**	0.2829	0.1496	**0.0719**	0.1100	0.0207	0.0131	**0.0140**	1.0117
1988	0.3428	**0.2919**	**0.1500**	0.0722	0.1109	**0.0188**	0.0116	**0.0140**	1.0123
1991	**0.3377**	**0.3010**	**0.1500**	**0.0716**	0.1144	0.0176	0.0120	0.0140	1.0182
1995	**0.3325**	**0.3100**	0.1536	0.0710	0.1155	**0.0138**	0.0096	0.0104	1.0164
1998	**0.3273**	**0.3100**	**0.1603**	0.0711	0.1153	**0.0100**	0.0098	**0.0090**	1.0129
1999	0.3222	**0.3100**	0.1671	**0.0694**	0.1141	0.0098	0.0105	**0.0085**	1.0115
2000	0.3153	**0.3100**	0.1681	0.0676	**0.1147**	0.0095	0.0088	**0.0080**	1.0021
2001	0.3156	**0.3100**	**0.1700**	**0.0670**	**0.1154**	**0.0095**	0.0071	0.0077	1.0023
2002	**0.3100**	0.3111	**0.1700**	0.0664	0.1160	**0.0095**	**0.0060**	**0.0077**	0.9967
2003	0.3093	0.3062	0.1702	**0.0670**	0.1154	0.0095	0.0055	0.0078	0.9909

Source: BTRE estimates.

TABLE II.18 ROAD FREIGHT SHARE BY CAPITAL CITIES—INTERPOLATED AND NORMALISED

	SYD	MEL	BNE	ADL	PER	HOB	DRW	CBR	8 CAPS
1971	0.3970	0.2752	0.0871	0.0940	0.1103	0.0160	0.0063	0.0141	1.0000
1972	0.3937	0.2753	0.0899	0.0936	0.1105	0.0165	0.0063	0.0141	1.0000
1973	0.3904	0.2754	0.0928	0.0932	0.1107	0.0170	0.0064	0.0141	1.0000
1974	0.3871	0.2754	0.0956	0.0928	0.1110	0.0176	0.0065	0.0141	1.0000
1975	0.3838	0.2755	0.0984	0.0923	0.1112	0.0181	0.0065	0.0141	1.0000
1976	0.3805	0.2756	0.1012	0.0919	0.1114	0.0186	0.0066	0.0141	1.0000
1977	0.3743	0.2752	0.1090	0.0910	0.1116	0.0188	0.0060	0.0141	1.0000
1978	0.3681	0.2748	0.1168	0.0901	0.1117	0.0189	0.0055	0.0140	1.0000
1979	0.3619	0.2744	0.1246	0.0893	0.1119	0.0191	0.0049	0.0140	1.0000
1980	0.3586	0.2749	0.1315	0.0831	0.1119	0.0187	0.0074	0.0139	1.0000
1981	0.3553	0.2753	0.1385	0.0769	0.1119	0.0183	0.0099	0.0139	1.0000
1982	0.3521	0.2758	0.1455	0.0707	0.1119	0.0179	0.0124	0.0138	1.0000
1983	0.3499	0.2770	0.1463	0.0708	0.1109	0.0187	0.0126	0.0138	1.0000
1984	0.3477	0.2783	0.1471	0.0709	0.1098	0.0196	0.0128	0.0138	1.0000
1985	0.3455	0.2796	0.1479	0.0711	0.1087	0.0204	0.0130	0.0138	1.0000
1986	0.3432	0.2825	0.1480	0.0712	0.1090	0.0198	0.0125	0.0138	1.0000
1987	0.3409	0.2854	0.1481	0.0713	0.1093	0.0192	0.0120	0.0138	1.0000
1988	0.3386	0.2884	0.1482	0.0714	0.1096	0.0186	0.0115	0.0138	1.0000
1989	0.3363	0.2908	0.1479	0.0710	0.1105	0.0181	0.0116	0.0138	1.0000
1990	0.3340	0.2932	0.1476	0.0707	0.1114	0.0177	0.0117	0.0138	1.0000
1991	0.3316	0.2956	0.1473	0.0703	0.1123	0.0173	0.0118	0.0137	1.0000
1992	0.3305	0.2979	0.1483	0.0702	0.1127	0.0163	0.0112	0.0129	1.0000
1993	0.3294	0.3003	0.1492	0.0701	0.1130	0.0154	0.0106	0.0120	1.0000
1994	0.3283	0.3026	0.1502	0.0700	0.1133	0.0145	0.0101	0.0111	1.0000
1995	0.3271	0.3050	0.1511	0.0699	0.1137	0.0136	0.0095	0.0102	1.0000
1996	0.3258	0.3054	0.1535	0.0700	0.1137	0.0123	0.0095	0.0098	1.0000
1997	0.3245	0.3057	0.1559	0.0701	0.1138	0.0111	0.0096	0.0093	1.0000
1998	0.3232	0.3061	0.1583	0.0702	0.1138	0.0099	0.0097	0.0089	1.0000
1999	0.3185	0.3065	0.1652	0.0686	0.1128	0.0097	0.0104	0.0084	1.0000
2000	0.3147	0.3094	0.1677	0.0675	0.1145	0.0095	0.0088	0.0080	1.0000
2001	0.3149	0.3093	0.1696	0.0668	0.1151	0.0095	0.0071	0.0077	1.0000
2002	0.3110	0.3122	0.1706	0.0666	0.1164	0.0095	0.0060	0.0077	1.0000
2003	0.3122	0.3090	0.1718	0.0676	0.1165	0.0095	0.0056	0.0078	1.0000

Source: BTRE Estimates.

TABLE II.19 ROAD FREIGHT TASK BY CAPITAL CITIES—FINAL

(billion tonne–kilometres)

	SYD	MEL	BNE	ADL	PER	HOB	DRW	CBR	8 CAPS
1971	2.82	1.96	0.62	0.67	0.78	0.11	0.04	0.10	7.11
1972	2.98	2.09	0.68	0.71	0.84	0.13	0.05	0.11	7.58
1973	3.16	2.23	0.75	0.75	0.90	0.14	0.05	0.11	8.10
1974	3.41	2.42	0.84	0.82	0.98	0.15	0.06	0.12	8.80
1975	3.49	2.51	0.90	0.84	1.01	0.16	0.06	0.13	9.10
1976	3.62	2.62	0.96	0.87	1.06	0.18	0.06	0.13	9.50
1977	3.82	2.81	1.11	0.93	1.14	0.19	0.06	0.14	10.20
1978	3.87	2.89	1.23	0.95	1.17	0.20	0.06	0.15	10.50
1979	4.09	3.10	1.41	1.01	1.26	0.22	0.06	0.16	11.30
1980	4.45	3.41	1.63	1.03	1.39	0.23	0.09	0.17	12.40
1981	4.69	3.63	1.83	1.01	1.48	0.24	0.13	0.18	13.20
1982	4.93	3.86	2.04	0.99	1.57	0.25	0.17	0.19	14.00
1983	4.90	3.88	2.05	0.99	1.55	0.26	0.18	0.19	14.00
1984	5.22	4.17	2.21	1.06	1.65	0.29	0.19	0.21	15.00
1985	5.56	4.50	2.38	1.14	1.75	0.33	0.21	0.22	16.10
1986	5.87	4.83	2.53	1.22	1.86	0.34	0.21	0.24	17.10
1987	5.90	4.94	2.56	1.23	1.89	0.33	0.21	0.24	17.30
1988	6.23	5.31	2.73	1.31	2.02	0.34	0.21	0.25	18.40
1989	6.49	5.61	2.85	1.37	2.13	0.35	0.22	0.27	19.30
1990	7.08	6.21	3.13	1.50	2.36	0.38	0.25	0.29	21.20
1991	6.93	6.18	3.08	1.47	2.35	0.36	0.25	0.29	20.90
1992	6.81	6.14	3.05	1.45	2.32	0.34	0.23	0.26	20.60
1993	7.05	6.43	3.19	1.50	2.42	0.33	0.23	0.26	21.40
1994	7.29	6.72	3.33	1.55	2.52	0.32	0.22	0.25	22.20
1995	7.75	7.23	3.58	1.66	2.69	0.32	0.22	0.24	23.70
1996	8.21	7.69	3.87	1.76	2.87	0.31	0.24	0.25	25.20
1997	8.40	7.92	4.04	1.82	2.95	0.29	0.25	0.24	25.90
1998	8.80	8.33	4.31	1.91	3.10	0.27	0.26	0.24	27.22
1999	8.95	8.61	4.64	1.93	3.17	0.27	0.29	0.24	28.10
2000	9.36	9.20	4.99	2.01	3.40	0.28	0.26	0.24	29.74
2001	9.62	9.45	5.18	2.04	3.52	0.29	0.22	0.24	30.56
2002	10.02	10.06	5.50	2.15	3.75	0.31	0.19	0.25	32.22
2003	10.39	10.28	5.71	2.25	3.87	0.32	0.19	0.26	33.27

Source: BTRE estimates.

II.4 ESTIMATING THE REST OF STATE ROAD FREIGHT TASK

The “Rest of State” freight task is simply the total freight task by state of operation—Table II.13—minus the interstate freight task by state of operation (Table II.9), minus the capital city freight task (Table II.19).

The rest of state freight task estimates are presented in Table II.20.

II.5 ESTIMATES OF SECTORS BY STATE

Tables II.21 to II.28 and Figures II.1 to II.8 show the results of these calculations on a state basis.

The forecasts for each state were made using a methodology outlined in Appendix IV.

TABLE II.20 REST OF STATE FREIGHT TASK

(billion tonne–kilometres)

	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	Rest of State
1971	4.20	2.56	1.53	1.32	2.10	0.50	0.44	0.01	12.65
1972	4.28	2.61	1.56	1.37	2.13	0.52	0.49	0.00	12.96
1973	4.17	2.54	1.54	1.36	2.11	0.54	0.52	0.00	12.78
1974	4.67	2.89	1.70	1.54	2.25	0.60	0.60	0.00	14.25
1975	4.94	3.11	1.78	1.64	2.25	0.62	0.64	0.00	14.99
1976	5.24	3.35	1.87	1.76	2.28	0.65	0.70	0.00	15.86
1977	5.80	3.46	2.28	1.86	2.49	0.71	0.77	0.00	17.36
1978	6.14	3.41	2.63	1.87	2.59	0.73	0.80	-0.01	18.16
1979	6.82	3.51	3.18	1.97	2.88	0.80	0.89	-0.01	20.04
1980	7.62	3.97	3.61	2.23	3.24	0.91	0.97	-0.01	22.53
1981	8.32	4.39	4.01	2.45	3.57	1.00	1.03	-0.01	24.76
1982	9.01	4.81	4.42	2.68	3.89	1.09	1.08	0.00	26.97
1983	8.90	4.88	4.66	2.74	3.96	1.09	1.08	0.00	27.31
1984	9.28	5.23	5.25	2.96	4.36	1.18	1.17	0.00	29.43
1985	9.74	5.66	5.94	3.21	4.81	1.28	1.27	0.01	31.92
1986	10.01	6.23	6.82	3.23	5.60	1.33	1.36	0.01	34.58
1987	9.61	6.41	7.32	3.04	6.09	1.30	1.36	0.00	35.12
1988	9.68	6.99	8.28	2.99	6.98	1.34	1.44	0.00	37.70
1989	9.71	7.62	9.15	2.96	7.43	1.38	1.50	0.01	39.75
1990	9.26	7.92	9.85	2.81	7.72	1.39	1.54	0.00	40.48
1991	8.58	7.98	10.03	2.57	7.57	1.32	1.48	0.00	39.52
1992	8.49	7.83	9.95	2.52	7.36	1.33	1.43	0.00	38.91
1993	8.84	8.19	10.51	2.60	7.63	1.44	1.48	0.01	40.69
1994	9.12	8.48	11.01	2.66	7.84	1.54	1.51	0.01	42.16
1995	9.96	9.28	12.08	2.86	8.44	1.72	1.61	0.02	45.97
1996	10.46	9.99	12.97	3.09	9.09	1.85	1.64	0.02	49.10
1997	10.53	10.39	13.46	3.20	9.47	1.92	1.60	0.01	50.57
1998	11.10	11.26	14.48	3.47	10.21	2.06	1.62	0.01	54.21
1999	11.62	12.03	15.37	4.00	10.92	2.16	1.69	0.01	57.81
2000	11.05	12.21	15.76	4.17	11.32	2.23	1.73	0.01	58.49
2001	10.86	12.46	16.30	4.54	11.78	2.27	1.81	0.01	60.04
2002	10.57	12.80	17.08	4.95	12.50	2.34	1.89	0.02	62.14
2003	9.98	13.35	18.23	5.33	13.34	2.43	1.93	0.01	64.59

Source: *BTRE estimates.*

FIGURE II.1 FREIGHT DISAGGREGATION BY STATE OF OPERATION—NSW

Source: *Table II.21.*

TABLE II.21 FREIGHT DISAGGREGATION BY STATE OF OPERATION—NSW

(billion tonne–kilometres)

	NSW State Op	NSW Interstate	NSW Sydney	NSW Rest State
1971	9.27	2.25	2.82	4.20
1972	9.85	2.59	2.98	4.28
1973	10.34	3.01	3.16	4.17
1974	11.47	3.40	3.41	4.67
1975	11.97	3.54	3.49	4.94
1976	12.66	3.80	3.62	5.24
1977	13.81	4.19	3.82	5.80
1978	14.37	4.37	3.87	6.14
1979	15.89	4.98	4.09	6.82
1980	17.62	5.55	4.45	7.62
1981	19.08	6.07	4.69	8.32
1982	20.49	6.55	4.93	9.01
1983	20.42	6.62	4.90	8.90
1984	22.01	7.51	5.22	9.28
1985	23.78	8.48	5.56	9.74
1986	25.40	9.52	5.87	10.01
1987	25.58	10.07	5.90	9.61
1988	27.20	11.28	6.23	9.68
1989	28.52	12.32	6.49	9.71
1990	29.65	13.31	7.08	9.26
1991	28.72	13.21	6.93	8.58
1992	28.27	12.97	6.81	8.49
1993	29.63	13.75	7.05	8.84
1994	30.86	14.46	7.29	9.12
1995	33.51	15.80	7.75	9.96
1996	35.99	17.33	8.21	10.46
1997	37.41	18.48	8.40	10.53
1998	40.13	20.23	8.80	11.10
1999	43.01	22.44	8.95	11.62
2000	44.91	24.50	9.36	11.05
2001	46.38	25.89	9.62	10.86
2002	49.08	28.49	10.02	10.57
2003	51.51	31.15	10.39	9.98
2004	**54.08**	**32.99**	**11.22**	**9.87**
2005	**56.91**	**34.84**	**11.64**	**10.42**
2006	**59.70**	**36.79**	**12.08**	**10.83**
2007	**62.63**	**38.84**	**12.54**	**11.26**
2008	**65.10**	**40.57**	**12.93**	**11.60**
2009	**67.62**	**42.35**	**13.32**	**11.95**
2010	**70.20**	**44.17**	**13.71**	**12.32**
2011	**72.83**	**46.03**	**14.11**	**12.69**
2012	**75.52**	**47.92**	**14.52**	**13.07**
2013	**78.25**	**49.85**	**14.94**	**13.45**
2014	**80.97**	**51.78**	**15.34**	**13.85**
2015	**83.74**	**53.74**	**15.76**	**14.25**
2016	**86.55**	**55.72**	**16.16**	**14.68**
2017	**89.40**	**57.72**	**16.58**	**15.10**
2018	**92.28**	**59.74**	**17.04**	**15.50**
2019	**95.19**	**61.78**	**17.43**	**15.98**
2020	**98.13**	**63.84**	**17.85**	**16.44**

Source: BTRE estimates.

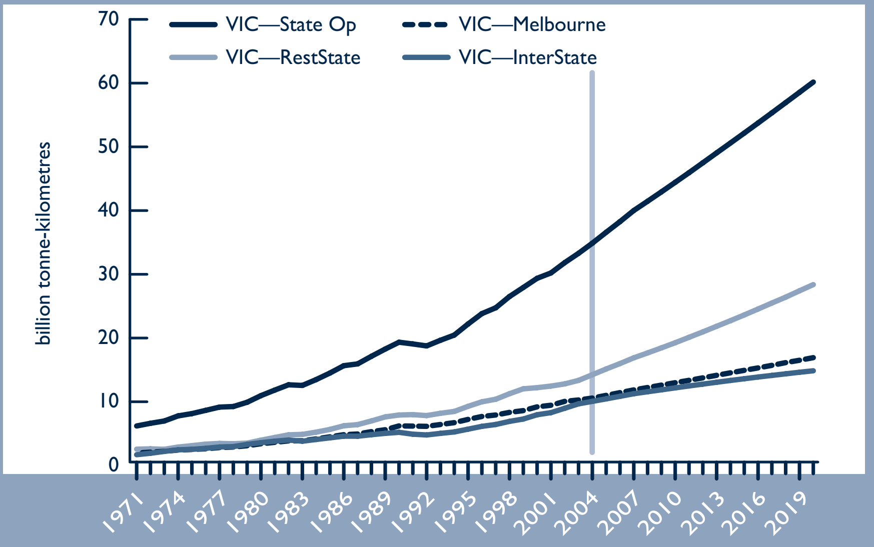
TABLE II.22 FREIGHT DISAGGREGATION BY STATE OF OPERATION—VIC

(billion tonne–kilometres)

	VIC State Op	VIC Interstate	VIC Melbourne	VIC Rest State
1971	6.20	1.69	1.96	2.56
1972	6.62	1.92	2.09	2.61
1973	6.98	2.21	2.23	2.54
1974	7.78	2.46	2.42	2.89
1975	8.14	2.53	2.51	3.11
1976	8.65	2.69	2.62	3.35
1977	9.16	2.90	2.81	3.46
1978	9.25	2.96	2.89	3.41
1979	9.92	3.31	3.10	3.51
1980	10.96	3.58	3.41	3.97
1981	11.83	3.81	3.63	4.39
1982	12.66	3.99	3.86	4.81
1983	12.56	3.81	3.88	4.88
1984	13.48	4.08	4.17	5.23
1985	14.51	4.34	4.50	5.66
1986	15.66	4.60	4.83	6.23
1987	15.94	4.59	4.94	6.41
1988	17.13	4.83	5.31	6.99
1989	18.27	5.04	5.61	7.62
1990	19.34	5.20	6.21	7.92
1991	19.07	4.91	6.18	7.98
1992	18.76	4.79	6.14	7.83
1993	19.65	5.04	6.43	8.19
1994	20.46	5.26	6.72	8.48
1995	22.20	5.70	7.23	9.28
1996	23.83	6.14	7.69	9.99
1997	24.74	6.43	7.92	10.39
1998	26.51	6.92	8.33	11.26
1999	27.93	7.29	8.61	12.03
2000	29.37	7.96	9.20	12.21
2001	30.21	8.29	9.45	12.46
2002	31.83	8.98	10.06	12.80
2003	33.29	9.67	10.28	13.35
2004	**34.88**	**10.06**	**10.58**	**14.24**
2005	**36.59**	**10.45**	**11.00**	**15.14**
2006	**38.26**	**10.85**	**11.43**	**15.99**
2007	**40.01**	**11.26**	**11.86**	**16.89**
2008	**41.46**	**11.57**	**12.23**	**17.66**
2009	**42.93**	**11.87**	**12.61**	**18.45**
2010	**44.43**	**12.18**	**12.99**	**19.26**
2011	**45.94**	**12.48**	**13.36**	**20.11**
2012	**47.49**	**12.77**	**13.75**	**20.96**
2013	**49.05**	**13.06**	**14.15**	**21.84**
2014	**50.60**	**13.34**	**14.54**	**22.72**
2015	**52.16**	**13.61**	**14.93**	**23.62**
2016	**53.74**	**13.88**	**15.31**	**24.55**
2017	**55.33**	**14.13**	**15.71**	**25.49**
2018	**56.94**	**14.38**	**16.14**	**26.41**
2019	**58.55**	**14.63**	**16.51**	**27.41**
2020	**60.17**	**14.86**	**16.92**	**28.38**

Source: BTRE estimates.

FIGURE II.2 FREIGHT DISAGGREGATION BY STATE OF OPERATION—VIC



Source: Table II.22.

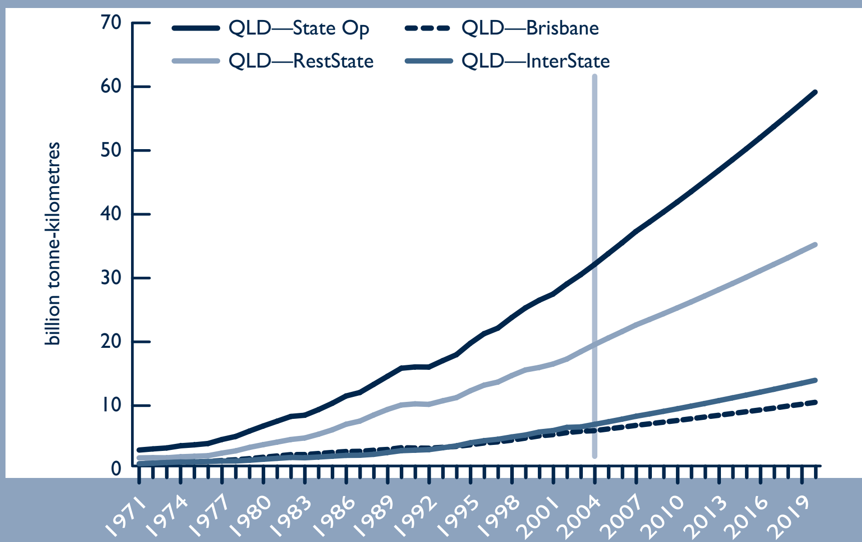
TABLE II.23 FREIGHT DISAGGREGATION BY STATE OF OPERATION—QLD

(billion tonne–kilometres)

	QLD State Op	QLD Interstate	QLD Brisbane	QLD RestState
1971	2.76	0.61	0.62	1.53
1972	2.94	0.69	0.68	1.56
1973	3.09	0.80	0.75	1.54
1974	3.43	0.88	0.84	1.70
1975	3.58	0.90	0.90	1.78
1976	3.79	0.96	0.96	1.87
1977	4.42	1.03	1.11	2.28
1978	4.90	1.04	1.23	2.63
1979	5.75	1.16	1.41	3.18
1980	6.55	1.31	1.63	3.61
1981	7.30	1.45	1.83	4.01
1982	8.05	1.59	2.04	4.42
1983	8.24	1.54	2.05	4.66
1984	9.12	1.66	2.21	5.25
1985	10.12	1.79	2.38	5.94
1986	11.27	1.92	2.53	6.82
1987	11.82	1.94	2.56	7.32
1988	13.09	2.08	2.73	8.28
1989	14.37	2.37	2.85	9.15
1990	15.64	2.66	3.13	9.85
1991	15.84	2.74	3.08	10.03
1992	15.82	2.82	3.05	9.95
1993	16.82	3.12	3.19	10.51
1994	17.77	3.42	3.33	11.01
1995	19.56	3.90	3.58	12.08
1996	21.07	4.23	3.87	12.97
1997	21.95	4.46	4.04	13.46
1998	23.61	4.82	4.31	14.48
1999	25.14	5.13	4.64	15.37
2000	26.34	5.60	4.99	15.76
2001	27.31	5.83	5.18	16.30
2002	28.90	6.33	5.50	17.08
2003	30.35	6.40	5.71	18.23
2004	**31.96**	**6.80**	**5.81**	**19.34**
2005	**33.67**	**7.20**	**6.08**	**20.39**
2006	**35.37**	**7.62**	**6.35**	**21.40**
2007	**37.15**	**8.07**	**6.64**	**22.44**
2008	**38.66**	**8.45**	**6.89**	**23.32**
2009	**40.21**	**8.85**	**7.15**	**24.21**
2010	**41.79**	**9.25**	**7.41**	**25.13**
2011	**43.41**	**9.67**	**7.68**	**26.06**
2012	**45.07**	**10.09**	**7.96**	**27.02**
2013	**46.75**	**10.53**	**8.23**	**27.99**
2014	**48.44**	**10.97**	**8.51**	**28.96**
2015	**50.15**	**11.41**	**8.79**	**29.95**
2016	**51.90**	**11.86**	**9.07**	**30.97**
2017	**53.67**	**12.32**	**9.36**	**31.98**
2018	**55.46**	**12.79**	**9.68**	**32.99**
2019	**57.27**	**13.26**	**9.96**	**34.06**
2020	**59.11**	**13.74**	**10.27**	**35.10**

Source: BTRE estimates.

FIGURE II.3 FREIGHT DISAGGREGATION BY STATE OF OPERATION—QLD



Source: Table II.23.

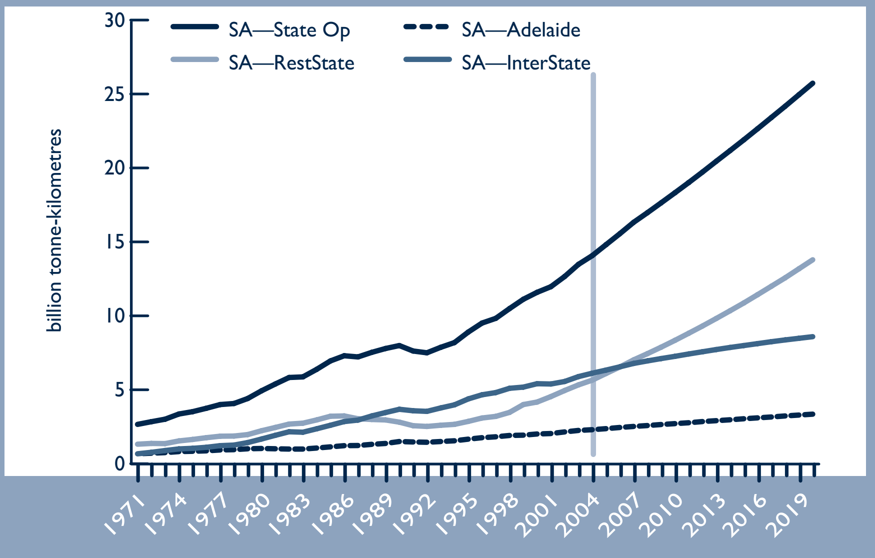
TABLE II.24 FREIGHT DISAGGREGATION BY STATE OF OPERATION—SA

(billion tonne–kilometres)

	SA State Op	SA Interstate	SA Adelaide	SA RestState
1971	2.66	0.67	0.67	1.32
1972	2.84	0.77	0.71	1.37
1973	3.01	0.89	0.75	1.36
1974	3.36	1.00	0.82	1.54
1975	3.52	1.04	0.84	1.64
1976	3.75	1.11	0.87	1.76
1977	4.00	1.22	0.93	1.86
1978	4.07	1.26	0.95	1.87
1979	4.41	1.43	1.01	1.97
1980	4.93	1.67	1.03	2.23
1981	5.39	1.92	1.01	2.45
1982	5.83	2.16	0.99	2.68
1983	5.87	2.13	0.99	2.74
1984	6.38	2.36	1.06	2.96
1985	6.95	2.60	1.14	3.21
1986	7.30	2.85	1.22	3.23
1987	7.22	2.95	1.23	3.04
1988	7.53	3.23	1.31	2.99
1989	7.79	3.46	1.37	2.96
1990	7.99	3.68	1.50	2.81
1991	7.62	3.58	1.47	2.57
1992	7.50	3.54	1.45	2.52
1993	7.87	3.77	1.50	2.60
1994	8.19	3.98	1.55	2.66
1995	8.90	4.38	1.66	2.86
1996	9.51	4.66	1.76	3.09
1997	9.83	4.81	1.82	3.20
1998	10.49	5.10	1.91	3.47
1999	11.12	5.18	1.93	4.00
2000	11.59	5.41	2.01	4.17
2001	11.97	5.39	2.04	4.54
2002	12.66	5.56	2.15	4.95
2003	13.48	5.89	2.25	5.33
2004	**14.07**	**6.12**	**2.30**	**5.65**
2005	**14.81**	**6.33**	**2.37**	**6.10**
2006	**15.55**	**6.55**	**2.45**	**6.54**
2007	**16.32**	**6.78**	**2.52**	**7.02**
2008	**16.97**	**6.95**	**2.58**	**7.44**
2009	**17.64**	**7.11**	**2.65**	**7.88**
2010	**18.32**	**7.26**	**2.71**	**8.34**
2011	**19.01**	**7.42**	**2.77**	**8.82**
2012	**19.72**	**7.57**	**2.85**	**9.31**
2013	**20.45**	**7.72**	**2.91**	**9.82**
2014	**21.17**	**7.86**	**2.97**	**10.34**
2015	**21.90**	**7.99**	**3.04**	**10.87**
2016	**22.65**	**8.12**	**3.10**	**11.43**
2017	**23.41**	**8.25**	**3.16**	**12.00**
2018	**24.17**	**8.37**	**3.23**	**12.57**
2019	**24.95**	**8.48**	**3.29**	**13.18**
2020	**25.73**	**8.59**	**3.35**	**13.79**

Source: BTRE estimates.

FIGURE II.4 FREIGHT DISAGGREGATION BY STATE OF OPERATION—SA



Source: *Table II.24.*

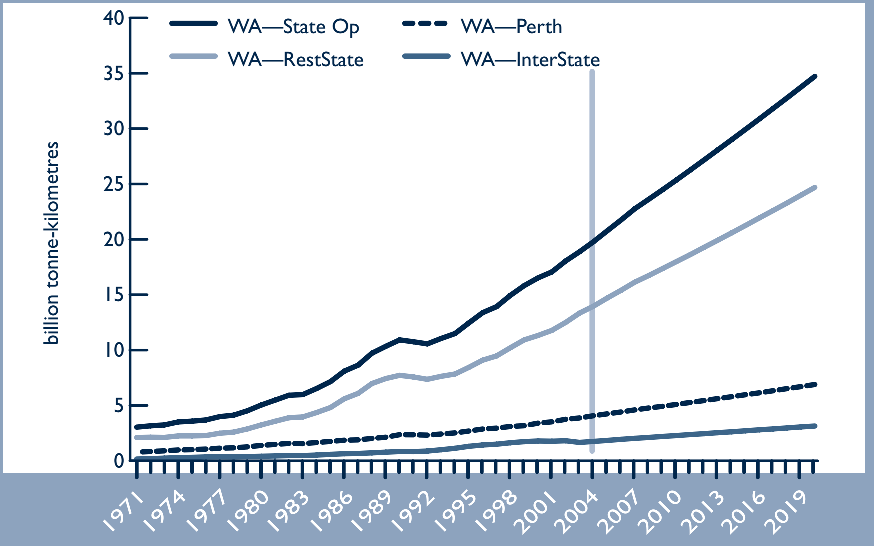
TABLE II.25 FREIGHT DISAGGREGATION BY STATE OF OPERATION—WA

(billion tonne–kilometres)

	WA State Op	WA Interstate	WA Perth	WA RestState
1971	3.04	0.16	0.78	2.10
1972	3.16	0.19	0.84	2.13
1973	3.24	0.24	0.90	2.11
1974	3.51	0.29	0.98	2.25
1975	3.58	0.31	1.01	2.25
1976	3.69	0.35	1.06	2.28
1977	3.99	0.36	1.14	2.49
1978	4.12	0.35	1.17	2.59
1979	4.52	0.38	1.26	2.88
1980	5.04	0.41	1.39	3.24
1981	5.48	0.44	1.48	3.57
1982	5.92	0.47	1.57	3.89
1983	5.98	0.47	1.55	3.96
1984	6.53	0.52	1.65	4.36
1985	7.15	0.58	1.75	4.81
1986	8.10	0.64	1.86	5.60
1987	8.64	0.66	1.89	6.09
1988	9.72	0.72	2.02	6.98
1989	10.34	0.78	2.13	7.43
1990	10.92	0.84	2.36	7.72
1991	10.75	0.83	2.35	7.57
1992	10.56	0.88	2.32	7.36
1993	11.05	1.00	2.42	7.63
1994	11.49	1.13	2.52	7.84
1995	12.45	1.31	2.69	8.44
1996	13.38	1.43	2.87	9.09
1997	13.92	1.50	2.95	9.47
1998	14.94	1.63	3.10	10.21
1999	15.82	1.73	3.17	10.92
2000	16.52	1.79	3.40	11.32
2001	17.06	1.77	3.52	11.78
2002	18.05	1.81	3.75	12.50
2003	18.88	1.66	3.87	13.34
2004	**19.78**	**1.75**	**4.07**	**13.96**
2005	**20.77**	**1.84**	**4.24**	**14.70**
2006	**21.75**	**1.94**	**4.41**	**15.40**
2007	**22.77**	**2.03**	**4.60**	**16.14**
2008	**23.62**	**2.11**	**4.77**	**16.73**
2009	**24.48**	**2.20**	**4.92**	**17.36**
2010	**25.36**	**2.28**	**5.09**	**17.99**
2011	**26.26**	**2.37**	**5.27**	**18.62**
2012	**27.17**	**2.45**	**5.44**	**19.28**
2013	**28.09**	**2.54**	**5.62**	**19.93**
2014	**29.01**	**2.62**	**5.79**	**20.59**
2015	**29.94**	**2.71**	**5.97**	**21.26**
2016	**30.88**	**2.80**	**6.14**	**21.94**
2017	**31.83**	**2.88**	**6.33**	**22.61**
2018	**32.78**	**2.97**	**6.52**	**23.29**
2019	**33.75**	**3.06**	**6.70**	**23.99**
2020	**34.72**	**3.14**	**6.89**	**24.69**

Source: BTRE estimates.

FIGURE II.5 FREIGHT DISAGGREGATION BY STATE OF OPERATION—WA



Source: *Table II.25.*

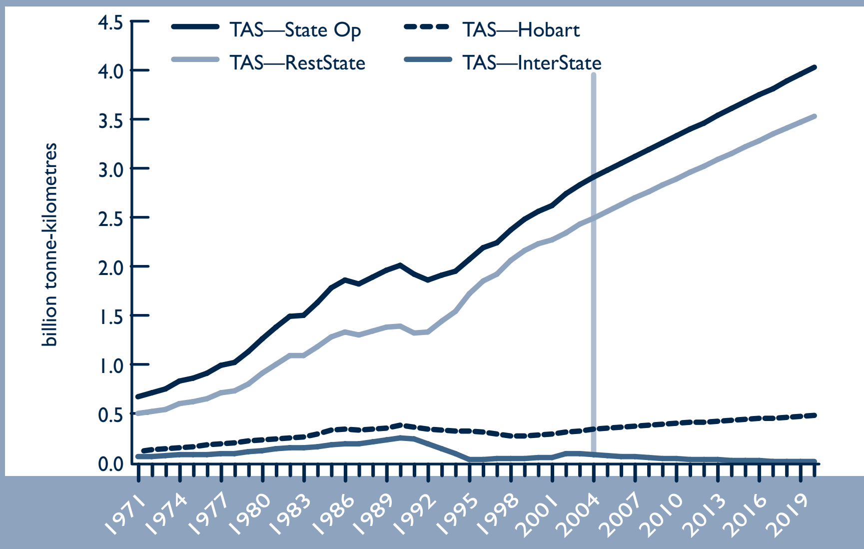
TABLE II.26 FREIGHT DISAGGREGATION BY STATE OF OPERATION—TAS

(billion tonne–kilometres)

	TAS State Op	TAS Interstate	TAS Hobart	TAS RestState
1971	0.67	0.06	0.11	0.50
1972	0.71	0.06	0.13	0.52
1973	0.75	0.07	0.14	0.54
1974	0.83	0.08	0.15	0.60
1975	0.86	0.08	0.16	0.62
1976	0.91	0.08	0.18	0.65
1977	0.99	0.09	0.19	0.71
1978	1.02	0.09	0.20	0.73
1979	1.13	0.11	0.22	0.80
1980	1.26	0.12	0.23	0.91
1981	1.38	0.14	0.24	1.00
1982	1.49	0.15	0.25	1.09
1983	1.50	0.15	0.26	1.09
1984	1.63	0.16	0.29	1.18
1985	1.78	0.18	0.33	1.28
1986	1.86	0.19	0.34	1.33
1987	1.82	0.19	0.33	1.30
1988	1.89	0.21	0.34	1.34
1989	1.96	0.23	0.35	1.38
1990	2.01	0.25	0.38	1.39
1991	1.92	0.24	0.36	1.32
1992	1.86	0.19	0.34	1.33
1993	1.91	0.14	0.33	1.44
1994	1.95	0.09	0.32	1.54
1995	2.07	0.03	0.32	1.72
1996	2.19	0.03	0.31	1.85
1997	2.24	0.04	0.29	1.92
1998	2.37	0.04	0.27	2.06
1999	2.48	0.04	0.27	2.16
2000	2.56	0.05	0.28	2.23
2001	2.62	0.05	0.29	2.27
2002	2.74	0.09	0.31	2.34
2003	2.83	0.09	0.32	2.43
2004	**2.91**	**0.08**	**0.34**	**2.49**
2005	**2.98**	**0.07**	**0.35**	**2.56**
2006	**3.05**	**0.06**	**0.36**	**2.63**
2007	**3.12**	**0.06**	**0.37**	**2.70**
2008	**3.19**	**0.05**	**0.38**	**2.76**
2009	**3.26**	**0.04**	**0.39**	**2.83**
2010	**3.33**	**0.04**	**0.40**	**2.89**
2011	**3.40**	**0.03**	**0.41**	**2.96**
2012	**3.46**	**0.03**	**0.41**	**3.02**
2013	**3.54**	**0.03**	**0.42**	**3.09**
2014	**3.61**	**0.02**	**0.43**	**3.15**
2015	**3.68**	**0.02**	**0.44**	**3.22**
2016	**3.75**	**0.02**	**0.45**	**3.28**
2017	**3.81**	**0.01**	**0.45**	**3.35**
2018	**3.89**	**0.01**	**0.46**	**3.41**
2019	**3.96**	**0.01**	**0.47**	**3.47**
2020	**4.03**	**0.01**	**0.48**	**3.53**

Source: BTRE estimates.

FIGURE II.6 FREIGHT DISAGGREGATION BY STATE OF OPERATION—TAS



Source: Table II.26.

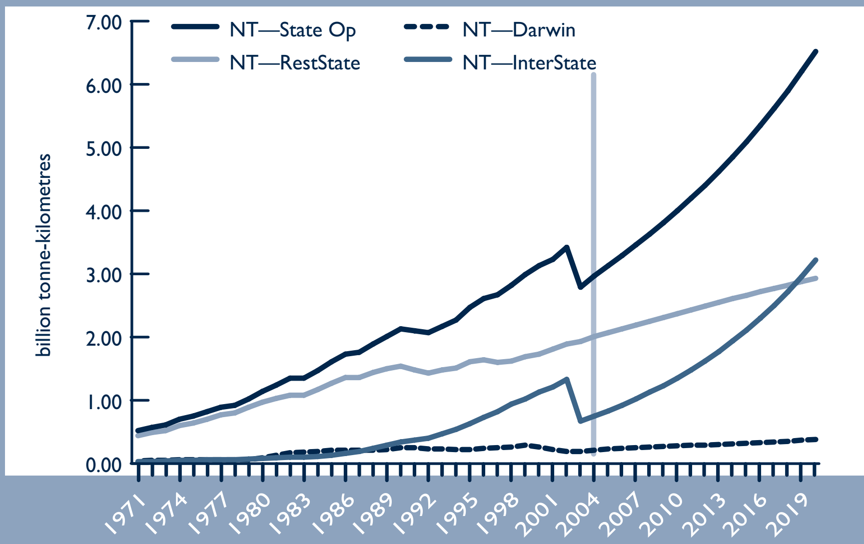
TABLE II.27 FREIGHT DISAGGREGATION BY STATE OF OPERATION—NT

(billion tonne–kilometres)

	NT State Op	NT Interstate	NT Darwin	NT RestState
1971	0.52	0.03	0.04	0.44
1972	0.57	0.03	0.05	0.49
1973	0.61	0.04	0.05	0.52
1974	0.70	0.05	0.06	0.60
1975	0.75	0.05	0.06	0.64
1976	0.82	0.06	0.06	0.70
1977	0.89	0.06	0.06	0.77
1978	0.92	0.06	0.06	0.80
1979	1.02	0.07	0.06	0.89
1980	1.14	0.08	0.09	0.97
1981	1.24	0.09	0.13	1.03
1982	1.35	0.10	0.17	1.08
1983	1.35	0.10	0.18	1.08
1984	1.47	0.11	0.19	1.17
1985	1.61	0.13	0.21	1.27
1986	1.73	0.16	0.21	1.36
1987	1.76	0.19	0.21	1.36
1988	1.89	0.24	0.21	1.44
1989	2.01	0.29	0.22	1.50
1990	2.13	0.34	0.25	1.54
1991	2.10	0.37	0.25	1.48
1992	2.07	0.40	0.23	1.43
1993	2.17	0.47	0.23	1.48
1994	2.27	0.54	0.22	1.51
1995	2.47	0.63	0.22	1.61
1996	2.61	0.73	0.24	1.64
1997	2.67	0.82	0.25	1.60
1998	2.82	0.94	0.26	1.62
1999	2.99	1.02	0.29	1.69
2000	3.13	1.13	0.26	1.73
2001	3.23	1.21	0.22	1.81
2002	3.42	1.33	0.19	1.89
2003	2.79	0.67	0.19	1.93
2004	**2.97**	**0.75**	**0.21**	**2.01**
2005	**3.13**	**0.83**	**0.23**	**2.07**
2006	**3.29**	**0.92**	**0.24**	**2.13**
2007	**3.46**	**1.02**	**0.25**	**2.19**
2008	**3.63**	**1.13**	**0.26**	**2.25**
2009	**3.81**	**1.23**	**0.27**	**2.31**
2010	**4.00**	**1.35**	**0.28**	**2.37**
2011	**4.20**	**1.48**	**0.29**	**2.43**
2012	**4.40**	**1.62**	**0.29**	**2.49**
2013	**4.62**	**1.77**	**0.30**	**2.55**
2014	**4.85**	**1.94**	**0.31**	**2.61**
2015	**5.09**	**2.11**	**0.32**	**2.66**
2016	**5.35**	**2.30**	**0.33**	**2.72**
2017	**5.62**	**2.50**	**0.34**	**2.77**
2018	**5.90**	**2.72**	**0.35**	**2.82**
2019	**6.21**	**2.96**	**0.37**	**2.88**
2020	**6.52**	**3.22**	**0.38**	**2.93**

Source: BTRE estimates.

FIGURE II.7 FREIGHT DISAGGREGATION BY STATE OF OPERATION—NT



Source: Table II.27.

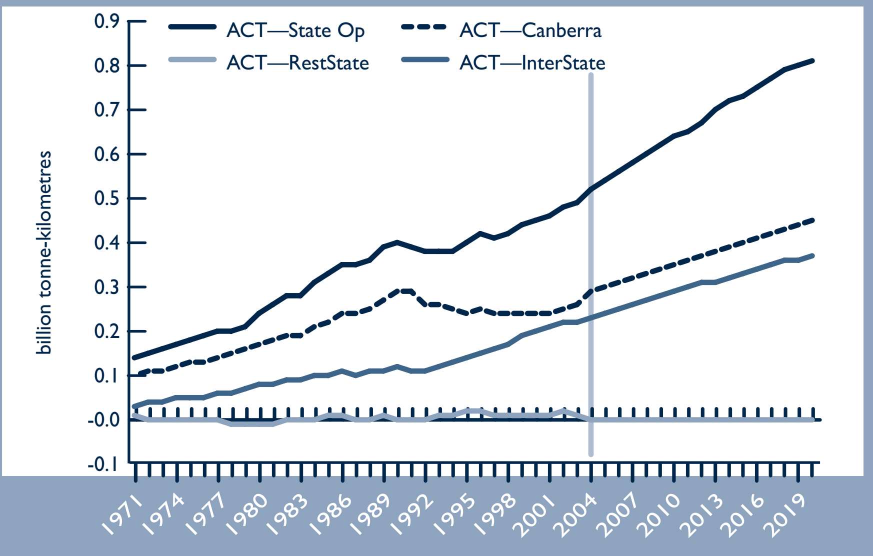
TABLE II.28 FREIGHT DISAGGREGATION BY STATE OF OPERATION—ACT

(billion tonne–kilometres)

	ACT State Op	ACT Interstate	ACT Canberra	ACT RestState
1971	0.14	0.03	0.10	0.01
1972	0.15	0.04	0.11	0.00
1973	0.16	0.04	0.11	0.00
1974	0.17	0.05	0.12	0.00
1975	0.18	0.05	0.13	0.00
1976	0.19	0.05	0.13	0.00
1977	0.20	0.06	0.14	0.00
1978	0.20	0.06	0.15	-0.01
1979	0.21	0.07	0.16	-0.01
1980	0.24	0.08	0.17	-0.01
1981	0.26	0.08	0.18	-0.01
1982	0.28	0.09	0.19	0.00
1983	0.28	0.09	0.19	0.00
1984	0.31	0.10	0.21	0.00
1985	0.33	0.10	0.22	0.01
1986	0.35	0.11	0.24	0.01
1987	0.35	0.10	0.24	0.00
1988	0.36	0.11	0.25	0.00
1989	0.39	0.11	0.27	0.01
1990	0.40	0.12	0.29	0.00
1991	0.39	0.11	0.29	0.00
1992	0.38	0.11	0.26	0.00
1993	0.38	0.12	0.26	0.01
1994	0.38	0.13	0.25	0.01
1995	0.40	0.14	0.24	0.02
1996	0.42	0.15	0.25	0.02
1997	0.41	0.16	0.24	0.01
1998	0.42	0.17	0.24	0.01
1999	0.44	0.19	0.24	0.01
2000	0.45	0.20	0.24	0.01
2001	0.46	0.21	0.24	0.01
2002	0.48	0.22	0.25	0.02
2003	0.49	0.22	0.26	0.01
2004	**0.52**	**0.23**	**0.29**	**0.00**
2005	**0.54**	**0.24**	**0.30**	**0.00**
2006	**0.56**	**0.25**	**0.31**	**0.00**
2007	**0.58**	**0.26**	**0.32**	**0.00**
2008	**0.60**	**0.27**	**0.33**	**0.00**
2009	**0.62**	**0.28**	**0.34**	**0.00**
2010	**0.64**	**0.29**	**0.35**	**0.00**
2011	**0.65**	**0.30**	**0.36**	**0.00**
2012	**0.67**	**0.31**	**0.37**	**0.00**
2013	**0.70**	**0.31**	**0.38**	**0.00**
2014	**0.72**	**0.32**	**0.39**	**0.00**
2015	**0.73**	**0.33**	**0.40**	**0.00**
2016	**0.75**	**0.34**	**0.41**	**0.00**
2017	**0.77**	**0.35**	**0.42**	**0.00**
2018	**0.79**	**0.36**	**0.43**	**0.00**
2019	**0.80**	**0.36**	**0.44**	**0.00**
2020	**0.81**	**0.37**	**0.45**	**0.00**

Source: BTRE estimates.

FIGURE II.8 FREIGHT DISAGGREGATION BY STATE OF OPERATION—ACT



Source: Table II.28.

APPENDIX III

CAPITAL CITY FREIGHT

III.1 DEFINITION OF CAPITAL CITY AREAS

Data on freight transport in urban areas is taken from the Survey of Motor Vehicle Use (SMVU, ABS Cat. No. 9208.0). The capital city urban classification used in the survey corresponds with the *Statistical Division* area definition as defined in the Census of Population and Housing (ABS 2001b). Note that in 1971, the ACT was included in the capital city urban classification for New South Wales.

Any issue of the survey also contains a definition of the capital city area in the glossary. However, the survey definition is not clear . For example, the survey defines Sydney as the area bounded by Gosford and Wyong; Hawkesbury and Blue Mountains; Campbelltown, Wollondilly and the Sutherland Local Government Areas. This could be read in either of two ways: either as the area inclusive of or as the areas bounded by, and within, the specified regions. The Australian Standard Geographic Classification makes it clear that the capital city areas are inclusive of the survey-specified boundary regions—see Table III.1.

TABLE III.1 AUSTRALIAN STANDARD GEOGRAPHICAL CLASSIFICATION AREAS FOR CAPITAL CITIES

Urban area	Geographical area
Sydney	Sydney SD (105)
Melbourne	Melbourne SD (205)
Brisbane	Brisbane SD (305)
Adelaide	Adelaide SD (405)
Perth	Perth SD (505)
Hobart	Greater Hobart SD (605)
Darwin	Darwin SD (705)
Canberra	Canberra SD (805)

Note: SD denotes Statistical Division. Numbers in parentheses are the associated SD code.

Sources: ABS (1996a), BTRE estimates.

III.2 DEFINITION OF TRAVEL WITHIN A CITY AREA

The BTRE has copies of survey questionnaires for the 1971, 1976, 1985 and 1991 surveys. The 1971 survey questionnaire for passenger and for commercial vehicles is for Victorian-registered vehicles. The survey question relating to mileage characteristics asked respondents their total mileage for business, professional, farm or government; total mileage to and from work, paid and unpaid other mileage, by area of operation. There were four areas of operation:

(i) within Melbourne and environs

(ii) within Geelong, Ballarat and Bendigo

(iii) within other areas of Victoria

(iv) within other states and territories.

The 1976 survey, and all subsequent surveys, did not appear to have the same tabular format, for entering vehicle kilometres—or tonne–kilometres for freight vehicles—but asked respondents for the same information on area travelled.

The questionnaire, as it is written, suggests that urban vehicle kilometres travelled will include not only intra-urban travel by residents of the urban area, and all vehicle kilometres travelled in the urban area by vehicles registered in the same state as the urban area. The measure does not include passenger vehicle kilometres travelled of interstate vehicles. Therefore, the measure of urban passenger vehicle kilometres travelled is not strictly all intra-urban passenger vehicle kilometres travelled. But it might be expected that a large proportion of total urban passenger vehicle kilometres travelled would be attributable to vehicles registered within the urban area. For the purposes of estimation, it is therefore assumed that the measure of urban passenger vehicle kilometres travelled is equal to intra-urban passenger vehicle kilometres travelled.

The urban area vehicle kilometres travelled definition is considered more of a problem for the measurement of urban freight transport.

III.3 CAPITAL CITY MODEL VARIABLES: ESTIMATES AND PROJECTIONS

Actual and projected estimated resident population estimates for the major capital cities are listed in Table III.2.

III.4 INDIVIDUAL CAPITAL CITY FORECASTS

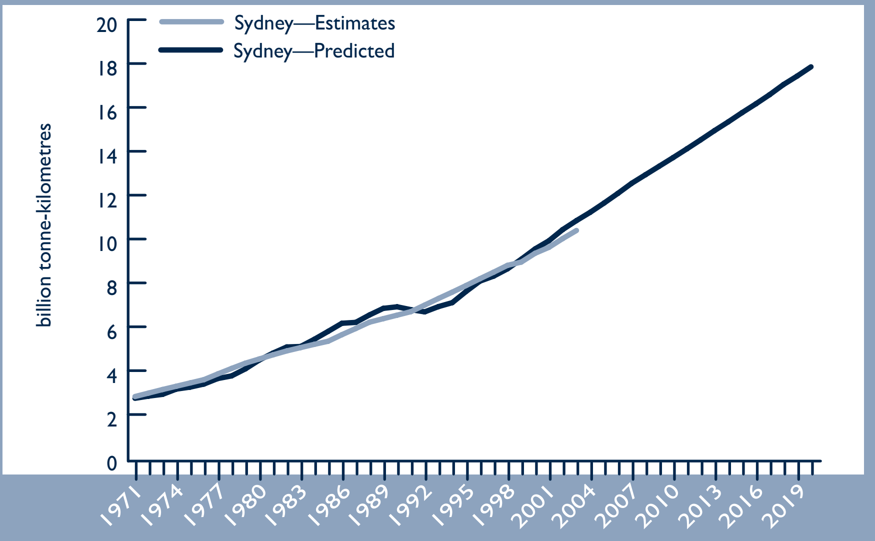
Figures III.1 to III.8 show the fit and forecasts of the urban freight tasks in each capital city.

TABLE III.2 ACTUAL AND PROJECTED ESTIMATED RESIDENT POPULATION (ERP) FOR AUSTRALIAN CAPITAL CITIES, 1971–2020

Year	Sydney	Melbourne	Brisbane	Adelaide	Perth	Hobart	Darwin	Canberra	Total
1971	3 047 205	2 613 344	885 180	870 321	731 177	160 704	38 047	150 476	8 496 454
1972	3 065 066	2 634 437	903 130	882 247	755 487	162 560	39 568	162 403	8 604 898
1973	3 082 927	2 655 530	921 080	894 173	779 797	164 416	41 089	174 329	8 713 341
1974	3 100 788	2 676 623	939 030	906 099	804 107	166 272	42 610	186 256	8 821 785
1975	3 118 649	2 697 716	956 980	918 025	828 417	168 128	44 131	198 183	8 930 229
1976	3 136 510	2 718 809	974 930	929 951	852 727	169 984	45 652	210 110	9 038 673
1977	3 174 438	2 749 348	993 351	936 318	869 130	171 307	47 626	213 640	9 155 158
1978	3 212 366	2 779 887	1 011 772	942 685	885 533	172 630	49 600	217 170	9 271 643
1979	3 250 294	2 810 426	1 030 193	949 052	901 936	173 953	51 574	220 700	9 388 128
1980	3 288 222	2 840 965	1 048 614	955 419	918 339	175 276	53 548	224 230	9 504 613
1981	3 326 150	2 871 504	1 067 035	961 786	934 742	176 599	55 522	227 760	9 621 098
1982	3 359 396	2 895 955	1 093 664	971 381	954 601	178 006	58 586	233 570	9 745 159
1983	3 392 642	2 920 406	1 120 293	980 976	974 460	179 413	61 650	239 380	9 869 220
1984	3 425 888	2 944 857	1 146 922	990 571	994 319	180 820	64 714	245 190	9 993 281
1985	3 459 134	2 969 308	1 173 551	1 000 166	1 014 178	182 227	67 778	251 000	10 117 342
1986	3 492 380	2 993 759	1 200 180	1 009 761	1 034 037	183 634	70 842	256 810	10 241 403
1987	3 528 475	3 026 138	1 231 743	1 019 241	1 064 982	185 055	72 022	263 086	10 390 742
1988	3 564 570	3 058 517	1 263 306	1 028 721	1 095 927	186 476	73 203	269 362	10 540 082
1989	3 600 665	3 090 896	1 294 869	1 038 201	1 126 872	187 897	74 383	275 638	10 689 421
1990	3 636 760	3 123 275	1 326 432	1 047 681	1 157 817	189 318	75 564	281 914	10 838 761
1991	3 672 855	3 155 654	1 357 995	1 057 161	1 188 762	190 739	76 745	288 190	10 988 101
1992	3 712 199	3 178 566	1 385 065	1 061 253	1 207 456	191 689	77 575	290 762	11 104 565
1993	3 752 476	3 202 674	1 414 353	1 065 499	1 227 289	192 668	78 534	293 769	11 227 262
1994	3 793 731	3 228 059	1 446 261	1 069 901	1 248 398	193 678	79 643	297 381	11 357 051
1995	3 836 011	3 254 807	1 481 377	1 074 462	1 270 947	194 720	80 924	301 875	11 495 123
1996	3 879 370	3 283 014	1 520 596	1 079 184	1 295 132	195 795	82 408	307 692	11 643 191
1997	3 933 724	3 321 788	1 546 244	1 082 439	1 318 781	195 468	84 591	307 681	11 790 716
1998	3 981 641	3 367 005	1 573 304	1 087 710	1 340 261	194 896	86 550	307 732	11 939 099
1999	4 042 082	3 417 777	1 601 670	1 093 084	1 364 430	194 233	88 115	310 252	12 111 643
2000	4 094 067	3 463 497	1 624 674	1 097 586	1 385 179	193 292	89 611	312 042	12 259 948
2001	4 140 054	3 504 288	1 646 598	1 102 480	1 403 428	192 364	90 852	313 400	12 393 465
2002	4 182 444	3 542 108	1 668 597	1 108 315	1 419 870	191 473	91 804	314 642	12 519 254
2003	4 225 932	3 579 027	1 690 870	1 114 738	1 436 548	190 617	92 671	315 340	12 645 744
2004	4 270 426	3 614 785	1 713 146	1 121 696	1 453 398	189 686	93 350	315 580	12 772 066
2005	4 314 993	3 650 596	1 735 631	1 128 558	1 470 310	188 790	94 046	315 877	12 898 801
2006	4 358 483	3 685 406	1 757 623	1 134 997	1 486 860	187 773	94 732	315 940	13 021 814
2007	4 401 756	3 720 108	1 779 749	1 141 288	1 503 308	186 782	95 431	315 946	13 144 367
2008	4 444 979	3 754 659	1 801 838	1 147 448	1 519 679	185 718	96 044	315 899	13 266 263
2009	4 488 386	3 789 372	1 823 948	1 153 707	1 536 119	184 685	96 673	315 806	13 388 695
2010	4 532 073	3 824 257	1 846 238	1 159 937	1 552 692	183 578	97 317	315 658	13 511 751
2011	4 571 258	3 855 098	1 866 716	1 165 092	1 567 727	182 301	97 970	315 118	13 621 280
2012	4 610 626	3 886 032	1 887 328	1 170 199	1 582 859	180 949	98 537	314 621	13 731 150
2013	4 649 971	3 916 802	1 907 951	1 175 279	1 597 887	179 710	99 109	314 045	13 840 754
2014	4 689 735	3 947 779	1 928 767	1 180 543	1 613 060	178 400	99 697	313 418	13 951 400
2015	4 729 339	3 978 559	1 949 681	1 185 767	1 628 216	177 000	100 290	312 809	14 061 660
2016	4 767 575	4 008 057	1 969 912	1 190 601	1 642 870	175 556	100 858	312 122	14 167 550
2017	4 805 945	4 037 523	1 990 220	1 195 445	1 657 572	174 131	101 535	311 367	14 273 738
2018	4 844 508	4 067 088	2 010 673	1 200 338	1 672 279	172 627	102 125	310 550	14 380 188
2019	4 882 990	4 096 438	2 031 115	1 205 086	1 686 862	171 132	102 719	309 749	14 486 091
2020	4 921 636	4 125 944	2 051 635	1 209 898	1 701 475	169 660	103 328	308 889	14 592 465

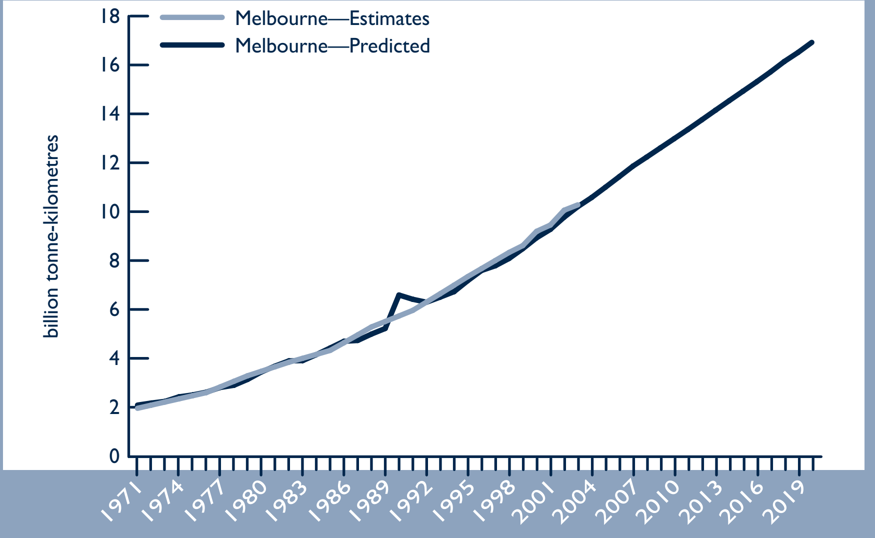
Sources: ABS (1997a), BTRE estimates.

FIGURE III.1 ACTUAL AND PROJECTED URBAN FREIGHT TASK—SYDNEY



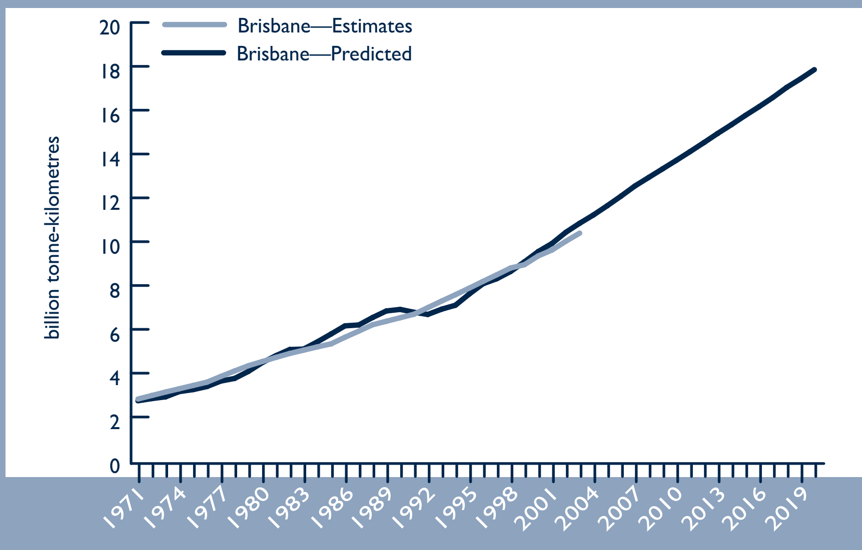
Source: *BTRE Estimates.*

FIGURE III.2 ACTUAL AND PROJECTED URBAN FREIGHT TASK—MELBOURNE



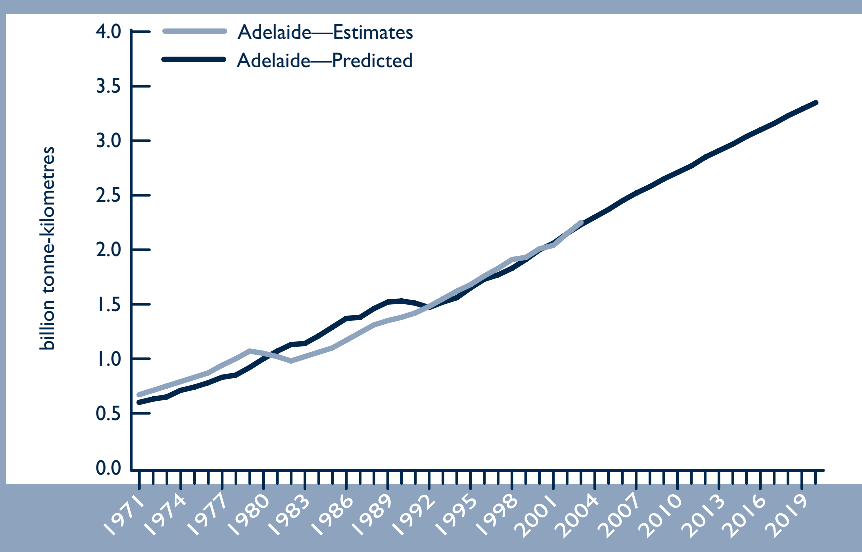
Source: *BTRE Estimates.*

FIGURE III.3 ACTUAL AND PROJECTED URBAN FREIGHT TASK—BRISBANE



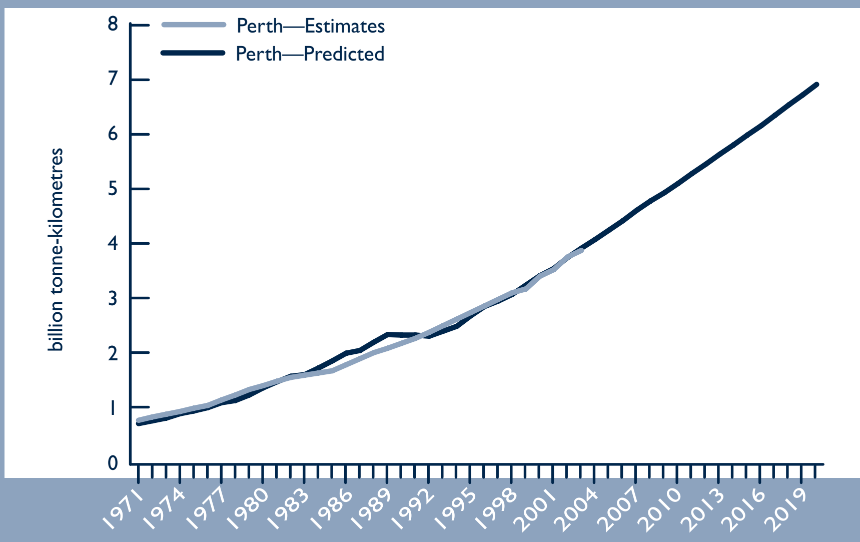
Source: *BTRE Estimates.*

FIGURE III.4 ACTUAL AND PROJECTED URBAN FREIGHT TASK—ADELAIDE



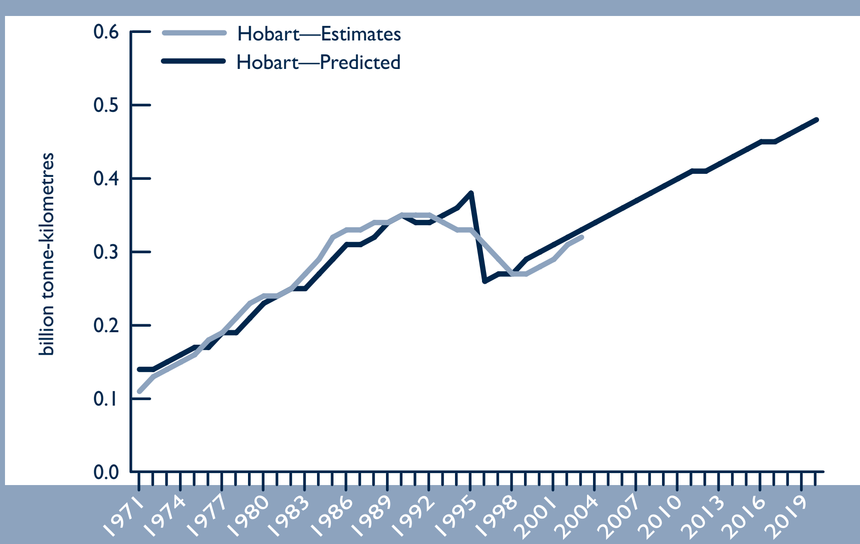
Source: *BTRE Estimates.*

FIGURE III.5 ACTUAL AND PROJECTED URBAN FREIGHT TASK—PERTH



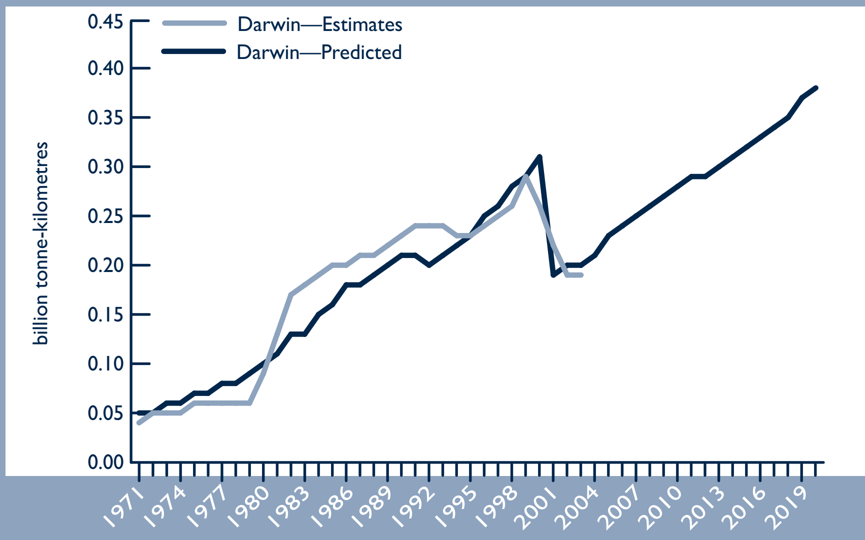
Source: BTRE Estimates.

FIGURE III.6 ACTUAL AND PROJECTED URBAN FREIGHT TASK—HOBART



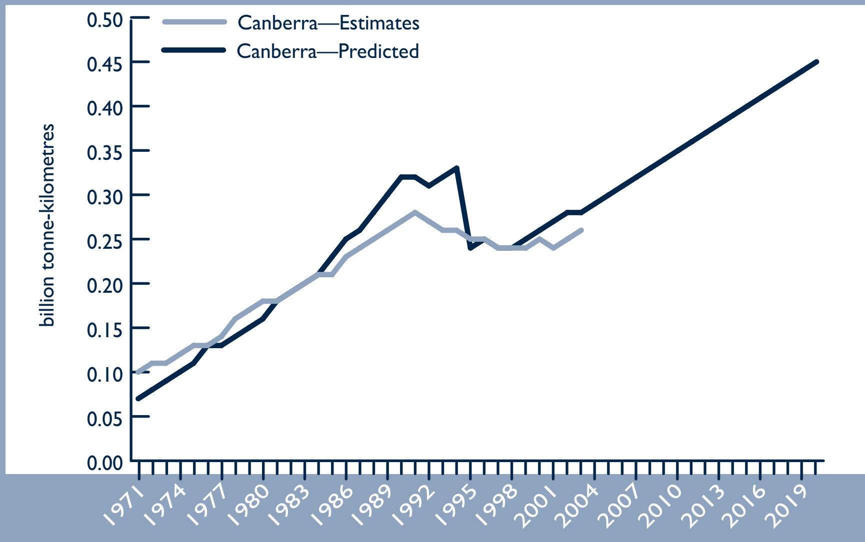
Source: BTRE Estimates.

FIGURE III.7 ACTUAL AND PROJECTED URBAN FREIGHT TASK—DARWIN



Source: *BTRE Estimates.*

FIGURE III.8 ACTUAL AND PROJECTED URBAN FREIGHT TASK—CANBERRA



Source: *BTRE Estimates.*

APPENDIX IV

STATE ROAD FREIGHT FORECASTING

For the complete road freight series for each state presented in Appendix 2, four separate sets of forecasts need to be produced. One for each of the road freight tasks by:

- state of operation
- interstate by state of operation
- capital city
- rest of state.

This appendix gives an overview of the forecasting analyses used for each of the road freight tasks.

IV.1 STATE OF OPERATION

The state of operation road freight forecasts are detailed in Chapter 4. Simple linear models were used to forecast the relative share of freight handled by each state. The forecast shares were then applied to the forecast aggregate road freight task given in Chapter 2.

IV.2 INTERSTATE BY STATE OF OPERATION

Interstate by state of operation forecasts are obtained by applying a share analysis to historical interstate data. The shares are then applied to the total interstate projections from Chapter 5—plus the seven per cent interstate bulk portion.

The general share model is based on the method of multi–technological diffusion (substitution) models of Marchetti and Nakicenovic (1979) and Kwasnicki and Kwasnicka (1996). The model provides long-term estimates of shares based on historical share trends. The model satisfies the properties of a good forecasting tool but does not give an adequate explanation of behavioural factors affecting freight transport.

The underlying philosophy of the model is that some states are more 'competitive' than others. This will lead to their share increasing at the expense of less competitive states.

These models are good for providing long-term forecasts, because they require few assumptions about the value of future exogenous variables. However, they do not provide a method for differentiating between different influences.

The relative competitiveness term bundles many different influences such as road improvements, industry and economic development, new mines, and shifts from other modes. Forecasts of state share based on the model implicitly assume that the effect of these factors will remain constant.

State share equations were estimated using logistic substitution models. The logistic substitution model is an evolutionary model of technology use. In this case technology refers to the state in which the road transport occurs. The model is based on two simple assumptions:

a. each technology at time t can be characterised by a single index describing its performance; its index of competitiveness

b. the amount of technology i in use at time t+1 is proportional to the amount of technology in use in the previous period and its competitiveness.

These assumptions give the 'evolution' equation:

$$f_i(t+1) = \frac{c_i}{c_{av}} f_i(t)$$, for each i. (IV.1)

where

1. $f_i\,(t)$ is the share total freight transport of state i at time t;
2. c_i is the competitiveness of state i
3. $c_{av}\,(t)$ is the weighted average competitiveness of all states at time t.

Rearranging (IV.1) and back substituting gives (IV.2):

$$\ln\frac{f_i(t)}{f_k(t)} = \ln\frac{f_i(t_0)}{f_k(t_0)} + \ln\frac{c_i}{c_k}\,(t - t_0)$$ (IV.2)

where subscript k denotes the base, or reference, state—in this case taken as Victoria.

Equation (IV.2) is then estimated using the estimating equation (IV.3):

$$y_i(t) = a_i + b_i\,(t - t_0)$$ (IV.3)

where $y_i(t) = \ln\frac{f_i(t)}{f_k(t)}$, $a_i = \ln\frac{f_i(t_0)}{f_k(t_0)}$ and $b_i = \ln\frac{c_i}{c_k}$.

Once b_i for say, New South Wales is estimated, the competitiveness index of New South Wales (c_i) can be calculated as $c_2 = \exp(b_2)$

Results

Applying the share analysis to the interstate shares given in appendix II, Table II.6, for the years 1990–2003 gives the competitiveness indexes for each of the states and territories presented in Table IV.1. Note: with the introduction of the interstate rail line from South Australia to the Northern Territory, dummy variables were used in the regression analysis for South Australia between 2001 and 2003 the Northern Territory in 2003.

The forecast shares of the interstate freight task by state and territory of operation are illustrated in Figure IV.1.

TABLE IV.1 COMPETITIVENESS INDICES FOR INTERSTATE BY STATE OF OPERATION ROAD FREIGHT

State	i	a	b	c
VIC	1	–	–	1
NSW	2	0.9332	0.0169	1.0170
QLD	3	-0.5749	0.0196	1.0198
SA	4	-0.2895	-0.0032	0.9968
WA	5	-1.6709	0.0122	1.0123
TAS	6	-3.2644	-0.1569	0.8548
NT	7	-2.6638	0.0666	1.0689
ACT	8	-3.7664	0.0054	1.0054

Note: Victoria was used as the base state.

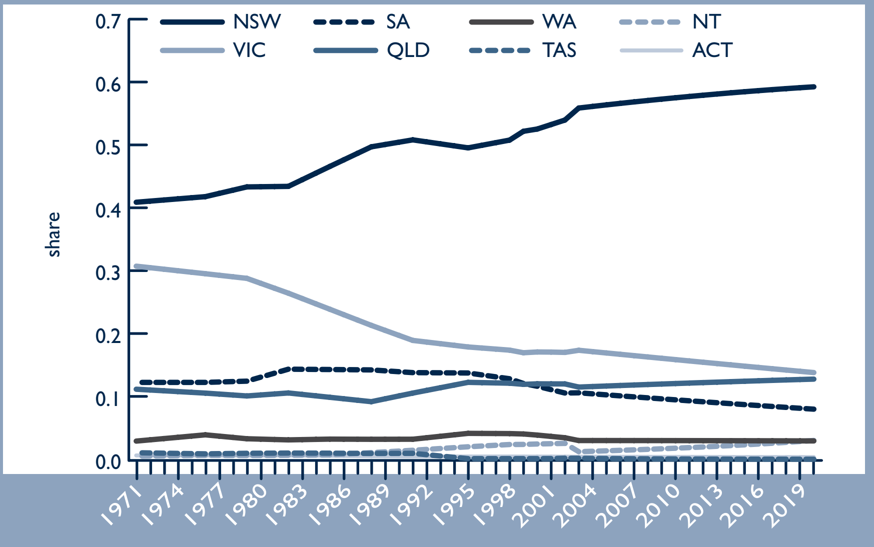
Source: BTRE estimates.

Chapter 5 presents forecasts of the total Australian interstate non-bulk road freight task to 2020. As with the state-based model, the aggregate forecasts rely on a range of assumptions about future economic activity, relative prices of road transport and the structure of road freight demand. The estimated shares presented in Figure IV.1, were applied to the forecasts of the aggregate interstate road freight task presented in Chapter 5. This gave the BTRE estimates and forecasts of the interstate by state of operation road freight task. The results are presented in Figure IV.2.

IV.3 CAPITAL CITY

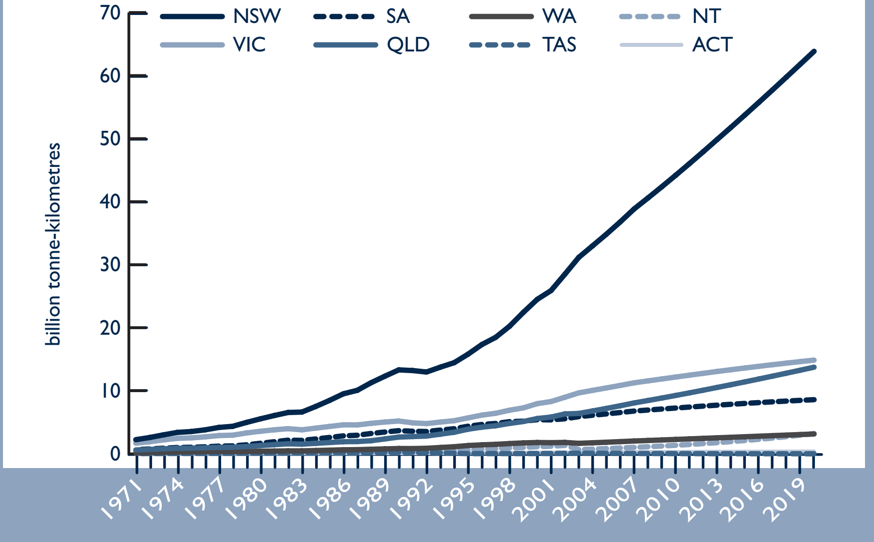
The capital city forecasts are derived in three steps—for details of the models and procedures used refer to Chapter 3. First, the aggregate metropolitan model is used to forecast the total metropolitan freight task. Then the cross-section time series, model is used to derive each city's provisional freight task. Finally each city's share of the cross-section time series, total for the eight capitals is multiplied by the aggregate 'metro' forecast to get the city's final forecast freight task.

FIGURE IV.1 SHARES OF THE INTERSTATE ROAD FREIGHT TASK BY STATE AND TERRITORY OF OPERATION



Source: BTRE Estimates.

FIGURE IV.2 INTERSTATE ROAD FREIGHT TASK BY STATE AND TERRITORY OF OPERATION



Source: BTRE Estimates.

IV.4 REST OF STATE

The rest of state figures either:

- are the difference between the state of operation figures and the interstate and capital city figures—as for New South Wales, Victoria, Queensland, South Australia and Western Australia
- are specified by a simple line trend—as for Tasmania and the Northern Territory or are set to zero—as for the Australian Capital Territory.

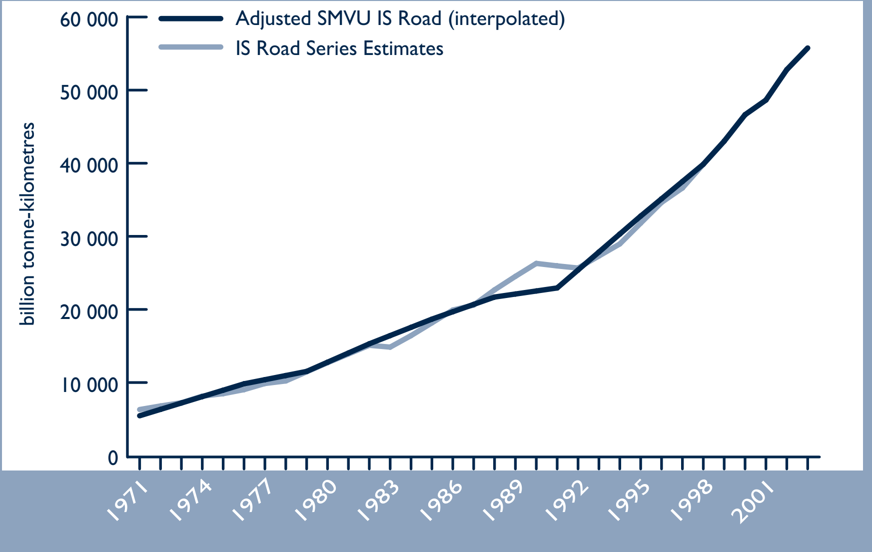
APPENDIX V

INTERSTATE FREIGHT

V.1 DATA SOURCES AND CONSTRUCTION OF ESTIMATES

The data on interstate road freight for the period 1971–2003 was based on the Survey of Motor Vehicle Use (SMVU, ABS 2004, and earlier). Chapter 2 and Appendix II give the basis for estimating interstate road freight data for survey years from 1971 to 2003. An interpolated series was generated and a simple regression against GDP and real road freight rates, combined with the adjusted survey values from 1998 onwards. The estimated interstate road freight series that resulted is shown in Figure V.1. It was then assumed that the non-bulk/bulk split was

FIGURE V.1 NON-BULK INTERSTATE ROAD FREIGHT—ACTUALS AND ESTIMATES



Source: BTRE Estimates.

93 per cent/7 per cent throughout the time period. The resulting non-bulk interstate road freight estimates are given in Table V.3.

Data on non-bulk interstate rail freight tonne–kilometres was sourced from the Australasian Railway Association, National Rail Corporation and individual systems. The estimates of interstate non-bulk rail tonne–kilometres are shown in Table 5.1 in Chapter 5.

Data on coastal shipping came from the BTRE *Transport Indicators* Database and the BTRE Coastal Shipping database. 'Cargo tonnes' as used before 1980–81 were translated into tonnes by multiplying by 0.66. Multiplying by an estimated average haul series (BTCE 1996) gave the estimate of interstate non-bulk shipping tonne–kilometres given in Table 5.1 in Chapter 5.

TABLE V.1 ESTIMATED EQUATION FOR TOTAL INTERSTATE NON-BULK FREIGHT

Variable	Coefficient estimate	t-statistic
Constant	-14.587	-26.437
Ln(real GDP)	+1.410	+32.174
Dum 83on	-0.057	-2.081

a. Dependent variable—In total interstate freight (billion tonne-kilometres).
b. Estimation method—Ordinary Least Squares.
c. Adjusted R2—0.99.
d. Estimation period—1970/71–2002/03.

V.2 ESTIMATED EQUATIONS

Total interstate non-bulk freight was estimated with a single equation that related the level of interstate freight to the level of national income—that is, gross domestic product. Freight is co-integrated with economic activity—its ultimate generator. So a simple Ordinary Least Squares regression results in a super-consistent estimator of the coefficient on gross domestic product. The simple Ordinary Least Squares coefficient was 1.40 (Table V.1).

Mode share equations were estimated using logistic substitution models. The logistic substitution model is an evolutionary model of technology use. In this case technology refers to the freight transport mode. The model is based on two simple assumptions:

- each mode at time t can be characterised by a single index describing its performance; its index of competitiveness
- the amount of mode i in use at time t+1 is proportional to the amount of the mode in use in the previous period and its relative competitiveness.

These assumptions give the evolution equation:

$$f_i(t+1) = \frac{c_i}{c_{av}} f_i(t) \text{, for each } i. \qquad \text{(V.1)}$$

where

$f_1\,(t)$ is the share total freight transport of mode i at time t;

c_i is the competitiveness of mode i

$c_{av}\,(t)$ is the weighted average of the competitiveness of all modes at time t.

Rearranging (V.1) and back substituting gives (V.2):

$$\ln\frac{f_i(t)}{f_k(t)} = \ln\frac{f_i(t_0)}{f_k(t_0)} + \ln\frac{c_i}{c_k}(t - t_0) \qquad \text{(V.2)}$$

where subscript k denotes the base, or reference, mode—in this case taken as road.

Equation (V.2) is then estimated using the estimating equation (V.3):

$$y_i(t) = a_i + b_i(t - t_0) \qquad \text{(V.3)}$$

where $y_i(t) = \ln\frac{f_i(t)}{f_k(t)}$, $a_i = \ln\frac{f_i(t_0)}{f_k(t_0)}$ and $b_i = \ln\frac{c_i}{c_k}$.

Once b_2 for rail has been estimated, the competitiveness index of rail can be calculated as $c_2 = \exp(b_2)$.

The resulting parameter estimates are given in Table V.2.

TABLE V.2 PARAMETER ESTIMATES: PERIOD 2004 TO 2020

Mode	i	a	b	c
Road	1	–	–	1.00
Rail	2	-0.7543	-0.0116	0.9885
Sea	3	-2.4173	0.0120	1.0121

Note: Road was used as the base mode.

Source: BTRE estimates.

These parameter estimates were obtained from the forecasts of aggregate corridor traffic presented in Chapter 6. It was felt this was the best way to control the realism of the aggregate mode share forecasts.

V.3 INTERSTATE NON-BULK

TABLE V.3 ESTIMATED AND FORECAST INTERSTATE NON-BULK FREIGHT TASK AND ASSUMPTIONS

Year	Road	Rail	Coastal Shipping	Total	Real GDP
		(billion tonne–kilometres)			*1999=100*
1970–71	5.86	8.38	6.58	20.82	246 212
1971–72	6.32	8.43	6.56	21.31	255 680
1972–73	6.73	8.56	6.05	21.34	264 505
1973–74	7.57	9.10	6.32	22.99	278 124
1974–75	7.88	8.65	5.77	22.31	281 052
1975–76	8.40	8.93	5.42	22.75	288 602
1976–77	9.18	9.22	4.82	23.21	297 870
1977–78	9.50	8.93	4.57	23.00	300 195
1978–79	10.66	9.69	3.99	24.35	316 750
1979–80	11.82	10.45	3.75	26.02	324 485
1980–81	12.93	10.93	3.54	27.40	334 865
1981–82	14.04	11.31	3.48	28.82	345 290
1982–83	13.81	9.95	2.40	26.16	336 257
1983–84	15.27	11.40	2.82	29.49	354 126
1984–85	16.89	11.31	2.88	31.08	372 053
1985–86	18.52	11.40	2.63	32.55	387 724
1986–87	19.15	11.78	2.60	33.53	397 491
1987–88	21.09	12.92	2.53	36.54	418 795
1988–89	22.81	14.54	2.79	40.13	435 727
1989–90	24.45	14.70	2.72	41.87	451 977
1990–91	24.14	13.57	2.84	40.55	451 563
1991–92	23.86	13.57	2.93	40.36	452 779
1992–93	25.40	14.21	3.07	42.68	469 355
1993–94	26.93	14.50	3.26	44.69	487 611
1994–95	29.58	13.92	3.44	46.94	507 945
1995–96	32.21	14.41	3.55	50.17	529 355
1996–97	34.05	15.27	3.55	52.86	548 814
1997–98	37.07	15.93	4.30	57.31	573 243
1998–99	40.00	16.50	4.36	60.86	603 446
1999–00	43.37	17.45	5.72	66.55	627 559
2000–01	45.23	17.64	6.90	69.78	638 597
2001–02	49.11	18.59	6.16	73.86	662 676
2002–03	51.86	19.54	7.33	78.73	682 300
2003–04	54.67	20.37	7.82	82.86	707 450
2004–05	57.48	21.17	8.33	86.98	732 211
2005–06	60.44	22.00	8.86	91.30	757 838
2006–07	63.54	22.86	9.43	95.83	784 362
2007–08	66.12	23.52	9.93	99.57	805 932
2008–09	68.76	24.17	10.45	103.38	827 693
2009–10	71.45	24.83	10.99	107.27	849 626
2010–11	74.19	25.49	11.55	111.22	871 717
2011–12	76.97	26.14	12.13	115.24	893 946
2012–13	79.81	26.79	12.72	119.32	916 294
2013–14	82.63	27.42	13.33	123.38	938 285
2014–15	85.49	28.04	13.96	127.49	960 335
2015–16	88.38	28.65	14.61	131.64	982 423
2016–17	91.30	29.26	15.27	135.83	1 004 527
2017–18	94.25	29.86	15.96	140.07	1 026 627
2018–19	97.23	30.44	16.66	144.33	1 048 699
2019–20	100.22	31.02	17.38	148.62	1 070 722

Source: BTRE estimates.

TABLE V.4 ESTIMATED AND FORECAST INTERSTATE NON-BULK FREIGHT MODESHARE

Year	Road	Rail	Coastal Shipping
		(per cent)	
1970–71	28	40	32
1971–72	30	40	31
1972–73	32	40	28
1973–74	33	40	28
1974–75	35	39	26
1975–76	37	39	24
1976–77	40	40	21
1977–78	41	39	20
1978–79	44	40	16
1979–80	45	40	14
1980–81	47	40	13
1981–82	49	39	12
1982–83	53	38	9
1983–84	52	39	10
1984–85	54	36	9
1985–86	57	35	8
1986–87	57	35	8
1987–88	58	35	7
1988–89	57	36	7
1989–90	58	35	6
1990–91	60	33	7
1991–92	59	34	7
1992–93	60	33	7
1993–94	60	32	7
1994–95	63	30	7
1995–96	64	29	7
1996–97	64	29	7
1997–98	65	28	8
1998–99	66	27	7
1999–00	65	26	9
2000–01	65	25	10
2001–02	66	25	8
2002–03	66	25	9
2003–04	66	25	9
2004–05	66	24	10
2005–06	66	24	10
2006–07	66	24	10
2007–08	66	24	10
2008–09	67	23	10
2009–10	67	23	10
2010–11	67	23	10
2011–12	67	23	11
2012–13	67	22	11
2013–14	67	22	11
2014–15	67	22	11
2015–16	67	22	11
2016–17	67	22	11
2017–18	67	21	11
2018–19	67	21	12
2019–20	67	21	12

Sources: BTRE estimates.

APPENDIX VI

INTERCAPITAL FREIGHT DATA ESTIMATION

There is no single comprehensive source of time series data on freight transport movements in Australia. Time series of Australian freight movements must be derived from a range of different sources together with a range of assumptions. This appendix examines the task of constructing consistent time series estimates of interstate non-bulk freight movements, by the major transport modes: road, rail and coastal shipping. It also outlines the methods and the raw data sources used to derive those estimates. The estimates update the work undertaken by the Bureau of Transport and Communications Economics in 1989. To the BTRE's knowledge, they are the only consistent time series of intercity freight movements in Australia

Data for the freight task on these corridors was obtained from several sources. The main sources of raw data were:

- Australian Bureau of Statistics Survey of Motor Vehicle Use (periodically)
- Australia Yearbook (annual)
- ABS Freight Movements (2001a), Cat. No. 9220.0
- 'Experimental Estimates' Cat. No. 9217.0 provides quarterly (experimental) estimates of freight movements by all modes, for the period between June 1994 and June 1995, and for rail, sea and air for the period between September 1995 and December 1998
- 'Freight Forwarder's Survey' Cat. No. 9212.0 provides annual estimates of interstate freight movements by all modes, for the period between 1980–81 and 1990–91 (missing 1981–82) and Cat. No. 9214.0 provides quarterly estimates of interstate road freight movements, for the period between September 1982 and June 1994

FreightInfo™ 1986–87, 1988–89, 1992–93, 1995–96

Bureau of Transport and Communications Economics 1990, *Freight Flows in Australian Transport Corridors*, BTCE Occasional Paper 98, AGPS, Canberra

Bureau of Transport and Regional Economics Coastal Shipping database

- Indicators Database.

The issue of rail data is perhaps the most vexing. From 1998 to 2001, the rail corridor freight estimates were derived from the ABS Freight Movements Survey *State to State* origin–destination data. City-to-city traffic was assumed to be a similar fraction of the state-to-state traffic as in 1995 to 1997—the last years for which city-to-city data was available. Since 1997, the recently privatised railways have declined to permit the public release of city-to-city data. Furthermore, since 2001, they have not allowed *any* origin–destination data—even state-to-state—to be released. This raises severe difficulties for future estimates of rail flows on any of the corridors discussed here.

VI.1 INTERCAPITAL ROAD FREIGHT FLOWS

The point of departure for the road freight corridor estimates was the Occasional Paper 98 (OP98) set of estimates—see Table VI.1. The aim of the exercise was to fill in the missing values and extend the estimates to 2000–01.

TABLE VI.1 BTCE OCCASIONAL PAPER 98 NON-BULK ROAD FREIGHT FLOWS

(million tonnes)

	Corridor							
Year	Mel-Syd	ES-Per	Syd-Bne	Syd-Adl	Mel-Adl	Mel-Bne	Syd-Cbr	Total
1964–65	1.29	0.02						
1965–66	1.34	0.03						
1966–67	1.45	0.05						
1967–68	1.55	0.06						
1968–69	1.65	0.06						
1969–70	1.71	0.05						
1970–71	1.69	0.05						
1971–72	1.76	0.05	0.85	0.31	0.75	0.37		4.09
1972–73	2.03	0.04	0.90	0.37	0.88	0.44		4.66
1973–74	2.22	0.04	0.97	0.46	0.93	0.55		5.17
1974–75	2.32	0.06	0.90	0.47	0.98	0.50		5.23
1975–76	2.59	0.09	0.86	0.48	0.94	0.46		5.42
1976–77	2.68	0.19	0.94	0.53	1.02	0.50		5.86
1977–78	2.68	0.25	1.10	0.56	1.00	0.58		6.17
1978–79	2.89	0.34	0.91	0.55	0.98	0.62		6.29
1979–80	3.21	0.38	1.00	0.61	1.08	0.68		6.96
1980–81	3.40	0.35	1.06	0.64	1.14	0.72		7.31
1981–82	3.57	0.42	1.11	0.68	1.20	0.76		7.74
1982–83	3.19	0.42	0.98	0.60	1.06	0.67		6.92
1983–84	3.84	0.46	1.17	0.72	1.27	0.80		8.26
1984–85	3.91	0.47	1.23	0.69	1.16	0.84		8.30
1985–86	4.34	0.53	1.43	0.81	1.44	0.93		9.48

Source: BTCE (1990).

The final result of all the transformations performed on the raw data, is the set of road freight flow estimates given in Table VI.2.

The intercapital road freight flows in Table VI.2 are derived from several sources, including the ABS Freight Forwarder's Survey—hereafter referred to as FFS—*FreightInfo*™, and Marulan truck count data. The following sections consider the data for the various corridors.

TABLE VI.2 NON-BULK ROAD FREIGHT FLOWS – REVISED ESTIMATES

(million tonnes)

	Corridor							
Year	Mel-Syd	ES-Per	Syd-Bne	Syd-Adl	Mel-Adl	Mel-Bne	Syd-Cbr	Total
1964–65	1.282	0.020	0.534	0.171	0.534	0.183	0.090	2.81
1965–66	1.341	0.030	0.556	0.184	0.557	0.198	0.094	2.96
1966–67	1.449	0.050	0.588	0.203	0.590	0.219	0.102	3.20
1967–68	1.550	0.060	0.627	0.228	0.631	0.247	0.109	3.45
1968–69	1.650	0.060	0.671	0.258	0.677	0.280	0.116	3.71
1969–70	1.707	0.050	0.722	0.295	0.730	0.321	0.120	3.95
1970–71	1.675	0.050	0.764	0.327	0.775	0.357	0.117	4.06
1971–72	1.616	0.050	0.850	0.310	0.750	0.370	0.268	4.21
1972–73	1.864	0.040	0.900	0.370	0.880	0.440	0.268	4.76
1973–74	2.039	0.040	0.970	0.460	0.930	0.550	0.340	5.33
1974–75	2.130	0.060	0.900	0.470	0.980	0.500	0.300	5.34
1975–76	2.378	0.090	0.860	0.480	0.940	0.460	0.388	5.60
1976–77	2.461	0.190	0.940	0.530	1.020	0.500	0.490	6.13
1977–78	2.461	0.250	0.950	0.560	1.000	0.580	0.398	6.20
1978–79	2.654	0.340	0.910	0.550	0.980	0.620	0.480	6.53
1979–80	2.948	0.380	1.000	0.610	1.080	0.680	0.528	7.23
1980–81	3.150	0.346	1.051	0.641	1.137	0.717	0.533	7.57
1981–82	3.280	0.364	1.118	0.660	1.184	0.772	0.639	8.02
1982–83	2.900	0.349	1.058	0.618	1.128	0.793	0.571	7.42
1983–84	3.450	0.389	1.227	0.679	1.245	0.865	0.672	8.53
1984–85	3.470	0.433	1.322	0.651	1.140	0.939	0.786	8.74
1985–86	3.810	0.554	1.573	0.759	1.573	1.072	1.016	10.36
1986–87	3.810	0.640	1.470	0.769	1.447	1.042	1.032	10.21
1987–88	4.220	0.590	1.548	0.730	1.490	1.149	1.097	10.82
1988–89	4.500	0.581	1.629	0.700	1.570	1.135	1.291	11.41
1989–90	4.790	0.748	1.504	0.711	1.616	1.203	1.609	12.18
1990–91	4.840	0.834	1.778	0.745	1.520	1.313	1.273	12.30
1991–92	4.810	0.928	1.973	0.821	1.689	1.467	1.377	13.06
1992–93	5.110	1.041	2.255	0.994	1.844	1.627	1.590	14.46
1993–94	5.340	1.067	2.565	1.045	1.889	1.886	1.241	15.03
1994–95	5.590	1.125	2.732	1.080	1.978	2.021	1.300	15.83
1995–96	6.080	1.089	3.014	1.125	2.192	2.023	1.379	16.90
1996–97	6.472	1.054	3.325	1.171	2.429	2.026	1.463	17.94
1997–98	6.867	1.018	3.669	1.220	2.691	2.028	1.553	19.05
1998–99	7.369	0.982	4.047	1.271	2.982	2.031	1.648	20.33
1999–00	7.877	0.947	4.465	1.323	3.305	2.033	1.749	21.70
2000–01	8.097	0.911	4.926	1.378	3.662	2.036	1.856	22.87

Sources: BTRE estimates, BTCE (1990).

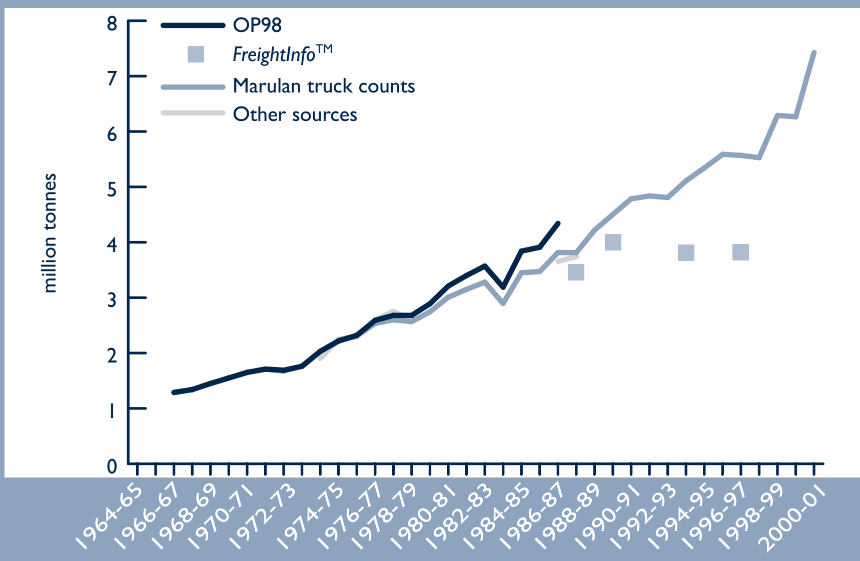
Melbourne–Sydney

The OP98 data was based on truck counts at Marulan in both directions, multiplied by an estimated fraction of total truck traffic—that is, Melbourne–Sydney origin—destination (OD) traffic (BTCE 1990) and an average load per truck (BTCE 1990).

Three main sources of raw data were used to update the data: FFS, *FreightInfo*™, and truck counts at Marulan.

The Marulan truck count data and FFS data measures are broadly consistent. That is, they move in the same direction. The *FreightInfo*™ data is not consistent with the other two data sources—Figure VI.1 and Table VI.3.

FIGURE VI.1 TRANSPORT INDICATORS REAL FREIGHT RATES INDEX



Sources: BTRE estimates, BTCE (1990), FreightInfo™, Marulan Truck Counts.

A consistent series was derived based on Marulan truck count data and is listed in Table VI.4. Total Melbourne–Sydney freight, column (5), is equal to the average load times the estimated number of trucks counted at Marulan that are Melbourne–Sydney OD traffic, column (4) times (3). The number of Melbourne–Sydney OD trucks are estimated from total trucks (1) times an OD fraction. This fraction was assumed to decline from 0.552 in 1964–65 to about 0.345 in 1999–2000. The OD fraction is based time series evidence from the Bureau of Transport and Communications Economics (BTCE 1990).

Eastern States–Perth, Sydney–Brisbane, Sydney–Adelaide, Melbourne–Adelaide, Melbourne–Brisbane

Raw data up to 1985–86 was taken from BTE Occasional Paper 98. Data for Eastern States–Perth was estimated from truck count data at Ceduna and estimates of average load per truck. This data also came from BTCE Occasional Paper 98 (BTCE 1990).

TABLE VI.3 RAW DATA BY SOURCE—SYDNEY–MELBOURNE ROAD FREIGHT

(million tonnes)

Year	OP98	*FreightInfo*™	Marulan truck counts	Other sources	
1964–65	1.29		1.282		
1965–66	1.34		1.341		
1966–67	1.45		1.449		
1967–68	1.55		1.550		
1968–69	1.65		1.650		
1969–70	1.71		1.707		
1970–71	1.69		1.675		
1971–72	1.76		1.764		
1972–73	2.03		2.031	1.9	btce od survey Hume
1973–74	2.22		2.214	2.25	“
1974–75	2.32		2.306	2.3	“
1975–76	2.59		2.536	2.6	“
1976–77	2.68		2.598	2.75	“
1977–78	2.68		2.568	2.6	“
1978–79	2.89		2.745		
1979–80	3.21		3.007		
1980–81	3.40		3.150	3.6	abs census
1981–82	3.57		3.280		
1982–83	3.19		2.895		
1983–84	3.84		3.450		
1984–85	3.91		3.472		
1985–86	4.34		3.815	3.65542 rta od survey Hume	
1986–87		3.46	3.813	3.740948 ghd od survey Hume	
1987–88			4.220		
1988–89		4.00	4.503		
1989–90			4.785		
1990–91			4.837		
1991–92			4.808		
1992–93		3.81	5.110		
1993–94			5.342		
1994–95			5.588		
1995–96		3.82	6.080		
1996–97			6.472		
1997–98			6.867		
1998–99			7.369		
1999–00			7.877		
2000–01			8.097		

Sources: BTRE estimates, BTCE (1990).

For the other routes, estimates of freight data for the period between 1964–65 and 1995–96 were based on FFS data. The data was scaled up for the degree of under-coverage of the survey—as revealed on the Melbourne–Sydney route— or on other indicators such as predictions based on real GDP growth and movements in real freight rates. The scaled FFS data is of the same magnitude as the data in BTCE Occasional Paper 98 and the *FreightInfo*™ data.

The full period data set is equal to the BTCE Occasional Paper 98 data for the period between 1964–65 and 1985–86 and the FFS data from 1986–87 to 1994–95, spliced onto the Occasional Paper 98 data in 1986–87 using the 1985–86 values. The 1995–96 to 2000–01 data

TABLE VI.4 ESTIMATED MELBOURNE–SYDNEY ROAD FREIGHT

	No trucks through Marulan	Fraction Mel–Syd OD	Mel–Syd trucks	Average load	Estimated Mel–Syd freight
Financial year ending	(1) *(trucks)*	(2) *(fraction)*	(3) *(trucks)*	(4) *(tonnes)*	(5) *(million tonnes)*
1965	199 356	0.552	110 045	11.650	1.282
1966	196 630	0.533	104 804	12.800	1.341
1967	201 413	0.514	103 526	14.000	1.449
1968	215 930	0.495	106 885	14.500	1.550
1969	237 821	0.476	113 203	14.580	1.650
1970	254 461	0.457	116 289	14.680	1.707
1971	258 977	0.438	113 432	14.770	1.675
1972	283 384	0.419	118 738	14.860	1.764
1973	339 856	0.400	135 942	14.940	2.031
1974	388 362	0.380	147 578	15.000	2.214
1975	404 622	0.380	153 756	15.000	2.306
1976	447 299	0.378	169 079	15.000	2.536
1977	460 711	0.376	173 227	15.000	2.598
1978	457 692	0.374	171 177	15.000	2.568
1979	491 852	0.372	182 969	15.000	2.745
1980	541 879	0.370	200 495	15.000	3.007
1981	570 679	0.368	210 010	15.000	3.150
1982	597 451	0.366	218 667	15.000	3.280
1983	530 303	0.364	193 030	15.000	2.895
1984	635 346	0.362	229 995	15.000	3.450
1985	642 906	0.360	231 446	15.000	3.472
1986	708 456	0.359	254 336	15.000	3.815
1987	710 019	0.358	254 187	15.000	3.813
1988	785 201	0.357	280 317	15.055	4.220
1989	849 382	0.356	302 380	14.891	4.503
1990	879 360	0.355	312 173	15.328	4.785
1991	878 834	0.354	311 107	15.547	4.837
1992	869 994	0.353	307 108	15.657	4.808
1993	920 700	0.352	324 086	15.766	5.110
1994	958 654	0.351	336 488	15.876	5.342
1995	995 356	0.350	348 375	16.040	5.588
1996	1 075 127	0.349	375 219	16.204	6.080
1997	1 136 062	0.348	395 350	16.369	6.472
1998	1 196 996	0.347	415 358	16.533	6.867
1999	1 275 568	0.346	441 347	16.697	7.369
2000	1 354 139	0.345	467 178	16.861	7.877
2001	1 382 489	0.344	475 576	17.025	8.097

Sources: BTRE estimates, BTCE (1989).

was based on the ABS Freight Movements Survey data (Cat. No. 9217.0 and 9220.0) and the ABS Survey of Motor Vehicle Use.

Sydney–Canberra

Sydney–Canberra corridor traffic was not estimated in Occasional Paper 98. The actual raw data sources considered are examined below.

In 1986, there was a one-week survey of truck traffic through Marulan which obtained origin–destination truck traffic counts. The survey results suggest that 16 per cent of all trucks through Marulan were Sydney–Canberra OD traffic. The average load for Sydney–Canberra

OD traffic was 0.59 times the size of the average load for all trucks travelling through Marulan. Applying these factors to the total number of trucks through Marulan for the year, an estimate of 1.0157 million tonnes for 1986 Sydney–Canberra freight traffic.

The 1980–81 Census of Freight Forwarders (ABS 1983) provided an estimate of total Sydney–Canberra road freight movements of 0.2209 million tonnes.

The estimate of 1986 Sydney–Canberra freight is assumed to be close to the actual level and is used as a reference value for calculating values of the scaled FFS data between 1980–81 and 1994–95. Based on the 1986 Sydney–Canberra estimate, an estimate of the survey coverage of the FFS is calculated. The survey coverage for Sydney–Canberra is assumed to change in the same proportion as changes in the Melbourne–Sydney survey coverage. This was determined by using the Marulan truck counts as a base and comparing this to the FFS estimate of Melbourne–Sydney traffic. The size of the scaled FFS data, therefore, depends critically on the 1986 estimate.

For calculating scaled FFS data from 1971–72 to 1977–78, the 1980–81 Census figure is taken as a base figure for the actual amount of Sydney–Canberra road freight traffic and a correspondence between this and Marulan truck count data is calculated. The correspondence is used to calculate an estimate of Sydney–Canberra road freight for 1976–77 and 1977–78. It is based on the Marulan truck counts in those years. The implicit assumption is that the proportions of Marulan trucks that are Sydney–Canberra OD and average load factors remain constant. A simple average of the 1976–77 and 1977–78 Marulan Sydney–Canberra estimates are used to calculate the degree of under-coverage of the Sydney–Canberra estimates at that time. This under-coverage estimate is used to factor up the FFS estimates for the period between 1971–72 and 1977–78.

FreightInfo™ gives non-bulk and total road freight movements. Table VI.5 shows that the *FreightInfo*™ total road freight is generally about half the size of the scaled FFS data.

The Bureau of Transport Economics Information Paper 6 (BTE 1982) gives estimates of the total Sydney–Canberra road freight between 1973 and 1978. The estimate of Sydney–Canberra total and non-bulk—defined as total less Minerals and Metals, Petroleum and Building Materials—road freight is given in Table IV.3. It can be seen that the estimate of non-bulk freight in Information Paper 6 is of the same magnitude as the scaled FFS estimate.

Considering the data in Table VI.5, the scaled FFS data is judged to be a good measure of total non-bulk road freight between Canberra and

TABLE VI.5 SYDNEY–CANBERRA FREIGHT—'RAW' ESTIMATES

(million tonnes)

Year	Marulan OD survey 1986	FFS (Census 1980–81)	Scaled FFS	*FreightInfo*™ Non-bulk	*FreightInfo*™ Total	BTE IP6 (Total)	BTE IP6 (Non-bulk)
1964–65							
1965–66							
1966–67							
1967–68							
1968–69							
1969–70							
1970–71							
1971–72			0.107				
1972–73			0.107			0.157	0.142
1973–74			0.136			0.198	0.121
1974–75			0.120			0.258	0.148
1975–76			0.155			0.302	0.182
1976–77			0.196			0.328	0.188
1977–78			0.159			0.284	0.166
1978–79							
1979–80							
1980–81		0.2209	0.533				
1981–82			0.639				
1982–83			0.571				
1983–84			0.672				
1984–85			0.786				
1985–86	1.0157		1.016				
1986–87			1.032	0.335	0.443		
1987–88			1.097				
1988–89			1.291	0.534	0.676		
1989–90			1.609				
1990–91			1.273				
1991–92			1.377				
1992–93			1.590	0.576	0.738		
1993–94			1.241				
1994–95			1.300				
1995–96			1.379	0.566	1.015		
1996–97			1.463				
1997–98			1.553				
1998–99			1.648				
1999–00			1.749				
2000–01			1.856				

Sources: BTRE estimates, ABS, BTE (1982).

Sydney. The final estimates are based on the scaled FFS data for 1971–72 to 1977–78 and 1980–81 to 2000–01. The 1980–81 Census estimates were ignored—their value was less than half the value of the scaled FFS result. The *FreightInfo*™ estimates were judged to be underestimating total Sydney–Canberra road freight.

VI.2 INTERCAPITAL RAIL FREIGHT FLOWS

Principal data sources

Intersystem rail freight data, provided by the state rail authorities, refers to state-to-state freight tonnages. Origin–destination fractions were required to determine the intercapital freight flow on all corridors except Eastern States–Perth, where it was desired to measure all trans-Nullarbor freight flows. The Adelaide and Brisbane corridors have an origin–destination fraction that applies for each direction of freight.

Origin–destination rail freight on the Melbourne–Sydney corridor was initially difficult to estimate. Grain shipments over the border to Victorian ports disrupted the data series, particularly for southbound traffic. Once the amount of grain crossing the border by rail was eliminated from the time series, general freight between the two capitals could be assessed.

An origin–destination fraction for the Melbourne-Sydney corridor was determined using three studies. Table VI.6 gives details of the studies and the fractions derived for the Melbourne–Sydney corridor. As no trend over time was apparent in the figures, information from all three studies was used in arriving at a final judgement of the origin–destination fractions.

TABLE VI.6 ORIGIN-DESTINATION FRACTION ESTIMATES FOR MELBOURNE–SYDNEY RAIL FREIGHT

Source	Year	Melbourne–Sydney[a] (kT)	Total NSW–Vic (kT)	Total w/o Wheat (kT)	Fraction[b]
BTE (1976)	1971–72	1761	2097	2076	0.85
BTE (1979)	1975–76	1428	1765	1740	0.82
BTE (1983)	1979–80	1774[c]	2356	1910	0.93

a. *'Melbourne' includes Melbourne, Westernport and Geelong. 'Sydney' includes Sydney, Newcastle and Wollongong.*
b. *Equals Melbourne-Sydney tonnages divided by 'total w/o wheat' tonnages.*
c. *Intercity traffic levels were overestimated as this figure refers to Sydney, Newcastle and Wollongong to Victoria, and Melbourne, Westernport and Geelong to NSW. Therefore the origin-destination fraction is also overestimated.*

Table VI.7 shows the origin–destination fractions for rail freight flows for five of the corridors. No origin-destination fraction was necessary for the Eastern States–Perth corridor as the aim was to measure all trans–Nullarbor freight flows. The final estimates of origin–destination fractions adopted for each corridor were derived by combining information from Table VI.7 with information derived from discussions with the individual state rail systems.

These OD fractions were applied to state-to-state rail tonnages to derive corridor freight estimates up to 1985–86 (BTCE 1998). The remaining rail intercity freight data was brought together from a wide range of sources including:

TABLE VI.7 RAIL FREIGHT ORIGIN–DESTINATION FRACTION ESTIMATES FOR FIVE OF THE MAINLAND CORRIDORS

	Year		
Corridor	**1971–72**	**1975–76**	**1979–80**
Melbourne–Sydney	0.85	0.82	0.93[a]
Melbourne–Brisbane			
Northbound	0.91	0.76	0.78[a]
Southbound	0.77	0.70	Na
Melbourne–Adelaide			
Eastward	0.87	0.79	0.82[a]
Westward	0.62	0.61	0.68
Sydney–Brisbane			
Northbound	0.74	0.70	0.96[a]
Southbound	0.74	0.39	Na
Sydney–Adelaide			
Eastward	0.14	0.15	0.94[a]
Westward	0.12	0.17	0.27

a. Based on city to system statistics: overestimates origin-destination fraction; for example, Adelaide–NSW includes substantial traffic to Broken Hill.

b. na not available

Sources: BTE (1976, 1979, 1983); BTCE estimates.

TABLE VI.8 ESTIMATED RAIL FREIGHT FLOWS

('000 tonnes)

Year	Mel–Syd	ES–Per	Syd–Bne	Syd–Adl	Mel–Adl	Mel–Bne	Syd–Cbr
1964–65	1 134	273	311	101	447	131	81
1965–66	1 150	271	325	101	474	147	90
1966–67	1 158	279	358	101	420	157	93
1967–68	1 174	326	385	101	403	166	94
1968–69	1 083	370	426	101	277	136	101
1969–70	1 093	371	465	101	390	143	117
1970–71	1 130	388	512	101	425	131	118
1971–72	1 082	419	516	101	425	135	116
1972–73	1 156	463	620	101	579	146	129
1973–74	1 183	606	663	101	619	154	116
1974–75	998	593	654	101	545	136	104
1975–76	977	694	651	99	522	163	94
1976–77	1 002	743	691	103	508	190	84
1977–78	916	734	624	100	553	171	90
1978–79	957	777	704	96	605	191	82
1979–80	1 072	801	780	105	594	205	26
1980–81	1 049	868	808	96	668	199	24
1981–82	1 007	942	899	99	814	234	23
1982–83	798	894	686	52	639	143	21
1983–84	925	959	751	61	772	175	27
1984–85	952	981	808	83	799	165	32
1985–86	961	1 086	932	103	823	190	25
1986–87	1 078	1 126	938	208	784	160	22
1987–88	1 188	1 196	954	233	858	191	21
1988–89	1 217	1 355	1 022	312	988	271	21
1989–90	1 131	1 450	990	376	926	315	15
1990–91	1 116	1 450	984	381	867	376	10
1991–92	1 159	1 459	987	353	942	546	70
1992–93	1 263	1 119	1 071	380	956	345	4
1993–94	1 163	1 318	1 039	350	967	358	50
1994–95	1 060	1 509	935	415	862	660	50
1995–96	983	1 501	971	367	831	594	0
1996–97	855	1 566	793	305	669	662	0
1997–98	921	1 702	992	325	712	750	0
1998–99	873	1 884	914	318	726	786	0
1999–00	1 139	2 043	1 022	317	834	961	0
2000–01	1 032	2 192	905	308	639	932	0

Sources: BTE estimates using; BTCE (1990); FreightInfo™; ABS (1997, 2001a); BTCE (1987); National Freight Group (1992).

Australian Bureau of Statistics Experimental Estimates:

— Freight Forwarders Survey

— Interstate Freight Movements

Bureau of Transport Economics 1979, *Australian Rail Freight Movements, 1975–76*, Information Bulletin, AGPS, Canberra.

— 1983, *Australian Rail Freight Movements, 1979–80*, Information Paper 8, AGPS, Canberra.

— unpublished, *Intersystem Rail Freight Movements, 1984–85*, BTE, Canberra.

FreightInfo™, Database of national freight flows 1986–87, 1988–89, 1992–93, 1995–96.

State Railway Authority Annual reports

V/Line (PTC) Annual reports

Westrail Annual reports

Queensland Railways Annual reports

The intercity rail freight flow estimates of Table VI.8 were finalised.

VI.3 COASTAL SHIPPING DATA

The main data sources for the coastal shipping data were:

Australian Bureau of Statistics, Interstate Freight Movement, Cat. No. 9212.0.

— Experimental Estimates, Cat. No. 9217.0.

Bureau of Transport and Regional Economics, Coastal Freight Database

Department of Transport and Communications, Sea Transport Statistics; Coastal Freight, Australia

The time series data for sea freight refers to non-bulk freight. This was calculated by eliminating bulk freight from the total sea freight data provided by the state port authorities, according to outgoing freight, and incoming freight, from the respective interstate ports.

Bulk freight included oil and petroleum products, grain, sugar, minerals, timber, chemicals and any other categorised bulky material. Non-bulk freight included iron and steel, motor vehicles and parts, steel products, food and beverages, fruit and vegetables and any other non-bulky products or materials.

The freight tonnages destined for cities beyond the corridor could not be assessed. So state-to-state sea freight was used as an approximate estimate for freight consigned between the two cities determining a particular corridor. Therefore, no corridor origin–destination fractions were applied to sea freight. The BTRE believed this assumption was realistic. Corridor origin–destination fractions are very slow to change—see the discussion of rail origin–destinations fractions above. Given this, the BTRE felt that the assumption would not bias the elasticities estimated in the sea freight models.

The Department of Transport and Communications lists interstate non-bulk freight movements. For New South Wales and Victoria there are large amounts of non-bulk freight from Newcastle, Wollongong and Geelong. These may be identified by investigation of the ABS 9212.0 data.

The previous estimates—up to 1994–95—of intercity coastal shipping movements were based on Department of Transport and Communications data and appear to have significantly over-estimated intercity non-bulk freight movements. Since 1994–95 the Bureau of Transport and Regional Economics Coastal Freight Database has supplied more accurate shipping data. The BTCE (1990) includes the ports of Port Kembla and Newcastle, in estimates of coastal freight to and from the port of Sydney Geelong and Westernport, in its estimates of coastal freight to and from the port of Melbourne. Geelong handles mainly bulk liquids and some dry bulk products, but little to no non-bulk. The data set listed Table VI.9, provides total non-bulk coastal shipping between capital cities only—that is, it excludes Newcastle and Wollongong from Sydney and Geelong and Westernport from Melbourne.

TABLE VI.9 NON-BULK COASTAL FREIGHT FLOWS—REVISED ESTIMATES

('000 tonnes)

	Corridor							
Year	Mel–Syd	ES–Per	Syd–Bne	Syd–Adl	Mel–Adl	Mel–Bne	Syd–Cbr	Total
1971–72	180	714	143	3	12	230	0	1 282
1972–73	257	732	127	2	210	243	0	1 571
1973–74	227	671	70	1	18	257	0	1 244
1974–75	164	653	49	2	43	219	0	1 130
1975–76	76	536	37	0	46	129	0	824
1976–77	48	73	79	1	32	26	0	259
1977–78	27	66	32	1	77	16	0	219
1978–79	36	112	85	2	43	13	0	291
1979–80	61	146	80	1	79	18	0	385
1980–81	10	62	12	0	3	4	0	91
1981–82	11	47	5	0	5	2	0	70
1982–83	4	21	14	0	16	4	0	59
1983–84	9	24	15	0	0	5	0	53
1984–85	5	29	26	0	0	10	0	70
1985–86	5	95	11	4	0	1	0	116
1986–87	4	37	12	0	0	1	0	54
1987–88	1	65	5	0	0	0	0	71
1988–89	2	39	4	0	0	1	0	46
1989–90	0	9	19	0	0	0	0	28
1990–91	3	19	14	0	0	0	0	36
1991–92	4	85	8	3	0	3	0	103
1992–93	6	63	11	7	0	6	0	93
1993–94	17	95	15	11	5	11	0	154
1994–95	21	203	20	12	1	6	0	263
1995–96	23	196	7	3	2	12	0	243
1996–97	13	330	3	2	8	21	0	377
1997–98	23	331	17	4	14	14	0	403
1998–99	11	378	18	4	5	20	0	436
1999–00	47	600	39	9	11	50	0	756
2000–01	10	694	31	16	21	45	0	817

Sources: BTRE estimates, BTCE (1990).

APPENDIX VII

COMMODITY RAIL FREIGHT: DATA SOURCES, ASSUMPTIONS AND ESTIMATIONS

Production Data

Grains production data is from the Australian Bureau of Agricultural and Resource Economics (ABARE), *Australian Commodity Statistics*, 2000 (and earlier issues). Grains include wheat, oats, barley, sorghum and maize. No estimates were used for grains production data.

Other agriculture production data includes production of rice, cotton (unginned), flax, peanuts, safflower, sugarcane, wool (shorn greasy), canola, cottonseed, soybeans, and sunflowers. Also included are grapes, apples, apricots, bananas, cherries, oranges, peaches, pears, pineapples, plums and prunes, beans, cabbages, carrots, cauliflower, onions, potatoes, tomatoes and peas. Estimates are used and are generally based on relative proportions of the national or state totals of a particular commodity. Data is taken from ABARE's *Australian Commodity Statistics*, 2000 (and earlier issues) and the Australian Bureau of Statistics (ABS) *Australia and State Year Books*, 2001d (and earlier issues).

Livestock production data includes cattle, sheep and pig meat and is a live- weight estimate derived from data on livestock numbers and slaughterings. Data is taken from ABARE, *Australian Commodity Statistics*, 2000 (and earlier issues) and ABS, *Australia and State Year Books*, 2001d (and earlier issues).

Fertiliser data is either the fertiliser used by state or, if this was unavailable, the fertiliser imported by state was used as a substitute. Estimates were used as necessary and reflected state production levels as a proportion of national totals. Data is taken from ABARE, *Australian Commodity Statistics*, 2000 (and earlier issues) and ABS, *Australia and State Year Books*, 2001d (and earlier issues).

Coal production data was taken from ABARE, *Australian Commodity Statistics*, 2000 (and earlier issues). State raw production figures were converted to net production figures by using the same proportion of Australian total raw and net coal production. No estimates were used in coal production.

Other minerals production data includes production of copper concentrates, mineral sands, lead concentrates, zinc concentrates, manganese, nickel, dolomite, gypsum, salt, silica, clays and limestone. State estimates have been made in proportion with total Australian production. Some Australian production estimates have been made based upon previous years' data. Data is taken from ABARE, *Australian Commodity Statistics*, 2000 (and earlier issues) and ABS, *Australia and State Year Books*, 2001d (and earlier issues).

Cement production figures were estimated at the state level by using a linear regression against state production of limestone. The regression was based on cement production figures from ABARE, *Australian Mineral Industry Annual Review*, 1987 (and earlier issues).

Timber production figures are estimates based on the volume of timber produced by state, supplied by ABARE, personal communications. The volume figures were converted to weight using a separate average density for both hard and soft woods.

Rail carriage data

Rail carriage figures are derived from government railways annual reports, ABS State Year Books, personal communications with Queensland Rail and personal communications with the Australasian Railways Association. South Australian and Tasmanian data is estimated from Australian National Rail total carriage figures.

The data used in the figures is supplied in the following tables.

TABLE VII.1 AUSTRALIA PRODUCTION

('000 tonnes)

Year	Grain	Other Agriculture	Livestock	Coal	Other Minerals	Fertilisers	Cement	Timber
1960–61	10 705	5 430	2 947	23 996	17 626	2 674	2 917	2 918
1961–62	9 133	6 337	3 186	25 320	18 447	2 800	2 839	2 733
1962–63	10 981	6 547	3 268	25 245	19 362	3 020	3 001	2 854
1963–64	11 544	6 988	3 387	27 415	21 266	3 352	3 386	3 018
1964–65	12 804	7 240	3 431	29 474	22 437	3 607	3 821	3 135
1965–66	9 445	7 591	3 466	33 144	23 534	3 839	3 762	3 070
1966–67	16 557	8 352	3 262	34 150	25 000	4 089	3 734	2 983
1967–68	9 577	8 576	3 505	36 493	28 239	4 198	3 881	3 025
1968–69	18 625	8 653	3 031	41 306	33 336	3 873	4 140	2 830
1969–70	14 226	8 403	3 301	45 865	38 911	4 013	4 499	2 935
1970–71	13 356	8 917	3 493	46 391	42 189	3 512	4 685	2 973
1971–72	14 266	9 645	3 921	50 328	42 529	3 395	4 884	2 984
1972–73	10 027	9 276	3 867	55 858	44 226	3 640	5 097	2 995
1973–74	15 786	8 504	3 187	55 904	48 278	4 152	5 412	3 065
1974–75	15 365	9 580	3 301	64 872	47 368	3 574	5 273	2 860
1975–76	17 487	9 248	4 429	63 286	49 391	2 692	5 100	2 727
1976–77	16 980	10 361	4 699	70 585	49 791	2 856	5 083	2 822
1977–78	14 058	10 305	4 889	72 074	49 018	2 929	5 016	2 725
1978–79	24 683	9 931	4 428	74 501	50 613	3 012	5 085	2 645
1979–80	22 369	10 525	3 825	74 843	52 859	3 273	5 201	2 848
1980–81	16 258	11 178	3 774	88 471	52 763	3 256	5 656	2 955
1981–82	22 938	11 609	3 771	92 073	51 361	3 270	6 070	2 796
1982–83	13 637	11 095	3 917	100 350	47 768	3 250	5 444	2 278
1983–84	31 309	11 179	3 167	106 296	48 622	3 115	5 072	2 468
1984–85	27 236	12 689	3 377	119 062	57 658	3 479	5 680	2 648
1985–86	24 144	12 391	3 650	135 161	57 025	3 256	6 160	2 625
1986–87	23 153	12 018	3 634	149 541	61 443	3 000	5 920	2 568
1987–88	19 466	12 669	3 704	137 159	62 117	3 631	6 158	2 688
1988–89	20 705	13 607	3 407	150 101	65 440	3 712	6 901	2 810
1989–90	21 056	13 989	3 826	161 125	68 322	3 594	7 075	2 682
1990–91	21 645	13 625	3 983	167 281	65 723	3 366	6 110	2 364
1991–92	18 488	13 025	4 019	177 286	64 284	2 496	5 731	2 459
1992–93	24 262	15 158	4 135	178 690	73 484	2 557	6 225	2 591
1993–94	26 372	15 971	4 112	178 730	69 395	2 710	6 733	2 849
1994–95	14 323	17 100	3 487	193 050	80 338	2 871	7 124	3 022
1995–96	26 100	17 664	3 654	195 180	79 556	3 083	6 397	2 829
1996–97	27 228	18 154	3 514	208 100	77 907	3 763	7 000	2 844
1997–98	27 393	18 391	4 545	222 920	79 910	4 061	7 000	2 932
1998–99	30 461	19 621	4 659	225 530	73 734	3 826	7 000	2 884
1999–00	33 672	19 831	4 665	234 850	75 524	3 904	7 000	2 884

Sources: BTRE estimates, ABARE Commodity Statistics (2000 and earlier issues), ABS State and National Year Books (2001 and earlier issues), ABARE pers. comms.

TABLE VII.2 AUSTRALIA RAIL CARRIAGE

('000 tonnes)

Year	Grain	Other Agriculture	Livestock	Coal	Other Minerals	Fertilisers	Cement	Timber	All Others	Total
1960–61	9 031	3 892	2 086	15 309	5 598	2 111	1 482	1624	15 071	56 205
1961–62	9 672	3 789	1 847	16 442	5 588	2 129	1 356	1385	14 281	56 489
1962–63	8 775	4 121	1 846	15 730	5 420	2 284	1 421	1432	15 771	56 801
1963–64	10 467	4 264	1 930	16 893	6 048	2 623	1 745	1603	17 183	62 756
1964–65	10 206	4 556	1 913	18 488	6 452	2 844	1 965	1651	17 804	65 879
1965–66	8 884	4 095	1 719	20 316	6 324	3 047	1 957	1566	17 540	65 449
1966–67	10 727	3 960	1 254	20 989	7 766	3 099	1 914	1484	18 110	69 303
1967–68	9 511	4 451	1 513	22 472	9 323	2 705	1 983	1496	18 385	71 840
1968–69	9 611	4 123	1 486	24 286	10 927	2 683	1 981	1371	20 267	76 736
1969–70	10 607	3 432	1 425	26 379	11 686	2 435	2 232	1475	22 697	82 368
1970–71	12 460	4 079	1 287	25 903	15 098	2 016	2 251	1418	22 661	87 173
1971–72	12 396	3 758	1 250	28 066	15 120	1 917	2 199	1334	22 563	88 603
1972–73	8 357	4 265	1 367	32 263	15 565	2 267	2 253	1343	22 672	90 352
1973–74	9 288	4 004	1 081	33 711	17 136	2 776	2 239	1252	23 297	94 784
1974–75	12 652	4 810	1 231	39 027	16 979	1 741	1 971	1168	21 964	101 543
1975–76	11 946	4 847	1 528	39 327	17 974	1 438	2 063	1139	22 415	102 677
1976–77	13 634	4 023	1 623	41 647	19 740	1 842	1 940	1043	22 781	108 273
1977–78	13 160	3 620	1 782	42 459	19 554	1 920	1 800	771	22 444	107 509
1978–79	12 258	3 605	1 509	45 544	20 155	2 025	1 870	813	23 306	111 085
1979–80	18 950	3 585	1 400	49 880	22 432	2 148	1 832	863	26 311	127 401
1980–81	15 112	3 131	1 160	55 830	22 396	1 883	1 998	818	24 614	126 942
1981–82	15 346	3 346	1 029	56 086	21 119	1 702	2 036	648	25 983	127 295
1982–83	11 160	3 032	975	63 442	19 701	1 316	1 700	551	22 235	124 112
1983–84	16 115	3 136	812	74 712	19 466	1 317	1 798	595	23 185	141 136
1984–85	20 705	2 825	689	85 890	22 136	1 317	1 899	535	24 165	160 161
1985–86	22 111	3 057	632	95 691	22 469	1 039	1 848	465	24 510	171 822
1986–87	17 447	3 181	545	100 822	22 371	950	1 708	548	21 927	169 499
1987–88	13 835	3 082	523	101 496	23 922	1 105	1 766	527	30 042	176 298
1988–89	12 178	3 408	318	102 541	24 460	1 013	1 908	426	32 308	178 560
1989–90	13 907	3 515	315	107 665	26 472	837	1 836	319	31 915	186 781
1990–91	13 355	3 584	372	113 800	24 623	487	1 802	268	31 467	189 758
1991–92	10 452	3 166	379	124 571	25 761	432	1 753	333	30 774	197 621
1992–93	11 940	4 387	432	126 254	26 350	354	1 622	269	30 741	202 349
1993–94	17 458	4 064	407	130 576	27 349	355	1 712	293	33 777	215 991
1994–95	10 940	3 759	329	138 968	23 966	366	1 982	274	39 108	219 692
1995–96	14 155	4 218	288	140 752	23 854	344	1 788	283	30 681	216 363
1996–97	23 476	4 097	271	154 005	27 754	304	1 623	282	23 409	235 221
1997–98	19 462	3 780	320	169 463	30 719	217	1 520	222	24 087	249 790
1998–99	21 590	3 593	355	181 326	34 545	223	1 571	214	19 425	262 842
1999–00	22 548	3 894	341	189 425	36 242	206	1 541	215	22 906	277 318

Sources: BTRE estimates, ABS State and National Year Books (2001 and earlier issues), SRA, V/Line, Westrail, NR, FreightCorp and QR Annual Reports (2000–01 and earlier issues), ARA pers. comms.

TABLE VII.3 NEW SOUTH WALES PRODUCTION

('000 tonnes)

Year	Grain	Other Agriculture	Livestock	Coal	Other Minerals	Fertilisers	Cement	Timber
1960–61	2 879	912	694	17 294	5 548	550	746	825
1961–62	2 566	1 023	690	17 945	5 526	560	712	746
1962–63	3 491	1 047	552	17 636	5 620	610	732	791
1963–64	3 905	1 115	583	18 818	6 005	660	826	877
1964–65	4 776	1 084	594	20 275	6 304	660	937	938
1965–66	1 440	1 076	486	23 178	6 330	640	922	909
1966–67	6 632	1 176	444	23 918	6 506	640	904	894
1967–68	2 742	1 204	488	25 443	6 872	700	924	928
1968–69	6 792	1 177	511	28 609	8 501	530	970	840
1969–70	5 325	1 208	581	31 037	8 843	530	1 046	905
1970–71	4 488	1 281	614	30 351	8 913	354	1 099	874
1971–72	3 462	1 330	665	30 781	9 055	338	1 166	958
1972–73	2 855	1 265	577	31 621	9 128	333	1 231	970
1973–74	5 179	1 374	557	30 112	9 286	385	1 326	955
1974–75	4 927	1 460	345	34 499	8 739	309	1 282	939
1975–76	5 804	1 420	768	32 801	8 518	330	1 163	858
1976–77	6 597	1 531	834	37 849	7 903	271	1 028	894
1977–78	5 262	1 535	897	39 841	7 704	316	1 138	931
1978–79	8 373	1 856	833	40 329	7 725	312	1 152	898
1979–80	7 401	1 849	701	39 740	9 323	343	1 284	972
1980–81	3 781	1 862	635	47 966	9 258	323	1 422	982
1981–82	7 802	2 082	567	49 437	9 471	371	1 361	934
1982–83	2 952	1 740	607	55 828	7 671	392	1 168	743
1983–84	11 567	2 026	519	54 251	7 495	418	1 175	805
1984–85	7 515	2 656	502	57 064	8 268	471	1 304	860
1985–86	7 664	2 491	568	63 363	7 842	628	1 348	855
1986–87	6 623	2 302	626	72 160	8 760	611	1 324	853
1987–88	6 001	2 541	677	62 016	8 151	735	1 405	855
1988–89	6 079	2 643	638	65 948	7 906	420	1 579	895
1989–90	5 040	2 719	741	76 506	8 559	414	1 659	911
1990–91	5 766	2 897	754	78 683	7 839	657	1 355	831
1991–92	4 028	3 149	774	81 896	8 008	286	1 254	779
1992–93	6 342	3 250	761	82 320	8 171	295	1 346	754
1993–94	7 337	3 363	793	81 926	8 389	310	1 469	768
1994–95	1 855	3 262	754	87 393	9 214	353	1 593	767
1995–96	6 954	3 615	753	90 525	8 432	380	1 424	707
1996–97	6 079	4 105	757	98 200	8 833	457	1 522	770
1997–98	8 302	4 155	778	106 943	8 741	521	1 535	716
1998–99	9 624	4 606	780	103 990	9 071	481	1 572	670
1999–00	11 041	4 404	781	105 192	9 134	541	1 571	670

Sources: BTRE estimates, ABARE Commodity Statistics (2000 and earlier issues), ABS NSW Year Books (2001 and earlier issues), ABARE pers. comms.

TABLE VII.4 NEW SOUTH WALES RAIL CARRIAGE

('000 tonnes)

Year	Grain	Other Agriculture	Livestock	Coal	Other Minerals	Fertilisers	Cement	Timber	All Others	Total
1960–61	2 601	840	648	10 137	2 525	496	611	332	6 301	24 491
1961–62	2 734	855	560	10 671	2 303	411	486	292	6 124	24 436
1962–63	2 806	826	518	9 710	2 069	439	505	275	6 872	24 020
1963–64	3 460	916	562	9 984	2 326	546	688	317	7 429	26 228
1964–65	3 750	1 005	574	10 998	2 655	604	733	362	7 654	28 335
1965–66	2 132	822	443	12 342	2 680	618	697	332	7 370	27 436
1966–67	3 209	791	290	13 425	2 799	555	636	311	7 726	29 742
1967–68	3 491	834	375	14 566	2 830	510	582	282	7 767	31 237
1968–69	3 419	816	355	15 311	2 854	483	528	267	8 347	32 380
1969–70	3 834	950	262	15 631	3 149	402	655	339	8 755	33 977
1970–71	3 935	1039	199	14 892	3 354	285	690	301	9 040	33 735
1971–72	3 693	902	174	13 989	3 429	248	657	262	8 954	32 308
1972–73	1 992	762	261	13 506	3 914	122	754	231	9 502	31 044
1973–74	2 632	714	150	14 156	3 951	356	615	212	9 865	32 651
1974–75	3 620	1 056	166	15 846	3 530	236	444	176	8 402	33 476
1975–76	3 900	925	212	14 557	2 908	187	556	135	7 854	31 234
1976–77	5 217	925	181	16 126	2 999	191	444	104	7 590	33 777
1977–78	5 126	1 116	205	16 408	2 643	279	401	100	7 156	33 434
1978–79	3 260	1 208	160	17 913	2 939	271	425	94	7 212	33 482
1979–80	6 056	1 223	119	20 068	3 476	304	483	95	7 861	39 685
1980–81	5 513	785	113	22 259	3 819	161	521	83	7 186	40 440
1981–82	5 311	769	116	22 618	3 552	120	559	74	7 274	40 393
1982–83	3 106	785	170	27 910	3 031	69	452	56	6 111	41 690
1983–84	5 357	785	116	29 959	3 091	8	489	51	6 156	46 012
1984–85	6 630	724	76	29 825	3 762	92	458	55	6 288	47 910
1985–86	7 779	804	76	33 339	3 768	55	492	61	7 429	53 803
1986–87	5 415	952	35	36 135	3 932	35	463	18	3 106	50 091
1987–88	4 912	1 188	25	36 130	3 975	26	525	9	7 622	54 412
1988–89	3 300	1 358	14	32 700	4 075	17	579	0	8 157	50 200
1989–90	4 500	1 453	4	35 775	4 525	14	560	0	6 869	53 700
1990–91	3 900	1 576	0	41 000	3 359	10	541	0	7 884	58 270
1991–92	2 300	1 578	0	43 100	3 278	7	522	0	7 555	58 340
1992–93	3 300	2 141	0	45 100	3 298	2	502	0	7 257	61 600
1993–94	4 600	1 772	0	47 600	3 278	2	522	0	7 726	65 500
1994–95	2 100	1 764	0	49 300	3 359	3	541	0	8 133	65 200
1995–96	3 800	1 726	0	52 300	2 940	4	560	0	2 470	63 800
1996–97	7 800	1 500	0	58 700	3 100	4	500	0	996	72 600
1997–98	6 800	1 200	0	69 100	4 000	4	500	0	496	82 100
1998–99	6 300	1 200	0	72 500	4 000	4	500	0	996	85 500
1999–00	7 200	1 200	0	70 700	4 000	4	500	0	1 896	85 500

Sources: BTRE estimates, ABS NSW Year Books (2001 and earlier issues), SRA and FreightCorp Annual Reports (2000–01 and earlier issues), ARA pers. comms.

TABLE VII.5 QUEENSLAND PRODUCTION

('000 tonnes)

Year	Grain	Other Agriculture	Livestock	Coal	Other Minerals	Fertilisers	Cement	Timber
1960–61	656	2 625	861	2 878	2 137	110	724	501
1961–62	763	3 157	953	3 211	2 223	129	690	427
1962–63	978	3 366	1 035	3 225	2 365	139	710	425
1963–64	1 037	3 589	1 071	4 119	2 526	187	802	441
1964–65	1 096	3 773	1 076	4 447	2 623	203	909	462
1965–66	959	4 075	1 161	5 072	2 714	219	895	442
1966–67	1 710	4 568	1 033	5 443	2 935	247	877	398
1967–68	1 330	4 919	1 123	6 403	3 305	269	896	413
1968–69	1 709	4 904	786	8 164	2 913	270	940	338
1969–70	1 063	4 322	743	10 237	3 376	286	1 015	391
1970–71	1 099	4 851	709	12 168	3 722	282	1 066	441
1971–72	1 919	5 462	775	15 832	3 887	324	1 131	402
1972–73	1 185	5 417	846	20 669	4 423	333	1 194	338
1973–74	1 482	4 776	697	22 319	4 905	360	1 287	426
1974–75	1 723	5 409	797	26 174	4 996	352	1 244	336
1975–76	2 080	5 330	971	26 183	4 866	347	1 094	338
1976–77	1 892	6 332	1 086	28 037	4 989	385	1 161	343
1977–78	1 374	6 372	1 199	27 618	4 811	378	960	359
1978–79	2 947	5 408	1 249	29 744	5 209	350	1 228	386
1979–80	2 011	5 781	1 005	29 803	5 501	350	987	388
1980–81	1 837	6 453	842	35 186	5 121	349	987	425
1981–82	3 021	6 597	1 003	37 305	5 252	342	1 278	375
1982–83	1 876	6 620	952	38 821	5 195	438	1 133	288
1983–84	4 045	6 224	927	46 643	5 253	320	1 140	292
1984–85	3 547	6 838	899	56 396	5 604	325	1 265	322
1985–86	3 812	6 688	950	65 677	5 764	304	1 308	312
1986–87	2 302	6 538	1 040	71 002	5 891	294	1 284	334
1987–88	2 388	6 875	1 048	68 797	6 604	360	1 362	385
1988–89	3 053	7 668	924	77 479	7 247	348	1 532	439
1989–90	2 448	7 750	984	77 655	7 836	342	1 609	417
1990–91	3 014	7 227	1 075	81 099	8 005	419	1 315	415
1991–92	1 605	6 303	1 192	87 683	7 817	381	1 217	486
1992–93	1 385	8 466	1 184	88 735	8 687	381	1 305	488
1993–94	1 765	8 892	1 139	89 295	8 896	407	1 425	553
1994–95	1 297	10 318	1 022	97 278	10 854	292	1 545	538
1995–96	1 951	10 738	977	96 801	9 223	409	1 382	476
1996–97	3 697	10 778	1 039	102 361	7 429	487	1 477	501
1997–98	2 395	10 711	1 228	108 180	7 628	504	1 489	569
1998–99	3 739	10 909	1 266	113 813	7 884	470	1 524	565
1999–00	3 679	10 914	1 267	121 945	8 019	547	1 524	565

Sources: BTRE estimates, ABARE Commodity Statistics (2000 and earlier issues), ABS Queensland Year Books (2001 and earlier issues), ABARE pers. comms.

TABLE VII.6 QUEENSLAND RAIL CARRIAGE

('000 tonnes)

Year	Grain	Other Agriculture	Livestock	Coal	Other Minerals	Fertilisers	Cement	Timber	All Others	Total
1960–61	453	2 207	729	1 568	1 341	67	103	269	1 478	8 215
1961–62	527	2 084	682	1 846	1 531	72	109	198	1 356	8 405
1962–63	675	2 484	681	1 839	1 466	77	115	187	1 461	8 985
1963–64	716	2 473	731	2 574	1 485	82	121	219	1 683	10 084
1964–65	757	2 666	678	2 866	1 269	87	127	147	1 717	10 314
1965–66	662	2 491	761	3 383	947	92	133	143	1 737	10 349
1966–67	1 180	2 335	581	3 164	844	97	139	132	1 917	10 389
1967–68	918	2 820	585	3 860	827	102	145	135	1 964	11 356
1968–69	1 180	2 514	570	5 389	957	106	133	121	2 265	13 235
1969–70	754	1 703	560	7 209	1 148	118	167	124	2 945	14 728
1970–71	806	2 266	547	8 089	1 222	112	195	147	2 342	15 726
1971–72	1 177	2 118	561	11 314	1 040	118	207	144	2 663	19 342
1972–73	1 064	2 871	602	16 090	1 274	147	214	171	2 233	24 666
1973–74	902	2 628	504	17 064	2 455	120	226	112	1 390	25 401
1974–75	1 290	3 073	580	19 831	2 831	178	228	112	2 085	30 208
1975–76	604	3 206	705	21 271	3 848	131	212	134	3 007	33 118
1976–77	1 657	2 423	761	21 769	4 244	173	161	116	2 933	34 237
1977–78	1 126	1 959	921	22 445	4 566	168	150	95	2 725	34 155
1978–79	1 816	1 816	860	24 121	4 179	122	139	113	3 376	36 542
1979–80	2 022	1 874	844	25 637	4 440	179	158	115	3 171	38 440
1980–81	1 268	1 845	619	29 742	4 356	157	182	113	3 222	41 504
1981–82	2 042	2 092	655	30 067	4 740	135	205	102	3 621	43 659
1982–83	1 350	1 847	577	32 130	4 321	94	162	61	3 164	43 706
1983–84	2 260	2 005	567	41 257	3 545	122	182	70	3 105	53 113
1984–85	2 817	1 776	516	52 378	4 188	97	179	61	3 440	65 452
1985–86	3 488	1 973	478	59 008	4 748	99	178	59	3 568	73 599
1986–87	2 492	1 944	486	61 311	4 353	100	177	55	4 251	75 169
1987–88	1 452	1 773	465	62 025	4 442	111	223	17	4 385	74 893
1988–89	2 018	1 935	299	66 018	4 568	96	266	12	5 296	80 508
1989–90	1 913	1 958	285	67 778	4 754	86	226	9	5 534	82 543
1990–91	1 917	1 910	348	68 375	4 681	62	227	33	5 412	82 965
1991–92	1 064	1 444	365	76 708	4 994	56	221	45	5 761	90 658
1992–93	890	2 179	419	76 578	4 870	54	182	61	5 070	90 303
1993–94	1 093	2 250	394	78 759	4 820	63	213	48	4 452	92 092
1994–95	730	1 888	316	85 196	4 312	89	288	40	3 948	96 807
1995–96	1 031	2 353	288	84 232	4 435	82	258	37	3 404	96 120
1996–97	2 485	2 480	271	91 036	4 847	73	262	36	3 473	104 963
1997–98	1 755	2 463	320	96 008	5 569	55	185	39	3 992	110 386
1998–99	1 770	2 276	355	104 507	7 395	60	256	31	3 837	120 487
1999–00	2 189	2 577	341	114 416	7 545	42	226	32	4 169	131 537

Sources: BTRE estimates, ABS Queensland Year Books (2001 and earlier issues), QR Annual Reports (2000–01 and earlier issues), QR pers. comms.

TABLE VII.7 VICTORIA PRODUCTION

('000 tonnes)

Year	Grain	Other Agriculture	Livestock	Coal	Other Minerals	Fertilisers	Cement	Timber
1960–61	2 394	966	855	1 893	2 363	760	754	719
1961–62	1 955	1 095	1 011	1 886	2 351	794	719	675
1962–63	2 469	1 090	1 116	1 891	2 010	839	739	715
1963–64	2 535	1 153	1 171	1 971	2 196	1 150	835	717
1964–65	2 635	1 201	1 216	1 971	2 272	1 200	947	731
1965–66	2 048	1 271	1 231	1 957	2 355	1 250	931	713
1966–67	2 620	1 315	1 182	1 888	2 616	1 300	913	713
1967–68	957	1 216	1 269	1 806	3 499	1 200	933	692
1968–69	3 248	1 229	1 071	1 508	4 106	969	979	702
1969–70	3 004	1 499	1 188	1 569	4 058	1 024	1 057	689
1970–71	1 791	1 386	1 398	1 391	4 430	1 021	1 110	699
1971–72	2 643	1 466	1 599	1 308	4 564	921	1 177	693
1972–73	1 700	1 235	1 545	1 228	4 642	1 014	1 243	711
1973–74	2 011	1 087	1 181	1 164	5 291	1 109	1 340	734
1974–75	2 598	1 287	1 322	1 092	4 816	877	1 295	691
1975–76	2 309	1 095	1 666	956	4 996	546	1 283	695
1976–77	2 493	1 099	1 735	1 035	4 582	644	1 353	725
1977–78	2 127	1 030	1 810	1 064	4 827	685	1 380	621
1978–79	3 965	1 204	1 451	1 131	3 952	753	1 163	612
1979–80	4 137	1 381	1 250	1 253	4 041	815	1 312	663
1980–81	3 281	1 318	1 376	1 081	4 274	813	1 458	691
1981–82	3 235	1 337	1 305	993	4 162	845	1 391	670
1982–83	568	1 218	1 397	760	3 870	699	1 343	584
1983–84	5 224	1 324	930	746	4 064	718	1 187	667
1984–85	3 654	1 432	1 156	802	4 672	879	1 317	741
1985–86	3 127	1 457	1 246	851	4 511	821	1 362	735
1986–87	3 680	1 413	1 091	811	4 794	796	1 337	682
1987–88	2 781	1 411	1 052	809	4 969	917	1 419	722
1988–89	2 567	1 454	986	751	5 134	940	1 595	661
1989–90	2 989	1 488	1 076	715	4 979	925	1 675	623
1990–91	2 448	1 538	1 150	721	4 188	774	1 369	476
1991–92	2 351	1 613	1 089	616	5 149	640	1 267	526
1992–93	3 923	1 416	1 140	700	6 222	660	1 359	593
1993–94	4 121	1 534	1 120	750	6 352	693	1 484	663
1994–95	1 606	1 409	722	700	6 194	789	1 609	809
1995–96	3 666	1 047	1 011	650	6 434	848	1 439	737
1996–97	3 895	1 028	745	600	6 148	1 187	1 538	753
1997–98	2 816	1 071	1 521	550	6 150	1 399	1 550	782
1998–99	3 033	1 203	1 563	500	6 150	1 275	1 587	765
1999–00	4 064	1 293	1 566	450	6 153	1 201	1 587	765

Sources: BTRE estimates, ABARE Commodity Statistics (2000 and earlier issues), ABS Victoria Year Books (2001 and earlier issues), ABARE pers. comms.

TABLE VII.8 VICTORIA RAIL CARRIAGE

('000 tonnes)

Year	Grain	Other Agriculture	Livestock	Coal	Other Minerals	Fertilisers	Cement	Timber	All Others	Total
1960–61	2 813	524	296	1 893	127	723	499	346	3 930	11 151
1961–62	2 793	513	268	1 886	106	763	480	293	3 414	10 516
1962–63	2 747	494	298	1 891	113	831	476	336	3 829	11 015
1963–64	3 305	535	317	1 971	114	966	582	353	4 182	12 325
1964–65	3 215	562	365	1 971	138	1 094	742	408	4 302	12 797
1965–66	2 890	489	243	1 957	140	1 172	795	402	4 262	12 350
1966–67	2 751	507	161	1 888	153	1 190	820	382	4 415	12 267
1967–68	2 061	482	340	1 806	155	891	778	369	4 410	11 292
1968–69	2 444	434	282	1 324	177	928	777	330	4 799	11 495
1969–70	2 321	422	299	1 418	145	897	866	351	5 305	12 024
1970–71	3 356	461	246	1 262	123	835	858	335	5 214	12 690
1971–72	2 855	460	272	1 174	160	755	855	309	4 954	11 794
1972–73	2 234	380	258	1 112	273	868	923	297	5 130	11 475
1973–74	2 068	379	212	1 036	376	908	918	276	5 197	11 370
1974–75	2 660	380	255	986	334	470	852	242	4 878	11 057
1975–76	2 597	435	356	758	319	394	822	261	4 861	10 803
1976–77	2 456	435	310	837	512	593	903	247	4 681	10 974
1977–78	2 927	354	277	740	758	616	803	189	4 456	11 120
1978–79	2 884	348	162	783	745	672	774	180	4 643	11 191
1979–80	5 062	311	128	867	867	631	718	187	5 524	14 295
1980–81	4 257	268	105	628	908	618	789	177	4 971	12 721
1981–82	3 500	268	52	487	913	557	718	149	4 976	11 620
1982–83	1 441	277	69	430	767	419	689	129	4 349	8 570
1983–84	3 156	218	24	412	754	408	657	128	4 729	10 486
1984–85	4 250	187	13	398	949	352	758	120	4 845	11 872
1985–86	3 426	161	11	388	920	261	714	93	4 538	10 512
1986–87	3 466	193	7	344	880	229	665	76	4 714	10 574
1987–88	2 822	45	0	353	935	245	593	50	5 858	10 901
1988–89	1 510	17	0	302	1 003	201	632	40	6 245	9 950
1989–90	2 164	0	0	303	1 024	120	628	30	5 981	10 250
1990–91	1 990	0	0	320	758	75	563	20	5 933	9 659
1991–92	1 188	0	0	333	620	39	491	10	5 811	8 492
1992–93	2 017	0	0	279	676	23	368	0	6 283	9 646
1993–94	3 946	0	0	228	622	38	440	0	6 653	11 927
1994–95	2 760	0	0	152	618	36	545	0	6 165	10 276
1995–96	1 195	0	0	140	330	34	431	0	4 747	6 877
1996–97	4 541	0	0	120	680	35	346	0	1 156	6 878
1997–98	2 597	0	0	100	800	36	220	0	3 126	6 879
1998–99	4 300	0	0	80	1 000	37	200	0	1 263	6 880
1999–00	4 200	0	0	60	1 000	38	200	0	1 383	6 881

Sources: BTRE estimates, ABS Victoria Year Books (2001 and earlier issues), V/Line Annual Reports (2000–01 and earlier issues), ARA pers. comms.

TABLE VII.9 WESTERN AUSTRALIA PRODUCTION

('000 tonnes)

Year	Grain	Other Agriculture	Livestock	Coal	Other Minerals	Fertilisers	Cement	Timber
1960–61	2 328	237	230	703	1 616	733	179	343
1961–62	2 331	227	240	879	1 720	763	176	339
1962–63	2 447	249	248	880	1 566	829	178	326
1963–64	1 843	249	250	851	1 918	735	206	356
1964–65	2 055	283	232	888	2 406	861	253	367
1965–66	3 349	300	258	985	3 000	992	266	363
1966–67	3 362	340	260	988	3 527	1 118	288	350
1967–68	3 428	351	281	962	4 366	1 244	322	390
1968–69	3 685	415	330	994	5 302	1 350	371	376
1969–70	2 369	372	383	1 028	7 963	1 417	447	364
1970–71	4 246	383	326	1 003	10 640	1 161	480	347
1971–72	3 579	412	414	1 008	11 287	1 139	509	316
1972–73	2 855	365	424	941	12 021	1 249	515	332
1973–74	5 220	355	367	986	13 914	1 425	505	340
1974–75	3 806	392	402	1 533	15 314	1 289	537	321
1975–76	5 013	392	534	1 729	17 873	989	574	315
1976–77	4 149	375	536	1 925	19 520	1 033	504	327
1977–78	4 112	337	447	1 958	20 277	1 097	535	308
1978–79	5 670	375	420	1 924	23 017	1 064	561	274
1979–80	4 770	398	414	2 472	22 891	1 199	546	311
1980–81	4 203	411	441	2 567	23 018	1 226	652	309
1981–82	5 822	421	405	2 826	21 379	1 223	852	309
1982–83	6 784	424	411	3 277	20 354	1 228	600	229
1983–84	5 571	414	358	3 205	22 411	1 167	539	244
1984–85	8 471	520	367	2 974	28 854	1 196	670	274
1985–86	5 729	498	365	3 078	28 515	1 050	892	293
1986–87	6 407	517	375	3 082	31 277	876	754	277
1987–88	5 020	525	395	3 000	31 204	1 132	698	283
1988–89	6 415	556	349	3 157	33 356	1 344	816	308
1989–90	5 963	611	447	3 365	34 308	1 274	781	273
1990–91	6 695	641	456	4 239	35 007	1 010	767	214
1991–92	6 255	594	391	4 436	31 829	767	799	224
1992–93	7 854	593	456	4 320	38 216	797	848	254
1993–94	8 603	612	438	4 139	32 597	866	879	308
1994–95	6 791	524	387	4 719	39 599	915	927	321
1995–96	8 736	632	370	4 779	42 048	912	1 028	321
1996–97	9 866	612	442	4 438	41 253	1 031	953	312
1997–98	10 353	798	466	4 629	43 252	1 027	984	324
1998–99	10 042	1 115	481	4 543	34 587	1 084	939	345
1999–00	10 753	1 414	482	4 566	36 418	1 099	940	345

Sources: BTRE estimates, ABARE Commodity Statistics (2000 and earlier issues), ABS Western Australia Year Books (2001 and earlier issues), ABARE pers. comms.

TABLE VII.10 WESTERN AUSTRALIA RAIL CARRIAGE

('000 tonnes)

Year	Grain	Other Agriculture	Livestock	Coal	Other Minerals	Fertilisers	Cement	Timber	All Others	Total
1960–61	2 035	224	143	491	310	451	0	336	921	4 911
1961–62	2 290	221	128	659	412	490	0	324	904	5 428
1962–63	1 733	214	127	693	351	508	0	307	937	4 870
1963–64	1 705	225	117	716	637	530	0	349	992	5 271
1964–65	1 370	230	102	770	882	548	0	335	1 076	5 313
1965–66	2 287	218	109	689	1 120	596	0	334	1 133	6 486
1966–67	2 643	263	98	600	2 300	675	0	320	1 100	7 999
1967–68	2 539	270	89	365	3 534	714	0	339	1 203	9 053
1968–69	1 813	303	89	233	4 422	678	0	338	1 201	9 077
1969–70	2 469	277	85	137	5 523	569	0	338	1 438	10 836
1970–71	3 065	267	71	189	7 591	421	0	297	1 556	13 457
1971–72	3 435	234	81	194	7 667	423	0	281	1 552	13 867
1972–73	2 361	206	84	163	8 330	586	0	284	1 692	13 706
1973–74	2 669	239	66	134	8 506	797	90	298	2 040	14 839
1974–75	3 664	260	67	808	8 290	501	125	293	2 145	16 153
1975–76	3 873	235	55	1 140	9 155	472	130	278	2 309	17 647
1976–77	3 454	191	71	1 179	10 247	525	92	271	2 973	19 003
1977–78	3 381	191	28	1 285	9 904	453	98	221	3 064	18 625
1978–79	3 108	178	17	1 399	10 680	476	68	210	3 152	19 288
1979–80	3 534	177	19	1 775	11 722	517	75	228	3 341	21 388
1980–81	2 529	162	15	1 623	11 696	513	79	151	3 503	20 271
1981–82	3 642	154	6	1 519	10 510	515	74	188	3 168	19 776
1982–83	4 698	123	4	1 489	9 864	440	34	189	2 950	19 791
1983–84	3 599	93	3	1 777	10 379	438	33	134	3 414	19 870
1984–85	5 216	105	2	1 576	11 057	467	31	165	3 466	22 085
1985–86	5 700	91	1	870	10 836	393	30	143	2 813	20 877
1986–87	4 711	72	1	764	11 447	405	27	220	3 616	21 263
1987–88	3 300	76	0	600	12 368	479	25	200	3 913	20 961
1988–89	4 500	97	0	950	12 979	520	23	200	3 909	23 178
1989–90	4 100	104	0	1 100	13 947	450	22	80	5 103	24 906
1990–91	4 000	98	0	1 800	13 791	190	21	100	4 410	24 410
1991–92	4 600	144	0	2 000	14 794	200	19	100	4 033	25 890
1992–93	4 500	67	0	1 900	15 800	152	18	104	3 983	26 524
1993–94	6 030	40	0	1 700	16 029	142	17	47	3 721	27 726
1994–95	4 500	70	0	2 000	13 413	132	16	71	9 114	29 317
1995–96	7 159	117	0	2 034	14 220	122	15	83	7 331	31 081
1996–97	7 159	117	0	2 000	17 000	122	15	83	5 212	31 708
1997–98	6 310	117	0	2 000	18 000	122	15	83	6 178	32 825
1998–99	7 320	117	0	2 000	19 600	122	15	83	3 818	33 075
1999–00	7 159	117	0	2 000	19 747	122	15	83	4 757	34 000

Sources: BTRE estimates, ABS Western Australia Year Books (2001 and earlier issues), WestRail Annual Reports (1998–99 and earlier issues), ARA pers. comms.

TABLE VII.11 SOUTH AUSTRALIA PRODUCTION

('000 tonnes)

Year	Grain	Other Agriculture	Livestock	Coal	Other Minerals	Fertilisers	Cement	Timber
1960–61	2 429	476	225	956	5 356	412	373	151
1961–62	1 484	561	201	1 157	5 966	439	396	203
1962–63	1 556	545	221	1 390	7 050	475	472	230
1963–64	2 187	561	211	1 492	7 788	473	529	232
1964–65	2 211	631	215	1 775	7 946	537	571	227
1965–66	1 611	561	230	1 861	8 171	571	549	227
1966–67	2 188	664	239	1 841	8 327	608	552	219
1967–68	1 073	583	243	1 799	8 845	610	580	203
1968–69	3 149	643	220	1 934	10 408	590	617	177
1969–70	2 422	732	283	1 889	11 609	600	666	181
1970–71	1 685	740	320	1 377	11 510	547	670	204
1971–72	2 620	712	332	1 299	10 488	539	627	209
1972–73	1 398	708	328	1 292	10 459	554	615	229
1973–74	1 858	656	262	1 225	11 437	693	645	191
1974–75	2 277	759	303	1 460	10 387	622	617	180
1975–76	2 258	751	335	1 471	9 944	415	662	181
1976–77	1 811	753	362	1 577	9 366	440	700	193
1977–78	1 158	773	382	1 440	8 355	351	667	196
1978–79	3 686	787	350	1 173	7 186	409	648	175
1979–80	4 021	816	348	1 403	7 652	423	745	197
1980–81	3 124	813	367	1 424	7 696	399	725	208
1981–82	3 020	848	366	1 190	7 702	362	768	211
1982–83	1 425	749	414	1 200	7 150	372	845	228
1983–84	4 840	825	323	1 085	6 090	360	685	197
1984–85	3 999	875	347	1 426	6 701	472	719	165
1985–86	3 763	904	362	1 781	6 880	326	825	157
1986–87	4 102	872	379	1 981	7 467	322	813	155
1987–88	3 233	905	400	2 049	7 591	345	846	174
1988–89	2 564	861	394	2 240	7 954	516	887	203
1989–90	4 581	943	441	2 396	8 677	496	854	158
1990–91	3 675	922	422	2 059	7 420	387	829	166
1991–92	4 195	953	446	2 218	8 258	323	785	188
1992–93	4 700	1 004	467	2 232	8 886	323	962	219
1993–94	4 486	1 030	490	2 162	9 379	327	1 063	253
1994–95	2 733	1 115	459	2 465	9 540	423	1 023	272
1995–96	4 733	1 158	419	1 961	8 416	428	719	286
1996–97	3 640	1 153	397	2 056	9 089	477	1 098	230
1997–98	3 479	1 181	398	2 155	8 897	412	1 020	250
1998–99	3 977	1 314	410	2 216	10 685	410	974	259
1999–00	4 087	1 331	411	2 227	10 686	379	974	259

Sources: BTRE estimates, ABARE Commodity Statistics (2000 and earlier issues), ABS South Australia Year Books (2001 and earlier issues), ABARE pers. comms.

TABLE VII.12 SOUTH AUSTRALIA RAIL CARRIAGE

('000 tonnes)

Year	Grain	Other Agriculture	Livestock	Coal	Other Minerals	Fertilisers	Cement	Timber	All Others	Total
1960–61	1 129	45	214	956	1 290	269	146	0	1 863	5 913
1961–62	1 328	45	179	1 157	1 195	283	149	0	1 929	6 265
1962–63	814	44	181	1 390	1 389	304	160	0	2 147	6 429
1963–64	1 281	45	152	1 492	1 431	357	167	0	2 388	7 314
1964–65	1 114	36	142	1 775	1 403	371	170	0	2 543	7 554
1965–66	913	29	118	1 861	1 330	409	162	0	2 548	7 370
1966–67	944	23	87	1 841	1 487	412	159	0	2 514	7 467
1967–68	502	18	92	1 799	1 446	338	268	0	2 423	6 886
1968–69	755	21	119	1 934	1 532	338	284	0	2 720	7 703
1969–70	1 229	28	172	1 889	1 675	311	284	0	2 953	8 541
1970–71	1 298	23	161	1 377	1 650	251	275	0	3 082	8 118
1971–72	1 236	22	139	1 299	1 790	258	269	0	2 967	7 980
1972–73	706	25	149	1 292	1 676	444	147	0	3 471	7 910
1973–74	1 017	27	141	1 225	1 806	488	145	0	3 849	8 698
1974–75	1 418	27	160	1 460	1 934	289	144	0	3 489	8 921
1975–76	972	33	199	1 471	1 707	208	138	0	3 542	8 270
1976–77	850	34	298	1 577	1 716	298	147	0	3 832	8 752
1977–78	600	0	350	1 440	1 377	332	184	0	4 119	8 402
1978–79	1 190	55	310	1 153	1 320	393	178	0	3 970	8 569
1979–80	2 276	0	290	1 364	1 577	406	178	0	5 147	11 238
1980–81	1 545	71	308	1 382	1 561	361	138	0	4 407	9 773
1981–82	851	63	200	1 134	1 149	305	194	0	5 692	9 588
1982–83	565	0	155	1 173	1 689	219	140	0	4 403	8 344
1983–84	1 743	35	102	1 030	1 662	265	195	0	4 476	9 508
1984–85	1 792	33	82	1 402	1 794	232	216	0	4 765	10 316
1985–86	1 718	28	66	1 745	2 157	164	170	0	4 806	10 854
1986–87	1 363	20	16	1 903	1 715	124	155	0	4 896	10 192
1987–88	1 349	0	33	2 013	2 141	183	150	0	6 903	12 772
1988–89	850	1	5	2 195	1 779	106	112	0	7 385	12 433
1989–90	1 230	0	26	2 340	2 158	76	154	0	7 373	13 357
1990–91	1 548	0	24	2 009	1 948	69	240	0	6 862	12 700
1991–92	1 300	0	14	2 145	2 019	47	254	0	6 864	12 643
1992–93	1 233	0	13	2 136	1 647	34	224	0	7 333	12 620
1993–94	1 789	2	13	1 982	2 518	8	200	0	10 292	16 804
1994–95	850	37	13	2 088	1 910	20	292	0	10 745	15 955
1995–96	970	23	0	1 842	1 302	32	224	0	11 711	16 104
1996–97	1 491	0	0	1 945	1 500	0	200	0	11 555	16 691
1997–98	2 000	0	0	1 955	1 700	0	280	0	8 465	14 400
1998–99	1 900	0	0	1 939	1 900	0	280	0	7 381	13 400
1999–00	1 800	0	0	1 949	3 300	0	280	0	8 571	15 900

Sources: BTRE estimates, ABS South Australia Year Books (2001 and earlier issues), ANR Annual Reports (1998–99 and earlier issues), ARA pers. comms.

TABLE VII.13 TASMANIAN RAIL CARRIAGE

('000 tonnes)

Year	Grain	Other Agriculture	Livestock	Coal	Other Minerals	Fertilisers	Cement	Timber
1960–61	19	216	82	272	606	109	140	379
1961–62	34	274	91	241	661	115	146	343
1962–63	40	250	96	222	750	129	170	368
1963–64	37	320	102	165	835	147	188	395
1964–65	31	268	99	119	886	146	203	410
1965–66	38	309	101	91	964	167	198	417
1966–67	45	289	104	72	1 089	176	199	410
1967–68	47	303	101	80	1 351	176	227	399
1968–69	42	285	113	98	2 106	164	262	398
1969–70	43	270	122	105	3 061	156	268	405
1970–71	47	276	125	102	2 974	147	259	408
1971–72	43	263	136	100	3 247	134	275	406
1972–73	34	286	146	106	3 552	157	298	415
1973–74	36	256	124	99	3 445	180	309	419
1974–75	34	272	133	114	3 116	125	298	394
1975–76	23	259	154	145	3 195	66	324	340
1976–77	38	271	147	162	3 430	85	337	341
1977–78	25	259	154	154	3 044	102	336	310
1978–79	42	301	125	200	3 523	124	334	300
1979–80	29	300	107	171	3 452	143	326	318
1980–81	32	321	114	247	3 397	147	411	340
1981–82	38	324	124	322	3 393	127	420	297
1982–83	32	344	136	463	3 529	121	356	207
1983–84	62	365	109	367	3 308	133	346	264
1984–85	50	368	107	399	3 559	135	406	285
1985–86	49	353	160	410	3 513	126	426	273
1986–87	39	376	124	505	3 254	101	408	267
1987–88	43	412	132	488	3 598	141	428	270
1988–89	27	425	116	527	3 844	145	492	304
1989–90	35	479	137	489	3 963	142	497	300
1990–91	47	399	126	480	3 264	119	475	260
1991–92	54	414	126	437	3 223	98	409	256
1992–93	58	429	127	384	3 303	102	405	283
1993–94	60	541	133	458	3 783	107	412	304
1994–95	41	474	144	495	4 936	100	427	315
1995–96	60	474	124	464	5 004	105	406	301
1996–97	51	477	135	445	5 155	123	413	278
1997–98	48	475	154	463	5 243	198	423	291
1998–99	46	474	158	467	5 357	106	403	280
1999–00	48	474	159	469	5 113	137	404	280

Sources: BTRE estimates, ABARE Commodity Statistics (2000 and earlier issues), ABS Tasmanian Year Books (2001 and earlier issues), ABARE pers. comms.

TABLE VII.14 TASMANIAN RAIL CARRIAGE

('000 tonnes)

Year	Grain	Other Agriculture	Livestock	Coal	Other Minerals	Fertilisers	Cement	Timber	All Others	Total
1960–61	0	52	56	264	5	105	123	341	578	1 524
1961–62	0	71	30	223	41	110	132	278	554	1 439
1962–63	0	59	41	207	32	125	165	327	525	1 481
1963–64	0	70	51	156	55	142	187	365	509	1 535
1964–65	0	57	52	108	105	140	193	399	512	1 566
1965–66	0	46	45	85	107	160	170	355	490	1 458
1966–67	0	41	37	70	183	170	160	339	439	1 439
1967–68	0	27	32	76	531	150	210	371	619	2 016
1968–69	0	35	71	95	985	150	259	315	936	2 846
1969–70	0	52	47	95	46	138	260	323	1 301	2 262
1970–71	0	23	63	94	1 158	112	233	338	1 427	3 447
1971–72	0	22	23	96	1 034	115	211	338	1 473	3 312
1972–73	0	21	13	100	98	100	215	360	644	1 551
1973–74	0	17	8	96	42	107	245	354	956	1 825
1974–75	0	14	3	96	60	67	178	345	965	1 728
1975–76	0	13	1	130	37	46	205	331	842	1 605
1976–77	0	15	2	159	22	62	193	305	772	1 530
1977–78	0	0	1	141	306	72	164	166	924	1 774
1978–79	0	0	0	175	293	91	286	216	953	2 014
1979–80	0	0	0	169	350	111	220	238	1 267	2 355
1980–81	0	0	0	196	56	73	289	294	1 325	2 233
1981–82	0	0	0	261	255	70	286	135	1 252	2 259
1982–83	0	0	0	310	29	75	223	116	1 258	2 011
1983–84	0	0	0	277	35	76	242	212	1 305	2 147
1984–85	0	0	0	311	386	77	257	134	1 361	2 526
1985–86	0	0	0	341	40	67	264	109	1 356	2 177
1986–87	0	0	0	365	44	57	221	179	1 344	2 210
1987–88	0	0	0	375	61	61	250	251	1 361	2 359
1988–89	0	0	0	376	56	73	296	174	1 316	2 291
1989–90	0	0	0	369	64	91	246	200	1 055	2 025
1990–91	0	0	0	296	86	81	210	115	966	1 754
1991–92	0	0	0	285	56	83	246	178	750	1 598
1992–93	0	0	0	261	59	89	328	104	815	1 656
1993–94	0	0	0	307	82	102	320	198	933	1 942
1994–95	0	0	0	232	354	86	300	163	1 002	2 137
1995–96	0	0	0	204	627	70	300	163	1 017	2 381
1996–97	0	0	0	204	627	70	300	163	1 017	2 381
1997–98	0	0	0	300	650	0	320	100	1 830	3 200
1998–99	0	0	0	300	650	0	320	100	2 130	3 500
1999–00	0	0	0	300	650	0	320	100	2 130	3 500

Sources: BTRE estimates, ABS Tasmanian Year Books (2001 and earlier issues), ANR Annual Reports (1998–99 and earlier issues), ARA pers. comms.

APPENDIX VIII

TOWARDS CONSISTENT TIME SERIES OF INTERSTATE NON-BULK FREIGHT RATES

VIII.1 INTRODUCTION

Information on freight rates in Australia is scarce and of variable reliability. This appendix provides a list of the major raw data sources available of Australian road, rail, coastal shipping and air freight rates since 1964–65. It also explains an explanation of the methods used to construct consistent annual time series of freight rates. This is one of few comprehensive assessments of freight rates in Australia.

The freight rate data analysed in this appendix include only published sources —or unpublished BTRE data—of consistent time series collections. Data sources that contain few observations—one or two years only—have not been included here.

The main sources of raw freight rate data included in this report are:

- Transport Indicators (DoT 1981a, 1981b, 1982, 1983; Bureau of Transport Economics 1983 to 1988).
- Transport Indicators Database (Bureau of Transport and Regional Economics unpublished).
- Australian Bureau of Statistics *Yearbook Australia* (ABS 1999a and earlier issues).
- *FreightInfo*™ 1986–87, 1988–89, 1992–93, 1995–96.
- Bureau of Transport and Communications Economics 1990, *Freight Flows in Australian Transport Corridors*, BTCE Occasional Paper 98, AGPS, Canberra.
- Bureau of Transport and Regional Economics Coastal Shipping database.

This appendix is principally concerned with deriving consistent annual, financial year basis, time series of freight rates. Some quarterly data appears in the paper, and where it appears is referenced as Mar–85 for March Quarter 1985, for example.

VIII.2 TRANSPORT INDICATORS FREIGHT RATE DATA

The Commonwealth Department of Transport initiated the preparation of transport indicators in 1976. The data was drawn from a range of market sources. The indicators aimed to:

- provide timely evidence on the direction and order of magnitude of short and long-term trends
- help identify the impact of changes in the economy on the transport sector
- assist in the process of setting investment priorities and monitor the impact of policy changes (Department of Transport 1980, p. vii).

The *Transport Indicators* bulletin was first released in March 1980 and published quarterly by the department up to the December Quarter 1982. From Mar–83 the *Transport Indicators* bulletin was produced by the Bureau of Transport Economics (BTE 1983 and later issues). The December Quarter 1980 issue provided a time series collection of real freight rates from Mar–71 to Dec–80, where available, which are reproduced in Table VIII.1. Real rates were constructed by deflating nominal rates by the consumer price index (ABS 1999b and earlier issues).

In brief, the measures of freight rates appearing in Table VIII.1 were derived in the following manner:

- intrastate rail freight rate—general freight rates on the five rail systems weighted by tonnes consigned on those systems
- interstate rail freight rate—general freight rates applicable to freight forwarding agents on fourteen interstate routes, weighted by tonnes consigned on each route
- intercity road freight forwarders rate—scheduled freight forwarders' rates for a 10 tonne consignment over a set of intercity pair(s) weighted by traffic on each route
- non-bulk coastal shipping freight rate—by rates on five intercity routes weighted by tonnes carried
- air freight rates—air freight rates for the Sydney–Melbourne OD pair.

From the Mar–81 issue (DoT 1983 earlier issue, BTE 1983 to BTE 1988) the *Transport Indicators* discontinued its freight rates index, but reported the annual percentage change in real freight rates. The annual changes in real freight rates are listed in Table VIII.2.

Two additional road freight rate indexes appear in Table VIII.2—a road subcontractors' recommended minimum rate and a road subcontractors'

TABLE VIII.1 TRANSPORT INDICATORS REAL FREIGHT RATES[a], 1971 TO 1980

(Index)

Quarter	Rail Intrastate[b]	Rail Interstate[c]	Intercity road freight forwarders rates[d]	Non–bulk coastal shipping[e]	Air[f]
Sep–71			100.0	100.0	100.0
Dec–71			97.9	97.7	100.5
Mar–72			104.5	96.9	100.5
Jun–72			103.4	95.9	99.7
Sep–72			102.0	94.6	98.3
Dec–72			100.8	93.5	97.1
Mar–73			97.4	91.6	95.0
Jun–73			99.2	88.6	103.5
Sep–73			95.8	107.0	99.9
Dec–73			92.4	103.2	96.5
Mar–74			90.3	100.8	94.2
Jun–74			86.7	96.9	90.6
Sep–74			82.5	110.5	86.1
Dec–74			105.5	95.9	89.1
Mar–75			101.9	92.6	89.0
Jun–75	100.0	100.0	98.5	89.5	86.0
Sep–75	105.2	104.2	103.1	118.4	89.6
Dec–75	110.5	98.5	102.0	112.1	84.9
Mar–76	107.3	110.6	99.0	108.8	82.4
Jun–76	104.7	107.9	96.5	106.1	82.7
Sep–76	105.8	110.9	101.8	136.4	83.2
Dec–76	104.9	104.9	96.1	128.7	80.1
Mar–77	104.0	102.3	93.9	136.3	76.7
Jun–77	101.7	99.9	91.8	133.2	74.9
Sep–77	101.6	99.7	97.6	131.8	75.4
Dec–77	101.5	97.7	95.4	154.6	73.7
Mar–78	103.0	97.7	94.2	152.7	74.7
Jun–78	100.9	95.7	92.3	149.5	73.2
Sep–78	105.4	95.8	98.9	146.7	75.4
Dec–78	104.5	93.7	99.4	151.0	79.1
Mar–79	102.7	95.1	98.3	148.5	77.9
Jun–79	100.0	92.6	95.7	149.0	75.9
Sep–79	108.3	94.2	110.2	149.5	80.9
Dec-79	105.1	91.5	107.0	154.8	78.6
Mar–80	102.9	94.4	125.8	158.8	83.4
Jun–80	101.6	91.8	122.3	154.3	85.7
Sep–80	107.4	98.9	158.5	158.5	88.7
Dec–80	109.7	96.9	155.3	171.6	87.0

Notes:
a. Deflated by the aggregate consumer price index (ABS 1999b and earlier issues).
b. General freight rates on the five rail systems weighted by tonnes consigned on those systems (DoT, BTE "Australian Rail Freight Movements 1975-76").
c. General freight rates applicable to forwarding agents, on fourteen routes, weighted by tonnes consigned on each route (DoT, BTE "Australian Rail Freight Movements 1975-76").
d. Period Sep-71 to Sep-75: scheduled rate for a 10 tonne consignment Sydney to Melbourne (Source: One national freight forwarding company); Sep-75 to Mar-80: scheduled rate for a 10 tonne consignment on 20 routes between the five mainland capital cities, weighted by tonnes carried on each route (Source: One national freight forwarding company, ABS unpublished survey); Mar-80 to Dec-80, scheduled rate for 10 tonne consignment on 20 routes between five mainland capital cities, weighted by tonne carried on each route (Source: Three national freight forwarding companies, ABS unpublished survey).
e. Rates on five routes, weighted by tonnes carried on each route (DoT Annual Reports).
f. Rate for Melbourne-Sydney route (TAA: 'Fares and Rates', Ansett: 'Fares and Rates').

Sources: DoT (1981a and 1981b).

TABLE VIII.2 FOUR QUARTER INCREASE IN REAL FREIGHT RATE RATES[a]

(per cent per annum)

Quarter	Rail Intrastate[b]	Rail Interstate[c]	Intercity road freight forwarders rates[d]	Road sub-contractors rate: Min[e]	Road sub-contractors rate: Max[f]	Coastal shipping non-bulk rates[g]	Air[h]
Mar–81	4.8	4.0	na	8.8	na	1.0	6.2
Jun–81	4.9	4.7	na	6.5[i]	na[i]	2.7	6.2
Sep–81	-1.2	2.0	na	1.9	2.8	12.9	10.7
Dec–81	-0.4	0.0	25.1	na	na	3.7	35.1
Mar–82	-3.0	4.0	8.1	0.6	4.3	4.0	39.3
Jun–82	3.0	-2.9	22.5	na	na	4.1	21.4
Sep–82	na	na	na	-7.0	-4.2	na	na
Dec–82	-2.2	-3.5	25.4	na	na	-1.0	12.7
Mar–83	-5.2	0.8	17.4	-10.4	-12.8	na	11.9
Jun–83	-4.1	0.5	-3.4	na	na	na	10.0
Sep–83	-0.6	-4.4	-3.7	-10.4	na	na	5.7
Dec–83	-2.6	-3.9	11.7	na	na	na	6.1
Mar–84	3.6	na	14.6	na	na	na	16.0
Jun–84	4.8	-2.8	21.4	na	na	na	22.4
Sep–84	5.5	1.7	38.4	4.0	na	na	22.4
Dec–84	-2.6	-3.9	11.7	na	na	na	6.1
Mar–85	7.6	-0.1	24.1	1.3	na	na	16.3
Jun–85	8.1	2.7	-0.2	na	na	na	9.7
Sep–85	-1.7	-2.5	-0.5	0.0	na	na	12.8
Dec–85	-1.0	1.2	-4.0	na	na	na	16.2
Mar–86	-3.7	0.3	-4.9	2.1	na	na	15.2
Jun–86	-0.6	0.2	-4.4	na	na	na	16.0
Sep–86	-0.6	0.3	-4.1	1.9	na	na	-15.0
Dec–86	-0.6	0.3	-1.0	na	na	na	-20.7
Mar–87	na	-3.2	-1.6	-1.2	na	na	-22.8
Jun–87	na	-3.0	-4.0	-8.5	na	na	-22.7
Sep–87	na	-4.1	-4.8	-5.4	na	na	-2.6
Dec–87	na	-3.0	-8.3	-4.4	na	na	38.5

Notes: na – not available.

a. Values in table show the four-quarter increase in real freight rates.

b. General freight rates on the five rail systems weighted by tonnes consigned on those systems. Source notes there are some inadequacies in the data, over the course of the sample, as only percentage changes in rates were available, rather than actual rates, leading to imprecise weighting.

c. General freight rates applicable to forwarding agents, on fourteen routes, weighted by tonnes consigned on each route. From Jun–83 based on percentage change in rates paid by forwarding agents who qualify for special freight rates (consigning substantial quantities) as supplied by the Railways Committee of Australia (BTE 1983 to 1988).

d. Mar–80 to Mar–85, scheduled rate for 10 tonne consignment on 20 routes between five mainland capital cities, weighted by tonne carried on each route (Three national freight forwarding companies, ABS unpublished survey); Jun–85 to Dec–87 Freight Forwarders' Interstate contract freight rates indicator based on discounted or contract rates for customers with a substantial number of full truck loads of freight per week. These rates, supplied by six major freight forwarders, are weighted according to estimated activity on each of six intercity routes and appropriately deflated to convert to real terms.

e. Road sub-contractors recommended minimum freight rate. Jun–73 to Jun–80 (annual data); Dec-80 to current: minimum rates of remuneration for 20 tonne consignments on twenty routes between five mainland capital cities, weighted by tonnes carried on each route (BTE 1980 'The Long Distance Road Haulage Industry', Australian Road Transport Federation and the Transport Workers Union of Australia: 'Agreement Determining Rights and Privileges of Prime Contractors and Owner Drivers in the Interstate Road Transport Industry'; ABS unpublished survey.

f. Upper range = 100 at Mar–81 (DoT 1981b, TI Dec–80). Discontinued from Sep–83—Previous bulletins presented two of these indicators, showing maximum and minimum rates respectively. The maximum rates are no longer provided, and the indicator shown represents the previously so-called minimum rate. Series no longer reported from Sep–83 issue.

g. Rates on five routes, weighted by tonnes carried on each route (DoT Annual Reports). Coastal shipping rates no longer appear after Dec–82, no explanation given.

h. Rate for Melbourne–Sydney route (TAA: 'Fares and Rates', Ansett: 'Fares and Rates').

i. Annualised rate increase Mar 81 to Sep 81.

Sources: DoT (1981a and 1981b), BTE (1983 and later issues).

maximum rate paid. The two series attempt to measure minimum subcontractors interstate freight rates. In practice, market-determined freight rates paid to subcontractors were well below the recommended minimum rate and the recommended minimum freight rates appears to be close to the upper bound of observed market freight rates.

The annual freight rate increases were applied to the freight rate indices in Table VIII.1 to produce consistent freight rate indexes for the period Sep–71 to Dec–87, listed in Table VIII.3 and shown in Figure VIII.1. The data in Table VIII.3 will reappear in sections VIII.3, VIII.4, VIII.5, and VIII.6 comparing the various raw data and construction of consistent freight rate indexes.

TABLE VIII.3 TRANSPORT INDICATORS REAL FREIGHT RATES, 1971 TO 1987

(Index)

Quarter	Rail Intrastate	Rail Interstate	Intercity road freight forwarders rates[a]	Road sub-contractors recommended minimum rate: Min[b]	Road sub-contractors rate: Max c	Sea: Coastal non-bulk rates	Air
Sep–71			100.0			100.0	100.0
Dec–71			97.9			97.7	100.5
Mar–72			104.5			96.9	100.5
Jun–72			103.4			95.9	99.7
Sep–72			102.0			94.6	98.3
Dec–72			100.8			93.5	97.1
Mar–73			97.4			91.6	95.0
Jun–73			99.2			88.6	103.5
Sep–73			95.8			107.0	99.9
Dec–73			92.4			103.2	96.5
Mar–74			90.3			100.8	94.2
Jun–74			86.7			96.9	90.6
Sep–74			82.5			110.5	86.1
Dec–74			105.5			95.9	89.1
Mar–75			101.9			92.6	89.0
Jun–75	100.0	100.0	98.5	100.0		89.5	86.0
Sep–75	105.2	104.2	103.1			118.4	89.6
Dec–75	110.5	98.5	102.0			112.1	84.9
Mar–76	107.3	110.6	99.0			108.8	82.4
Jun–76	104.7	107.9	96.5	95.0		106.1	82.7
Sep–76	105.8	110.9	101.8			136.4	83.2
Dec–76	104.9	104.9	96.1			128.7	80.1
Mar–77	104.0	102.3	93.9			136.3	76.7
Jun–77	101.7	99.9	91.8	88.0		133.2	74.9
Sep–77	101.6	99.7	97.6			131.8	75.4
Dec–77	101.5	97.7	95.4			154.6	73.7
Mar–78	103.0	97.7	94.2			152.7	74.7
Jun–78	100.9	95.7	92.3	87.0		149.5	73.2
Sep–78	105.4	95.8	98.9			146.7	75.4
Dec–78	104.5	93.7	99.4			151.0	79.1
Mar–79	102.7	95.1	98.3			148.5	77.9
Jun–79	100.0	92.6	95.7	86.0		149.0	75.9
Sep–79	108.3	94.2	110.2	86.0		149.5	80.9
Dec-79	105.1	91.5	107.0	86.0		154.8	78.6
Mar–80	102.9	94.4	125.8	86.0		158.8	83.4
Jun–80	101.6	91.8	122.3	86.0		154.3	85.7
Sep–80	107.4	98.9	158.5	88.5		158.5	88.7
Dec–80	109.7	96.9	155.3	91.1		171.6	87.0
Mar–81	107.8	98.2		93.6	100.0	160.4	88.6
Jun–81	106.6	96.1		94.5[e]	101.4[e]	158.5	91.0
Sep–81	106.1	100.9		95.4	102.8	178.9	98.2
Dec–81	109.3	96.9	194.3	94.8[e]	103.6[e]	177.9	117.5
Mar–82	104.6	102.1	191.0	94.2	104.3	174.9	123.4
Jun–82	109.8	93.3	222.1	91.5[e]	101.4[e]	165.0	110.5
Sep–82[d]	106.6	96.3	251.0	88.7	98.5	181.4	128.7
Dec–82	106.9	93.5	243.7	86.6	94.7	176.1	132.4
Mar–83	99.2	102.9	224.2	84.4	90.9		138.1
Jun–83	105.3	93.8	214.5	82.0[e]			121.6
Sep–83	106.0	92.1	241.7	79.5			136.0
Dec–83	104.1	89.9	272.2	80.3[e]			140.5
Mar–84	102.8	91.4	256.9	81.1[e]			160.2
Jun–84	110.4	91.2	260.4	81.9[e]			148.8
Sep–84	111.8	93.7	334.5	82.7			166.5

CONTINUED

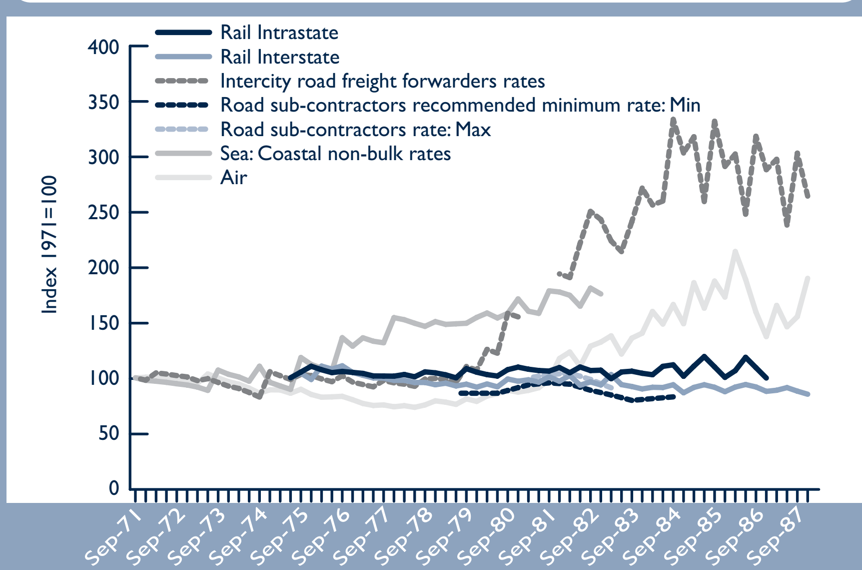
TABLE VIII.3 TRANSPORT INDICATORS REAL FREIGHT RATES, 1971 TO 1987 (continued)

(Index)

Quarter	Rail Intrastate	Rail Interstate	Intercity road freight forwarders rates[a]	Road sub-contractors recommended minimum rate: Min[b]	Road sub-contractors rate: Max[c]	Sea: Coastal non-bulk rates	Air
Dec–84	101.4	86.4	304.0				149.1
Mar–85	110.6	91.3	318.8	82.2			186.3
Jun–85	119.3	93.7	259.9				163.2
Sep–85	109.9	91.4[f]	332.8	82.7			187.8
Dec–85	100.4	87.4	291.8				173.3
Mar–86	106.5	91.6	303.2	83.9			214.6
Jun–86	118.6	93.9	248.5				189.3
Sep–86	109.2	91.7	319.2	84.3			159.6
Dec–86	99.8	87.7	288.9				137.4
Mar–87	na	88.7	298.3	82.9			165.7
Jun–87	na	91.1	238.6				146.3
Sep–87	na	87.9	303.9	79.7			155.5
Dec–87	na	85.1	264.9				190.3

Notes: na not available.
a. Minimum sub-contractor's real freight rate index = 100 in Jun–75;
b. Upper range based on index = 100 in Mar–81;
c. Annual growth estimates not available—estimated by applying constant annual growth rate between Dec–80 and Dec–81;
d. Annual growth to Sep–82 not available—estimated from quarterly change Sep–82 to Dec–83;
e. Simple linear interpolation between quarters;
f. Annual growth to Mar–84 not available—back-estimated directly from quarterly change Mar–84 to Jun–84.
Sources: DoT (1981a, 1981b), BTE (1983 to 1988), BTRE estimates.

FIGURE VIII.1 TRANSPORT INDICATORS REAL FREIGHT RATES INDEX



Sources: DoT (1981a, 1981b), BTE (1983 to 1988), BTRE estimates.

VIII.3 RAIL FREIGHT RATES

This section presents the major sources of rail freight rate data and estimates of consistent time series of interstate non-bulk rail freight rates.

The principal sources of rail freight rate data reported in this paper are:

- state rail authority annual reports—list total rail freight task and total revenue from freight operations (1964–65 to 1996–97)
- National Rail annual reports—list total rail freight task and total revenue from freight operations (1994–95 to 2000–01)
- BTCE (1990)—reported recommended freight rates for non-bulk freight and six intercapital corridors (1964–65 to 1985–86)
- V/Line annual reports and unpublished rail freight data – list total rail freight task and total revenue, by type of freight, from its freight operations (1969–70 to 1982–83 and 1982–83 to 1990–91)
- Queensland Rail annual reports—list total rail freight task and total revenue, by type of freight, from its freight operations (1959–60 to 1994–95).

State Rail Authority Annual Report data

The ABS Yearbooks (ABS 1997 and earlier issues) report total freight carried and total revenue received from freight operations for all State–owned rail operators[1]—the raw data is listed at the end of the appendix in Tables VIII.33 to VIII.35. Average freight revenue—defined as freight revenue divided by the freight task—provides a measure of freight rates paid by shippers to rail freight operators. However, intrastate bulk freight movements—in particular coal in New South Wales and Queensland and grains in Victoria—would account for a large proportion of the rail freight traffic and revenue. Consequently, average freight revenue of these systems is probably not a representative measure of non-bulk rail freight rates.

Between 1971–72 and 1985–86, the ABS Yearbook (ABS 1999a and earlier issues) reported rail freight and earnings by broad traffic type—the raw data is listed at the end of the appendix in Tables VIII.36 to VIII.38. Rail freight classified as non-bulk varies according to the available data classification presented in ABS (1999a). Broadly, non-bulk rail freight is defined as: 'All other commodities' for the period 1971–72 to 1977–78, 'All other commodities, Containers & Iron and Steel' for

1 State owned rail operators often received operating subsidies from State governments. The BTRE's understanding is that revenue received from freight operations does not include operating subsidies, and so only measures the cost to shippers of transporting goods by rail.

the period 1978–79 to 1982–83, and 'Manufactured goods, Machinery and transport equipment & Miscellaneous' for the period 1983–84 to 1985–86.

The last available National Rail and Australia National data available in the ABS yearbook is for 1996–97. However National Rail annual reports (NR 2001 and earlier issues) have provided freight revenue figures for 1993-94 to 1997–98, and operating revenue from 1998 through to 2001—Tables VIII.4, VIII.5, VIII.6, VIII.7 and VIII.8. The National Rail annual report also provides total tonne–kilometres. With the sale of National Rail and FreightCorp in January 2002 it is not known whether data of this nature will be published in the future under the new Pacific National.

TABLE VIII.4 AVERAGE RAIL FREIGHT REVENUE PER TONNE, BY SYSTEM

($ per tonne)

Year	NSW	Vic	Qld	SA	WA	Tas	NR	AN	Total
1964–65	5.43	12.03	15.10	30.36	28.98	138.88	..	51.91	2.34
1965–66	4.97	11.04	13.36	28.58	21.03	125.22	..	45.11	2.09
1966–67	5.00	12.13	14.38	30.64	18.61	135.77	..	46.94	2.14
1967–68	5.09	14.09	14.06	36.56	17.57	134.75	..	43.17	2.21
1968–69	4.95	13.95	12.17	31.57	17.68	127.14	..	35.88	2.08
1969–70	5.14	14.53	11.91	29.19	16.12	136.67	..	35.64	2.09
1970–71	5.21	13.85	11.22	28.87	13.06	144.03	..	39.47	2.01
1971–72	5.41	14.83	9.08	29.08	12.61	134.63	..	42.46	1.97
1972–73	5.20	14.06	6.54	27.90	11.77	103.81	..	37.91	1.74
1973–74	na	na	na	na	na	na	..	na	Na
1974–75	5.76	17.45	6.39	28.64	11.94	111.47	..	47.04	1.86
1975–76	6.68	19.31	6.30	33.98	11.82	129.58	..	54.84	2.00
1976–77	7.25	22.31	7.15	38.23	12.88	148.87	..	62.61	2.23
1977–78	na	na	na	..	na	..	..	na	Na
1978–79	7.54	22.55	6.90	..	13.08	..	..	23.75	2.27
1979–80	8.35	24.62	8.62	..	15.48	..	..	26.07	2.64
1980–81	9.01	28.65	8.78	..	17.98	..	..	29.52	2.86
1981–82	10.67	37.10	9.88	..	21.80	..	..	36.29	3.39
1982–83	10.95	52.82	10.36	..	22.87	..	..	42.40	3.65
1983–84	12.02	53.39	10.53	..	28.18	..	..	46.34	3.94
1984–85	13.41	53.91	9.79	..	29.03	..	..	49.81	4.00
1985–86	13.70	70.06	10.01	..	35.29	..	..	56.46	4.29
1986–87	13.50	69.76	9.83	..	34.77	..	..	57.31	4.23
1987–88	14.11	70.44	10.25	..	34.99	..	..	68.14	4.43
1988–89	13.29	67.04	8.29	..	27.46	..	..	48.26	3.73
1989–90	12.42	65.07	8.08	..	26.78	..	..	47.20	3.60
1990–91	13.45	81.13	9.44	..	32.10	..	..	59.41	4.16
1991–92	13.76	92.94	8.71	..	30.48	..	..	60.33	4.04
1992–93	13.24	84.53	9.03	..	30.74	..	679.45	58.66	4.01
1993–94	10.52	90.88	7.48	..	24.84	..	78.27	46.10	3.18
1994–95	9.78	111.52	6.58	..	21.74	..	63.11	81.24	2.97
1995–96	12.70	117.86	8.43	..	26.08	..	81.53	102.53	3.76
1996–97	11.24	99.69	7.77	..	25.68	..	89.13	93.90	3.47

.. not applicable.
na – not available.
Notes: NR—National Rail, AN—Australian National.
Sources: ABS (1999a and earlier issues), BTRE estimates.

TABLE VIII.5 AVERAGE RAIL FREIGHT REVENUE PER TONNE-KILOMETRE, BY SYSTEM

(cents per net tonne–kilometres)

Year	NSW	VIC	QLD	SA	WA	TAS	NR	AN	Total
1964–65	2.00	1.90	2.36	1.84	2.22	2.62	..	0.93	1.97
1965–66	1.95	1.88	2.21	1.81	2.22	2.91	..	0.97	1.93
1966–67	2.00	1.99	2.29	1.90	2.07	3.06	..	1.00	1.98
1967–68	2.01	1.98	2.25	1.87	1.77	3.09	..	1.00	1.93
1968–69	1.99	1.88	2.10	1.78	1.72	3.28	..	1.02	1.87
1969–70	1.98	1.85	1.89	1.70	1.68	3.20	..	1.05	1.82
1970–71	1.94	1.86	1.80	1.67	1.54	3.34	..	1.11	1.77
1971–72	2.03	1.98	1.76	1.71	1.60	3.21	..	1.15	1.82
1972–73	1.99	1.96	1.63	1.63	1.47	2.88	..	1.12	1.72
1973–74	na	na	na	na	na	Na	..	Na	na
1974–75	2.20	2.33	1.81	2.02	2.03	2.72	..	1.29	1.99
1975–76	2.44	2.62	2.08	2.11	2.38	3.24	..	1.54	2.24
1976–77	2.63	2.93	2.33	2.22	2.49	3.30	..	1.73	2.45
1977–78	na	na	na	..	na	..	..	na	na
1978–79	2.87	3.24	2.61	..	3.07	..	..	2.15	2.73
1979–80	3.11	3.50	2.83	..	3.03	..	..	2.34	2.93
1980–81	3.46	3.79	3.20	..	3.31	..	..	2.61	3.25
1981–82	4.03	4.02	3.68	..	3.99	..	..	2.88	3.72
1982–83	4.96	4.41	3.86	..	4.19	..	..	3.02	4.10
1983–84	5.03	5.17	4.35	..	4.62	..	..	3.25	4.47
1984–85	5.17	5.14	4.50	..	4.84	..	..	3.41	4.62
1985–86	5.49	5.45	4.43	..	5.02	..	..	3.35	4.68
1986–87	5.46	4.95	4.60	..	4.94	..	..	3.46	4.73
1987–88	5.40	5.26	4.40	..	4.86	..	..	3.30	4.63
1988–89	4.92	5.09	4.89	..	4.75	..	..	3.53	4.68
1989–90	4.73	4.70	4.53	..	4.84	..	..	3.48	4.46
1990–91	5.51	4.44	4.92	..	5.14	..	..	3.53	4.86
1991–92	5.71	5.01	4.65	..	5.22	..	..	3.42	4.82
1992–93	5.50	4.11	4.82	..	5.00	..	na	3.24	4.84
1993–94	4.25	3.77	4.78	..	4.95	..	3.19	2.98	4.10
1994–95	7.08	6.21	4.69	..	4.45	..	2.89	4.99	4.58
1995–96	8.05	6.15	4.92	..	3.74	..	2.82	5.34	4.78
1996–97	6.72	5.19	3.74	..	3.42	..	2.78	5.56	4.10

.. not applicable.
Na – not available.
Notes: NR—National Rail, AN—Australian National.
Sources: ABS (1999a and earlier issues), BTRE estimates.

TABLE VIII.6 AVERAGE NON-BULK RAIL FREIGHT REVENUE, BY SYSTEM

($ per tonne)

Year	NSW	VIC	QLD	SA	WA	TAS	AN	Total
1971–72	na	5.72	14.01	4.90	11.35	8.36	13.02	na
1972–73	na	5.57	13.70	4.86	10.72	5.73	13.08	na
1973–74	na	5.99	13.45	4.85	10.74	5.51	14.02	na
1974–75	na	5.83	12.52	4.78	10.50	4.76	13.80	na
1975–76	na	na	na	na	na	na	na	na
1976–77	na	14.74	52.64	13.43	40.35	8.41	20.62	na
1977–78	na	8.87	15.54	6.52	14.26	5.52	20.88	na
1978–79	na	10.48	19.27	..	13.38	..	17.69	na
1979–80	na	11.33	20.10	..	13.21	..	16.14	na
1980–81	na	10.48	19.27	..	13.38	..	17.69	na
1981–82	na	11.33	20.10	..	13.21	..	16.14	na
1982–83	na	na	na	..	na	..	na	na
1983–84	na	12.85	23.43	..	20.26	..	20.29	na
1984–85	na	14.53	25.55	..	na	..	24.34	na
1985–86	na	15.82	26.12	..	na	..	na	na

.. not applicable.
na – not available.
Notes: Rail freight classified as non-bulk varies according to the classification of data in ABS (1999). Non-bulk rail freight defined as: 'All other commodities' (1971–72 to 1977–78), 'All other commodities, Containers and Iron and Steel' – 1978–79 to 1982–83, and 'Manufactured goods, Machinery and transport equipment & Miscellaneous' (1983–84 to 1985–86).
Sources: ABS (1999a and earlier issues), BTRE estimates.

TABLE VIII.7 AVERAGE NON-BULK RAIL FREIGHT REVENUE

(cents per net tonne–kilometres)

Year	NSW	Vic	Qld	SA	WA	Tas	AN	Total
1971–72	na	1.71	0.66	1.44	2.44	3.53	1.32	na
1972–73	na	1.72	0.62	1.39	2.18	3.95	1.39	na
1973–74	na	1.87	0.55	1.42	2.19	3.79	1.41	na
1974–75	na	1.88	0.50	1.42	2.13	2.81	1.37	na
1975–76	na	na	na	na	na	na	na	na
1976–77	na	4.76	1.87	3.90	8.32	4.05	1.84	na
1977–78	na	2.68	na	1.85	2.97	3.17	1.75	na
1978–79	na	3.16	na	na	3.48	na	2.08	na
1979–80	na	3.65	na	na	3.52	na	2.18	na
1980–81	na	3.16	na	na	3.48	na	2.08	na
1981–82	na	3.65	na	na	3.52	na	2.18	na
1982–83	na	na	na	na	na	na	na	na
1983–84	na	3.66	5.08	na	4.36	na	2.78	na
1984–85	na	4.24	5.31	na	na	na	na	na
1985–86	na	4.54	4.88	na	na	na	na	na

.. not applicable.
na – not available.
Notes: Rail freight classified as non-bulk varies according to the classification of data in ABS (1999). Non-bulk rail freight defined as: 'All other commodities' (1971–72 to 1977–78), 'All other commodities, Containers and Iron and Steel' – 1978–79 to 1982–83, and 'Manufactured goods, Machinery and transport equipment & Miscellaneous' (1983–84 to 1985–86).
Sources: ABS (1999a and earlier issues), BTRE estimates.

TABLE VIII.8 NATIONAL RAIL TASK, REVENUE AND REVENUE IN CENTS PER NET TONNE KILOMETRE

Year	Tonnes carried (million)	Tonne kilometres (billion)	Freight revenue. (million $)	Bulk Revenue (million $)	Rate ($ per tonne)	Rate (cents per net tonne–kilometres)
1993–94	8.8	13.92	443.10		19.86	3.18
1994–95	10.1	16.60	479.10		21.08	2.89
1995–96	9.9	16.90	475.70		20.81	2.81
1996–97	9.2	16.00	444.50		20.70	2.78
1997–98	9.3	15.52	424.35	16.00	21.92	2.73
1998–99	8.4	15.10	417.00	17.00	20.14	2.76
1999–00	11.4	16.20	460.00	27.00	24.78	2.84
2000–01	13.4	17.10	470.00	42.00	28.51	2.75

Sources: NR (2001 and earlier issues), ARA (pers. comm.), BTRE estimates.

Bureau of Transport and Communications Economics Corridor Study (BTCE 1990)

The Bureau of Transport and Communications Economics (1990) provided a comprehensive analysis of non-bulk corridor freight flows in the major Australian interstate freight corridors. Tables VIII.9 and VIII.10 list the freight rates in dollars per tonne and cents per net tonne-kilometre, respectively, for six major intercapital corridors—Melbourne–Sydney, Eastern States–Perth, Sydney–Adelaide, Sydney–Brisbane, Melbourne–Adelaide, and Melbourne–Brisbane—published by the bureau (BTCE 1990). The weighted average freight

TABLE VIII.9 CORRIDOR RAIL FREIGHT RATES

($ per tonne)

Year	Mel–Syd a.	ES–Per b.	Syd–Adl c.	Syd–Bne d.	Mel–Adl e.	Mel–Bne f.	Weighted Average g.
1964–65	9.00	13.16	33.25	23.80	18.60	38.90	16.19
1965–66	9.00	13.16	33.25	23.80	18.60	38.90	16.26
1966–67	9.00	13.16	33.25	23.80	18.60	38.90	16.36
1967–68	9.00	13.16	33.25	23.80	18.60	38.90	16.39
1968–69	9.00	13.19	33.34	23.86	18.64	39.00	16.48
1969–70	9.45	13.82	34.94	25.00	19.53	40.87	17.52
1970–71	9.45	13.82	34.94	25.00	19.53	40.87	17.41
1971–72	9.86	14.23	35.42	25.36	19.80	41.44	18.01
1972–73	9.95	14.56	35.75	25.39	19.97	41.82	18.27
1973–74	10.37	15.00	37.25	26.66	20.82	43.58	18.95
1974–75	12.14	17.24	41.70	28.80	24.37	51.00	21.94
1975–76	12.80	19.18	45.70	31.97	27.84	55.88	24.22
1976–77	14.40	21.52	57.46	40.80	36.83	69.98	29.97
1977–78	15.09	23.25	63.83	45.80	40.95	77.31	32.96
1978–79	15.85	24.89	72.41	55.13	46.68	87.24	37.57
1979–80	17.60	27.34	84.49	61.52	53.39	101.53	42.42
1980–81	21.35	33.17[h]	116.78	84.53	76.69	134.55	49.03
1981–82	24.04	35.40	142.17	101.75	105.76	165.27	71.36
1982–83	26.95	39.54	157.35	112.35	107.97	199.28	75.03
1983–84	24.77	38.27	178.35	126.55	113.52	207.61	79.55
1984–85	22.87	37.46	195.40	139.70	125.66	228.69	86.49
1985–86	24.69	39.92	213.48	152.80	137.52	249.73	94.86

Notes: na – not available.
a. Rail rate applies to forwarding agent rates (State Transport Authority, Victoria, pers. comm. 1987).
b. Rates represent the Melbourne–Perth route (ROA 1986 for rates 1974 to 1986, prior to that Melbourne–Sydney rates used as an approximation to the change in rates).
c. ROA (1986).
d. ROA (1986).
e. ROA (1986).
f. ROA (1986).
g. Weighted average of rates on six routes.
h. Eastern states–Perth rate 1980-81 not published—estimated by using the growth in Melbourne–Sydney rate.
Source: BTCE (1990).

TABLE VIII.10 CORRIDOR RAIL FREIGHT RATES

(cents per net tonne–kilometres)

Year	Mel–Syd a.	ES–Per b.	Syd–Adl c.	Syd–Bne d.	Mel–Adl e.	Mel–Bne f.
1964–65	0.937	0.305	1.857	2.416	2.236	2.004
1965–66	0.937	0.305	1.857	2.416	2.236	2.004
1966–67	0.937	0.305	1.857	2.416	2.236	2.004
1967–68	0.937	0.305	1.857	2.416	2.236	2.004
1968–69	0.937	0.305	1.862	2.422	2.240	2.009
1969–70	0.983	0.320	1.951	2.538	2.347	2.106
1970–71	0.983	0.320	1.951	2.538	2.347	2.106
1971–72	1.026	0.330	1.978	2.575	2.380	2.135
1972–73	1.035	0.337	1.996	2.578	2.400	2.155
1973–74	1.079	0.347	2.080	2.707	2.502	2.245
1974–75	1.263	0.399	2.328	2.924	2.929	2.628
1975–76	1.332	0.444	2.552	3.246	3.346	2.879
1976–77	1.498	0.498	3.208	4.142	4.427	3.605
1977–78	1.570	0.538	3.564	4.650	4.922	3.983
1978–79	1.649	0.576	4.043	5.597	5.611	4.495
1979–80	1.831	0.633	4.717	6.246	6.417	5.231
1980–81	2.222	0.768[g]	6.520	8.582	9.218	6.932
1981–82	2.502	0.820	7.938	10.330	12.712	8.515
1982–83	2.804	0.916	8.786	11.406	12.977	10.267
1983–84	2.578	0.886	9.958	12.848	13.644	10.696
1984–85	2.380	0.868	10.910	14.183	15.103	11.782
1985–86	2.569	0.925	11.920	15.513	16.529	12.866

Notes: na not available.
a. Rail rate applies to forwarding agent rates (State Transport Authority, Victoria, pers. comm. 1987).
b. Rates represent the Melbourne–Perth route (ROA 1986 for rates 1974 to 1986, prior to that Melbourne–Sydney rates used as an approximation to the change in rates).
c. ROA (1986).
d. ROA (1986).
e. ROA (1986).
f. ROA (1986).
g. Eastern states–Perth rate 1980-81 not published—estimated by using the growth in Melbourne–Sydney rate.
Source: BTCE (1990).

rate listed in Table VIII.9 is equal to the sum of the freight rates in the six listed corridors weighted by rail freight task in each corridor. The rates listed for the Melbourne–Sydney corridor are the only rates based on forwarding agent rates as opposed to published rates. They are therefore considered the only useful estimate for comparison with actual freight consignment rates derived in this analysis.

Victorian rail freight rate data

The BTRE has V/Line intersystem rail freight data, including earnings, covering rail freight traffic between Victoria and Queensland and Victoria and New South Wales. The data covers the period 1982–83 to 1990–91. Table VIII.11 lists the aggregate freight data and estimated average freight revenue.

TABLE VIII.11 V/LINE–NSW AND V/LINE–QUEENSLAND INTERSYSTEM RAIL FREIGHT TRAFFIC, REVENUE AND AVERAGE REVENUE, 1982–83 TO 1990–91

	Rail freight task		Revenue	Average rail freight revenue	
Year	tonnes	tonne-kilometres	$ '000	$ / tonne	cents / net tonne–kilometres
1982–83	1 696 834	1 831 830	52 995	31.23	2.89
1983–84	1 900 205	2 066 109	60 226	31.69	2.91
1984–85	1 981 583	2 155 182	65 922	33.27	3.06
1985–86	1 971 343	2 170 603	67 920	34.45	3.13
1986–87	2 181 914	2 349 822	75 199	34.46	3.20
1987–88	2 229 125	2 429 988	74 161	33.27	3.05
1988–89	2 578 774	2 845 085	92 355	35.81	3.25
1989–90	2 499 922	2 786 618	93 447	37.38	3.35
1990–91	1 242 758	1 411 012	45 821	36.87	3.25

Note: Data for 1990–91 represents half-yearly result only.
Sources: V/Line unpublished rail freight data, BTRE estimates.

Until 1983 the Victorian Railways Commission (Victorian Railways 1983 and earlier issues) published, in appendixes to its annual report, detailed records of annual freight movements by commodity type. It also published annual intersystem freight movements to and from Victoria. Table VIII.12 presents Victorian Railways' total and non-bulk rail freight, revenue and average freight revenue, covering the period 1969–70 to 1982–83. Table VIII.13 lists aggregate intersystem freight movements, revenue and average revenue. The data set was compiled from the Department of Transport and Regional Services library collection of Victorian Railways annual reports. Missing values in the data set correspond to gaps in the annual reports.

TABLE VIII.12 SUMMARY OF V/LINE TOTAL RAIL FREIGHT MOVEMENTS

Year	Freight (million tonnes)	Freight (billion tonne-kilometres)	Revenue ($million)	Avg Freight Revenue ($/tonne)	Avg Freight Revenue ($/tonne–kilometres)
			All freight		
1969–70	12.07	3.35	62.13	5.147	1.857
1970–71	12.74	3.48	64.83	5.088	1.863
1971–72	11.84	3.28	63.43	5.357	1.935
1972–73	11.48	na	61.63	5.371	Na
1973–74	11.37	3.13	63.19	5.558	2.021
1974–75	11.06	na	71.41	6.459	Na
1975–76	10.80	3.07	78.20	7.239	2.546
1976–77	na	na	na	na	Na
1977–78	11.12	na	92.60	8.327	Na
1978–79	11.19	3.15	102.00	9.099	3.237
1979–80	13.45	3.89	136.00	10.126	3.504
1980–81	12.72	3.70	143.00	11.233	3.858
1981–82	11.62	3.43	138.00	11.846	4.018
1982–83	8.57	2.47	109.00	12.696	4.409
			Non-bulk goods		
1969–70	2.71	1.06	12.17	4.498	1.146
1970–71	2.05	0.90	11.13	5.420	1.237
1971–72	2.54	0.93	10.81	4.252	1.159
1972–73	3.02	na	15.50	5.129	Na
1973–74	3.19	1.04	17.23	5.410	1.662
1974–75	2.80	na	18.93	6.758	Na
1975–76	2.67	0.88	21.08	7.911	2.389
1976–77	na	na	na	Na	Na
1977–78	2.44	na	22.20	9.095	Na
1978–79	2.58	0.87	26.35	10.195	2.971
1979–80	2.81	0.96	29.53	10.517	3.076
1980–81	2.88	1.02	32.34	11.239	3.155
1981–82	2.77	1.01	33.63	12.120	3.322
1982–83	2.27	0.81	27.66	12.158	3.396

na - not available.
Note: Non-bulk goods include Motor vehicles & accessories, Machinery n.o.s., Manufactured products n.o.s., Forwarding agents, Containers n.o.s., and Iron, and Steel & Metals unfabricated.

Sources: Victorian Railways (1983, p. 34, 1982, p. 39, 1981, p. 35, 1980, p. 34, 1979, p. 34, 1976, p. 32, 1974, p. 32, 1972, p. 32, 1971, p. 32, 1970, p. 32), BTRE estimates.

TABLE VIII.13 SUMMARY OF VLINE INTERSYSTEM RAIL FREIGHT

Year	Freight (tonnes)	Revenue ($)	Ave freight revenue ($ / tonne)
1969–70	3 428 574	10 860 760	3.17
1970–71	3 387 477	9 529 587	2.81
1971–72	3 233 574	9 121 004	2.82
1972–73	na	na	na
1973–74	3 921 353	9 615 600	2.45
1974–75	na	na	na
1975–76	3 431 130	11 288 441	3.29
1976–77	na	na	na
1977–78	na	na	na
1978–79	3 650 832	15 080 129	4.13
1979–80	4 020 246	21 055 198	5.24
1980–81	4 184 511	20 146 283	4.81
1981–82	4 890 613	25 910 372	5.30
1982–83	3 369 543	18 427 412	5.47

na - not available.

Sources: Victorian Railways (1983, p. 35; 1982, p. 35; 1981, p. 34; 1980, p. 29; 1979, p. 29; 1976, p. 29; 1974, p. 30; 1972, p. 30; 1971, p. 30; 1970, p. 30), BTRE estimates.

Queensland rail freight rate data

The Queensland Railways Commission, like the Victorian Railways Commission, used to report detailed estimates of its rail freight operations. Since 1990 Queensland Rail has released less detail on its freight operations. Fortunately for our purposes, it remains possible to differentiate between bulk mineral and other rail freight traffic. Table VIII.14 presents Queensland Railways' average revenue for the period 1959–60 to 1994–95. See Tables VIII.39 and VIII.40 at the end of the appendix for total freight movements and freight revenue data, used to estimate the figures in Table VIII.14. Unfortunately the Queensland Railways annual reports no longer contain the breakdown of revenue by service.

TABLE VIII.14 QUEENSLAND RAILWAYS AVERAGE FREIGHT REVENUE[a]

($ per tonne)

Year	Coal & coke	Other minerals	Timber	Agricultural produce	Wool	General goods	Livestock	Misc	Non-minerals	Total
1959–60	3.63	5.54	8.39	3.84	35.99	14.69	9.97	na	8.29	7.03
1960–61	3.67	5.50	8.69	3.97	36.50	14.50	11.30	na	8.76	7.26
1961–62	3.81	4.82	9.24	4.25	35.49	15.14	12.32	na	9.14	7.18
1962–63	3.91	5.35	9.64	4.18	34.46	14.56	11.88	na	8.53	7.06
1963–64	3.74	5.43	9.79	4.58	34.96	14.69	11.94	na	9.08	7.18
1964–65	3.30	5.23	11.75	4.26	35.44	14.26	12.32	na	8.68	6.76
1965–66	3.29	8.01	11.77	4.54	36.75	13.91	12.43	na	8.94	7.01
1966–67	3.45	7.79	11.75	5.03	37.36	14.09	12.25	na	8.96	7.18
1967–68	3.47	8.28	11.82	5.11	37.33	14.23	12.85	na	9.04	7.09
1968–69	2.88	9.51	12.87	5.56	36.91	13.70	12.24	na	9.28	6.72
1969–70	2.87	9.38	12.79	6.08	33.97	13.41	11.98	na	9.93	6.46
1970–71	2.99	9.33	12.49	5.41	31.87	12.79	12.24	na	9.38	6.13
1971–72	2.99	10.29	12.15	5.53	32.05	12.49	13.15	na	9.21	5.68
1972–73	2.71	9.36	10.89	5.34	32.22	11.29	13.01	na	8.91	4.94
1973–74	3.17	9.96	11.05	5.32	33.66	11.99	14.25	na	9.46	5.27
1974–75	3.71	7.17	10.11	5.46	29.64	12.66	13.54	na	9.45	5.47
1975–76	4.32	9.29	13.79	6.69	29.03	15.21	16.79	na	11.46	6.54
1976–77	4.50	8.19	16.00	7.49	34.26	17.26	21.36	na	13.04	7.01
1977–78	4.88	7.74	16.94	8.25	34.38	18.06	22.59	na	14.68	7.31
1978–79	5.00	7.76	15.98	9.62	35.22	18.99	25.20	na	15.97	7.79
1979–80	5.92	8.69	15.63	10.07	42.69	19.84	25.06	na	16.00	8.43
1980–81	7.27	9.55	18.20	9.21	43.63	21.75	25.55	na	17.00	9.25
1981–82	9.11	10.61	22.54	9.91	45.71	22.74	29.84	na	17.72	11.02
1982–83	9.80	12.77	27.36	10.36	48.55	25.11	25.85	na	19.06	11.63
1983–84	10.74	17.23	28.09	11.58	49.28	26.21	31.24	na	19.90	12.60
1984–85	11.16	15.86	31.55	16.62	25.80	20.08	35.04	na	20.05	12.67
1985–86	10.92	14.68	32.10	13.51	22.00	23.77	36.23	na	19.46	12.30
1986–87	11.85	13.83	30.15	12.85	27.44	20.43	37.43	na	18.30	12.78
1987–88	11.12	14.83	32.82	12.94	27.80	19.75	37.92	na	18.39	12.16
1988–89	11.81	16.38	35.78	13.03	30.39	17.28	40.22	na	16.82	12.69
1989–90	..	..	..	..	..	..	..	..	..	..
1990–91	12.69	15.45	na	na	na	Na	na	na	18.69	13.56
1991–92	11.84	13.48	na	na	na	Na	na	na	20.04	12.74
1992–93	12.33	13.47	na	na	na	Na	na	na	20.67	13.21
1993–94	11.97	14.99	na	na	na	Na	na	na	22.06	13.06
1994–95	11.73	13.99	na	na	na	Na	na	na	23.45	12.71

.. not applicable.
na – not available.
Note: Inclusive of uniform gauge railway (Brisbane to NSW border).
Sources: Queensland Railways (1997, 1983 and 1960), BTRE estimates.

Comparisons of rail freight rates

None of the rail freight rate series presented above provides a complete time series of non-bulk interstate rail freight rates. However, by comparing and contrasting movements in the data—which correspond most closely to long distance non-bulk freight—three alternative 'consistent' time series estimates of non-bulk freight rates are suggested.

Figures VIII.2 and VIII.3 illustrate various rail freight rates measured per tonne and per tonne–kilometre—respectively[2].

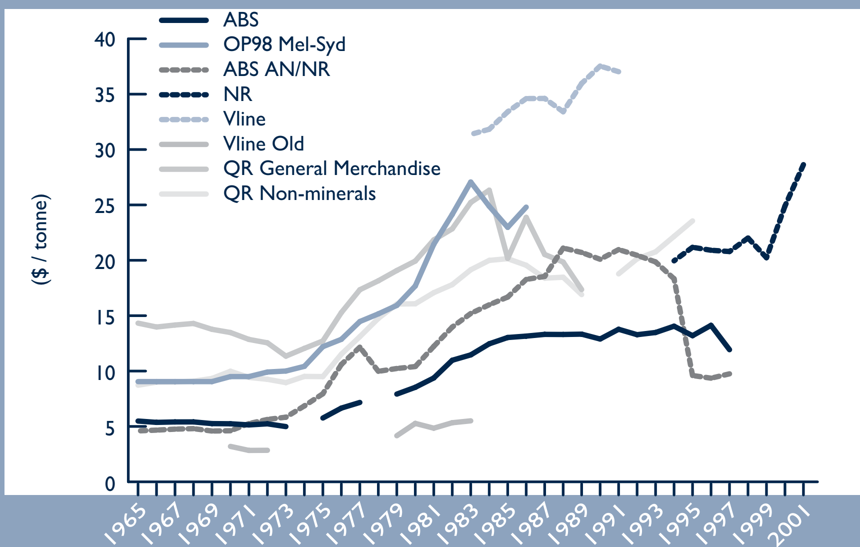
The data sources appearing in Figures 3.1 and 3.2 are:

- Australian Bureau of Statistics – average rail freight revenue all State Rail Authorities (ABS 1999 and earlier issues).
- Australian Bureau of Statistics, Australian National/ National Rail – average rail freight revenue for Australian National/ National Rail (ABS 1999 and earlier issues).
- National Rail—average rail freight or operation revenue for National Rail (NR 2001 and earlier issues and ABS 1999 and earlier issues)
- Bureau of Transport and Communications Economics *Occasional Paper 98* Mel–Syd—forwarding agent freight rates for Melbourne-Sydney corridor (BTCE 1990).
- Queensland Railways general—Queensland Railways general merchandise average rail freight revenue (QR 1997 and earlier issues).
- Queensland Railways non-minerals—Queensland Railways non-mineral freight average rail freight revenue (QR 1997 and earlier issues).
- V/Line—Victorian Railways intersystem average rail freight revenue (V/Line unpublished rail freight data).
- V/Line (Old)—Victorian Railways non-bulk average rail freight revenue (Victorian Railways 1983 and earlier issues).
- V/Line intrastate—Victorian Railways intrastate average rail freight revenue for all freight.
- V/Line non-bulk intrastate—Victorian Railways intrastate non-bulk rail freight average revenue.

2 Freight rate data is variously available on per tonne and per tonne–kilometre basis. Freight rates per tonne–kilometre are the preferred measure where there is more than one market being analysed. Where possible, freight rates are specified on a per tonne–kilometre basis in this report, but where that is not possible movements in freight rates per tonne are used. It can be shown that changes in aggregate freight rates measures will differ depending on whether the rates are specified per tonne or per tonne–kilometre, but the differences in freight rates are expected to slight.

The freight rate data illustrated in Figure VIII.2 are measured per tonne. Of the series in Figure VIII.2, movements in rates are broadly consistent. The V/Line and V/Line (Old) series measure different markets, thus the difference in the average freight rate indicated by the two series. The recent V/Line data is based on a subset of all V/Line rail freight—non-bulk and premium intersystem rail freight. The V/Line (Old) data is based on all intersystem rail freight but it is not clear from the source data, whether the revenue relates to freight movements of all rail freight within Victoria or revenue of only inbound freight to Victoria.

FIGURE VIII.2 RAIL FREIGHT RATES PER TONNE



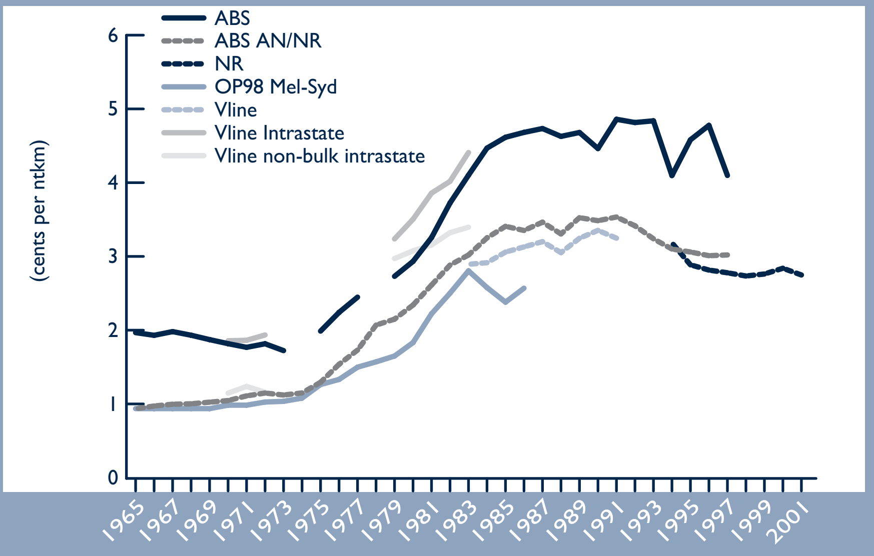
Note: ABS—average revenue of all freight carried by government systems.

Sources: ABS (1999a and earlier issues), BTCE (1990), V/Line unpublished freight data, V/Line (1983 and earlier issues), QR (1997 and earlier issues), NR (2001 and earlier issues), BTRE estimates.

The ABS data covers all freight carried by all state rail authorities—including bulk freight. For reference, non-bulk rail measured between 17 and 23 per cent of all rail freight by mass and between 34 and 57 per cent by mass-distance of all state rail freight between 1971–72 and 1985–86.

Australian National and National Rail carry a greater share of long–distance non-bulk freight than the national average operations, between 50 and 70 per cent by mass-distance from 1964–65 to 1996–97. The ABS Australian National /National Rail series may, therefore, be more representative of changes in non-bulk interstate rail freight rates. The markets covered by Australian National and National

FIGURE VIII.3 RAIL FREIGHT RATES PER NET TONNE-KILOMETRE



Sources: ABS (1999a and earlier issues), BTCE (1990), V/Line unpublished freight data, NR (2001 and earlier issues), BTRE estimates.

Rail operations have changed over time—for example NR operates services between Sydney and Melbourne whereas Australian National did not.

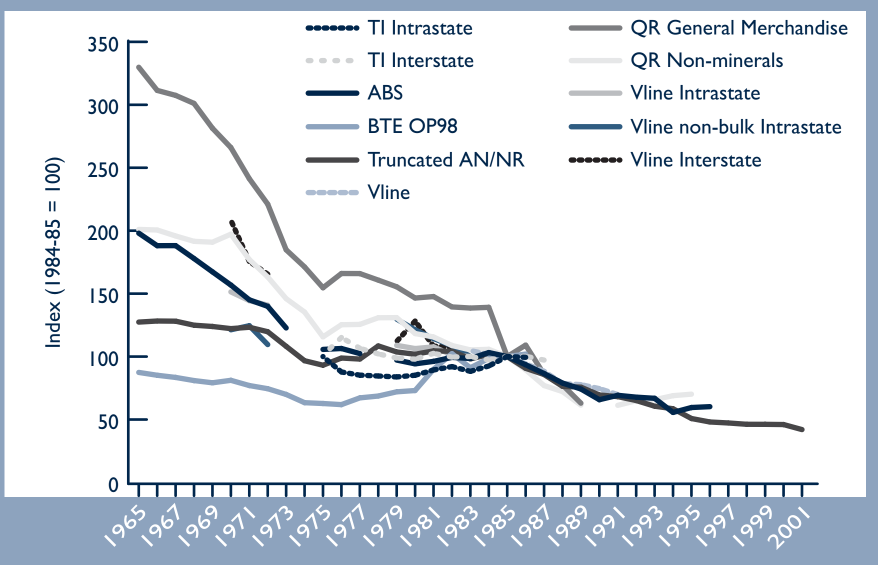
In 1993, Australian National lost its interstate rail operations to the new entity National Rail, which, as indicated also encompassed other interstate freight routes. The Australian National/ National Rail average series is very close to the pure National Rail series for the years 1994–97. However very little of National Rail's freight revenue is derived from bulk freight, only—3.8 per cent in 1998—and even less mass-distance. This means National Rail is probably a more accurate series. For these reasons it is believed that the most reasonable consistent series can be produced by following Australian National/ National Rail average rates up until 1993 and then using rates derived purely from National Rail sources from 1994 onwards. It is noteworthy that the change in series may exaggerate the rate reduction, part of which may be attributable to increased accuracy of measurement rather than an actual change in rate.

Consistent real rail freight rates

To compare movements in the different rail freight rate series, all data were first converted to real freight rates by deflating the nominal series by the CPI[3] and indexed such that 1984–85=100—where the data permits.

Figure VIII.4 provides a comparison of the real rail freight rate indexes. The Transport Indicators real interstate rail freight rate index (BTE 1988, DoT 1983), presented in section 2, are included in Figure VIII.4. Most of the series exhibit the same general downward trend in real rail freight rates. The major exception is Bureau of Transport and Communications Economics *Occasional Paper 98* (BTCE 1990) series. Of note, the real Queensland Railways general freight rate more than halved between 1964–65 and 1975–76. This was much greater than the reduction in any other measure of real rail freight rates. This paper has not explored this further. However, it indicates that Queensland Railways rates have fallen more than the other rates considered.

FIGURE VIII.4 REAL RAIL FREIGHT RATES INDEXES



Sources: ABS (1999a and earlier issues), ABS (1999b), V/Line unpublished freight data, BTE (1988 and earlier issues), BTCE (1990), DoT (1983 and earlier issues), NR (2001 and earlier issues), BTRE estimates.

3 The choice of deflator is arbitrary. If we were considering rail freight price movements relative to other prices in production the relevant price index may be all other inputs into production. Deflating rail freight rates by the price indexes of materials used in manufacturing industries (ABS 1999c) results in a slightly different measure of real freight rate movements through the mid–1980s, but little difference over the longer period 1964–65 to 2000–01.

Constructing consistent indexes of interstate real rail freight rates

The main aim of the paper is to derive consistent indexes of interstate (real) non-bulk freight rates. The series contained in Bureau of Transport and Communications Economics *Occasional Paper 98*, Australian Bureau of Statistics, ABS Australian National/ National Rail, V/Line and Transport Indicators interstate are measures of intersystem rail freight rates. The Queensland Railways general freight and Queensland Railways non-minerals series are non-bulk freight rates, but the remaining V/Line series are intrasystem series.

This paper contends the three series that most closely approximate movements in interstate non-bulk rail freight rates are Bureau of Transport and Communications Economics *Occasional Paper 98*, Australian Bureau of Statistics and Composite Australian National/ National Rail. Of these, Composite Australian National/National Rail is judged as the best indicator, since Australian National/ National Rail carries predominantly long-distance non-bulk freight. Bureau of Transport and Communications Economics *Occasional Paper 98* data, a measure of published recommended freight rates, is judged the least best of the three as an indicator of changes in actual rail freight rates. Since 1985–86 all of the freight rate series have changed at more or less the same rate.

Three different indexes of real rail freight rates, composites of the three preferred rates, are recommended as candidates of interstate non-bulk freight rates. The series cover the period 1964–65 to 2000–01 and are constructed as follows:

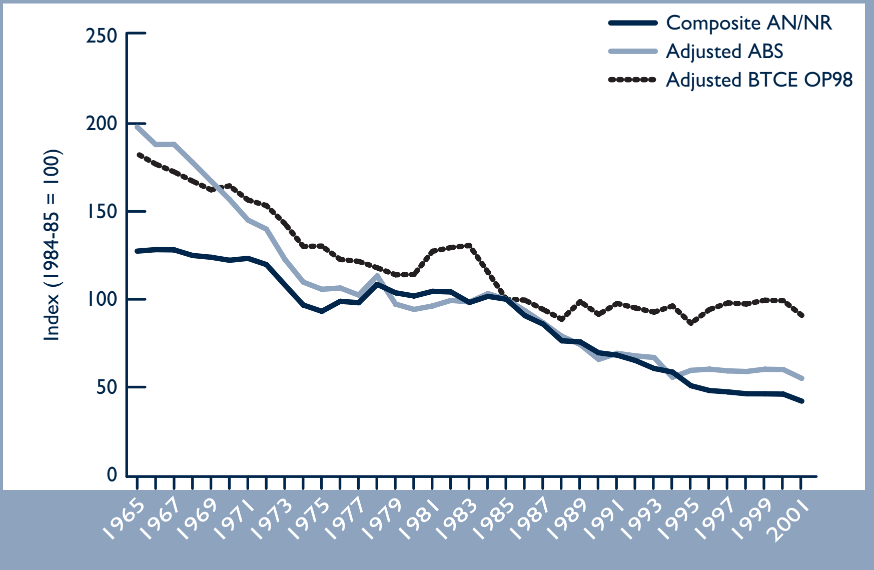
1. Composite Australian National/ National Rail.
2. Australian Bureau of Statistics with missing data points—1973–74 and 1977–78—interpolated based on movement in the Australian Bureau of Statistics Australian National/ National Rail series, and National Rail spliced onto series from 1996–97.
3. Bureau of Transport and Communications Economics *Occasional Paper 98* to 1985–86 with Australian Bureau of Statistics Australian National/ National Rail spliced onto series from 1986–87 and National Rail spliced on from 1993–94.

Estimates of these three real interstate non-bulk freight rate indexes are illustrated in Figure VIII.5 and listed in Table VIII.15.

VIII.4 ROAD FREIGHT RATES

Constructing consistent and reliable time series of rail freight rates is a difficult task. The road freight industry comprises many separate

FIGURE VIII.5 CONSISTENT RAIL FREIGHT RATE INDEXES



Sources: ABS (1999a and earlier issues), BTCE (1990), BTRE estimates.

TABLE VIII.15 CONSISTENT REAL RAIL FREIGHT RATE INDEXES

Year	Composite AN/NR	Adjusted ABS	Adjusted BTCE OP98
	Index (1985-86=100)		
1964–65	127.40	198.03	182.86
1965–66	128.25	188.08	176.96
1966–67	128.12	188.14	172.51
1967–68	124.93	177.87	167.25
1968–69	123.91	167.30	162.30
1969–70	122.20	156.81	164.57
1970–71	123.28	145.08	156.52
1971–72	119.75	139.90	153.32
1972–73	108.14	122.74	143.04
1973–74	96.70	109.75	130.06
1974–75	93.14	105.69	130.28
1975–76	98.84	106.42	122.67
1976–77	98.03	102.39	121.57
1977–78	108.48	113.31	117.92
1978–79	103.67	97.23	113.93
1979–80	101.85	94.22	114.13
1980–81	104.53	96.19	127.33
1981–82	104.15	99.37	129.44
1982–83	98.17	98.47	130.58
1983–84	101.67	103.18	115.43
1984–85	100.00	100.00	100.00
1985–86	90.67	93.52	99.53
1986–87	85.77	86.55	94.15
1987–88	76.36	78.96	88.62
1988–89	75.73	74.24	98.70
1989–90	69.52	65.75	91.37
1990–91	68.19	69.23	97.63
1991–92	65.09	67.77	95.01
1992–93	60.60	66.85	92.66
1993–94	58.56	55.63	96.18
1994–95	50.79	59.54	86.34
1995–96	48.05	60.22	94.16
1996–97	47.27	59.23	97.91
1997–98	46.21	58.88	97.32
1998–99	46.18	60.17	99.45
1999–00	46.01	60.00	99.18
2000–01	42.01	54.98	90.87

Sources: ABS (1999a and earlier issues), BTCE (1990), BTRE estimates, NR (2002 and earlier issues).

businesses. The majority of these are owner–driver operations, and a large range of market segments from bulk short haul, urban, to non-bulk long-distance freight movements. As a consequence of the large size and diffuse ownership of road freight operations, collecting freight rate data is more costly. So costly that much of the existing road freight data refers to published rates and not actual market rates. Consequently, sources of road freight rate series are fewer in number and consistent and reliable time series of road freight rates are, if anything, more difficult to construct than rail freight rates series.

A description of each data source, and a list of the raw data, appears below. Consistent time series indicators of interstate long distance interstate road freight rates are also presented. Movements in recommended (minimum) rates are assumed to reflect movements in the underlying market rates.

Department of Transport/Bureau of Transport Economics Transport Indicators

The Department of Transport/Bureau of Transport Economics Transport Indicators (DoT 1983 and BTE 1988), discussed in section 2, provide indexes of real intercity road freight forwarders' rates and real road sub-contractors' recommended minimum rates.

The intercity road freight forwarders' rate measures the scheduled rate for a 10 tonne consignment between several intercity pairs. The number and composition of intercity pairs varies over the period. The road subcontractors recommended minimum rates is the scheduled rate for a 10 tonne consignment on 20 routes between five mainland capital cities, weighted by tonnes consigned on each route.

Bureau of Transport and Regional Economics Transport Indicators Database

The Bureau of Transport and Regional Economics *Transport Indicators* database is a quarterly time series of road freight forwarders scheduled rates covering the period Mar–77 to Mar–99. The data is reproduced in Table VIII.16. The data is based on a weighted average of the Australian Road Transport Federation/Transport Workers Union recommended minimum freight rates for intercity traffic between the five mainland state capital cities.

Bureau of Transport and Communications Economics (1990)

The Bureau of Transport and Communications Economics (1990) published estimates of intercapital road freight transport rates for six intercapital city pairs. The freight rates are based on Henderson

TABLE VIII.16 ROAD FREIGHT FORWARDERS SCHEDULED RATES

($ per tonne)

Year	March	June	September	December
	Quarter			
1977	21.8	22.1	22.4	22.7
1978	23.0	23.4	23.8	24.2
1979	24.6	25.1	25.5	26.0
1980	26.4	27.9	29.3	30.1
1981	31.0	33.2	33.2	35.7
1982	35.7	35.7	35.7	35.7
1983	35.7	35.7	35.7	37.4
1984	37.4	38.4	38.4	39.5
1985	39.5	41.2	41.2	42.3
1986	42.3	45.7	45.7	45.7
1987	45.7	45.7	46.8	46.8
1988	46.8	46.8	46.8	49.6
1989	49.6	50.8	50.8	53.1
1990	53.1	55.6	55.6	59.8
1991	60.7	58.3	58.6	58.6
1992	58.6	58.6	58.6	58.6
1993	58.6	58.6	58.6	58.6
1994	58.6	58.6	58.6	58.6
1995	58.6	58.6	58.6	58.6
1996	59.2	59.7	60.1	60.6
1997	61.4	61.4	61.5	61.6
1998	61.6	61.9	58.7	58.7
1999	58.7	58.7	na	na

na - not available.

Sources: BTE (1988 and earlier issues), BTRE Transport Indicators Database.

Consultants (1987) sample of freight rates on the Melbourne–Sydney and Melbourne–Adelaide corridors. Movements in freight rates for the other corridors are based on movements in these rates. Table VIII.17 lists the freight rates published in Bureau of Transport and Communications Economics (1990).

TransEco rates index

TransEco Pty Ltd publishes quarterly indexes of road freight transport costs and observed freight rates for linehaul (long-distance) and short-haul operations. The TransEco rates date back to 1984. Table VIII.18 lists the freight rate and cost changes for linehaul (long-distance) road freight operators, as well as the rates for express and deferred road freight.

Victorian Road Transport Association/Transport Workers Union cartage rate index

The Victorian Road Transport Association has published an index of wage increases and cartage rate increases since January 1959. The cost index comprises the costs of capital, insurance, administration, tyres, repairs and maintenance, fuel and labour. General cartage operations appear to cover mainly short–haul operations, and so may not reflect movements in long–haul costs. Table VIII.19 lists the VRTA freight rate index.

TABLE VIII.17 ROAD FREIGHT RATES IN SPECIFIED CORRIDORS

($ per tonne)

Year	Mel–Syd[a]	Syd–Mel[b]	ES–Per[c]	Syd–Adl[d]	Adl–Syd[e]	Syd–Bne[f]	Bne–Syd[g]	Mel–Adl[h]	Adl–Mel[i]	Mel–Bne[j]	Bne–Mel[k]	Wgtd. Avg.
1964–65	18.20	16.00	16.00	28.40	19.40	21.42	13.42	15.65	10.90	20.85	16.00	17.08
1965–66	18.30	16.10	16.10	28.67	19.58	21.62	13.54	15.80	11.00	21.00	16.15	17.17
1966–67	18.80	16.70	16.70	29.76	20.38	22.45	14.10	16.40	11.45	21.85	16.80	17.72
1967–68	19.50	17.40	17.40	31.07	21.36	23.43	14.78	17.12	12.00	22.80	17.62	18.41
1968–69	19.90	18.20	18.20	32.30	21.93	24.36	15.17	17.80	12.32	23.71	18.10	19.02
1969–70	20.30	18.60	18.60	33.66	22.43	25.39	15.52	18.55	12.60	24.71	18.50	19.43
1970–71	21.50	19.70	19.70	35.64	23.77	26.88	16.44	19.64	13.35	26.17	19.60	20.58
1971–72	22.90	20.70	20.70	37.20	24.89	28.06	17.21	20.50	13.98	27.32	20.52	22.75
1972–73	24.60	22.20	22.20	39.65	26.58	29.90	18.38	21.85	14.93	29.10	21.92	24.38
1973–74	27.40	24.30	24.30	41.54	29.90	31.33	20.69	22.89	16.80	30.50	24.67	26.51
1974–75	30.80	27.40	27.40	50.16	33.81	37.83	23.38	27.64	18.99	36.82	27.88	31.17
1975–76	34.90	29.90	29.90	55.00	37.00	41.48	25.62	30.31	20.80	40.38	30.55	33.91
1976–77	37.70	32.20	32.20	58.78	40.29	44.33	28.26	32.39	22.95	43.15	33.70	36.56
1977–78	39.10	33.80	33.80	61.03	42.85	46.00	29.69	33.63	24.00	44.78	35.40	38.19
1978–79	40.80	35.40	35.40	64.24	46.25	47.43	30.52	35.40	25.69	46.17	36.40	39.37
1979–80	41.60	35.80	35.80	65.59	47.70	48.15	30.90	36.14	26.80	46.87	36.84	40.07
1980–81	42.70	36.90	na	67.29	48.83	49.10	31.73	37.08	27.43	47.80	37.84	39.35
1981–82	45.20	39.10	39.10	71.70	51.91	51.78	33.84	39.51	29.16	50.40	40.35	43.58
1982–83	47.40	41.70	41.70	75.49	55.99	54.53	33.66	41.60	31.45	53.08	40.14	45.89
1983–84	48.60	42.60	42.60	74.19	56.68	55.48	32.67	40.88	31.84	54.00	38.95	46.44
1984–85	51.60	44.20	44.20	78.87	58.75	58.98	32.86	43.46	33.00	57.41	39.18	48.90
1985–86	55.50	46.40	46.40	79.38	56.97	59.36	32.83	43.74	32.00	57.48	39.15	50.37

a. and b. *Henderson Consultants (1987).*

c. *Henderson Consultants (1987). No rates available for this corridor. The Melbourne-Sydney rates are used as estimates of the going rate for the service.*

d. and e. *BTE (1986). Henderson Consultants (1987). An initial rate was taken from the numerical series BTE (1986). The Melbourne-Sydney rates were used to approximate the changes in rates.*

f. and g. *Henderson Consultants (1984). The Sydney-Melbourne rates were used as a basis for determining rates of change between the years, prior to 1976 and after 1984.*

h. and i. *Henderson Consultants (1984).*

j. and k. *BTE (1986). Henderson Consultants (1987). An initial rate was taken from the numerical series BTE (1986). The Melbourne-Sydney rates were used to approximate the changes in rates.*

l. *Weighted average road freight rate is weighted average of Mel-Syd road freight rates for the period 1964–65 to 1970–71 and weighted average of all listed corridors thereafter.*

Source: *BTCE (1990).*

The association also publishes movements in award wages for road transport workers since January 1959, but these are not reproduced here.

TABLE VIII.18 TRANSECO LINEHAUL COST AND FREIGHT RATES INDICES AND EXPRESS AND DEFERRED FREIGHT RATES

	Total cost index	Rates Index	Express Road Freight Rates		Deferred Road Freight Rates	
			Mel–Per	Mel–Syd	Mel–Per	Mel–Syd
QTR	*Index (Dec–84=100)*		*Index (Jun–80=100)*		*Index (Jun–80=100)*	
Mar–80						
Jun–80			100.0	100.0	100.0	100.0
Sep–80			102.2	102.2	101.5	101.2
Dec–80			104.7	104.7	103.3	102.4
Mar–81			109.7	109.7	106.5	104.7
Jun–81			115.1	115.1	109.9	107.0
Sep–81			118.3	118.3	110.7	107.6
Dec–81			123.7	123.7	115.3	110.7
Mar–82			126.4	126.4	116.9	111.0
Jun–82			130.3	130.3	120.4	113.2
Sep–82			136.3	136.3	125.8	116.9
Dec–82			140.3	140.3	128.3	116.5
Mar–83			143.4	144.9	131.8	120.9
Jun–83			144.9	149.1	133.2	121.8
Sep–83			149.1	149.1	136.7	124.2
Dec–83			152.7	152.7	139.8	126.2
Mar–84			155.9	155.9	140.0	127.0
Jun–84			166.3	166.3	141.6	128.1
Sep–84			171.4	171.4	143.3	129.3
Dec–84	100.00	100.00	176.5	176.5	144.8	130.3
Mar–85	101.66	101.29	179.9	179.9	147.3	132.5
Jun–85	105.86	103.66	183.3	183.3	152.8	137.4
Sep–85	106.95	104.26	180.0	180.0	154.9	139.3
Dec–85	108.15	107.07	178.0	178.0	157.6	141.8
Mar–86	107.96	108.53	181.8	181.8	161.1	144.9
Jun–86	108.80	110.62	175.2	175.2	162.3	146.0
Sep–86	114.48	113.19	184.5	184.5	167.5	150.6
Dec–86	116.82	115.51	193.9	193.9	173.2	155.8
Mar–87	119.19	118.26	201.5	201.5	178.0	160.1
Jun–87	120.39	119.06	206.4	206.4	179.4	161.3
Sep–87	122.62	120.88	212.4	212.4	182.3	164.0
Dec–87	124.06	122.81	219.7	219.7	186.4	167.6
Mar–88	125.38	125.38	224.8	224.8	189.3	170.3
Jun–88	126.27	126.18	228.1	228.1	189.2	170.1
Sep–88	125.99	128.73	236.0	236.0	192.3	173.0
Dec–88	126.10	129.76	242.9	242.9	194.0	174.5
Mar–89	129.17	132.12	253.0	253.0	197.5	177.7
Jun–89	132.35	133.23	264.1	264.1	200.6	180.5
Sep–89	135.01	134.32	264.3	264.3	203.8	183.3
Dec–89	136.39	138.12	265.0	266.0	210.1	188.9
Mar–90	139.14	139.59	266.1	266.1	214	192.5
Jun–90	139.93	141.91	264.2	264.2	216.9	195.1
Sep–90	145.97	145.6	276.1	276.1	220.6	198
Dec–90	153.28	150.5	297	297	228.3	204.3
Mar–91	147.95	148.85	299	299	223.4	199.4
Jun–91	148.82	149.19	308.9	306.9	222.5	198.1
Sep–91	149.9	150.43	321.5	321.5	224.1	195.9
Dec–91	154.26	154.43	334.2	334.2	225.3	199.5
Mar–92	153.89	154.6	334.2	344.6	225.2	198.9
Jun–92	155.89	154.64	344.8	354.5	213.6	197.7
Sep–92	157.68	155.27	354.5	359.5	226.8	198.3
Dec–92	159.08	155.97	359.5	361.1	226.8	197.7
Mar–93	159.82	156.88	361.1	363.4	227.1	197.5
Jun–93	161.16	157.1	363.4	366.5	2274	197.2

CONTINUED

TABLE VIII.18 TRANSECO LINEHAUL COST AND FREIGHT RATES INDICES AND EXPRESS AND DEFERRED FREIGHT RATES (continued)

	Total cost index	Rates Index	Express Road Freight Rates		Deferred Road Freight Rates	
			Mel–Per	Mel–Syd	Mel–Per	Mel–Syd
QTR	*Index (Dec–84=100)*		*Index (Jun–80=100)*		*Index (Jun–80=100)*	
Sep–93	163.88	157.12	366.50	369.20	228.90	198.00
Dec–93	165.11	160.86	369.20	370.70	229.10	197.60
Mar–94	164.10	160.98	370.70	371.10	228.50	196.60
Jun–94	166.07	161.49	371.10	375.30	229.20	196.60
Sep–94	167.59	163.80	375.30	379.50	231.20	198.20
Dec–94	169.85	164.44	380.00	378.90	231.80	198.70
Mar–95	171.68	161.35	381.10	380.30	233.10	199.70
Jun–95	173.62	162.60	384.00	383.60	234.80	201.00
Sep–95	173.07	163.43	389.10	391.50	235.90	201.20
Dec–95	173.95	163.63	390.00	392.70	235.80	200.70
Mar–96	175.64	163.25	390.60	393.50	235.80	200.00
Jun–96	175.90	163.86	393.70	397.20	235.90	199.90
Sep–96	178.10	163.92	393.70	397.40	235.80	199.80
Dec–96	179.57	164.93	398.10	400.50	236.50	200.40
Mar–97	178.50	165.01	398.10	403.00	237.00	200.80
Jun–97	179.28	165.65	397.90	403.00	236.90	198.90
Sep–97	180.03	166.80				
Dec–97	182.09	167.49				
Mar–98	180.85	167.40				
Jun–98	181.35	168.18				
Sep–98	183.03	168.37				
Dec–98	183.60	168.64				
Mar–99	183.68	169.15				
Jun–99	186.84	170.04				
Sep–99	191.33	170.95				
Dec–99	197.51	171.90				
Mar–00	200.62	172.97				
Jun–00	203.15	174.38				
Sep–00	199.76	173.48				
Dec–00	201.99					
Mar–01	196.75					

Sources: TransEco (1998, 1999).

TABLE VIII.19 VRTA RATE INDEX—GENERAL CARTAGE DIVISION

(Index)

	Quarter			
Year	Mar	Jun	Sep	Dec
1959	1.050	1.075	1.075	1.075
1960	1.075	1.111	1.129	1.129
1961	1.129	1.129	1.129	1.129
1962	1.129	1.129	1.129	1.129
1963	1.129	1.129	1.166	1.185
1964	1.185	1.185	1.224	1.244
1965	1.244	1.244	1.265	1.307
1966	1.307	1.346	1.391	1.413
1967	1.413	1.413	1.432	1.470
1968	1.470	1.470	1.470	1.494
1969	1.543	1.543	1.620	1.620
1970	1.661	1.661	1.772	1.827
1971	1.918	1.918	1.918	1.918
1972	1.918	1.982	2.110	2.110
1973	2.427	2.427	2.427	2.516
1974	2.694	2.694	3.582	3.582
1975	3.672	3.947	4.251	4.628
1976	4.736	4.952	5.186	5.246
1977	5.365	5.598	5.672	5.821
1978	5.889	6.025	6.025	6.188
1979	6.683	6.683	6.850	6.850
1980	7.241	7.241	7.603	7.784
1981	8.095	8.378	8.875	9.364
1982	9.364	9.364	10.020	10.020
1983	10.020	10.020	10.020	11.324
1984	11.324	11.777	11.777	11.777
1985	11.777	12.266	12.266	12.532
1986	13.063	13.063	13.912	13.912
1987	14.202	14.781	14.781	14.781
1988	15.667	16.059	16.176	16.409
1989	16.543	16.812	16.812	17.838
1990	17.838	18.125	18.698	19.427
1991	19.688	19.819	19.938	20.176
1992	20.176	20.176	20.206	20.267
1993	20.267	20.267	20.775	21.791
1994	21.791	21.791	22.045	22.554
1995	22.554	22.554	22.874	23.515
1996	23.515	23.515	23.654	23.931
1997	23.931	23.931	23.709	23.265
1998	23.265	23.265	23.399	23.666
1999	23.666	23.666	23.865	24.264
2000	24.264			

Source: *VRTA (2000).*

New South Wales Roads and Traffic Authority carting tariff

The BTRE also has a series of road freight rates entitled New South Wales Roads and Traffic Authority carting tariff, listed in Table VIII.20. The series probably measures recommended minimum cartage rates. However, the market(s) covered by the series—that is, urban, long-distance non-bulk, intercapital, non-urban and bulk or non-bulk—are not known.

TABLE VIII.20 NSW RTA GENERAL CARTING TARIFF

Index

		Quarter		
Year	**Mar**	**Jun**	**Sep**	**Dec**
1979				187.07
1980	206.01	207.58	216.91	221.58
1981	231.23	240.53	262.16	268.50
1982	268.50	289.87	319.70	322.08
1983	323.91	327.57	327.57	342.34
1984	349.72	367.57	375.39	391.04
1985	391.04	415.07	416.78	429.01
1986	435.13	435.13	451.61	459.85
1987	498.87	505.02	505.02	505.02
1988	533.66	547.98	553.96	565.93
1989	572.46	585.51	585.51	585.51
1990	624.31	624.31	na	na

na - not available.

Source: NSW RTA.

Road freight subcontractors rate

The original source of the road freight subcontractors' freight rates series, listed in Table VIII.21 isn't known. The data appears to be very close to scheduled road freight forwarders' rates listed in the BTRE Transport Indicators database, itself based on the Australian Road Transport Federation/Transport Workers Union recommended minimum rates. These are described below.

TABLE VIII.21 ROAD FREIGHT SUB-CONTRACTORS RATE

($/tonne)

		Quarter		
Year	**Mar**	**Jun**	**Sep**	**Dec**
1977				23.00
1978	23.40	23.80	24.20	24.60
1979	25.10	25.50	26.00	26.40
1980	27.90	29.30	30.10	31.00
1981	33.18	33.18	35.70	35.70
1982	35.70	35.70	35.70	35.70
1983	35.70	35.70	35.70	37.35
1984	37.35	38.44	38.44	39.53
1985	39.53	41.18	41.18	42.27
1986	42.27	45.72	45.72	45.72
1987	45.72	45.72	46.81	46.81
1988	46.81	46.81	46.81	49.56
1989	49.59	50.81	50.81	53.10
1990	53.10	55.63	55.63	59.80
1991	60.68	58.32	58.63	58.63
1992	58.63	58.63	58.63	58.63
1993	58.63	58.63		

Source: Unknown.

Linehaul road freight rate

The BTRE also has a series of road freight rates entitled linehaul freight rate index. The data is listed in Table VIII.22. The original source of this data is not known, but visual inspection of the data suggests that the linehaul freight rate index and Bureau of Transport and Communications Economics *Occasional Paper 98* road freight rate are based on the same source data.

TABLE VIII.22 LINEHAUL ROAD FREIGHT RATE

(Index)

	Quarter			
Year	**Mar**	**Jun**	**Sep**	**Dec**
1965		37.11		
1966		37.34		
1967		38.73		
1968		40.36		
1969		42.21		
1970		43.14	43.78	44.42
1971	45.05	45.69	46.27	46.85
1972	47.43	48.01	48.88	49.75
1973	50.62	51.49	52.71	53.93
1974	55.14	56.36	58.16	59.96
1975	61.75	63.55	65.00	66.45
1976	67.90	69.35	70.68	72.02
1977	73.35	74.68	75.61	76.54
1978	77.47	78.40	79.33	80.26
1979	81.18	82.11	82.34	82.57
1980	82.80	83.03	83.67	84.31
1981	84.95	85.59	86.87	88.14
1982	89.42	90.69	92.20	93.71
1983	95.21	96.72	97.24	97.77
1984	98.29	98.81	99.74	100.67
1985	101.59	102.52	103.80	105.07
1986	106.35	107.62	109.84	112.07
1987	114.29	116.51	118.33	120.16
1988	121.98	123.80	125.59	127.38
1989	129.17	130.96	132.84	134.73
1990	136.61	138.49	141.00	143.52
1991	146.03	148.54	149.24	149.95
1992	150.65	151.35	152.11	152.88
1993	153.64	154.40	155.13	155.85
1994	156.58	157.30		

Source: BTRE estimates.

Australian Road Transport Federation/Transport Workers Union published interstate owner driver rates

The Australian Road Transport Federation/ Transport Workers Union publishes recommended minimum owner–driver rates for the major intercapital routes in Australia. In the past, the Australian Industrial Relations Commission determined the rates, following an application by the Transport Workers Union (TWU) for a change to the rates. Currently, minimum interstate owner-driver rates are determined by agreement between the Australian Road Transport Federation (ARTF) and the TWU on an annual basis. The rates apply to a person who supplies and drives their own vehicle under subcontract to another transport operator for the cartage of freight on an interstate long-distance transportation operation and who does not employ another driver except in such circumstances as during sickness or leave of absence.

Determinations by the Australian Industrial Relations Commission were handed down on the following dates:

1 January 1984

1 September 1984

1 March 1985

1 July 1985

1 October 1985

6 March 1986

1 October 1987

1 October 1988

1 April 1989

1 June 1989

1 April 1990

1 October 1990

1 January 1991

1 February 1991

1 March 1991

1 April 1991

The *Australasian Transport News* published recommended owner–driver rates applicable from 1 August 1996, which are the last set of published rates known by the BTRE. TransEco (Kim Hassall, pers. comm., September 1998) provided the freight rates covering the period 1992 to 1996.

Table VIII.23 lists the Australian Road Transport Federation/ Transport Workers Union published freight rates by route, from 1984 to 1996. The weighted average freight rate presented in Table VIII.23 is based on the published intercity rates weighted by a fixed set of weights—the weights used to calculate the weighted average rate are listed at the bottom of table.

TABLE VIII.23 ARTF/TWU PUBLISHED INTERSTATE OWNER-DRIVERS RATES, BY ROUTE

($ per tonne)

	Weighted average rate	Syd–Bne	Syd–Mel	Syd–Adl	Syd–Per	Mel–Bne	Mel–Syd	Mel–Adl	Mel–Per	Adl–Bne	Adl–Syd	Adl–Per	Adl–Mel	Bne–Syd	Bne–Mel	Bne–Adl	Bne–Per	Per–Adl	Per–Mel	Per–Syd	Per–Bne
1983	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1984	51.1	44.3	30.3	44.3	159.7	68.7	35.3	30.3	140.3	70.7	44.3	110.0	23.3	28.3	42.3	45.3	161.7	47.3	61.7	75.7	105.0
1985	55.3	47.1	32.6	47.1	171.6	73.7	38.1	32.6	151.1	75.7	65.8	99.3	25.6	30.6	45.1	48.1	173.6	50.3	71.7	81.2	112.8
1986	61.3	52.0	36.3	52.0	190.5	81.5	42.3	36.3	169.5	83.5	70.8	112.8	28.5	34.3	50.0	53.0	193.3	56.0	74.5	90.3	124.8
1987	62.3	53.3	37.3	53.3	195.3	83.5	43.3	37.3	173.0	85.5	53.3	134.0	29.3	35.3	51.3	54.3	197.0	57.0	76.0	92.5	127.0
1988	65.3	56.0	39.0	56.0	205.0	87.0	45.0	39.0	181.0	90.0	56.0	141.0	31.0	37.0	53.0	57.0	208.0	60.0	80.0	97.0	134.0
1989	69.2	60.0	41.0	60.0	217.0	93.0	47.0	41.0	192.0	96.0	60.0	149.0	33.0	39.0	57.0	61.0	220.0	64.0	84.0	103.0	142.0
1990	75.7	65.0	45.0	65.0	237.0	102.0	51.0	45.0	210.0	105.0	65.0	163.0	36.0	43.0	62.0	68.0	240.0	72.0	94.0	116.0	160.0
1991	77.8	67.0	46.0	67.0	245.0	105.0	53.0	46.0	217.0	108.0	67.0	168.0	37.0	44.0	64.0	68.0	248.0	72.0	94.0	116.0	160.0
1992	79.7	69.0	47.0	69.0	251.0	107.0	54.0	47.0	222.0	111.0	69.0	172.0	38.0	45.0	66.0	70.0	254.0	74.0	96.0	119.0	164.0
1993	71.9	61.8	38.8	61.6	238.0	98.6	50.3	42.9	207.1	93.6	59.6	160.0	27.4	33.0	46.0	60.3	242.5	79.8	103.6	119.0	121.3
1994	70.6	60.8	37.8	60.1	232.1	97.0	49.4	42.1	205.1	91.3	58.3	157.6	26.8	32.8	45.8	58.5	237.9	78.7	102.6	116.1	118.9
1995	69.3	59.9	36.8	58.5	226.2	95.4	48.5	41.2	203.1	89.0	57.0	155.2	26.2	32.7	45.7	56.8	233.3	77.5	101.5	113.1	116.6
1996	66.7	58.0	34.9	55.4	214.4	92.2	46.7	39.5	199.0	84.4	54.4	150.4	25.0	32.3	45.3	53.3	224.0	75.2	99.5	107.2	112.0
											(per cent)										
Weights		8.13	16.27	5.74	2.87	6.70	17.70	5.74	2.87	0.48	4.78	2.39	4.78	5.74	5.26	1.44	2.39	1.91	2.39	2.39	0.48

Notes: *Data appears to be sourced from ARTF/TWU published rates schedule applying to full-rig combination (owner-driver providing vehicle and trailer under contract to prime contractors).* Weighted average rate based on share of intercapital road freight movements by city-pair for 1996 (ABS 1996).

Sources: ARTF/TWU (1998), ATN (1996), TransEco (Kim Hassall pers. comm.).

Other sources of road freight rates

There are other publications that have estimates of road freight rates. However, most of those publications record only small sets of data, typically one observation only. As stated at the outset, the paper does not include those sources as the paper's primary aim is to construct consistent time series.

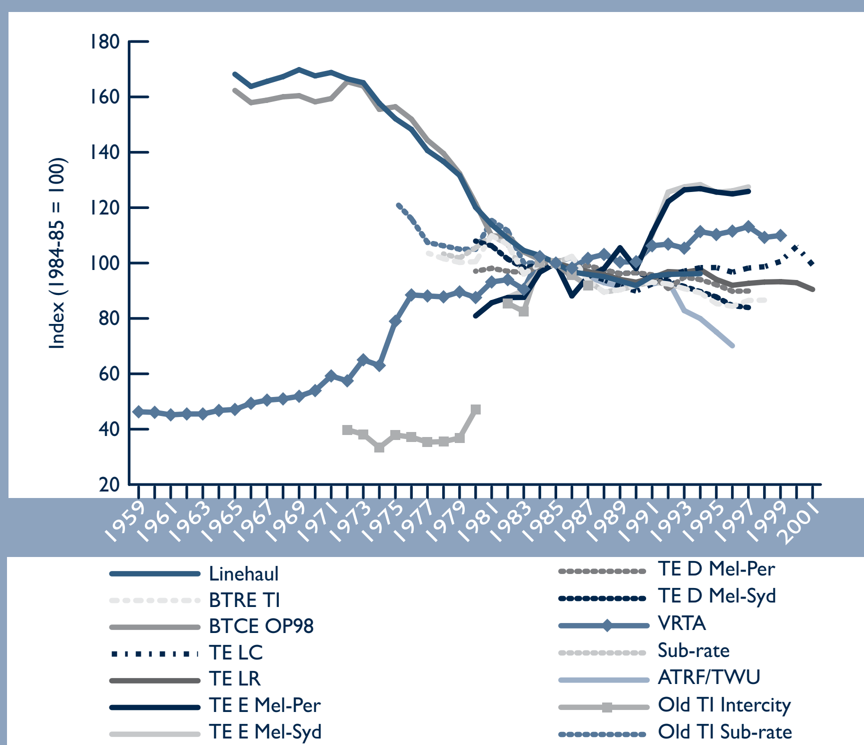
A couple of sources, for which the data is not included here, are worth mentioning. The Bureau of Transport Economics (1977) and (1975) list published freight forwarder freight rates on major intercapital routes at selected dates in 1971, 1972, 1974 and 1977. The Bureau of Transport Economics (1975) reports that no firm relationship exists between published and contract freight rates. However, one industry source indicated that in negotiating contract rates, the discount is never more than 20 per cent. A comparison of actual freight forwarders road freight rates (BTCE 1990) with the published freight rates (BTE 1975 and BTE 1977), for the Sydney–Melbourne route in years 1971, 1972 and 1974, bears out the anecdotal evidence.

Indexes of real intercapital road freight rates

As in the case of rail freight, none of the road freight rate series, presented above, provided a complete time series of non-bulk interstate road freight rates covering the period 1964–65 to 2000–01. Consistent time series estimates of non-bulk road freight rates are suggested following comparison of movements in the various road freight rate data series'.

Figure VIII.6 illustrates movements in real road freight rates, indexed to 1984–85=100. Real series were derived by deflating the nominal

FIGURE VIII.6 COMPARISON OF REAL ROAD FREIGHT RATE INDEXES



Sources: ATN (1998), ARTF/TWU (1991), BTCE (1990), BTRE Transport Indicators Database, Kim Hassall (pers. comm.), NSW RTA, TransEco (1999), TransEco (1998), VRTA (2000), BTE (1988 and earlier issues), BTRE estimates.

freight rates by the CPI (ABS 1999b). The data sources appearing in Figures VIII.6 and VIII.7 are:

Linehaul—linehaul road freight rate index

BTRE TI—BTRE Transport Indicators database scheduled road freight forwarders' rates

BTCE OP98—freight weighted average of road freight rates in six intercity corridors (BTCE 1990)

TE LC—TransEco linehaul cost index

TE LR—TransEco linehaul rates index

TE E Mel–Syd—TransEco express road freight rates Melbourne–Sydney

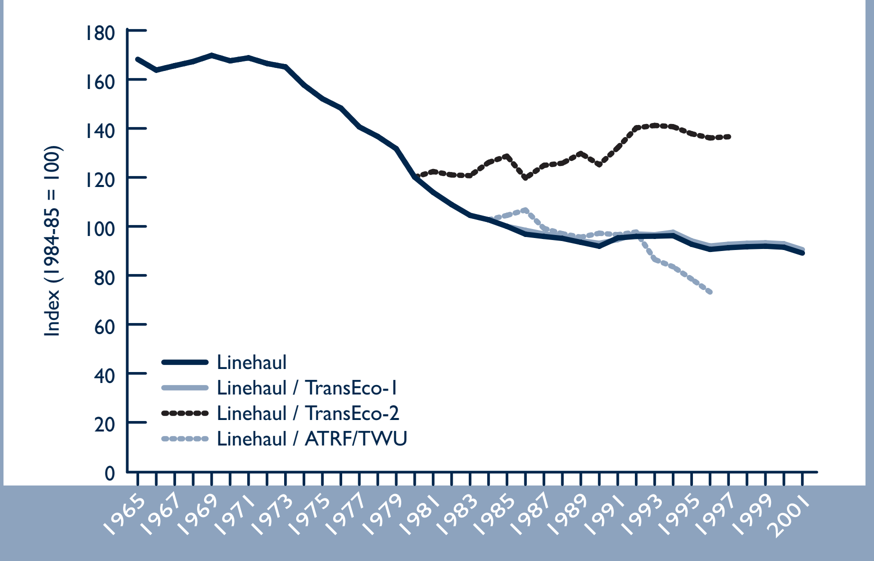
TE E Mel–Per—TransEco express road freight rates Melbourne–Perth

TE D Mel–Syd—TransEco deferred road freight rates Melbourne–Sydney

TE D Mel–Per—TransEco deferred road freight rates Melbourne–Perth

VRTA—VRTA general cargo division freight rates index

FIGURE VIII.7 CONSISTENT REAL ROAD FREIGHT RATE INDEXES



Sources: ATN (1998), ARTF/TWU (1991), BTCE (1990), BTRE Transport Indicators Database, Kim Hassall (pers. comm.), NSW RTA, TransEco (1999), TransEco (1998), VRTA (2000), BTE (1988 and earlier issues), BTRE estimates.

Subrate—sub-contractors road freight rates—see Table 4.6

ARTF/TWU—freight weighted average of ARTF/TWU scheduled freight forwarders rates

Old TI intercity—Transport Indicators intercity road freight forwarders rates

Old TI sub-rate—Transport Indicators road freight sub-contractors recommended minimum rate database (DoT 1981a and BTE 1983 and later issues).

Immediately apparent from Figure VIII.6 is that most indicators show real road freight rates declined appreciably after 1970. In other words, nominal road freight rates have not grown as quickly as consumer prices, as measured by the CPI. The major exceptions to the rule are the Victorian Road Transport Association rate index and the TransEco express road freight indexes. The Victorian Road Transport Association rate index appears to be an index of short-haul general cartage freight rates, and so may not be representative of movements in long-distance road freight rates. TransEco deferred freight rates have declined while premium road freight rates have increased in real terms since 1980. Intercity rail services have difficulty matching the door-to-door travel times of premium road freight services. This limits the scope for substitution to rail. Given the decline in deferred road freight rates, the premium service attributes appear to attract an increasing return.

The old Transport Indicators intercity freight rates index is also at odds with movements in other real road freight rates.

Although there appear to be several different road freight rate series, those series are probably based on only six original data sources—*BTCE OP98/Linehaul* data, ARTF/TWU recommended rates, actual/recommended sub-contractors road freight rates, TransEco deferred and express rates, Victorian Road Transport Association general cartage rates and the old Department of Transport 'Transport Indicators' data. Consistent measures of interstate and long-distance road freight rates are constructed from four of these basic data sources.

The *BTCE OP98 and Linehaul* series are the only measures of long distance road freight rates covering the period from about 1964–65 to 1974–75. From the mid-1970s onwards, there are a several series from which to select indicators of changes in freight rates. They include *BTCE OP98, Linehaul*, TransEco freight rates (*TE LC, TE LR, TE D) and Old TI subrate*. Between 1979–80 and 1991–92 these series decline by about the same amount. After 1991–92, however, the paths followed by these series diverge.

Based on these observations, four composite road freight rate indexes, covering the period 1964–65 to 2000–01, are suggested. The methods for constructing the series are suggested below, with the series plotted in Figure VIII.7 and listed in Table VIII.24:

Linehaul—Linehaul and BTCE OP98 (post-1965 the series appear highly correlated) spliced with the TransEco linehaul rates index from 1994–95

Linehaul/TansEco-1—Linehaul from 1964–65 with the TransEco linehaul rates index spliced on from 198485 (*Linehaul / TE LR*)

Linehaul/TansEco-2—Linehaul from 1964–65 with simple average of TransEco deferred and express road freight rates (Sydney–Melbourne and Sydney–Perth) from 1979-80 (*Linehaul / TE E/D*)

Linehaul ATRF/TWU—Linehaul from 1964–65 with the weighted average ATRF/ TWU scheduled rate spliced on from 1984–85.

TABLE VIII.24 CONSISTENT REAL ROAD FREIGHT RATE SERIES

		Index		
Year	**Linehaul**	**Linehaul / TransEco-1**	**Linehaul / TransEco-2**	**Linehaul / ATRF/TWU**
1964–65	168.2	168.2	168.2	168.2
1965–66	163.8	163.8	163.8	163.8
1966–67	165.6	165.6	165.6	165.6
1967–68	167.3	167.3	167.3	167.3
1968–69	169.8	169.8	169.8	169.8
1969–70	167.6	167.6	167.6	167.6
1970–71	168.8	168.8	168.8	168.8
1971–72	166.5	166.5	166.5	166.5
1972–73	165.1	165.1	165.1	165.1
1973–74	157.7	157.7	157.7	157.7
1974–75	152.1	152.1	152.1	152.1
1975–76	148.3	148.3	148.3	148.3
1976–77	140.6	140.6	140.6	140.6
1977–78	136.7	136.7	136.7	136.7
1978–79	131.7	131.7	131.7	131.7
1979–80	120.1	120.1	120.1	120.1
1980–81	113.9	113.9	122.4	113.9
1981–82	108.9	108.9	121.0	108.9
1982–83	104.5	104.5	120.7	104.5
1983–84	102.7	102.7	126.1	102.7
1984–85	100.0	100.0	128.7	104.5
1985–86	96.8	98.4	119.7	106.7
1986–87	95.9	96.9	124.9	99.2
1987–88	95.1	95.9	125.8	97.0
1988–89	93.5	94.1	129.8	95.6
1989–90	91.9	93.1	125.2	97.2
1990–91	95.3	94.6	132.1	96.6
1991–92	95.9	96.9	140.2	97.7
1992–93	96.0	96.6	141.2	86.5
1993–94	96.2	97.6	140.7	83.5
1994–95	92.7	94.1	137.8	78.5
1995–96	90.6	92.0	136.1	73.2
1996–97	91.3	92.7	136.6	na
1997–98	91.7	93.1	na	na
1998–99	91.9	93.3	na	na
1999–00	91.5	92.9	na	Na
2000–01	89.1	90.5	na	Na

na - not available.

Sources: ATN (1998), ARTF/TWU (1991), BTCE (1990), BTRE Transport Indicators Database, Kim Hassall (pers. comm.), NSW RTA, TransEco (1999), TransEco (1998), VRTA (2000), BTE (1988 and earlier issues), BTRE estimates.

VIII.5 COASTAL SHIPPING FREIGHT RATES

Most non-bulk coastal shipping cargo is carried to or from Tasmania. All data discussed within this section is therefore taken from this route. Shipping across Bass Straight is conducted in different economic circumstances than shipping between mainland cities. The primary differences are:

- the Tasmanian Freight Equalisation Scheme (TFES).
- some competing services forming part of continuous international voyages.
- the loading/unloading mechanism being roll on roll off (ro-ro) as opposed to lift on lift off (lo-lo).

For this reason, it is possible that significant differences exist in freight rates and freight rate trends between non bulk freight travelling to and from Tasmania and non-bulk freight travelling between mainland cities.

The following data sources are discussed in this section:

- Bureau of Transport and Communications Economics Occasional Paper 98 (1990).
- Australian Competition and Consumer Commission Monitoring of Coastal Shipping Freight Rates No. 3 December 1995.
- Tasmanian Department of Roads and Transport Submission to the Prices Surveillance Authority (1990).
- Tasmanian Freight Equalisation Scheme Administrators (2002).
- Bureau of Transport Economics Transport Indicators (1981).

Bureau of Transport and Communications Economics (1990)

The Bureau of Transport and Communications Economics (1990) provides estimates of annual average coastal shipping freight rates for a selected set of intercapital routes, which are reproduced in Tables 5.1 and 5.2. The coastal shipping freight rates are based on freight rates in markets of similar distance, and or characteristics. None of the series appear to draw on data from the route that they purport to measure—see notes in tables. The weighted average freight rates listed in Tables VIII.25 and VIII.26 are a freight weighted average of freight rates in the six specified corridors.

These figures are cited as being supplied by Australian National Line. The sharp jump in 1977 coinciding with the introduction of the Tasmanian Freight Equalisation Scheme introduces the possibility of altered reporting of charges. The figures before 1977 should therefore be used with caution.

TABLE VIII.25 SEA FREIGHT RATES BETWEEN SPECIFIED CORRIDORS

($ per tonne)

Year	Mel–Syd[a]	ES–Per[b]	Syd–Adl[c]	Syd–Bne[d]	Mel–Adl[e]	Mel–Bne[c]	Weighted[f] average
1964–65	8.45	25.52	10.00	7.66	10.85	10.60	15.57
1965–66	8.82	25.69	10.30	8.08	11.00	10.60	16.52
1966–67	9.70	26.02	10.30	9.00	11.13	10.60	17.20
1967–68	10.19	26.38	10.65	9.78	11.48	10.60	17.53
1968–69	10.45	26.57	12.00	10.27	11.58	12.00	18.43
1969–70	11.26	27.93	13.40	11.26	12.50	13.40	20.81
1970–71	12.39	29.29	16.20	12.39	13.14	16.20	21.67
1971–72	13.50	26.24	17.50	13.50	14.21	17.50	20.56
1972–73	16.86	25.64	21.93	16.86	14.21	21.93	22.23
1973–74	16.86	27.71	21.93	16.86	17.79	21.93	22.65
1974–75	20.36	33.50	26.45	20.36	21.57	26.45	27.27
1975–76	28.07	42.57	37.38	28.07	30.50	37.38	36.96
1976–77	51.14	49.07	59.05	51.14	38.93	59.05	51.13
1977–78	59.43	65.14	66.60	59.43	43.93	66.60	60.71
1978–79	60.64	70.00	70.04	60.64	46.21	70.04	63.10
1979–80	69.43	81.07	80.15	69.43	52.86	80.15	72.74
1980–81	78.14	91.24	90.17	78.14	59.50	90.17	81.54
1981–82	89.64	96.36	103.45	89.64	68.29	103.45	90.30
1982–83	100.36	110.36	115.85	100.36	76.43	115.85	102.68
1983–84	101.93	113.86	117.64	101.93	77.57	117.64	105.62
1984–85	101.93	113.36	117.64	101.93	78.50	117.64	106.23
1985–86	103.14	114.64	119.00	103.14	83.07	119.00	106.43

a. *Tasmania–Sydney rates.*
b. *Tasmania–Fremantle rates.*
c. *Tasmania–Brisbane rates.*
d. *Tasmania–Sydney rate used as a proxy.*
e. *Tasmania–Adelaide rates.*
f. *Sum of average freight rates by route weighted by freight task on each route.*

Sources: ABS (1972), ANL (pers. comm.), BTCE (1990).

TABLE VIII.26 SEA FREIGHT RATES BETWEEN SPECIFIED CORRIDORS

($ per tonne–kilometre)

Year	Mel–Syd[a]	ES–Per[b]	Syd–Adl[c]	Syd–Bne[d]	Mel–Adl[e]	Mel–Bne[c]	Weighted[f] average
1964–65	0.008736	0.007897	0.009775	0.008736	0.009975	0.009775	0.008787
1965–66	0.009118	0.007950	0.010068	0.009118	0.010113	0.010068	0.009095
1966–67	0.010028	0.008052	0.010068	0.010028	0.010233	0.010068	0.009738
1967–68	0.010535	0.008163	0.010411	0.010535	0.010554	0.010411	0.010155
1968–69	0.010804	0.008222	0.011730	0.010804	0.010646	0.011730	0.010496
1969–70	0.011641	0.008643	0.013099	0.011641	0.011492	0.013099	0.011328
1970–71	0.012809	0.009064	0.015836	0.012809	0.012080	0.015836	0.012519
1971–72	0.013957	0.008120	0.017107	0.013957	0.013064	0.017107	0.013348
1972–73	0.017431	0.007934	0.021437	0.017431	0.013064	0.021437	0.016158
1973–74	0.017431	0.008575	0.021437	0.017431	0.016355	0.021437	0.016437
1974–75	0.021049	0.010366	0.025855	0.021049	0.019831	0.025855	0.019852
1975–76	0.029020	0.013173	0.036540	0.029020	0.028041	0.036540	0.027332
1976–77	0.052870	0.015184	0.057722	0.052870	0.035791	0.057722	0.046631
1977–78	0.061441	0.020157	0.065103	0.061441	0.040388	0.065103	0.054298
1978–79	0.062692	0.021661	0.068465	0.062692	0.042484	0.068465	0.055864
1979–80	0.071779	0.025086	0.078348	0.071779	0.048598	0.078348	0.063999
1980–81	0.080784	0.028233	0.088143	0.080784	0.054702	0.088143	0.072025
1981–82	0.092673	0.029818	0.101124	0.092673	0.062783	0.101124	0.082229
1982–83	0.103756	0.034150	0.113245	0.103756	0.070267	0.113245	0.092183
1983–84	0.105379	0.035233	0.114995	0.105379	0.071315	0.114995	0.093705
1984–85	0.105379	0.035078	0.114995	0.105379	0.072170	0.114995	0.093728
1985–86	0.106630	0.035474	0.116325	0.106630	0.076371	0.116325	0.095016

a. *Tasmania–Sydney rates.*
b. *Tasmania–Fremantle rates.*
c. *Tasmania–Brisbane rates.*
d. *Tasmania–Sydney rate used as a proxy.*
e. *Tasmania–Adelaide rates.*
f. *Sum of average freight rates by route weighted by freight task on each route.*

Sources: ABS (1972), ANL (pers. comm.), BTCE (1990), BTRE estimates.

Department of Roads and Transport Tasmania (1990)

The Tasmanian Department of Roads and Transport submission to the Price Surveillance Authority provides a graphed series of average freight rates for Tasmanian Freight Equalisation Scheme claimants. These figures were attained from the Commonwealth Department of Transport.

This submission also contains a graph of average freight yields derived from aggregate records of cargo movements on the Straitsman service operated by the Tasmanian Government. While Straitsman carries relatively small volumes of cargo, its freight rates are competitive when compared with those offered by the major operators. It is possible that the freight yields derived from Straitsman could be extended and provide a good comparative index of the freight rates across Bass Strait.

Table VIII.27 provides rates per container and per tonne–kilometre. The tonne–kilometre figures were derived using the distance from Devonport to Melbourne and the average weight of a six-metre container, being 17.8 tonnes—taken from BTE 1978 and 1979 quotations of ANL rates.

TABLE VIII.27 STRAITSMAN SERVICE CONTAINER FREIGHT RATES

Year	$/Container	$/tonne–kilometre
1979–80	520	0.065964
1980–81	650	0.082456
1981–82	700	0.088798
1982–83	780	0.098947
1983–84	800	0.101484
1984–85	800	0.101484
1985–86	790	0.100215
1986–87	780	0.098947
1987–88	770	0.097678
1988–89	780	0.098947
1989–90	785	0.099581

Sources: PSA (1990), BTRE estimates.

The Australian Competition and Consumer Commission (1995)

The Australian Competition and Consumer Commission provides a freight rate index of Bass Strait freight activity from 1985–86 to 1992–93. This index is based on cargoes on each route carried throughout the period weighted by 1993–94 revenue. The data behind this is cited as 'TFES data supplied by Department of Transport to ACCC'. The report monitors the pricing impact of reforms of the coastal shipping trade, shows freight, and provides further analysis of demand and capacity of coastal shipping. The Australian Competition and Consumer Commission index has been scaled to the numerical value for 1985–86 in BTCE (1990) to calculate the nominal series.

TABLE VIII.28 ACCC BASS STRAIGHT SEA FREIGHT RATES

Year	Index	$/tonne–kilometre[a]
1985–86	100.00	0.095016
1986–87	96.95	0.092123
1987–88	100.98	0.095950
1988–89	103.63	0.098470
1989–90	100.29	0.095296
1990–91	100.69	0.095670
1991–92	98.92	0.093989
1992–93	98.23	0.093336

a. Scaled to BTCE (1990) numerical value for 1985–86.

Sources: ACCC (1995), BTCE (1990) BTRE estimates.

The Tasmanian Freight Equalisation Scheme 2002

Data obtained from the administrators of the TFES in Hobart enabled cost estimates per tonne–kilometre to be continued to the present. The data includes all freight subsidised, by route, weight volume and cost. Table VIII.29 lists the weighted average shipping rates for all routes travelling between Tasmania and the mainland. At present this looks to be the best source of continuing freight rate data for coastal shipping.

TABLE VIII.29 TASMANIAN COASTAL SHIPPING RATES

($ per tonne–kilometre)

Year	Weighted average rate[a]
1985–86	0.090077
1986–87	0.090358
1987–88	0.108038
1988–89	0.110563
1989–90	0.102703
1990–91	0.109414
1991–92	0.108041
1992–93	0.107115
1993–94	0.109785
1994–95	0.111113
1995–96	0.111104
1996–97	0.123443
1997–98	0.132378
1998–99	0.118966
1999–00	0.118055
2000–01	0.125421

a. Weighted average of all routes to and from Tasmania.

Sources: TFES (2002), BTRE estimates.

The distances used to derive the series were based on standard port-to-port shipping route distances. Distances from state to state were based on particular ports. For Victoria, Western Australia, South Australia and New South Wales, capital city ports were selected as the reference port. Gladstone was used as the reference port for Queensland. For southern Tasmania, Hobart was the only port to use. Devonport was selected for Northern Tasmania as it is about half way between Burnie and Bell Bay, both of which handle comparable amounts of non-bulk traffic.

An alternative series was attained using only six-metre containers and excluding Reefers. However, the reduced sample size made the variation in the series unacceptable, displaying little or no trend. The series indicated, without being conclusive, that there may exist a divergence between east–west freight rates and north–south freight rates.

The Bureau of Transport Economics 1981

The BTE Transport Indicators June 1981 provides a graph of real sea freight rates. The source of these is given as Department of Transport Annual Reports, and provides rates on five routes weighted by tonnes carried on each route. These real series have been multiplied by the CPI and scaled to the weighted average from *Occasional Paper 98* to provide a nominal series—Table VIII.30.

TABLE VIII.30 BTE TRANSPORT INDICATORS WEIGHTED FREIGHT RATE INDEX

	Real rate index	CPI	Nominal index	Rate scaled to OP98 1971–72
		(Base 1971–72=100)		*($/tonne–kilometre)*
1971–72	100	100	100	0.013348
1972–73	94.73684	105.1429	99.60902	0.013295
1973–74	103.1579	112.0000	115.5368	0.015421
1974–75	94.73684	121.1429	114.7669	0.015319
1975–76	115.7895	138.8571	160.7820	0.021461
1976–77	136.8421	162.2857	222.0752	0.029642
1977–78	152.6316	181.7143	277.3534	0.037020
1978–79	157.8947	206.2857	325.7143	0.043475
1979–80	162.1053	222.8571	361.2632	0.048220
1980–81	166.3158	242.2857	402.9594	0.053786

Sources: BTE (1981), BTRE estimates.

Other sources

Although the chapter has generally not included single data points, there are two other data points for coastal shipping freight rates from the Tasmanian Freight Equalisation Scheme:

- Recommended Northbound Assistance Rates at 1 January 1978 contains the then-published rates of Australian National Line for northbound cargo.
- Recommended Rates of Assistance for Southbound Cargoes, Livestock and Timber at 31 January 1979 contains the then–published rates of Australian National Line for southbound non-bulk cargo.

These are listed in Figure VIII.8. The movement between these two years gives further confidence in the other shipping rate series presented in this section.

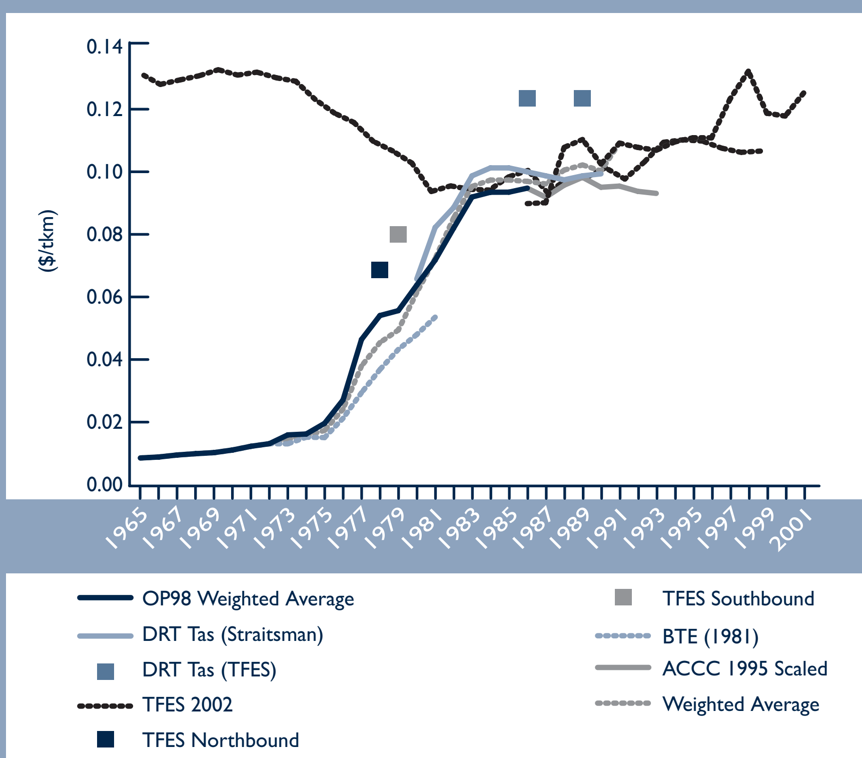
Indexes of intercapital coastal shipping freight rates

As with rail and road freight, none of the coastal shipping freight rate series, presented above, provided a complete time series of non-bulk interstate shipping freight rates covering the period between 1964–65 and 2000–01. A consistent time series estimate of real shipping freight rates is suggested following comparison of movements in the various freight rate data series.

Figure VIII.8 illustrates the nominal coastal shipping freight rates discussed above—in dollars per tonne–kilometre. As can be seen from the graph, the different series move in similar directions.

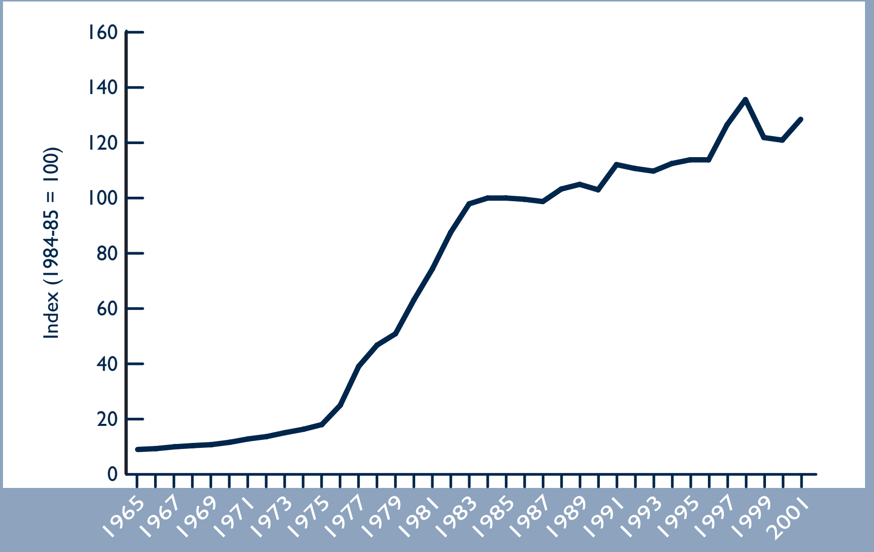
A consistent series was derived using weighted averages of the *Occasional Paper 98* (BTCE 1990), Straitsman, and TFES 2002 series. The weighting was based on BTRE opinions of the validity of the series. *Occasional Paper 98* and Bureau of Transport Economics 1981 rates were spliced on to *Occasional Paper 98* data from 1970–71. The Straitsmen series was included in the weighting from 1979–80. The TFES series is included from 1985–86. However, it is assumed to be less reliable in its first four years. The BTRE nominal freight rate index is illustrated in Figure VIII.9. A real series was derived by deflating the nominal freight rates by the CPI (ABS 2002) and is illustrated in Figure VIII.10. Since the 1980s, real non-bulk coastal shipping rates have declined, but are still above 1960s levels.

FIGURE VIII.8 COMPARISON OF NOMINAL COASTAL SHIPPING FREIGHT RATES



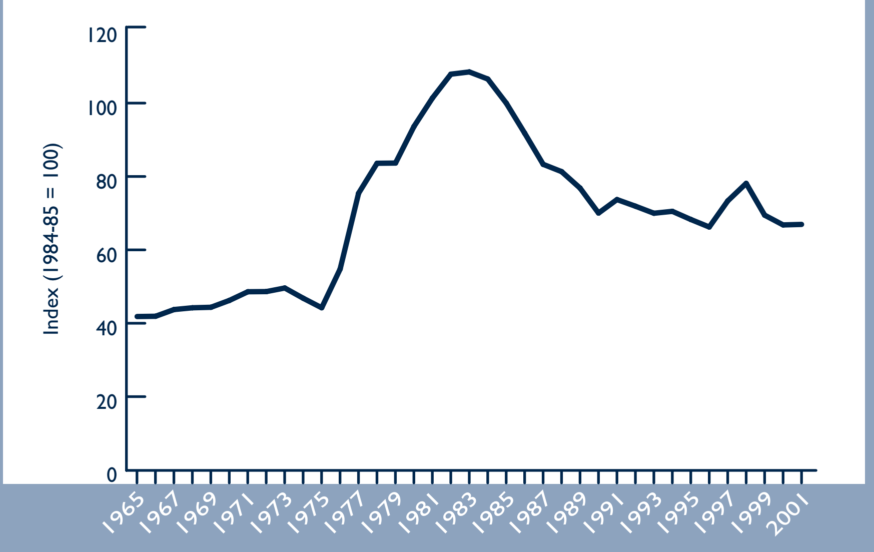
Sources: ACCC (1995), PSA (1990), BTCE (1990), TFES (Administration), BTE (1981), BTRE estimates.

FIGURE VIII.9 NOMINAL COASTAL SHIPPING FREIGHT RATES



Sources: PSA (1990), BTCE (1990), TFES (Administration), BTE (1981), BTRE estimates.

FIGURE VIII.10 REAL COASTAL SHIPPING FREIGHT RATES



Sources: PSA (1990), BTCE (1990), TFES (Administration), BTE (1981), BTRE estimates.

VIII.6 AIR FREIGHT RATES

The air freight industry in Australia comprises very little of the total tonnages, but a considerable percentage of the value of the freight task in Australia. Customers pay a premium for the speed of airfreight service. To compare like with like, it was necessary to decide on the speed of the services to be compared to construct this series. For this reason, the Melbourne–Sydney route was selected as the basis for comparison.

The following data sources are discussed in this section:

- Bureau of Transport and Communications Economics (1990)
- Bureau of Transport and Communications Economics (1987) Domestic Air Cargo In Australia
- Mayne Network average
- Personal communication with Kim Hassel
- Other carriers.

Bureau of Transport and Communications Economics (1990)

The Bureau of Transport and Communications Economics (1990) provides estimates of annual average air freight rates for a selected set of intercapital routes from 1964–65 through to 1977–78. These are published as schedule rates from ABS prior to 1977–78 and are extended using scheduled rates of the former Ansett and Australian Airlines. Table VIII.31 lists air freight rates between the Melbourne and Sydney route and the Eastern States to Perth.

TABLE VIII.31 AIR FREIGHT RATES BETWEEN SPECIFIED CORRIDORS

	Mel–Syd		ES–Per	
Year	$/kg	$/kgkm	$/kg	$/kgkm
1964–65	0.20	0.0283	0.73	0.0222
1965–66	0.21	0.0290	0.75	0.0228
1966–67	0.21	0.0296	0.79	0.0241
1967–68	0.21	0.0296	0.79	0.0241
1968–69	0.21	0.0296	0.79	0.0241
1969–70	0.21	0.0296	0.79	0.0241
1970–71	0.23	0.0326	0.86	0.0262
1971–72	0.24	0.0340	0.90	0.0274
1972–73	0.24	0.0340	0.90	0.0274
1973–74	0.27	0.0382	1.01	0.0308
1974–75	0.30	0.0425	1.13	0.0344
1975–76	0.37	0.0524	1.39	0.0423
1976–77	0.37	0.0524	1.39	0.0423
1977–78	0.39	0.0552	1.50	0.0457
1978–79	0.45	0.0637	1.76	0.0536
1979–80	0.55	0.0779	2.00	0.0609
1980–81	0.79	0.1119	Na	0.0000
1981–82	1.15	0.1629	3.27	0.0996
1982–83	1.45	0.2054	4.18	0.1273
1983–84	1.76	0.2493	5.03	0.1532
1984–85	2.22	0.3144	6.32	0.1924
1985–86	2.59	0.3669	7.37	0.2244

na - not available.

Sources: BTCE (1990), BTRE estimates.

Bureau of Transport Economics (1987)

The Bureau of Transport Economics 1987 provides one of the most comprehensive studies into the nature of air freight and air freight rates in Australia. It published an index of freight yields for Australian Airlines cargo rates from 1975–76 to 1985–86 (Table VIII.32) and also provides the insight that in 1986 the average charge paid by shippers was 51 per cent below the companies scheduled charge. A real series was derived from the percentage changes in yields. Nominal rates have been derived using the BTRE's 1975–76 estimate for its nominal series—discussed below—and multiplying that by the nominal change in each year.

TABLE VIII.32 AUSTRALIAN AIRLINES CARGO RATES

Year	Annual percentage change in real average yield	Real Rate Index	CPI (Base 1984–85=100)	Nominal Rates $/kgkm
1975–76		0.0266[a]	45.624	0.0266[a]
1976–77	-8.4	0.0243	51.793	0.0276
1977–78	-4.7	0.0232	55.954	0.0284
1978–79	-2.5	0.0226	60.832	0.0301
1979–80	5.9	0.0239	67.432	0.0354
1980–81	9.2	0.0261	73.314	0.0420
1981–82	-5.3	0.0248	81.205	0.0441
1982–83	-3.4	0.0239	90.244	0.0473
1983–84	1.6	0.0243	93.831	0.0500
1984–85	5.0	0.0255	100.000	0.0559
1985–86	4.5	0.0267	108.465	0.0634

a. Figure of $0.266/kgkm is based on BTRE's estimate for that year derived from the Mayne, OP 98, and Australia Post Melbourne to Sydney air freight rates.

Sources: BTE (1987), BTCE (1990), ABS (1999b), Mayne Nickless (2002), BTRE estimates.

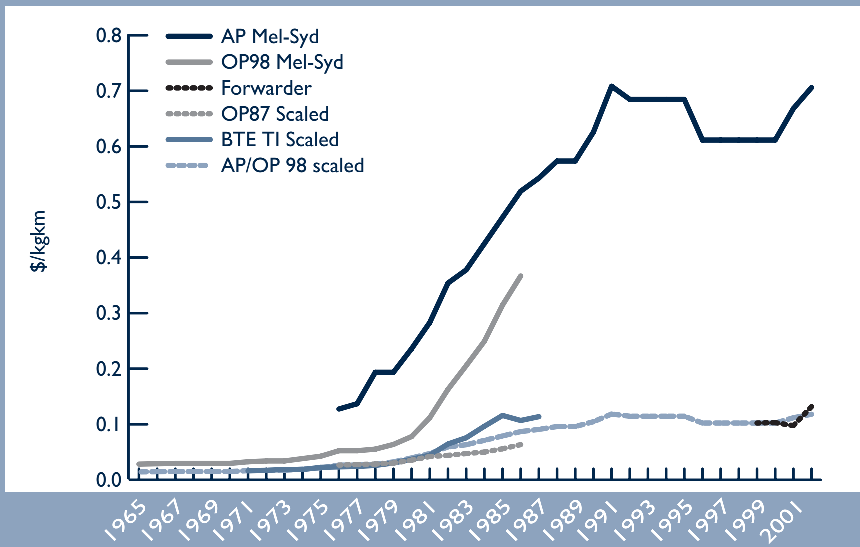
Department of Transport (1982)

The Department of Transport's *Transport Indicators*, referred to in Section 2, provides real air freight rates as an index for the period 1970–71 to 1986–87. These are derived from fares and rates of the former Ansett and Trans Australian Airlines. The series displayed in Figure VIII.11 is the nominal index generated from the real index and scaled to 50 per cent of the Trans Australian Airlines and Ansett Melbourne to Sydney figures provided in the Bureau of Transport and Communications Economics (1990) for 1970–71.

Australia Post 2002 and earlier

Australia Post scheduled parcel rates differ depending on city pairs and weight. Figure VIII.11 provides a series in dollars per kilogram-kilometre calculated for the Melbourne to Sydney route using a 3kg parcel. It is not surprising that this series lines up with earlier series based on scheduled rates.

FIGURE VIII.11 NOMINAL AIR FREIGHT RATES



Sources: BTE (1987), BTCE (1990), Mayne Nickless (2002), AP (2002), BTRE estimates.

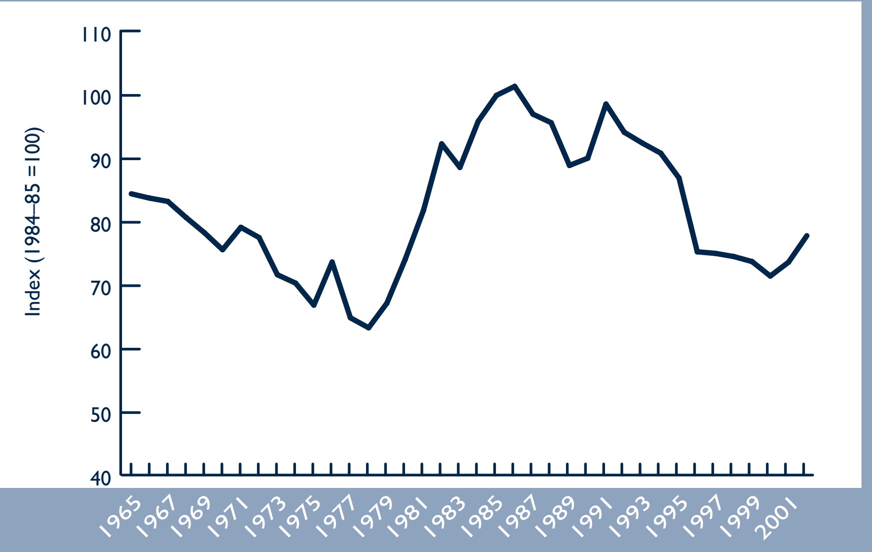
Other air freight companies

Average annual freight yields were made available to the BTRE from other air freight companies, including Mayne Nickless, and were used to verify trends in air freight rates. The Mayne Nickless series in Figure VIII.11 is consistent with the Australia Post trend. But it is at a far lower rate. This is to be expected given the lower rates for commercial freight as opposed to parcels.

Indexes of intercapital air freight rates

A consistent nominal series for intercapital air freight rates, illustrated as "AP/OP 98 scaled" in Figure VIII.11 was derived by scaling the Australia Post series between Melbourne and Sydney to the 1998–99 Mayne rates and truncating this to the *Occasional Paper 98* series for the period 1964–65 to 1978–79. As mentioned above, the Mayne rates—and other support commercial rates that are not publishable—provide a better estimation of the true costs of commercial air freight rates. The consistent nominal series was divided by the CPI to give the real freight index in Figure VIII.12. As can be seen from Figure VIII.12, real air freight rates have been making some fairly wide swings around a basically flat trend. However, after a period of higher rates in the 1980s, real air rates decreased in the 1990s.

FIGURE VIII.12 CONSISTENT REAL AIR FREIGHT RATE INDEX



Sources: BTE (1987), BTCE (1990), Mayne Nickless (2002), Australia Post (2002), BTRE estimates.

TABLE VIII.33 TOTAL GOVERNMENT RAIL FREIGHT CARRIED, BY SYSTEM

('000 tonnes)

Year	NSW	VIC	QLD	SA	WA	TAS	National Rail	Australian National	Total
1964–65	28447	12848	10232	5090	5334	1113	..	2977	66040
1965–66	27544	12399	10250	4790	6512	1093	..	3036	65624
1966–67	29861	12317	10389	4877	8031	1101	..	3183	69757
1967–68	31360	11338	11356	4369	9088	1185	..	3700	72396
1968–69	32383	11498	13183	5083	9077	1262	..	4472	76958
1969–70	33979	12025	14671	5983	10836	1278	..	4901	83673
1970–71	33737	12690	15665	6086	13457	1220	..	4452	87307
1971–72	32310	11795	19267	6014	13867	1299	..	4119	88671
1972–73	31044	11475	24666	5781	13706	1554	..	4255	92481
1973–74	32651	11370	25401	6607	14839	1828	..	4270	96966
1974–75	33476	11057	30208	6738	16153	1731	..	4102	103465
1975–76	31234	10803	33118	6139	17647	1610	..	3804	104355
1976–77	33777	10971	34237	6402	19003	1644	..	3909	109943
1977–78	33434	11120	34155	..	18625	..	..	9995	107329
1978–79	33482	11190	36542	..	19288	..	..	10623	111125
1979–80	39685	13454	38440	..	21388	..	..	12704	125671
1980–81	40440	12721	41504	..	20271	..	..	12345	127281
1981–82	40393	11623	43659	..	19776	..	..	11882	127333
1982–83	41350	8570	43706	..	19791	..	..	10676	124093
1983–84	46594	10486	53150	..	19870	..	..	12083	142183
1984–85	47800	11892	65452	..	22085	..	..	12870	160099
1985–86	53800	10516	73599	..	20877	..	..	13049	171841
1986–87	54747	10597	75169	..	21264	..	..	12900	174677
1987–88	54412	10901	74893	..	21946	..	..	11269	173421
1988–89	50188	9950	80508	..	24294	..	..	13821	178761
1989–90	53700	10250	82543	..	24906	..	..	14132	185531
1990–91	58266	9659	82965	..	24410	..	..	13189	188489
1991–92	57341	8492	90658	..	25890	..	..	13083	195464
1992–93	61597	9646	90303	..	26523	..	1200	13899	203168
1993–94	65500	7579	92092	..	27726	..	8800	14942	216639
1994–95	65200	5716	96807	..	29317	..	10100	7846	214986
1995–96	63800	6877	96120	..	31081	..	9941	7905	215724
1996–97	72600	8186	104963	..	31776	..	9156	8691	235372

.. not applicable.
na - not available.
Note: Substantial reduction in Victorian rail freight in 1994–95 due to drought and fall in grain traffic.
Sources: ABS (1999a and earlier issues).

TABLE VIII.34 TOTAL GOVT RAIL FREIGHT MOVEMENTS, BY SYSTEM

(million net tonne–kilometres)

Year	NSW	VIC	QLD	SA	WA	TAS	National Rail	Australian National	Total
1964–65	7 728	3 331	2 957	1 257	1 383	192	..	1 455	18 302
1965–66	7 030	3 267	3 288	1 231	1 676	186	..	1 447	18 126
1966–67	7 480	3 182	3 290	1 214	2 043	194	..	1 510	18 913
1967–68	7 955	2 917	3 615	1 118	2 581	193	..	1 761	20 139
1968–69	8 082	3 112	4 280	1 314	2 495	192	..	1 989	21 463
1969–70	8 804	3 331	5 086	1 550	2 860	195	..	2 146	23 973
1970–71	9 056	3 465	5 423	1 614	3 398	154	..	2 097	25 206
1971–72	8 615	3 264	6 315	1 583	3 448	170	..	2 008	25 403
1972–73	8 118	3 165	7 613	1 588	3 686	211	..	2 201	26 582
1973–74	8 643	3 126	7 855	1 753	4 143	278	..	2 532	28 329
1974–75	8 782	3 091	9 118	1 757	4 262	273	..	2 507	29 792
1975–76	8 567	3 071	10 101	1 687	4 542	232	..	2 609	30 809
1976–77	9 320	3 042	10 287	1 834	4 533	248	..	2 732	31 995
1977–78	9 243	3 109	10 417	..	4 273	..	..	4 794	31 837
1978–79	8 777	3 145	10 925	..	4 179	..	..	5 030	32 056
1979–80	10 665	3 888	11 465	..	4 730	..	..	5 618	36 366
1980–81	10 543	3 704	11 982	..	4 489	..	..	5 751	36 468
1981–82	10 705	3 427	13 079	..	4 390	..	..	5 731	37 332
1982–83	9 117	2 468	13 177	..	4 384	..	..	5 348	34 494
1983–84	11 131	3 111	15 391	..	3 903	..	..	5 912	39 448
1984–85	12 393	3 543	18 438	..	4 328	..	..	6 270	44 972
1985–86	13 415	3 094	20 450	..	4 005	..	..	7 081	48 045
1986–87	13 540	3 531	20 871	..	4 062	..	..	6 873	48 877
1987–88	14 212	3 351	20 676	..	4 203	..	..	7 165	49 607
1988–89	13 552	3 271	20 884	..	4 881	..	..	8 082	50 670
1989–90	14 100	3 672	22 579	..	4 872	..	..	8 112	53 335
1990–91	14 222	3 700	22 869	..	4 583	..	..	7 789	53 163
1991–92	13 811	2 704	24 461	..	4 878	..	..	7 799	53 653
1992–93	14 813	3 678	24 391	..	4 970	..	na	8 480	56 332
1993–94	16 200	4 212	25 011	..	5 447	..	13916	9 159	73 945
1994–95	9 000	1 790	26 492	..	6 235	..	16600	1 500	61 617
1995–96	10 067	1 970	26 368	..	6 804	..	16900	1 379	63 488
1996–97	12 140	2 270	28 754	..	7 496	..	16000	1 516	68 176

.. not applicable.
na - not available.
Note: Substantial reduction in Victorian rail freight in 1994–95 due to drought and fall in grain traffic.
Sources: ABS (1999a and earlier issues).

TABLE VIII.35 REVENUE RECEIVED FROM RAIL FREIGHT OPERATIONS, BY SYSTEM

($ '000)

Year	NSW	VIC	QLD	SA	WA	TAS	National Rail	Australian National	Total
1964-65	154 543	63 361	69 696	23 096	30 688	5 019	..	13 593	359 996
1965-66	136 921	61 442	72 535	22 218	37 296	5 419	..	14 070	349 901
1966-67	149 429	63 323	75 461	23 084	42 353	5 938	..	15 037	374 625
1967-68	159 712	57 801	81 313	20 929	45 656	5 952	..	17 642	389 005
1968-69	160 454	58 528	89 916	23 354	42 930	6 285	..	20 366	401 833
1969-70	174 665	61 766	96 055	26 276	48 151	6 246	..	22 443	435 602
1970-71	175 714	64 597	97 558	26 938	52 335	5 142	..	23 255	445 539
1971-72	174 886	64 552	111 063	27 098	55 166	5 441	..	23 045	461 251
1972-73	161 315	62 029	123 966	25 949	54 017	6 055	..	24 675	458 006
1973-74	na	na	na	na	na	na	..	na	na
1974-75	192 947	71 915	165 228	35 515	86 636	7 440	..	32 431	592 112
1975-76	208 627	80 409	210 046	35 596	108 126	7 512	..	40 101	690 417
1976-77	244 746	89 157	239 945	40 775	113 077	8 164	..	47 282	783 146
1977-78	na	na	na	..	na	..	..	na	na
1978-79	252 300	101 815	284 699	..	128 172	..	..	108 109	875 095
1979-80	331 185	136 235	324 170	..	143 299	..	..	131 514	1 066 403
1980-81	364 406	140 187	383 695	..	148 422	..	..	150 205	1 186 915
1981-82	431 157	137 676	481 193	..	175 054	..	..	165 214	1 390 294
1982-83	452 626	108 803	508 223	..	183 632	..	..	161 480	1 414 764
1983-84	559 876	160 841	669 362	..	180 439	..	..	192 223	1 762 741
1984-85	641 100	182 259	828 926	..	209 627	..	..	213 698	2 075 610
1985-86	736 795	168 641	905 494	..	200 974	..	..	237 345	2 249 249
1986-87	739 250	174 700	960 950	..	200 731	..	..	238 097	2 313 728
1987-88	767 820	176 161	910 409	..	204 330	..	..	236 782	2 295 502
1988-89	667 038	166 526	1 021 272	..	231 749	..	..	284 905	2 371 490
1989-90	667 000	172 603	1 021 854	..	235 983	..	..	282 638	2 380 078
1990-91	783 602	164 175	1 124 800	..	235 420	..	..	275 294	2 583 291
1991-92	789 236	135 393	1 138 000	..	254 617	..	..	266 363	2 583 609
1992-93	815 336	151 311	1 175 000	..	248 314	..	60 800	274 663	2 725 424
1993-94	688 796	158 747	1 196 000	..	269 494	..	443 400	272 656	3 029 093
1994-95	637 438	111 243	1 242 000	..	277 361	..	479 700	74 893	2 822 635
1995-96	810 500	121 210	1 297 000	..	254 704	..	475 747	73 578	3 032 739
1996-97	816 059	117 785	1 074 358	..	256 496	..	444 500	84 279	2 793 477

.. not applicable.
na - not available.
a. Revenue received from freight operations does not include government subsidy payments to rail operators.
Sources: ABS (1999a and earlier issues).

TABLE VIII.36 NON-BULK RAIL FREIGHT, BY SYSTEM

('000 tonnes)

Year	NSW	VIC	QLD	SA	WA	TAS	AN	Total
1971–72	8 386	5 175	2 237	2 136	1 451	343	1 173	20 902
1972–73	8 674	5 084	2 360	2 376	1 575	353	1 329	21 750
1973–74	8 587	4 823	2 488	2 317	1 570	406	1 247	21 439
1974–75	9 163	5 130	2 902	2 520	1 702	564	1 331	23 312
1975–76	Na	na	Na	Na	Na	na	Na	na
1976–77	8 096	4 878	3 139	2 644	2 147	885	1 573	23 362
1977–78	7 893	4 861	3 252	2 784	2 282	762	1 651	23 485
1978–79	7 212	4 643	3 253	..	3 148	..	4 009	22 265
1979–80	7 861	5 524	3 476	..	3 340	..	5 174	25 375
1980–81	7 212	4 643	3 253	..	3 148	..	4 009	22 265
1981–82	7 861	5 524	3 476	..	3 340	..	5 174	25 375
1982–83	na	na	Na	..	na	..	na	na
1983–84	7 273	4 976	3 936	..	2 678	..	5 675	24 538
1984–85	5 772	4 349	3 422	..	2 452	..	4 542	20 537
1985–86	6 016	4 195	2 960	..	1 492	..	na	na

.. not applicable.
na - not available.
Note: Rail freight classified as non-bulk varies according to the classification of data in ABS (1999). Non-bulk rail freight defined as: 'All other commodities' (1971-72 to 1977-78), 'All other commodities, Containers and Iron and Steel'—1978-79 to 1982-83, and 'Manufactured goods, Machinery and transport equipment & Miscellaneous' (1983-84 to 1985-86).

Sources: ABS (1999a and earlier issues).

TABLE VIII.37 NON-BULK RAIL FREIGHT MOVEMENTS, BY SYSTEM

(million net tonne–kilometres)

Year	NSW	VIC	QLD	SA	WA	TAS	AN	Total
1971–72	3 844	1 734	4 780	725	675	81	1 154	12 994
1972–73	4 101	1 645	5 208	830.	774	51	1 249	13 858
1973–74	3 953	1 547	6 080	789	772	59	1 239	14 439
1974–75	4 377	1 594	7 332	848	840	96	1 340	16 426
1975–76	na	na	na	na	na	na	Na	na
1976–77	4 084	1 511	8 832	912	1 041	184	1 762	18 325
1977–78	4 095	1 609	na	981	1 095	133	1 973	9 886
1978–79	4 269	1 541	na	..	1 211	..	3 410	10 432
1979–80	4 703	1 716	na	..	1 255	..	3 836	11 510
1980–81	4 269	1 541	na	..	1 211	..	3 410	10 432
1981–82	4 703	1 716	na	..	1 255	..	3 836	11 510
1982–83	na	na	na	..	na	..	na	na
1983–84	4 665	1 746	1 815	..	1 244	..	4 144	13 614
1984–85	3 712	1 491	1 645	..	na	..	na	na
1985–86	4 026	1 461	1 586	..	931	..	na	na

.. not applicable.
na - not available.
Notes: Rail freight classified as non-bulk varies according to the classification of data in ABS (1999). Non-bulk rail freight defined as: 'All other commodities' (1971–72 to 1977–78), 'All other commodities, Containers and Iron and Steel' – 1978–79 to 1982–83, and 'Manufactured goods, Machinery and transport equipment & Miscellaneous' (1983–84 to 1985–86).

Sources: ABS (1999a and earlier issues).

TABLE VIII.38 EARNINGS FROM NON-BULK RAIL FREIGHT, BY SYSTEM

($ '000)

Year	NSW	VIC	QLD	SA	WA	TAS	AN	Total
1971–72	na	29 602	31 333	10 474	16 479	2 866	15 276	na
1972–73	na	28 305	32 344	11 544	16 875	2 023	17 384	na
1973–74	na	28 904	33 466	11 233	16 876	2 235	17 487	na
1974–75	na	29 912	36 328	12 034	17 863	2 684	18 370	na
1975–76	na	na	na	na	na	na	na	Na
1976–77	na	71 915	165 228	35 515	86 636	7 440	32 431	Na
1977–78	na	43 100	50 536	18 156	32 549	4 205	34 473	Na
1978–79	na	48 641	62 672	..	42 114	..	70 901	Na
1979–80	na	62 566	69 878	..	44 129	..	83 504	Na
1980–81	na	48 641	62 672	..	42 114	..	70 901	Na
1981–82	na	62 566	69 878	..	44 129	..	83 504	Na
1982–83	na	na	na	..	na	..	na	Na
1983–84	na	63 956	92 214	..	54 243	..	115 152	Na
1984–85	na	63 209	87 415	..	na	..	110 563	Na
1985–86	na	66 346	77 323	..	na	..	na	Na

.. not applicable.
na - not available.
Note: Rail freight classified as non-bulk varies according to the classification of data in ABS (1999). Non-bulk rail freight defined as: 'All other commodities' (1971–72 to 1977–78), 'All other commodities, Containers and Iron and Steel'—1978–79 to 1982–83, and 'Manufactured goods, Machinery and transport equipment & Miscellaneous' (1983–84 to 1985–86).

Sources: ABS (1999a and earlier issues).

TABLE VIII.39 QUEENSLAND RAILWAYS FREIGHT TASK

(million tonnes)

Year	Coal & coke	Other minerals	Timber	Agricultural produce	Wool	General goods	Livestock	Misc.	Non-minerals	Total
1959–60	1.608	1.131	0.290	2.974	0.059	1.559	0.755		5.637	8.376
1960–61	1.568	1.341	0.269	2.660	0.054	1.578	0.744		5.305	8.214
1961–62	1.846	1.531	0.198	2.611	0.048	1.474	0.696		5.027	8.405
1962–63	1.840	1.466	0.187	3.159	0.047	1.591	0.695		5.679	8.985
1963–64	2.574	1.485	0.220	3.188	0.053	1.831	0.731		6.024	10.083
1964–65	2.866	1.269	0.147	3.422	0.051	1.880	0.678		6.178	10.314
1965–66	3.384	0.947	0.143	3.153	0.038	1.925	0.761		6.019	10.349
1966–67	3.163	1.056	0.132	3.535	0.038	2.000	0.582		6.288	10.508
1967–68	3.860	1.049	0.135	3.757	0.044	2.034	0.585		6.555	11.464
1968–69	5.390	1.174	0.121	3.733	0.049	2.170	0.738		6.812	13.376
1969–70	7.209	1.417	0.124	2.959	0.037	2.381	0.750		6.252	14.877
1970–71	8.088	1.523	0.148	3.035	0.028	2.549	0.552		6.312	15.923
1971–72	11.314	1.353	0.144	3.436	0.024	2.711	0.563		6.878	19.545
1972–73	16.152	1.621	0.170	3.263	0.021	3.234	0.607		7.296	25.069
1973–74	17.059	1.655	0.139	2.918	0.026	3.099	0.504		6.687	25.401
1974–75	19.831	2.831	0.146	3.597	0.036	3.188	0.580		7.546	30.208
1975–76	21.271	2.849	0.134	3.810	0.037	3.312	0.705		7.998	32.118
1976–77	21.769	4.244	0.116	3.986	0.034	3.327	0.761		8.223	34.237
1977–78	22.445	4.565	0.095	3.019	0.032	3.076	0.921		7.144	34.155
1978–79	24.121	4.179	0.113	3.580	0.033	3.303	1.212		8.241	36.542
1979–80	25.637	4.440	0.115	3.849	0.028	3.527	0.844		8.363	38.440
1980–81	29.742	4.356	0.113	3.113	0.021	3.540	0.619		7.406	41.504
1981–82	30.067	4.740	0.102	4.092	0.025	3.979	0.655		8.853	43.659
1982–83	32.130	4.321	0.061	3.188	0.018	3.413	0.577		7.256	43.706
1983–84	41.257	3.545	0.070	4.121	0.022	3.531	0.567		8.311	53.113
1984–85	52.378	4.187	0.061	3.557	0.040	4.713	0.516		8.886	65.452
1985–86	59.008	4.749	0.059	5.179	0.045	4.081	0.478		9.842	73.599
1986–87	61.311	4.353	0.055	4.436	0.034	4.494	0.486		9.505	75.169
1987–88	62.025	4.442	0.058	3.194	0.032	4.677	0.465		8.427	74.893
1988–89	66.018	4.568	0.064	3.924	0.026	5.608	0.299		9.921	80.508
1989–90	na	na	na	na	na	na	na	na	na	Na
1990–91	68.375	4.681							9.909	82.965
1991–92	76.708	4.994							8.956	90.658
1992–93	76.578	4.870							8.855	90.303
1993–94	78.759	4.820							8.513	92.092
1994–95	85.193	4.312							7.299	96.804
1995–96	84.232	4.435							7.453	96.120
1996–97	91.036	4.847							9.080	104.963

na - not available.
a. Inclusive of uniform gauge railway (Brisbane to NSW border).
Sources: Queensland Railways (1997, 1983, and 1960).

TABLE VIII.40 QUEENSLAND RAILWAYS FREIGHT REVENUE[a]

($ million)

Year	Coal & coke	Other minerals	Timber	Agricultural produce	Wool	General goods	Livestock	Misc.	Non-minerals	Total
1959-60	5.830	6.261	2.429	11.406	2.132	22.913	7.526	0.344	46.750	58.840
1960-61	5.761	7.374	2.341	10.555	1.966	22.874	8.406	0.327	46.470	59.605
1961-62	7.035	7.382	1.828	11.092	1.713	22.313	8.571	0.419	45.936	60.353
1962-63	7.202	7.837	1.803	13.190	1.626	23.167	8.258	0.380	48.423	63.462
1963-64	9.637	8.064	2.158	14.597	1.837	26.896	8.729	0.453	54.670	72.371
1964-65	9.460	6.639	1.730	14.569	1.807	26.799	8.353	0.339	53.597	69.696
1965-66	11.115	7.588	1.678	14.307	1.394	26.777	9.458	0.219	53.833	72.535
1966-67	10.912	8.227	1.551	17.782	1.428	28.177	7.126	0.258	56.322	75.461
1967-68	13.387	8.686	1.590	19.193	1.639	28.944	7.523	0.350	59.240	81.313
1968-69	15.526	11.171	1.561	20.739	1.794	29.733	9.038	0.354	63.219	89.916
1969-70	20.689	13.291	1.592	17.985	1.250	31.938	8.986	0.328	62.079	96.058
1970-71	24.184	14.204	1.848	16.412	0.902	32.608	6.754	0.645	59.171	97.558
1971-72	33.833	13.918	1.749	18.986	0.769	33.852	7.404	0.552	63.312	111.063
1972-73	43.715	15.171	1.850	17.424	0.691	36.510	7.893	0.611	64.979	123.865
1973-74	54.008	16.486	1.540	15.538	0.886	37.149	7.184	0.994	63.291	133.785
1974-75	73.618	20.303	1.480	19.632	1.058	40.348	7.848	0.941	71.306	165.228
1975-76	91.903	26.461	1.853	25.489	1.086	50.373	11.829	1.051	91.682	210.046
1976-77	97.970	34.742	1.855	29.836	1.162	57.416	16.248	0.716	107.233	239.945
1977-78	109.482	35.319	1.616	24.923	1.086	55.570	20.816	0.878	104.890	249.690
1978-79	120.608	32.443	1.813	34.435	1.147	62.731	30.551	0.970	131.647	284.699
1979-80	151.814	38.568	1.804	38.752	1.189	69.977	21.139	0.928	133.789	324.170
1980-81	216.252	41.576	2.047	28.668	0.913	76.979	15.818	1.442	125.867	383.695
1981-82	274.040	50.277	2.290	40.529	1.148	90.478	19.555	2.876	156.876	481.193
1982-83	314.765	55.188	1.663	33.024	0.873	85.701	14.900	2.107	138.269	508.223
1983-84	442.891	61.074	1.976	47.703	1.106	92.565	17.698	4.349	165.397	669.362
1984-85	584.299	66.418	1.936	59.101	1.021	94.648	18.071	3.432	178.209	828.926
1985-86	644.217	69.727	1.897	69.944	0.985	97.008	17.324	4.393	191.550	905.494
1986-87	726.806	60.182	1.660	57.024	0.924	91.829	18.188	4.337	173.962	960.950
1987-88	689.608	65.864	1.909	41.320	0.891	92.394	17.627	0.796	154.937	910.409
1988-89	779.513	74.838	2.302	51.113	0.791	96.883	12.033	3.798	166.921	1021.272
1989-90	na	na	na	na	na	na	na	na	na	na
1990-91	867.335	72.300							185.165	1124.800
1991-92	907.994	67.310							179.509	1154.813
1992-93	943.900	65.604							183.019	1192.523
1993-94	942.510	72.228							187.801	1202.539
1994-95	999.253	60.314							171.187	1230.754
1995-96										

na - not available.

a. Inclusive of uniform gauge railway (Brisbane to NSW border), excluding government subsidies and royalties.

Sources: Queensland Railways (1997, 1983, and 1960).

VIII.7 CONCLUDING REMARKS

This appendix has investigated the existing historical interstate and long-distance rail, road, coastal shipping and air freight rate data in Australia and suggested methods for deriving consistent series of interstate non-bulk freight rates. The constructed freight rates series suggest that real long-distance road and rail freight rates have fallen significantly since 1970. Long-distance road freight rates appear to have fallen by more than rail rates. In contrast, real coastal shipping and air freight rates are not significantly different from 30 years ago.

ABBREVIATIONS AND GLOSSARY

ABARE	Australian Bureau of Agricultural and Resource Economics.
ABS	Australian Bureau of Statistics.
ACCC	Australian Competition and Consumer Commission.
AGPS	Australian Government Publishing Service.
AIP	Australian Institute of Petroleum.
AN(R)	Australian National (Railways).
ANL	Australian National Line.
Ansett	(Airline Pty. Ltd.)—pre 2001 domestic carrier.
ARA	Australasian Railways Association.
ARTC	Australian Rail Track Corporation.
Artics	Articulated trucks – consists of a prime mover and trailer(s).
ATN	Australasian Transport News.
ATRF	Australasian Transport Research Forum.
Australian Airlines	A previous domestic carrier – now the domestic part of QANTAS.
AustRoads	The Association of Commonwealth, State and Territory Road Authorities.
Billions	10^9, e.g. 1,000,000,000.
Btkm	Billion tonne-kilometres.
BTRE	Bureau of Transport and Regional Economics (formerly known as Bureau of Transport and Economics, BTE, and also Bureau of Transport and Communications Economics, BTCE).

Bulk	Commodities that can be poured or dropped without damage, e.g. grain and timber.
Capital Cities	All eight capital cities in Australia, i.e. Sydney, Melbourne, Brisbane, Adelaide, Perth, Hobart, Darwin and Canberra.
Commercial vehicles	All non-passenger vehicles, e.g. utes and panel vans and light trucks (LCVs), rigid trucks and articulated trucks.
Commonwealth	The (Federal) Government of Australia.
Competitiveness	Index An index of whether a mode is losing or gaining mode shares relative to a standard mode (usually taken as road).
CPI	Consumer Price Index.
Cross Section	Time-Series A data set that includes several cases over time, e.g. data for 1971 to 2000 for each of the eight capital cities.
CSIRO	Commonwealth Scientific and Industrial Research Organisation.
DoT	Department of Transport.
DoTC	Department of Transport and Communications.
Elasticity	“Responsiveness to”. That is, an income elasticity for freight of 2.0 would imply that a 10 per cent increase in income would produce a 20 per cent increase in freight moved.
FDF	FDF Pty. Ltd. – a Melbourne based private firm specialising in freight data.
FFS	Freight Forwarders Survey (ABS, Cat. No. 9212.0).
FMS	Freight Movements Survey (see ABS publication Freight Movements, Cat. No. 9220.0).
FreightInfo	Interregional freight flow database from FDF.

FreightSim	Interregional freight flow model from FDF.
GDP	Gross Domestic Product.
ghd	Gutteridge, Haskins and Davey.
GHG	Greenhouse gases. Include water vapour (H_2O), carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), oxides of nitrogen (NO_x) other than nitrous oxide, carbon monoxide (CO), non-methane volatile organic compounds (NMVOCs), sulphur oxides (SO_x) and fluorocarbon (FC) species.
Gold Coast	Coastal city, south of Brisbane.
Gross Vehicle Mass (GVM)	Tare weight (i.e. unladen weight) of the motor vehicle plus its maximum carrying capacity.
Interstate (IS)	The ABS definition of this is “that freight task carried out by a State’s trucks in other States”. In other words, it corresponds really to what could be termed the “out-of-State” road freight task.
Kilograms	Thousand (1,000) grams.
Kilotonnes	Thousand (1,000) tonnes.
Km	Kilometre (Thousand metres).
Laden business kilometres (lbk)	Kilometres travelled by a commercial vehicle while carrying some freight.
LCVs	Light Commercial Vehicles which include rigid trucks less than 3.5 tonnes, utilities, panel vans and vans without rear seats.
Line-haul	The non-urban portion of an inter-city trip.
Marul(an)	A town on the Hume Highway near Mittagong that has a heavy vehicle weighing station.
Metro(politan)	Pertaining to or including all eight capital cities.
MVC	Motor Vehicle Census (ABS, Cat No. 9309.0).

NIEIR	National Institute of Economic and Industry Research (Australia).
Non-bulk	Other than bulk commodities.
Non-urban (Nu)	Area incorporating the 'rest of State' and 'interstate'. Excludes 'capital city' and 'provincial urban'.
NR(C)	National Rail (Corporation).
NRTC (NTC)	National (Road) Transport Commission.
OP	Occasional Paper.
Origin-Destination (OD)	Pertaining to a corridor between an origin region and a destination region.
PSA	Prices Surveillance Authority.
PTC (NSW)	Public Transport Commission (NSW).
Public access rail versus private rail	Private railways are built and owned by private companies. The best known are the iron ore railways of the North-West and the sugar tramways of the Queensland coast. Public access rail corresponds roughly to the previously State Government owned railways.
QR	Queensland Railways.
RBA	Reserve Bank of Australia.
Real	Deflated by the CPI or the GDP indices.
Rigid trucks	Motor vehicles exceeding 3.5 tonnes Gross Vehicle Mass (GVM), constructed with a load carrying area, including rigid trucks with a tow bar, draw bar or other non-articulated coupling on the rear of the vehicle.
ROA	Railways of Australia.
RTA	Roads and Traffic Authority (NSW).
SCT	SCT Logistics—A freight forwarder.
SD (Statistical Division)	A general purpose spatial unit and is the largest and most stable spatial unit within each state. SDs consist of one or more Statistical Subdivisions. In aggregate, SDs cover Australia without gaps or overlap.

Single (continuous) voyage permits	Permits offered to foreign ships to carry cargo on the Australian coast.
SMVU	Survey of Motor Vehicle Use (ABS, Cat. No. 9208.0).
SRA	State Rail Authority (NSW).
States (and Territories)	New South Wales (NSW), Victoria (VIC), Queensland (QLD), (South Australia (SA), Western Australia (WA), Tasmania (TAS), Northern Territory (NT) and Australian Capital Territory (ACT).
TAA	Trans Australian Airlines—an earlier version of Australian Airlines.
TasRail	Tasmanian Railways—before being subsumed into Australian National Railways.
TDRT	Tasmanian Department of Roads and Transport.
TI	Transport Indicators (see BTE 1998).
Tonne-kilometres (tkm)	Total tonne-kilometres is the number of tonnes moved multiplied by the distance travelled in kilometres (e.g. 25 tonnes of freight moved a distance of 100 kilometres is 2 500 tonne-kilometres).
TPDC	Transport and Population Data Centre (NSW Department of Infrastructure, Planning and Natural Resources).
TransEco (TE)	Melbourne company that publishes the “TransEco Road Freight Cost Indices” quarterly.
TWU	Transport Workers Union.
Urban (U)	Area includes capital city and environs and provincial urban.
V/Line	Victorian Railways.
VKT (vkt)	Vehicle kilometres travelled.
VRTA	Victorian Road Transport Association.
WestRail	Western Australia’s public rail service since 1975 which continued to manage both passenger and freight rail services in WA until December 2000.

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