Assessment of the Australian Road System: Travel Projections

Occasional Paper

The study undertaken to produce road travel projections, and reported in this Occasional Paper, had three basic elements. Firstly, recent trends in road travel were identified. Secondly, past patterns of the demand for road travel were analysed and, wherever possible, such demand relationships were quantified. Thirdly, scenarios relating to the future environment for road travel were developed and projections made.

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Occasional Paper 60

Assessment of the Australian Road System:

Travel Projections

Bureau of Transport Economics

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FOREWORD

In May 1982, the then Minister for Transport directed the Bureau of Transport Economics (BTE) to undertake an assessment of the Australian road system. The BTE reported previously on this subject in 1979 following similar reports prepared by the former Commonwealth Bureau of Roads in 1969, 1973 and 1975.

In satisfying the 1982 Ministerial reference a number of discrete but related investigations were carried out. Each investigation is being reported in a separate publication in support of BTE Report 56 'Assessment of the Australian Road System: 1984'.

The study undertaken to produce road travel projections, and reported in this Occasional Paper, had three basic elements. Firstly, recent trends in road travel were identified. Secondly, past patterns of the demand for road travel were analysed and, wherever possible, such demand relationships were quantified. Thirdly, scenarios relating to the future environment for road travel were developed and projections of future demand produced.

The work involved in producing these projections was undertaken by the BTE Forecasting Unit which is located in the Economic Assessment Branch. The Paper was prepared by members of the Unit, Dr M. Saad, D. Dao, S. Gerhardy and A. Biggs.

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Bureau of Transport Economics
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SUMMARY

Road travel reflects the combined effects of two components: vehicle fleet size (stock of cars and commercial vehicles) and its usage (vehicle kilometres travelled). Demand for each of these two components is derived from the demand for transport services and is influenced by socio-economic and demographic factors, community attitudes and government policies. Road travel is divided in this Paper into two segments: the passenger car segment representing on average some 79 per cent of road travel (measured in total annual kilometres travelled) over the last decade, and the commercial vehicle segment accounting for the remainder. The Paper reports the main analyses undertaken relating to fleet size and its usage in the two segments, and provides road travel projections (at a State level) to the turn of this century at five year intervals.

The passenger vehicle fleet is defined to comprise all sedans and station wagons, including light passenger four wheel drives, owned privately or by companies (businesses). Commercial vehicles are grouped according to vehicle characteristics into open and closed light commercial vehicles, rigid trucks, articulated trucks, other truck-type vehicles and buses. The number of passenger cars and commercial vehicles on register (fleet size) for Australia and the different States has been increasing steadily since the end of the Second World War and amounted to nearly 6.3 million passenger cars and 1.7 million commercial vehicles on the register at 30 June 1982. Since 1971-72 the number of passenger vehicles has increased by about 4.5 per cent per annum while the number of commercial vehicles has increased at an annual rate of over 5 per cent, peaking at 6.6 per cent in 1976. As a result, the share of commercial vehicles of the total vehicle fleet has increased slightly to nearly 21 per cent in 1981-82 compared with about 19.5 per cent in 1971-72.

Growth in the number of passenger vehicles since the early 1970s was not uniform across the different States. Queensland and Western Australia recorded higher rates than the national average, while growth rates in the remainder of the States were below the national average, with Tasmania and South Australia showing the lowest growth rates. For commercial vehicles, growth rates for vehicle types during the same period showed even greater variation among States (with significant growth rates in Western Australia and Queensland, and slower rates than the national average in South Australia and Tasmania for the major categories of commercial vehicles). Growth rates in the three major categories of commercial vehicles (light commercial, rigid trucks and articulated trucks) were very similar. The observed growth in new models in the light commercial range and the upsizing of trucks appear to be reflected in significant substitution within the broad vehicle types shown, rather than between types.

The observed growth in the passenger vehicle fleet over the analysis period was accompanied by an increase in fleet usage of road space. Total vehicle kilometres travelled (VKT) by passenger vehicles increased from less than 64 thousand million in the year ending 30 September 1971 to over 96 thousand million kilometres in 1982 (an annual average growth rate of a little under 4 per cent). Estimates of the annual growth rate in total VKT were highest in Queensland (over 6 per cent) and lowest in Victoria and South Australia (about 3 per cent) over the same period. Short trips in urban areas comprise by far the major part of passenger car usage.

Total vehicle kilometres travelled by commercial vehicles in Australia are estimated

to have increased from just over 19 thousand million in the year ending 30 June 1972 to about 31.5 thousand million in 1982. This represents an average rate of growth of 4.4 per cent per annum. During the period under analysis Queensland recorded the largest increase in commercial vehicle kilometres travelled (including the highest growth in the light commercial and rigid truck categories) with all other States except South Australia increasing at rates similar to the national average.

For the major categories of commercial vehicles, utilisation was higher for articulated trucks than for light commercial vehicles and rigid trucks. For Australia, total VKT by articulated trucks has increased by over 6 per cent per annum since 1972. With the exception of South Australia, the growth rates in total VKT by articulated trucks exceeded those of light commercial vehicles and rigid trucks. Approximately half the usage of light commercial vehicles and rigid trucks, and about 30 per cent of articulated truck usage was in urban areas.

Buses recorded a stronger growth in registrations but a decline in average utilisation. This results from changes in the composition of the bus fleet due to the recent rapid increase in micro-bus registrations. Other truck-type vehicles recorded substantial growth rates in total VKT at the national level and in each State during the analysis period.

Unavailability of annual time series data prevented the development of a multi-equation model which considered both fleet size and its usage simultaneously. To allow for this effect to some extent, a modified two-stage approach was followed in this study. In the first stage, fleet size was considered to be a function of income, population, vehicle purchase price and operating costs. In the second stage, total VKT was related to fleet size and other factors. Further, a model was specified to assess the effects of freight rates and to gauge road/rail competition on intercapital city non-bulk road freight movements.

The estimated regression models provided very satisfactory explanations of annual variations in fleet size, total VKT and non-bulk intercapital city freight movements. All the estimated coefficients were of the expected signs and, with the exception of the elasticities with respect to operating costs, all coefficient estimates were statistically significant.

The main results are:

- For the number of passenger cars per head of population, the estimated purchase price elasticities of demand were less than unity in all States except Queensland. Similar price elasticities could not be estimated for the major fleets of commercial vehicles.
- The own-price (road freight rates) elasticity for intercapital city non-bulk freight movements was less than unity. Demand response was found to be slightly higher (but still inelastic) with respect to the road/rail freight rates ratio.
- Estimates of the elasticity of the size of the passenger vehicle fleet with respect to income were less than one (inelastic) in all States except Victoria and Tasmania. By contrast, estimates of income elasticities for the major categories of commercial vehicles and for tonnes consigned by road on intercapital city routes were generally greater than unity, indicating that freight movements by road are sensitive to changes in economic activity.
- For vehicle usage (VKT) models, the estimated coefficients of the fleet size were significant The coefficient of passenger cars indicated a decrease in average VKT per car as fleet size increased. In contrast, the coefficients of fleet size for the major categories of commercial vehicles indicated that a given change in fleet size will be accompanied, on average, by a greater increase in total VKT.

To estimate demand for road travel between 1985 and 2000, the future likely levels of the explanatory factors affecting the two road travel components were projected.

Different values were assigned to these factors resulting in two scenarios (high growth reflecting conditions which favour growth in road travel, and low growth representing conditions which restrict growth in road travel). Two corresponding sets of projections (high and low growth respectively) were estimated. The broad conclusion to be drawn is that over the projection period (1985 to 2000) a continued significant growth in road travel is expected.

For the passenger car road travel segment, the main features of the projections are:

- for Australia as a whole, total passenger car usage will grow by between 1.5 per cent and 5 per cent per annum (low and high growth projections respectively); and
- car ownership level is expected to rise by the year 2000 under the high growth projection to those rates currently prevailing in those States of the USA with high car ownership rates (about 0.7 per head of population).

For the commercial vehicle travel segment, the important conclusions of the projections are as follows:

- annual growth rates of between 3 per cent and up to 6 per cent are expected in total VKT for the major categories of commercial vehicles (low and high growth projections respectively); and
- for other truck-type vehicles and buses, annual growth rates in total VKT are estimated to be about 5 per cent and 3.5 per cent respectively.

This paper projects a continued growth of total road travel activity to the turn of this century although at lower annual growth rates to those which prevailed in the 1970s. In addition, the growth in road travel is expected to be lower in the 1990s than in the remainder of the 1980s. Finally, there are indications that the growth in road travel will be higher in urban areas than rural areas, and this has important implications for road planning and investment.

CHAPTER 1—INTRODUCTION

OBJECTIVES OF THE STUDY

Effective road planning requires reliable projections of the demand for road travel. This demand is derived in nature as it depends on the requirement for transport services, and hence is determined by various socio-economic and demographic factors. As a result, road travel projections entail an evaluation of how these factors have shaped demand in the past and a projection of their future values to produce estimates of future demand.

The broad objectives of the study were:

- to identify recent trends in road travel;
- to analyse past patterns of the demand for road travel and wherever possible to quantify such demand relationships;
- to develop scenarios relating to the future environment of road travel and project future demand; and
- to indicate possible implications of the projections for road investment.

DEFINITION OF ROAD TRAVEL

Road travel is defined in this Paper to be the combined effects of the size of the vehicle fleet and its usage (vehicle kilometres travelled). Further, road travel is divided into the passenger car travel segment and the commercial vehicle travel segment. Motor cycles, tractors, plant and equipment, caravans and trailers are excluded from the study.

OUTLINE OF THE PAPER

The Paper consists of eight chapters. After the introduction of Chapter 1, the following three chapters relate to the passenger car segment. Chapter 2 defines this segment and reviews trends in private consumption expenditure on travel in Australia and overseas, car ownership and its usage and changes in car technology. This is followed in Chapter 3 by a review of previous studies and the development of regression models for vehicle fleet size and its usage. Chapter 4 develops the projection scenarios, reports the high and low growth projections and comments on forecasts prepared by other organisations.

Chapters 5 to 7 discuss the commercial vehicle segment. Chapter 5 gives an overview of the size and usage of commercial vehicles, briefly outlines the commercial vehicle freight services and comments on the utilisation level and areas of operation of commercial vehicles. The first part of Chapter 6 analyses the market forces for the three main categories of commercial vehicles (light commercial vehicles, rigid trucks and articulated trucks) and buses. In the second part of that chapter, models for fleet size and usage are developed along similar lines to those followed in the passenger car segment, while simple models based on time trends are proposed for other truck-type vehicles and buses. Projections of commercial vehicle fleet size and utilisation are reported in Chapter 7.

Finally, Chapter 8 contains concluding remarks relating to the study as a whole, combining the main findings of both the passenger car and commercial vehicle road travel segments.

CHAPTER 2—PASSENGER CAR TRENDS

The passenger car fleet is defined in this Paper to comprise all cars and station wagons, including the light passenger four-wheel drive vehicles (such as Subaru, Daihatsu and Suzuki) owned by private individuals or by business enterprises (companies).

This chapter reviews the main recent developments in the fleet size and usage of passenger cars in Australia. It starts with a comparison of consumption expenditure on travel in Australia with that in both the United Kingdom (UK) and the United States of America (USA) over the period 1971 to 1981. Fleet size is then examined by analysing the number of cars on register at State level by type of ownership (private versus company cars) and by fleet composition. Next, fleet usage (kilometres travelled) is considered from the standpoints of trip purpose, age of vehicle and area of operation. Finally, some developments in the quality and performance characteristics of passenger vehicles are examined.

PRIVATE CONSUMPTION EXPENDITURE ON TRAVEL

The share of private consumption expenditure allocated to travel indicates the importance of travel relative to all other items of private consumption. The expenditure on the various modes of transport indicates the relative importance of each mode, and over a period of time, possible substitution between modes.

Tables 2.1, 2.2 and 2.3 indicate for the USA, the UK and Australia the level of total private consumption expenditure on travel between 1971 and 1981[1]. In addition these tables show the percentages of total expenditure on travel spent on private motoring (both vehicle purchase and operating costs) and on various forms of public transport. For all three countries, travel expenditure as a percentage of total private consumption expenditure ranged between 12 and 15 per cent over the study period, but in most years was slightly higher in Australia than in the UK and the USA. Over the 11 year period, the share of the personal consumption budget spent on travel remained relatively constant in the three countries, suggesting the expenditure elasticity for travel is in the vicinity of unity. By contrast, the components of travel expenditure varied markedly between countries and over time. Expenditure on the motor vehicle (both purchase price and operation cost) was consistently more than 90 per cent of travel expenditure in the USA, about 75 per cent in the UK, and in excess of 75 per cent in Australia. Expenditure on public transport was more significant in the UK, while Australians spent relatively more on 'other fares' (mainly air).

In the 1970s all three countries witnessed declines in the shares of the travel budget going to public transport and to the purchase of new vehicles, whilst increases have occurred in the shares of the budget going to the operation of motor vehicles and 'other fares'.

The dominance of private motoring as the major mode of travel is obvious. It is also significant that the share of travel expenditure allocated to private motoring in each country over the study period remained relatively constant, with increased

1. The 11 year period under consideration relates to calendar years for the USA and the UK. For Australia, the figures relate to financial years with the latest being that for 1981-82. The difference between calendar and financial years is not expected to distort inter-country comparison.

TABLE 2.1—PERSONAL CONSUMPTION EXPENDITURE ON TRAVEL; UNITED STATES OF AMERICA, YEARS ENDING 31 DECEMBER 1971 TO 1981

Year Ending 31 December	Per cent of total travel expenditure: Rail, bus, coach, taxi transit system	Other fares	Purchase of motor vehicles	Operation of motor vehicles	Total travel (US$ million)	Travel as percentage of total expenditure
1971	4.3	3.1	40.6	52.1	94 421	14.0
1972	4.0	3.2	42.2	50.6	105 382	14.3
1973	3.8	3.3	42.0	50.9	114 576	14.1
1974	4.0	3.8	34.6	57.6	117 924	13.3
1975	3.8	3.7	35.4	57.1	129 367	13.2
1976	3.5	3.7	39.2	53.7	155 189	14.3
1977	3.2	3.7	39.8	53.3	179 328	14.9
1978	3.1	3.7	40.9	52.3	198 108	14.7
1979	3.1	4.0	36.3	56.6	219 446	14.6
1980	3.1	4.5	29.5	62.8	239 543	14.4
1981	3.2	4.5	29.7	62.5	260 773	14.1

Note. Percentages may not add to 100 due to rounding.

Source: United States, Bureau of Economic Analysis (1981).

TABLE 2.2—PERSONAL CONSUMPTION EXPENDITURE ON TRAVEL; UNITED KINGDOM, YEARS ENDING 31 DECEMBER 1971 TO 1981

Year Ending 31 December	Per cent of total travel expenditure				Total travel (£ million)	Travel as percentage of total expenditure
	Rail, bus, coach, taxi transit system	Other fares	Purchase of motor vehicles	Operation of motor vehicles		
1971	17.2	8.2	32.0	42.7	4 495	12.6
1972	15.9	8.5	34.4	41.2	5 213	13.0
1973	15.5	9.7	31.4	43.4	5 723	12.5
1974	15.6	10.1	25.6	48.6	6 299	11.9
1975	15.3	9.6	26.1	49.0	8 194	12.7
1976	15.5	9.5	27.4	47.6	9 698	13.0
1977	15.4	9.5	27.3	47.8	11 051	12.9
1978	14.7	9.6	33.2	42.8	13 086	13.2
1979	13.2	9.9	34.7	42.2	16 396	14.0
1980	13.7	11.6	28.3	47.0	18 439	13.6
1981	13.2	12.0	25.6	49.3	20 602	13.6

Note Percentages may not add to 100 due to rounding

Source: United Kingdom, Central Statistical Office (1983).

TABLE 2.3—PERSONAL CONSUMPTION EXPENDITURE ON TRAVEL; AUSTRALIA, YEARS ENDING 30 JUNE 1971 TO 1982

	Per cent of total travel expenditure					
Year Ending 31 December	*Rail, bus, coach, taxi transit system*	*Other fares*	*Purchase of motor vehicles*	*Operation of motor vehicles*	*Total travel ($A million)*	*Travel as percentage of total expenditure*
1971	8.3	14.6	34.6	42.4	3 018	14.8
1972	8.6	13.7	34.6	43.1	3 325	14.7
1973	8.2	14.5	34.3	42.9	3 636	14.3
1974	7.7	15.0	34.5	42.7	4 227	14.1
1975	7.1	14.4	34.0	44.4	5 105	14.0
1976	6.8	15.3	31.1	46.8	6 088	14.0
1977	6.2	15.5	32.0	46.3	6 954	14.0
1978	6.3	15.8	31.3	46.7	7 597	13.8
1979	5.8	15.8	30.9	47.5	8 693	14.0
1980	5.6	15.5	28.4	50.4	10 190	14.6
1981	6.0	15.4	27.6	51.0	11 523	14.7
1982	6.1	15.1	28.7	50.2	12 827	14.3

Note: Percentages may not add to 100 due to rounding.

Source: ABS (1983b)

expenditure on operation costs being balanced to a significant degree by reduced expenditure on new vehicles (see Figure 2.1). This no doubt partly reflects supply factors, with a decline in the real cost of new vehicle manufacture and increases in the real costs of operation including fuel, repair and insurance costs. It also appears to reflect a deliberate demand response by motorists who, faced with sharp increases in operation costs, have responded by devoting a smaller proportion of their budgets to car purchase.

FLEET SIZE AND USAGE

The structure of the passenger car fleet with respect to type, age, size, performance, and fuel consumption of vehicles, and future developments in these characteristics, will have important implications for the demands placed on the road network. Of equal importance are the characteristics of the owners of the passenger vehicle fleet and the extent to which level and form of usage varies with ownership characteristics. These characteristics include age, sex, marital status, size and composition of household, geographic location, and private versus business ownership. Also changing patterns and attitudes to work and leisure activities can be important, but these tend to be related to income levels.

This section examines recent historical developments in the above factors[1]. Throughout this exposition, relatively greater emphasis has been accorded to undertaking a critical analysis of the fleet (using time-series data relating to the number of cars on register) rather than of its use (due to the paucity of data relating to vehicle kilometres travelled). The only comprehensive information available on vehicle usage is that provided by the Australian Bureau of Statistics (ABS) in the four Surveys of Motor Vehicle Usage relating to the 12 month periods ending 30 September 1971, 1976, 1979 and 1982 (ABS 1973b, ABS 1978, ABS 1981f and ABS 1983l).

Number of passenger vehicles on register

Despite the recent depressed economic climate, higher fuel prices and measures to reduce vehicle pollution, the number of cars registered in Australia has continued on the strong growth path witnessed over the post-war period with about 6.3 million vehicles recorded as at the end of June 1982.

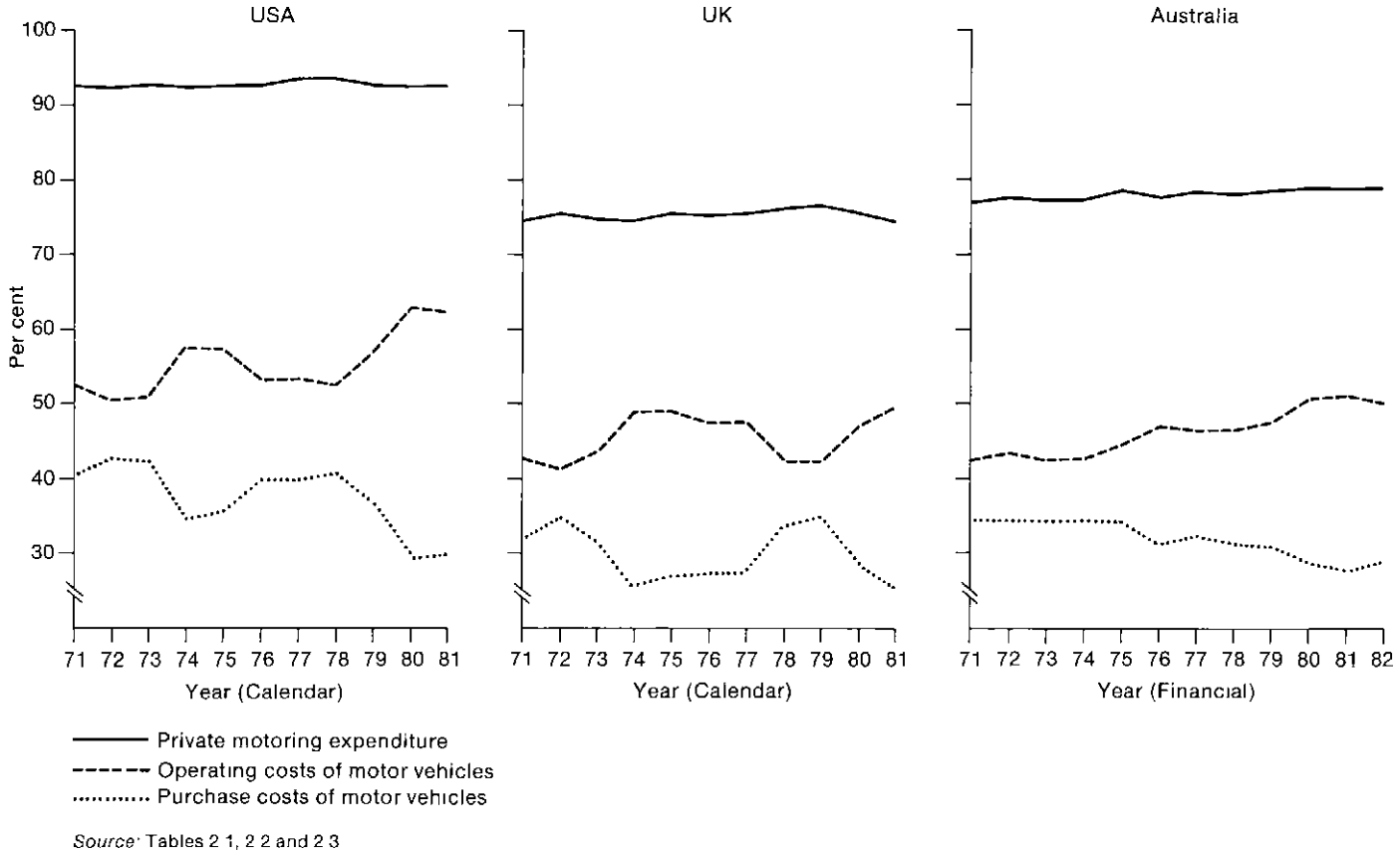
Table 2.4 presents the total number of passenger cars on register for Australia and the different States between the financial years of 1969-70 and 1981-82. Australia as a whole experienced an average annual growth rate of 4.5 per cent during the study period.

The growth in the number of passenger cars was not uniform across the States. Queensland and Western Australia (with average annual growth rates of 5.9 and 5.2 per cent respectively) had higher rates than the national average, while growth rates in the remainder of the States were below the national average, with South Australia showing the lowest rate of 3.8 per cent per annum during the period under consideration.

Business and private ownership of new vehicles

Passenger cars are categorised as private if owned by individuals or by unincorporated businesses, and as business if owned by companies or Commonwealth, State or local governments and authorities. While there are no data available on the type of ownership for the whole passenger vehicle fleet, the importance of the corporate vehicle fleet is highlighted in the registration figures for new vehicles. Tables 2.5

1. Further specific demand and supply factors of car ownership and usage are commented upon in Chapter 3



Source: Tables 2.1, 2.2 and 2.3

Figure 2.1—Percentage shares of total personal consumption expenditure on travel for private motoring expenditure, operating costs of motor vehicles and purchase costs of motor vehicles, USA, UK and Australia

TABLE 2.4—NUMBER OF PASSENGER CARS ON REGISTER BY STATE OF REGISTRATION, AS AT 30 JUNE 1970 TO 1982

('000)

As at 30 June	*New South Wales*[a]	*Victoria*	*Queensland*	*South Australia*[b]	*Western Australia*	*Tasmania*	*Australia*
1970	1346.3	1065.1	499.5	389.2	301.0	118.6	3719.7
1971	1424.5	1119.3	530.1	407.3	328.5	124.9	3934.6
1972	1509.3	1168.7	567.8	424.5	346.3	130 7	4147.3
1973	1583.0	1231.1	600.2	447.5	364.4	135.4	4361.6
1974	1656.1	1307.0	639.8	470.6	389.3	141.2	4604.0
1975	1748.0	1382.7	660.9	501.8	414.8	150.3	4858.5
1976	1787.6	1454.8	715.4	520.9	437.2	156.9	5072.8
1977	1833.7	1479.2	751.4	542.3	473.7	162.7	5243.0
1978	1891.7	1544.9	794.7	558.6	500.4	171.9	5462.2
1979	1965.4	1591.4	835.3	567.7	518.7	178.8	5657.2
1980	2041.9	1580.1	884.0	581.8	535.6	177.2	5800.6
1981	2111.4	1632.5	946.2	594.9	552.6	183.4	6021.0
1982	2207.7	1731 2	997.7	611.6	555.6	190.0	6293.8
Average annual growth rate (per cent)	4.2	4.1	5.9	3.8	5.2	4.0	4.5

a New South Wales includes the Australian Capital Territory.
b. South Australia includes the Northern Territory

Source. ABS (1983g).

TABLE 2.5—NEW PASSENGER CAR REGISTRATIONS BY BUSINESS[a] AND PRIVATE CATEGORIES BY STATE OF REGISTRATION; METROPOLITAN AREAS, AS AT 31 DECEMBER 1979 TO 1982

As at 31 December	Category	New South Wales[b] (number)	(per cent)	Victoria (number)	(per cent)	Queensland (number)	(per cent)	South Australia[c] (number)	(per cent)	Western Australia (number)	(per cent)	Tasmania (number)	(per cent)	Australia[d] (number)	(per cent)
1979	Business	51 570	51.5	39 460	47.5	14 973	51.0	14 058	48.7	13 624	45.9	2 957	54.5	139 828	50.0
	Private	48 584	48.5	43 593	52.5	14 359	49.0	14 825	51.3	16 048	54.1	2 467	45.5	139 876	50.0
1980	Business	53 350	49.0	37 487	47.9	15 735	50.6	14 124	51.2	12 852	44.2	2 580	50.0	140 467	49.4
	Private	55 527	51.0	40 742	52.1	15 359	49.4	13 450	48.8	16 254	55.8	2 580	50.0	143 912	50.6
1981	Business	56 399	51.2	39 838	50.5	17 446	53.1	14 862	53.9	14 768	47.7	2 567	51.0	149 363	51.7
	Private	53 777	48.8	39 045	49.5	15 391	46.9	12 674	46.1	16 198	52.3	2 471	49.0	139 556	48.3
1982	Business	55 286	51.0	40 982	52.2	19 223	55.0	16 846	55.6	11 014	37.2	2 354	54.7	148 670	51.4
	Private	53 105	49.0	37 476	47.8	15 759	45.0	13 474	44.4	18 603	62.8	1 948	45.3	140 365	48.6

a. Business category is defined to include vehicles owned by companies and the Commonwealth, State and local governments and authorities, and taxis
b Figures for the Australian Capital Territory are allocated entirely to metropolitan areas of New South Wales.
c. Figures for the Northern Territory are allocated entirely to metropolitan areas of South Australia.
d Australian totals include Commonwealth Government vehicles which are allocated entirely to metropolitan areas, but not to any particular State.

Source: Information provided by the Department of Industry and Commerce based on ADAPS data

and 2.6 summarise the data for the four calendar years 1979 to 1982 for metropolitan and rural areas respectively.

In metropolitan areas of Australia between 1979 and 1982, there were approximately equal numbers of new vehicles registered in the business category as in the private category. Moreover, during this period, the proportion of business vehicles increased slightly for Australia as a whole and in most States (an exception was Western Australia where business registrations fell sharply in 1982).

In rural areas, business ownership accounted for approximately 30 per cent of all new vehicles registered in 1982. However, this category has increased proportionally in all States except Western Australia.

The large and increasing share of passenger vehicles being registered in the business category may reflect, at least in part, the practice of putting company cars at the disposal of employees for their private use. This could have important implications for projecting vehicle usage. It is believed that business cars are, on average, subject to greater annual usage and quicker turnover. There is also a degree of uncertainty as to whether changes in taxation or registration policies could significantly affect this practice.

New cars and scrappage rate

The number of new passenger cars on the register showed a positive trend over the study period, increasing from about 0.41 million cars in the 1971-72 financial year to 0.47 million cars in the 1981-82 financial year (see Table 2.7). However, the relative significance of new cars in the total size of the fleet declined from about 10 per cent in the early part of the study period to over 7 per cent towards the end of the period. This indicates, among other things, an increase in the average life of cars (a corresponding reduction in the scrappage rate).

A crude indicator[1] of the number of vehicles scrapped during any one year was calculated (the difference between the number of new vehicle registrations in that year and the change in total fleet size between that year and the preceding year) Estimated scrappage rates for the ten year period to 1981-82 are presented in Table 2.7. Up to the financial year 1976-77 the motor car was scrapped relatively quickly, but subsequently was kept for longer periods as uncertainty concerning economic conditions and higher fuel costs undoubtedly influenced motorists to postpone the purchase of new vehicles. This was particularly evident in the financial year 1980-81 when the estimated scrappage rate slowed down to 4.0 per cent due no doubt in part to the marked increase in fuel prices (see Table 3.4).

Vehicle kilometres travelled

The observed growth of the passenger car fleet (number of sedans and station wagons) over the study period was accompanied by an increase in fleet usage of road space. Total vehicle kilometres travelled (VKT) by passenger cars in Australia (amounting to some 78 per cent of total kilometres travelled by all motor vehicles in the year ending 30 September 1979) increased from nearly 64 000 million kilometres in the year ending 30 September 1971 to about 96 000 million kilometres in the year ending 30 September 1982, representing an annual average growth rate of 3.8 per cent during this period (see Table 2.8)[2]. The growth rate in total VKT for Tasmania was similar to the national average of 3.8 per cent compared with 6.1 per cent recorded in

1. This measure is crude because it does not take into account the unregistered vehicles which are not scrapped

2. The statistics relate to the annual rate of usage of selected vehicles registered at the survey date of 30 September rather than the actual usage of all vehicles registered at any time during the year. Appropriate sample expansion factors were used to derive the car population estimates

TABLE 2.6—NEW PASSENGER CAR REGISTRATIONS BY BUSINESS[a] AND PRIVATE CATEGORIES BY STATE OF REGISTRATION; RURAL AREAS, AS AT 31 DECEMBER 1979 TO 1982

As at 31 December	Category	New South Wales[b]		Victoria		Queensland		South Australia[c]		Western Australia		Tasmania		Australia	
		(number)	(per cent)	(number)	(per cent)	(number)	(per cent)	(number)	(per cent)	(number)	(per cent)	(number)	(per cent)	(number)	(per cent)
1979	Business	19 886	28.6	7 583	19.7	11 150	28.1	2 597	22.1	2 139	20.6	2 828	35.1	46 183	26.0
	Private	49 664	71.4	30 842	80.3	28 516	71.9	9 161	77.9	8 259	79.4	5 233	64.9	131 675	74.0
1980	Business	17 763	29.0	6 571	19.2	11 160	27.1	2 385	21.9	2 119	20.5	2 849	35.2	42 847	25.8
	Private	43 488	71.0	27 595	80.8	29 945	72.9	8 498	78.1	8 236	79.5	5 247	64.8	123 009	74.2
1981	Business	20 053	32.8	6 875	20.5	13 248	30.9	2 449	24.7	2 401	24.1	2 982	39.6	48 008	29.1
	Private	41 047	67.2	26 648	79.5	29 574	69.1	7 479	75.3	7 549	75.9	4 555	60.4	116 852	70.9
1982	Business	19 876	33.1	7 690	21.3	14 079	33.1	3 186	28.6	1 670	18.4	2 674	42.9	49 175	29.8
	Private	40 120	66.9	28 446	78.7	28 505	66.9	7 949	71.4	7 399	81.6	3 557	57.1	115 976	70.2

a. Business category is defined to include vehicles owned by companies and the State and local governments and authorities, and taxis Commonwealth Government vehicles are allocated entirely to metropolitan areas.
b. Figures for the Australian Capital Territory are allocated entirely to metropolitan areas of New South Wales.
c Figures for the Northern Territory are allocated entirely to metropolitan areas of South Australia.

Source: Information provided by the Department of Industry and Commerce based on ADAPS data.

Queensland and 4.6 per cent in Western Australia between the two survey years of 1971 and 1982. New South Wales, South Australia and Victoria experienced annual growth rates below the national average during the same period.

Estimates of average vehicle kilometres travelled (obtained by dividing estimated total VKT by number of cars on register)[1] are given in Table 2 9. The decline in average VKT throughout the four survey years is noticeable in Victoria, South Australia and Western Australia. There was no definite pattern in average VKT in New South

TABLE 2.7—NEW AND TOTAL PASSENGER CAR NUMBERS AND ESTIMATED SCRAPPAGE RATES, YEARS ENDING 30 JUNE 1972 TO 1982

Year ending 30 June	*New cars ('000)*	*Total cars ('000)*	*Estimated scrapped cars ('000)*	*Scrappage rate (per cent)*
1972	412.5	4 147.3	..	..
1973	429.7	4 361.6	200.8	4.6
1974	465.0	4 604.0	214.0	4.6
1975	502.7	4 858.5	234.1	4.8
1976	454.6	5 072.8	277.6	5.5
1977	447.1	5 243.0	276.9	5 3
1978	432.4	5 462.2	213.2	3.9
1979	463.5	5 657.2	268.5	4.8
1980	451.9	5 800 6	308.5	5.3
1981	462.5	6 021.0	242.1	4.0
1982	471.3	6 293 8	198.5	3 2

.. not applicable

Source: BTE estimates based on ABS (1983g)

TABLE 2.8—TOTAL VEHICLE KILOMETRES TRAVELLED BY PASSENGER CARS BY STATE OF REGISTRATION, YEARS ENDING 30 SEPTEMBER 1971, 1976, 1979 AND 1982

(millions)

State of registration	*1971*	*1976*	*1979*	*1982*	*Average annual growth rate (per cent)*
New South Wales[a]	23 080	28 136	29 491	33 784	3.5
Victoria	18 642	22 790	24 038	25 813	3.0
Queensland	8 163	10 516	12 427	15 691	6.1
South Australia[b]	6 685	7 910	8 475	9 231	3.0
Western Australia	5 423	7 012	8 179	8 862	4.6
Tasmania	1 809	2 168	2 262	2 728	3.8
Australia	63 802	78 531	84 871	96 109	3.8

a New South Wales includes the Australian Capital Territory.
b. South Australia includes the Northern Territory

Note Figures may not add to totals due to rounding

Sources ABS (1973b, 1978, 1981f and 1983l)

1. Estimates of average vehicle kilometres travelled in this study are of the 'broad' average type as defined by ABS. A 'broad' average is distinct from a 'narrow' average where the number of cars reporting travel is used.

Wales, Queensland and Tasmania (with marked increases in 1982 compared with the 1979 levels). Average VKT was lowest in Tasmania with broadly similar levels in the mainland States.

Vehicle usage by age

The ABS Survey of Motor Vehicle Usage for 1979 provided information on the average vehicle kilometres travelled by passenger cars of different years of manufacture (vintages). Table 2.10 summarises the data for Australia as a whole and for the six States, where the age structure of the vehicles is grouped into seven categories (manufactured before 1968, 1968 to 1970, 1971 to 1973, 1974 to 1976, 1977, 1978 and 1979). This table reveals a strong relationship between average annual VKT and age. For Australia, average VKT declined from about 21 500 kilometres for new cars (less than one year old) to about 10 700 kilometres for vehicles more than ten years old (manufactured before 1968).

With minor exceptions, this inverse relationship between the usage of passenger

TABLE 2.9—AVERAGE ANNUAL VEHICLE KILOMETRES TRAVELLED BY PASSENGER CARS BY STATE OF REGISTRATION, YEARS ENDING 30 SEPTEMBER 1971, 1976, 1979 AND 1982

('000)

State of registration	*1971*	*1976*	*1979*	*1982*
New South Wales[a]	16.0	15.7	14.9	15.4
Victoria	16.3	15.7	15.6	15.2
Queensland	15.0	14.6	14.6	15.6
South Australia[b]	16.0	15.0	14.9	14.9
Western Australia	16.3	16.0	15.9	15.6
Tasmania	14.2	13.7	12.9	14.4
Australia	15.9	15.4	15.1	15.3

a. New South Wales includes the Australian Capital Territory.
b. South Australia includes the Northern Territory

Sources: ABS (1973b, 1978, 1981f and 1983l)

TABLE 2.10—AVERAGE ANNUAL VEHICLE KILOMETRES TRAVELLED BY PASSENGER CARS BY STATE OF REGISTRATION AND YEAR OF MANUFACTURE, YEAR ENDING 30 SEPTEMBER 1979

State of registration	*Before 1968*	*1968-70*	*1971-73*	*1974-76*	*1977*	*1978*	*1979*
New South Wales[a]	9 642	12 845	14 330	14 862	20 332	18 655	22 387
Victoria	11 878	13 237	16 009	17 177	18 211	19 116	19 670
Queensland	9 579	13 114	13 251	15 946	17 884	21 452	21 445
South Australia[b]	11 468	13 082	14 517	16 659	16 582	17 934	20 723
Western Australia	12 042	12 713	15 186	17 565	14 990	22 999	26 999
Tasmania	9 628	12 011	13 078	13 707	12 880	17 802	17 630
Australia	10 749	12 984	14 684	16 004	18 391	20 126	21 529

a. New South Wales includes the Australian Capital Territory.
b South Australia includes the Northern Territory.

Source. ABS (1981f).

vehicles measured by average annual VKT and the vehicle's age was observed in all States for all vehicle ages. New vehicles (less than one year old) were used most intensively in all States with the lowest average VKT being 17 630 kilometres in Tasmania and the highest in Western Australia at nearly 27 000 kilometres in 1979.

The greater usage of relatively new vehicles (which is to be expected) is relevant to any assessment of the national costs and benefits of the road system. Newer cars are generally of smaller size and lighter construction, and designed with greater emphasis on safety, energy conservation and environmental objectives. Developments of the technical attributes of the passenger vehicles in recent years are discussed later in this chapter.

Vehicle usage by trip purpose

The four Surveys of Motor Vehicle Usage undertaken by ABS provide valuable information on the trip purpose for which the vehicle was used in the years ending 30 September 1971, 1976, 1979 and 1982. Table 2.11 summarises the average annual kilometres travelled by passenger cars for the four main trip purposes: business, paid trips to and from work, unpaid trips to and from work, and other private travel[1].

In the 1979 Survey, private travel accounted for 57 per cent of VKT, business and unpaid work trips for 20 per cent each, and paid work trips for 3 per cent. These shares remained relatively constant between 1971 and 1979, with a slight increase in private travel at the expense of paid work trips.

It is noted that the share of VKT nominated as being for business purposes (20 per cent) is significantly lower than the share of the new passenger car registrations nominated as business registrations (as seen in Tables 2.5 and 2.6). Business cars do represent a higher proportion of new registrations due to their higher turnover compared to the total fleet, but the large difference between new registrations and usage must largely reflect substantial private use of business registered cars.

Usage by area of operation

In the Surveys of Motor Vehicle Usage of 1971, 1976, 1979 and 1982 respondents were asked to estimate VKT in each of the following areas of the State of registration:

- capital cities and environs;
- provincial urban;[2]
- rest of State (intrastate); and
- interstate.

Table 2.12 details the average annual kilometres travelled by sedans and station wagons by area of operation for Australia as a whole (obtained by adding distances for the States of registration) for the four survey years. A dominant feature is that in 1982 two-thirds of VKT in Australia occurred in urban areas, and this share increased between 1971 and 1981. Hence while long distance car travel is a common feature of the Australian way of life, it is important to remember that short trips in urban areas comprise by far the major part of passenger car usage.

Travel within capital cities and intrastate (other than provincial urban) recorded declines of 2.2 per cent and 11.8 per cent respectively between the two surveys of 1971 and 1982. While interstate travel remained almost constant over the study period, travelling within the provincial urban category rose by 23 per cent between the surveys of 1971 and 1976 and remained at the higher level in 1979 and 1982.

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1. For detailed definition of purpose classification see ABS (1983l).
2. Defined as centres not included in capital cities and having populations greater than 40 000 persons in the 1971 Population and Housing Census.

TABLE 2.13—AVERAGE ANNUAL VEHICLE KILOMETRES TRAVELLED BY PASSENGER CARS BY STATE OF REGISTRATION AND AREA OF OPERATION, YEARS ENDING 30 SEPTEMBER 1971, 1976 AND 1979

Year and area of operation	New South Wales[a]		Victoria		Queensland		South Australia[b]		Western Australia[c]		Tasmania	
	('000 km)	(per cent)	('000 km)	(per cent)	('000 km)	(per cent)	('000 km)	(per cent)	('000 km)	(per cent)	('000 km)	(per cent)
1971												
Capital city	9.2	59	9.3	57	6.0	40	9.6	60	11.1	68	4.2	29
Provincial urban	1.8	11	1.2	7	2.1	14	0.2	1	–	–	1.9	13
Rest of State	4.5	29	5.0	31	6.0	40	5.3	33	4.8	30	7.8	55
Interstate	0.4	2	0.9	5	0.9	6	0.9	6	0.4	3	0.4	3
Total	16.0	100	16.3	100	15.0	100	16.0	100	16.3	100	14.2	100
1976												
Capital city	8.7	55	8.8	56	5.9	40	9.8	65	10.3	64	4.6	34
Provincial urban	1.8	11	1.5	9	2.9	20	0.1	1	–	–	2.1	15
Rest of State	4.3	27	4.6	29	5.1	35	4.4	29	5.4	34	6.6	48
Interstate	0.9	6	0.9	6	0.7	5	0.7	5	0.3	2	0.4	3
Total	15.7	100	15.7	100	14.6	100	15.0	100	16.0	100	13.7	100
1979												
Capital city	8.1	55	9.3	60	6.3	43	9.6	64	10.4	66	4.4	34
Provincial urban	2.1	14	1.5	10	2.4	16	0.1	1	–	–	2.2	17
Rest of State	4.0	27	4.0	26	5.3	36	4.5	30	5.1	32	6.1	47
Interstate	0.6	4	0.7	5	0.6	4	0.7	5	0.3	2	0.2	2
Total	14.9	100	15.6	100	14.6	100	14.9	100	15.9	100	12.9	100

a New South Wales includes the Australian Capital Territory.
b. South Australia includes the Northern Territory.
c. It should be noted that no provincial urban centres exist in Western Australia by the 1971 Population and Housing Census definition, hence care must be exercised in interpreting the results.

– nil

Note: Figures may not add to totals due to rounding

Sources. ABS (1973b, 1978 and 1981f)

TABLE 2.14—NEW PASSENGER CAR REGISTRATIONS BY NUMBER OF CYLINDERS, YEARS ENDING 31 DECEMBER 1976 TO 1982

	1976		1977		1978		1979		1980		1981		1982	
Cylinders	(number)	(per cent)	(number)	(per cent)	(number)	(per cent)	(number)	(per cent)	(number)	(per cent)	(number)	(per cent)	(number)	(per cent)
Four	240 379	51.8	227 167	53.2	252 055	56.5	259 272	56.7	297 332	66 0	295 897	65.2	295 791	65.1
Six	169 794	36.6	141 803	33.2	136 211	30.5	142 384	31.1	127 827	28.4	133 197	29 4	131 103	28.9
Eight	52 444	11 3	56 128	13.2	55 522	12.5	51 659	11.3	21 751	4.8	18 997	4.2	22 661	5.0
Total[a]	464 076	100.0	426 736	100.0	445 916	100 0	457 562	100.0	450 235	100 0	453 779	100.0	454 186	100.0

a Total includes diesel cars and others (5 and 12-cylinder motor vehicles)

Source Information provided by the Department of Industry and Commerce based on ADAPS data.

TABLE 2.15—NEW PASSENGER CAR REGISTRATIONS BY ENGINE CAPACITY, YEARS ENDING 31 DECEMBER 1977 TO 1982

	1977		1978		1979		1980		1981		1982	
Capacity	(number)	(per cent)	(number)	(per cent)	(number)	(per cent)	(number)	(per cent)	(number)	(per cent)	(number)	(per cent)
Less than 1000 cc	5 732	1.3	4 904	1.1	632	0.1	3 102	0.7	3 132	0.7	2 871	0.6
1001-1500 cc	61 666	14.5	61 646	13.8	51 629	11.3	55 822	12.4	81 285	17.9	91 063	20.0
1501-2000 cc	155 932	36.5	181 465	40.7	202 158	44.2	221 305	49.2	189 054	41.7	177 790	39.1
2001-3000 cc	32 694	7 7	34 729	7 8	28 159	6.2	36 580	8.1	48 839	10.8	55 698	12 3
3001-4000 cc	52 053	12.2	53 671	12 0	68 775	15.0	64 852	14.4	65 760	14.5	53 470	11.8
4001-4500 cc	81 896	19.2	76 739	17.2	78 573	17.2	57 367	12.7	53 502	11.8	60 714	13.4
More than 4500 cc	36 763	8.6	32 762	7.3	27 636	6.0	11 207	2.5	12 207	2.7	12 580	2.8
Total	426 736	100.0	445 916	100.0	457 562	100.0	450 235	100.0	453 779	100.0	454 186	100.0

Note Percentages may not add to totals due to rounding.

Source: Information provided by the Department of Industry and Commerce based on ADAPS data

TABLE 2.16—AVERAGE PETROL CONSUMPTION BY PASSENGER CARS, YEARS ENDING 30 SEPTEMBER 1971, 1976, 1979 AND 1982

Year ending 30 September	*Litres/100 km*
1971	12.4
1976	12.6
1979	12.7
1982	12.5

Sources: ABS (1973b, 1978, 1981f and 1983l).

years of 1971, 1976, 1979 and 1982. Although a marginal reduction in ARPC between 1979 and 1982 has been recorded, the level observed in 1982 was hardly different from that of 1971.

The fact that improvements in vehicle and engine design have not resulted in a significant reduction in ARPC for the vehicle fleet suggests that road congestion and the driving habits and skills of motorists are important factors contributing to fuel efficiency. Other factors working against fuel economy have been the aging of the vehicle fleet (lower scrappage rates), and the introduction of stiffer emission controls.

Forster (1983) has shown that the fuel consumption of large cars can be lowered by using automatic transmission with adequate shifting programs, to satisy the demand for high acceleration without frequent manual change of gear. Other factors contributing to fuel efficiency include the speed of cruising and the frequency of car care and maintenance (especially tyres).

CHAPTER 3—EMPIRICAL ANALYSIS

Australia, like most developed countries, has experienced continued growth in both the number of cars and the level of vehicle ownership (per person and per household) since the end of World War II The growth in number of cars was brought about by the interaction of a number of market forces which can be conveniently classified into demand and supply factors. Demand factors considered in this study include population, personal disposable income, household size, the total costs of owning and operating a vehicle and the availability and prices of alternative travel modes. On the supply side, investment in road infrastructure and improvements in vehicle quality add to the attractiveness of car travel through reduction in travel time costs, and through increased comfort and convenience for travellers. By contrast, adverse factors in the form of road congestion, accidents and pollution have had a negative influence.

Ideally, the demand and supply factors should be combined in a partial equilibrium framework and the system analysed simultaneously. Unfortunately, available data only permitted simple and highly aggregate models to be specified This chapter reports on the empirical analysis leading to the development of two sets of aggregate regression models. The first set of models attempts to explain the variation in the number of passenger cars on register at the State level. The second model seeks to quantify, for Australia as a whole, the relationship between vehicle usage and certain factors such as fleet size and the cost of fuel. It should be noted that the models are influenced by the historical relationship between the fleet size and its usage and variables such as car purchase price, income, operating costs and population.

FACTORS AFFECTING CAR OWNERSHIP

The demand for passenger vehicles and their usage is derived from the demand for transport services to provide personal mobility. This characteristic is recognised in a number of studies which treat the passenger vehicle as a consumer durable good which provides transport services over a number of periods of time (Wykoff 1973). However, the relationship between the provision of transport services and car ownership is complex. Some car services may be provided without ownership by the user of the service through ride sharing, use of a business car or taxis. Demand for transport services may be met, in part, by public transport services. Car ownership has special attributes such as availability, comfort, flexibility, privacy, time saving and prestige.

It is necessary in empirical work to identify all the major factors affecting demand in order to isolate the influence of each factor Examining the way in which these factors might be expected to affect the car fleet and its usage, provides the basis for the demand models used in the empirical analysis reported below.

On the demand side, factors affecting the size of the passenger car fleet and its use comprise population, income, purchase price of cars, cost of car operation, accessibility to and price of public transport and physical characteristics of the owner such as occupational status, age, household size and place of residence. On the supply side, relevant factors include developments in the provision of transport infrastructure (and policy relating to the level of cost recovery), the cost of producing and repairing motor vehicles, the cost of providing public transport services, and

government regulations aimed at safety and pollution control. For ease of exposition, these factors are categorised in the Paper into two groups: important economic and population factors, and other factors (including some supply factors) which indirectly affect car ownership and usage. Subject to data availability, each of these groups of factors is commented upon below.

Economic and population factors

This group of factors comprise income, population, car purchase price and operating costs. Limitations of the data relating to VKT restricted the discussion below to trends in these factors and their relationship to the stock of passenger cars on register.

Studies in the United States (Hemphill and Difiglio 1977) indicate that vehicle ownership is primarily determined by the disposable income of individuals and households. Households with high income are shown to have high vehicle ownership. The relationship between household income and vehicle ownership is nevertheless demonstrated to be highly non-linear with the average number of vehicles per household increasing much faster as income increases from low to medium levels compared to when income increases from medium to high levels. This suggests that income elasticity of demand for motor vehicles will decline as incomes rise over time. Comparable data are not available for Australia, although the ABS Household Expenditure Survey in 1974-75 (ABS 1977a) illustrated the positive association between levels of income received by different groups and their associated expenditure on the purchase and running costs of a car (see Table 3.1).

In Table 3.2 real household disposable income, population and the number of passenger cars on register are presented for the period 1962 to 1982. During this period the stock of passenger cars rose continuously by an average of 5.4 per cent per annum whereas disposable income and population increased by 4.5 per cent and 1.8 per cent per annum respectively. Figure 3.1 depicts these movements graphically. Up to the financial year 1974-75 the growth patterns in the stock of vehicles and disposable income were similar. Since then, the stock of passenger vehicles has continued to grow at more or less the same growth rate whereas growth of income has moderated markedly.

Average weekly household expenditure on the purchase and operation of motor vehicles is shown in Table 3.3 for households of different composition; the figures relate to all capital cities in the financial year 1974-75. On average, households without children spent about $17 per week on motor vehicles. The corresponding expenditure by families consisting of two adults and two, three or more children was about $23.

The three important costs incurred by motorists are the purchase price of the vehicle,

TABLE 3.1—WEEKLY HOUSEHOLD EXPENDITURE ON MOTOR VEHICLES BY HOUSEHOLD INCOME; ALL CAPITAL CITIES, 1974-75

($)

	Weekly household income					
Item	*Under $80*	*$80-under $140*	*$140-under $200*	*$200-under $260*	*$260-under $340*	*$340 or more*
Purchase	1.65	4.48	6.35	8.08	9.90	13.41
Petrol	1.29	3.31	4.60	5.75	6.55	8.53
Registration/ insurance	0.97	1.99	2.70	3.16	3.94	5.03
Other expenses	1.23	3.90	5.50	7.48	9.62	12.18
Total	5.14	13.68	19.15	24.47	30.01	39.15

Source. ABS (1977a)

the cost of fuel, and other running costs such as repairs, insurance and registration. Table 3.4 shows price indices for these three components of costs measured in real terms for the 10 year period between the financial years 1972-73 and 1981-82.

In 1980-81 prices, the index for vehicle purchase price fell from 113.6 in 1972-73 to 106.4 in 1974-75. After a temporary increase to 113.7 in 1975-76, the index declined continuously throughout the period. The price index for automotive fuel measured

TABLE 3.2—REAL HOUSEHOLD DISPOSABLE INCOME, POPULATION AND THE NUMBER OF PASSENGER CARS ON REGISTER, YEARS ENDING 30 JUNE 1962 TO 1982

Year ending 30 June	*Real household disposable income*[a] *($m)*	*Passenger cars ('000)*	*Population ('000)*
1962	35 640	2 200 7	10 644.8
1963	37 407	2 377.0	10 846.6
1964	40 450	2 582.6	11 059.3
1965	42 374	2 791.5	11 278 6
1966	42 764	2 946.6	11 599.5
1967	45 751	3 104.2	11 799.1
1968	46 129	3 305.0	12 008.6
1969	50 006	3 499.1	12 263.0
1970	52 668	3 719.7	12 507.3
1971	57 906	3 934.6	13 067 3
1972	61 036	4 147.3	13 303.7
1973	66 318	4 361.6	13 504.5
1974	71 682	4 604.0	13 722.6
1975	74 445	4 858.5	13 893.0
1976	74 845	5 072.8	14 033.1
1977	75 934	5 243.0	14 192.2
1978	76 599	5 462.2	14 359.3
1979	79 238	5 657.2	14 515.7
1980	79 264	5 800.6	14 695.4
1981	82 234	6 021.0	14 923.3
1982	85 327	6 293.8	15 178.4

a Deflated by the implicit price deflators for private final consumption expenditure (1979-80=100.0).

Sources ABS (1973a, 1974, 1983a, 1983b and 1983g).

TABLE 3.3—WEEKLY HOUSEHOLD EXPENDITURE ON MOTOR VEHICLES BY HOUSEHOLD COMPOSITION; ALL CAPITAL CITIES, 1974-75

($)

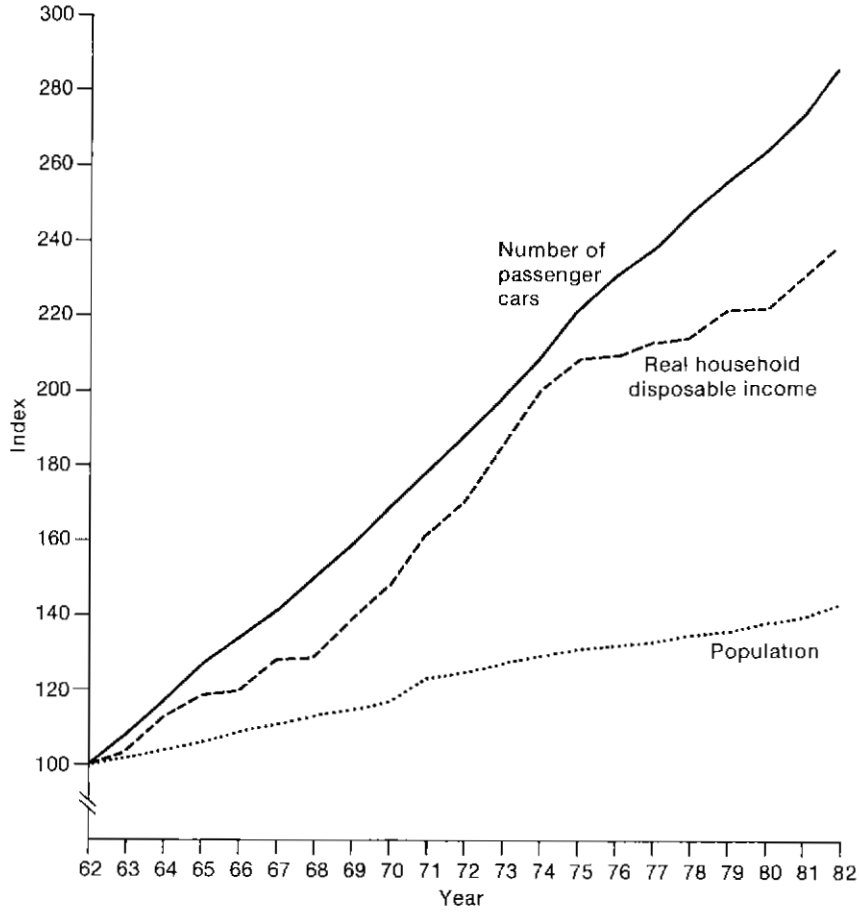
Item	*1 or more adults and no children*	*2 adults and 1 child*	*2 adults and 2 children*	*2 adults and 3 or more children*
Purchase	5.41	7.12	8 12	6.69
Petrol	3.93	5.11	5.24	5.80
Registration/insurance	2.52	2.78	2.99	3.07
Other expenses	5.33	6.55	7.01	7.19
Total	17.19	21.56	23.36	22.75

Source: ABS (1977b).

in real terms declined continually from the beginning of the period (1972-73) until the impact of Australia's move to import parity pricing for indigenous crude oil took effect after 1978-79. The index for automotive fuel peaked in 1980-81 and fell marginally in 1981-82. Despite the increase in the index of other running costs of the motor vehicle between 1974-75 and 1977-78 to over 110, this index was at about the same level at the beginning and end of the study period.

Other factors

This group of variables comprise factors determining the socio-geographic characteristics of the owner (family size, urban-rural split and population density), and factors shaping the wider scene of car ownership and its usage. These include attitudes towards car pooling, community and government attitudes to the negative aspects of motor vehicle usage, and government policy with respect to taxation, provision and improvements of road infrastructure, and so on.



Source. Table 3.2

Figure 3.1—Indices of real household disposable income, population and the number of passenger cars on register, years ending 30 June 1962 to 1982

TABLE 3.4—PRICE INDICES OF COMPONENTS OF PRIVATE MOTORING COSTS, YEARS ENDING 30 JUNE 1973 TO 1982[a]

Year ending 30 June	*Motor vehicle purchase*	*Automotive fuel*	*Other motoring costs*
1973	113.6	73.8	104.1
1974	106.7	73.4	100.2
1975	106.4	72.6	110.3
1976	113.7	73.7	115.3
1977	111.9	67.6	113.1
1978	111.7	67.3	111.0
1979	109.3	76.4	108.7
1980	104.4	94.2	103.4
1981	100.0	100.0	100.0
1982	99.8	97.6	100.2

a. The indices were deflated by the Consumer Price Index for all groups (1980-81=100 0)

Source: ABS, personal communication.

Family size

Income distribution statistics (ABS 1981c) indicated that between 1969 and 1979, the number of families[1] with four children declined from 11 1 per cent of total families in 1969 to 6.6 per cent in 1979. The number of families with one child also declined from 21.1 per cent to 19.8 per cent in the same period. By contrast, the proportion of families with two adults and no children increased from 33 per cent to 37 per cent between 1969 and 1979. This suggests that average family size was becoming smaller even though the 'norm' family of two adults and two children was continuously increasing in importance, amounting to 24 per cent of families in 1979. Continuation of these trends to smaller families may slightly favour the smaller car, but this is not expected to be a significant influence.

Urban-rural split

Australia is one of the most urbanised countries in the world. According to the 1981 Census (ABS 1983k), 86 per cent of the population lived in urban areas. Appendix I summarises important characteristics of the population derived from the 1976 and 1981 Censuses by region for the different States[2]. With the exception of Queensland and Western Australia, car ownership levels (per person and per household) were usually higher in rural regions than in urban regions (Tables I.1 to I.6).

Population density

Population densities in State capital cities have increased between the above two census years. For example, population density has increased from nearly 244 persons to 258 persons per square kilometre in the Sydney region between 1976 and 1981. Further increases in population density could affect urban congestion and choice of mode, but any impact on travel appears likely to be gradual.

Car occupancy rate

The observed growth in the number of cars on the roads has been associated with declines in average car occupancy rates. For instance, the average car occupancy rate in Melbourne in 1980 was 1.3 persons per car (including the driver) compared with 1.45 persons per car in 1964 (Victorian Transport Study 1980). The Study pointed out that a return of the 1964 average car occupancy rate would result in 10 per

1. For precise definition of 'family' see ABS (1981c)

2 In Appendix I, each State is divided into a number of regions reflecting basic differences in the demand for roads The methodology used in delineating the regions is described in BTE (1982a).

cent less cars on the road. This would lead in turn to lower fuel consumption, less congested roads and consequent reduction in noise and air pollution problems.

Car pooling arrangements
One way of reducing the number of vehicles on the road is through car pools. To facilitate arrangements for more extensive use of car pooling, the *Victorian Transport Regulation (Car Pools) Act* 1979 was enacted to legalise the sharing of costs by passengers carried in privately owned vehicles[1]. Car pooling introduces, however, considerable inflexibility in travel arrangements amongst the car-pool passengers. The limited use of car pooling suggests that most potential users place a high cost on the associated inflexibility in travel and loss of independence.

Pricing of public transport
The relatively low car occupancy rate reported above, coupled with the spare capacity in urban public transport, indicate inefficient usage of roads. This has prompted urban authorities to subsidise public transport in an attempt to keep prices low and increase patronage. The patronage response has generally been low, reflecting a fare elasticity for demand of public transport of around -0.3 (Biggs 1982), and also a low cross-price elasticity between demand for the private car and the price of public transport (Hensher and Bullock 1977).

Negative aspects of the car
The negative aspects of the motor vehicle and its usage affect all road users and many non-users and comprise traffic accidents, road congestion, noise and air pollution, and environmental hazards. Community and government attitudes towards these negative aspects (for example, introduction of further pollution controls and tougher driver licence and drink-driving regulations) could significantly affect future road travel growth.

Government policies
Policies relating to taxation, cost recovery and provision of road infrastructure affect the car fleet and its usage. Variations in taxation arrangements (for example, investment allowances and allowable rates of depreciation) alter the cost of purchasing and operating a business car. Similarly, changes to excise tax on road fuel, the crude oil production levy and cost recovery level will affect car usage. Improvements to the road system are expected to have some positive effects on the level of car usage (that is, average VKT), and possibly also on the level of car ownership.

In constant 1980-81 prices, total expenditure on the road system by the three levels of government (Federal, State and local) was approximately $2.4 billion per year from 1971-72 until 1978-79, and then about $2.2 billion per year up to 1980-81 (BTE 1982b). On average, about 70 per cent of the expenditure was allocated to road construction and the rest to maintenance, planning and research of the road system (BTE 1982b).

This expenditure has led to a significant upgrading of the physical and operational characteristics of the Australian road system (BTE 1984a). The resulting reductions in travel time, vehicle operating costs, accident costs and driving comfort have contributed to the attraction of, and growth in, car travel.

REVIEW OF PREVIOUS STUDIES

This section reviews relevant motor car demand studies undertaken overseas and in Australia. These studies are categorised according to the type of data used: time-

1. The study suggests that to obtain maximum benefits of car pooling, wide publicity of the legislation is required to produce a better understanding among participants coupled with clear pricing arrangements and active traffic management policies such as reserved traffic lanes.

series and cross-sectional[1]. The relative advantages and disadvantages of each of these studies, and the type of model used, are discussed in terms of the objective of the present study to project road travel between 1985 and 2000.

Time-series models

The literature on models using time-series data can be conveniently classified into two major groups. The first group of models considers the motor vehicle as a consumer durable good which provides transport services over a number of periods of time (Nerlove 1957, Wykoff 1973 and IAC 1981). The second group of models (resulting primarily from research at the Transport and Road Research Laboratory in the United Kingdom) analyses the trend and pattern of growth of the stock of motor vehicles and relates the stock of cars to a number of independent socio-economic variables (Tanner 1978)[2]. The following section presents the key aspects of each group of models in an attempt to illustrate significant differences.

Stock adjustment models

The 'stock adjustment' scheme assumes that demand for new cars in time period t is proportional to the difference between a 'desired level of stock' in period t and the actual stock of cars in the previous time period (t-1). Although the 'desired level of stock' is not observable, it is assumed to be a function of such variables as income, population, and prices of new and used cars. The regression equation of the 'stock adjustment' model (assuming linearity) can be expressed in its basic form as:

$$\text{Demand}_t = F(\text{income}_t, \text{population}_t, \text{price of new cars}_t, \text{price of used cars}_t, \text{stock of cars}_{t-1}, \text{error}), \qquad \textbf{Model 1}$$

where the subscript t refers to the current year and t-1 to the preceding year.

Variations to the above basic regression form can be made, for example, by adding consumer credit as an independent variable (Suits 1958), or estimating Model 1 separately for each passenger vehicle size group (Carlson 1976).

The main criticism of the 'stock adjustment' scheme is that it considers the services derived from all cars to be similar and as such vehicles are regarded to be a homogenous group[3]. Although vehicles of different make, model and vintage all provide a transport service, technological developments in design have created new and different tastes on the part of the consumer. Besides meeting the transport need, the two reasons that induce an individual to purchase a new car are the aesthetics and prestige of new car ownership, and the reliability of new cars (Wykoff 1973).

User-cost models

To overcome the above criticisms, the 'user-cost' approach was developed. The basic axiom underlying this approach is that the consumer derives utility mainly from the services provided by the car rather than from ownership of the car.

In these models, the price of the service (that is, the rental price which reflects both the opportunity cost of car ownership and its cost of depreciation) is the key determinant of demand rather than the purchase price of the vehicle. The rental

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1. One study (Taplin 1983) does not fit neatly into this classification and is discussed separately at the end of this review.

2. In its original and simplest form, time was considered as the independent variable in these models However, realisation that there is some correlation between year-to-year changes in stocks and corresponding variations in national income and/or other economic and demographic variables resulted in replacing time as the independent variable by socio-economic variables. A literature review of these two groups of models can be found in Carlson (1976) and Hopkin (1981).

3. Changes in vehicle characteristics make it difficult to analyse the variations in the price pattern of a vehicle of constant quality Some models dealing with the demand for motor cars adopt the concept of a hedonic price index to overcome this problem (see Grilliches 1968)

price for used cars is determined endogenously by income, rental price of new cars, existing stock of vehicles and price of other goods.

The difference in the level of service rendered by new and used cars is appropriately weighted by the relevant rental price, and demand models for each of the different vehicle categories are estimated separately. In practice, however, grouping the stock of used cars into a well defined commodity is achieved by selecting a particular car as a reference car, say a one-year old Datsun Bluebird. The stock of used cars is then translated into a one-year-old equivalent (Wykoff 1973).

The 'user-cost' model was applied in Australia in estimating the demand for passenger cars by the Industries Assistance Commission (IAC 1981). It overcomes problems encountered in the 'stock adjustment' scheme and also provides considerable scope for policy analysis. For instance, the effect of a credit squeeze on the demand for motor cars can be traced in this model through its impact on the rental price. 'User-cost' models, however, require considerable data inputs and manipulations. In addition, details of the total vehicle fleet by year of manufacture is not available in Australia on a regular basis (see Chapter 2). This limits the use of such a model.

Both the above models use aggregate time-series data (often quarterly) and concentrate on short-term forecasts of new car sales. Treatment of car stock tends to be rudimentary (assuming the 'desired' stock of cars exceeds the actual stock) and typically uses linear effects of socio-economic variables without a saturation point (see Tanner's work below). It is further argued that in countries where multi-car ownership is substantial, the car becomes a transport tool for the individual's daily travel. That is, the passenger vehicle has become almost a necessity of life for an average household in most developed countries (OECD 1981). This is particularly so because the private car offers a number of attributes such as comfort, flexibility, privacy and time saving, not characterised in the various forms of public transport.

Level of saturation

The model developed by the Transport Road Research Laboratory in the United Kingdom (Tanner 1978) assumes that growth over time in the number of cars per person follows a modified logistic curve. The shape of this curve is assumed to be a function of the current per capita gross domestic product (GDP) and the cost of motoring, and their corresponding values in a base period. In this formulation, a level of saturation in the number of cars per person is imposed *a priori* in the model; the level of saturation is the level of car ownership at which the percentage growth rate of the number of cars per person would be zero. This is based on the observation that there exists a low percentage growth rate in the number of cars per person in areas where there are high levels of car ownership.

The sensitivity of the forecasts to the assumed value of the saturation point is an undesirable feature of the model. In addition, it is debatable whether a saturation point is a theoretical concept or a long-run average (OECD 1981).

Cross-sectional models

The alternative approach to modelling demand for motor vehicles uses cross-sectional data. The common aim of such studies (often at a highly disaggregated level) is to highlight the most relevant socio-economic factors that affect the level of car ownership at the consumer or micro level (Carlson 1976). However, the models used in these studies are very diverse, ranging from relatively simple regression models to modelling the individual's choice behaviour.

The most recent Australian study following this approach was undertaken by Abelson and Baker (1982) in the Sydney area, using 1976 census data. Median income, household size, residential density, distance to central business district (CBD), access

to rail and number of employed persons per household were used as explanatory (independent) variables to explain the level of car ownership. Two versions of car ownership models were explored; the dependent variable represented either the number of cars per household or the number of cars per capita. The results obtained were similar for the two versions of the model, and the income elasticity of demand with respect to both household and per capita income was around unity. Variables that were found to be statistically significant in explaining car ownership were residential density, distance from the CBD, access to rail and household size.

A considerable number of studies (for instance, Beckman et al. 1974, McFadden 1971, Burns and Golob 1976, and Hensher and Johnson 1981) used the concept of utility maximisation with a logit specification in modelling the individual's choice behaviour. These studies attempted, *inter alia*, to capture the inter-relationships between joint automobile ownership, and trip frequency and distribution decisions. However, this approach has not been applied to the area of long-term forecasting of either car ownership or its usage (OECD 1981).

Advantages and disadvantages of each type of model

While the cross-sectional analysis enjoys obvious advantages as it is capable of discerning the effects of socio-economic and geographical as well as demographic factors across different localities, it suffers two main shortcomings. Firstly, it does not capture the effect of the cost of car ownership because such cost is usually constant across the units under study. Secondly, cross-sectional analysis depends crucially on the economic conditions prevailing during the survey period. However, the economic situation is not static over time, and the level of car ownership may be related to the business cycle. Consequently, although the coefficients estimated from models using cross-sectional data are generally regarded as depicting long-run effects, their possible variation over time reduces their suitability for long-term forecasting.

On the other hand, time-series models have the advantage of being able to trace the impact of changes in the explanatory variables through time on the levels of car ownership. On the negative side, this approach loses its appeal if it is desired to consider the impact of a given factor (say household size) on car ownership

System of demand equations

Taplin (1983) specified a system of demand equations for the road sector and forecast future road demand with a 10 to 20 year horizon. Long-term demand was estimated for urban (short distance) and non-urban (long distance) travel separately. The system comprises a demand equation for each mode of travel and explicitly accounts for inter-modal substitution. Taplin found demand for leisure non-urban car travel to be affected by overseas and domestic air fares (indicating substitutability for long distance car travel).

In this work, vehicle usage was indirectly analysed in terms of the volume of fuel consumed The elasticities were not empirically estimated but were derived from other studies subject to a set of standard restrictions imposed on the system of equations.

MODEL SPECIFICATION

A limitation of the above approaches is that they concentrate on only one component of road travel (that is, fleet size). A comprehensive model of road travel should consider its two components (fleet size and its usage) simultaneously in a multi-equation

model as they are jointly determined[1]. In practice, constraints on the availability of data and the measurability of some characteristics restrict the comprehensiveness of the approach. These constraints comprise lack of continuous time-series data on fleet usage, urban-rural split and population density, car pooling, community and government attitudes towards congestion, pollution and public transport, and so on.

Given the study's main objective (projections of both components of road travel to the year 2000), time-series analyses were undertaken as they identify trends and trace the impact of changes in the variables. A modified approach representing an approximation to the use of a simultaneous equation model was adopted. It comprises two stages. In the first stage, fleet size (car ownership per person) at the State level was considered to be a function of the purchase price and operating costs (including petrol) of the vehicle, and a proxy variable for income. That is:

Number of cars per capita=f (purchase price, income per head, operating costs), **Model 2**

where the explanatory variables were in real terms. Two comments need to be made in regard to the above model specification. Firstly, average weekly earnings (at State level) was used as a proxy for income. Secondly, this study uses an index of the purchase price of new cars alone rather than indices of both new and used are prices or an index of both prices[2].

In the second stage of the procedure, the model parameters for total vehicle kilometres travelled at a State level were estimated by pooling the information provided by the ABS Surveys of Motor Vehicle Usage[3]. Total VKT was determined by fleet size, price of petrol and dummy variables (representing State difference in average VKT). That is:

Total VKT=f (fleet size, petrol cost, State dummy variables), **Model 3**

for each State. Inclusion of State dummy variables in the above model, accounts for differences in the levels of fleet usage (representing State differences in average VKT) due to factors not covered by the other explanatory variables included in the model.

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1 To allow for the interactive nature of the two components of road travel, such a model may be specified as

fleet size=f (purchase price, operating costs, income, VKT), and
VKT =f (fleet size, price of petrol).

Cost factors in the above model approximate the constraints on supply imposed by costs of purchasing and operating a vehicle. Estimation procedures for the unknown parameters of this model are those adopted for simultaneous equation systems (including maximum likelihood procedures and two-stage least-squares method) In general, the same approach applies to modelling commercial vehicles' road travel

2. For an enumeration of studies using the price of only new cars, see OECD (1981) and Mogridge (1983).

3. In an attempt to estimate the missing VKT figures between survey years, the National Roads and Motorists Association (NRMA 1982) links State total VKT to a petrol consumption series. However, reported petrol consumption by States refers to usage by the whole car fleet (that is, passenger cars and commercial vehicles).

CAR OWNERSHIP

Data and estimation procedure

Information relating to the number of cars on register, population, an index of new car purchase price, an index of average weekly earnings[1] and an index of the cost of operating a vehicle (including petrol, insurance, registration, and so on), all indeces in real terms, for the period from 1962-63 to 1980-81 were used in the analysis[2]. Given the long-term objective of this study, Model 2 which concentrates on economic and population factors, is felt to be an appropriate specification of car ownership levels. An underlying assumption is that the factors not included in the model, such as consumer's socio-geographic characteristics and his/her changing patterns and attitudes to work, vary only slowly through time and are generally income related. The method of ordinary least-squares was applied to various formulations of Model 2 above. These formulations included linear, semi-log and log-linear specifications.

Results and discussion

The estimated coefficients of Model 2 in its linear (with varying elasticities), semi-log (implying a saturation level) and log-linear (assuming constant or average elasticities) forms resulted in marginally different elasticities at mean values. The log-linear specification was selected in view of the following: firstly, its better fit to the data[3], and secondly, car ownership levels in Australia (see Appendix I) appear to be well below possible saturation levels as indicated, for example, by car ownership levels in some States of the USA.

The results of the log-linear form for all States are presented in Table 3.5. The regression models used provided a very satisfactory explanation of variations in the number of passenger cars over the study period (estimated $\bar{R}^2$ being approximately 98 per cent). All the estimated coeefficients were of the expected sign on *a priori* grounds Further, with the exception of the elasticities with respect to operating costs, all the elasticity coefficients and the constants were statistically significant. Finally, Durbin-Watson statistics indicated lack of serious serial/auto correlation problems.

Price elasticities of demand were less than unity (inelastic) in the States of New South Wales, Victoria and South Australia, about 0.9 in Tasmania and Western Australian and over unity in Queensland[4]. The IAC (1981), using the 'user-cost' approach and the 'rental price' concept, estimated price elasticity to vary between -0.5 and -0.9. Despite the difference in approach, the IAC results are in line with those obtained in this study with the exception of Queensland.

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1. Average male weekly earnings before tax and other deductions includes overtime earnings, ordinary time earnings, shift allowances, penalty rates, commission and similar payments together with that part of paid annual leave, paid sick leave, long service leave and paid holidays taken during a specified ABS reference period Between the financial years 1971-72 and 1980-81, real average weekly earnings increased at an average 1 8 per cent per annum, while Gross Domestic Product per head (in real terms) increased by about 1.5 per cent per annum (ABS 1983b and 1983d).

2. ABS was the main source of data for the variables used in the analysis. For motor vehicle purchase price and operating cost indices, NRMA (1982) and ABS, personal communication, data were used. ABS information on population, fuel prices and CPI were obtained from ABS (1983a, 1981a and 1981b) respectively.

3 It is recognised that use of constant or average elasticities in deriving long-term projections may introduce bias. However, the absolute magnitude of such bias is not felt to be of major importance (see Chapter 4)

4. The higher price elasticities in Western Australia and Queensland, probably reflect omission of an 'economic growth' factor from Model 2 See comments on the indicator of economic activity in these States in Chapter 6

TABLE 3.5—ESTIMATES OF ELASTICITIES OF THE NUMBER OF PASSENGER CARS ON REGISTER WITH RESPECT TO PURCHASE PRICE, INCOME AND OPERATING COSTS BY STATE OF REGISTRATION[a]

State of registration	Constant	Purchase price	Income	Operating costs	$\bar{R}^2$	Durbin-Watson
New South Wales	-1.00	-0.66	0.75	0.05	0.99	1.93
	(-26.49)	(-3.16)	(7.51)	(0.23)		
Victoria	-0.83	-0.48	1.02	-0.27	0.99	1.58
	(-17.87)	(-2.44)	(7.80)	(-1.31)		
Queensland	-1.03	-1.12	0.63	0.14	0.98	2.16
	(-16.11)	(-3.78)	(4.35)	(0.48)		
South Australia	-0.85	-0.59	0.76	-0.06	0.99	1.71
	(-22.98)	(-3.79)	(8.90)	(-0.41)		
Western Australia	-0.89	-0.92	0.76	-0.32	0.99	1.76
	(-18.24)	(-4.77)	(6.67)	(-1.56)[b]		
Tasmania	-0.81	-0.89	0.90	-0.17	0.98	1.80
	(-15.99)	(-3.41)	(7.73)	(-0.66)		

a. t-values are in brackets
b. Significant at the 90 per cent level

Estimates of income elasticities for all States are highly significant and are all inelastic (less than one) except for Victoria and Tasmania (about unity). These estimates are in line with income elasticities estimated by other authors (Abelson and Baker 1982).

Although the coefficients for the operating cost variable (including petrol costs) were generally not significant[1], the coefficient for Western Australia was significant at the 90 per cent level. An estimate of -0.3 compares favourably with Donnelly's (1982) estimate of about -0.2 for the demand elasticity of petrol in Western Australia between 1958 and 1981. There is considerable evidence for Australia and other countries that the demand for petrol is price inelastic, particularly in the short run (Latham 1983).

CAR USAGE

Total VKT model

Determination of the main factors that affect total vehicle kilometres travelled throughout the road network was seriously affected by the lack of data. The ideal situation would be to model total VKT in a simultaneous equation system together with the car ownership model discussed earlier, so that total VKT is endogenously determined by car ownership and similar factors to those affecting it.

Two alternative views of the relationship between total VKT and car ownership were considered. The first assumes that the number of cars on the road can be used as an indicator of road travel, based on the historical observation that annual average vehicle kilometres travelled per car does not appear to change significantly even at a very high level of car ownership (Tanner 1978 and OECD 1983). The second view assumes that with the trend towards multiple-car ownership, the additional cars in each household will be used for specific purposes and less often. Consequently, average vehicle kilometres travelled per vehicle will decline over time.

1. Failure to obtain statistically significant coefficients may be due to data limitations and model specification problems

To assess this relationship between total VKT and the number of passenger cars in Australia, Model 3 was estimated. Information provided in the four Surveys of Motor Vehicle Usage of 1971, 1976, 1979 and 1982 relating to total vehicle kilometres travelled by sedans and station wagons in each State was pooled. Using these data, total VKT for a State was regressed on the number of cars in the relevant State, petrol costs and dummy variables to account for State differences in average VKT[1]. Ordinary least-squares regression was used to estimate the unknown coefficients of Model 3 in its additive specification (log-linear form).

The results are presented in Table 3.6. Although caution is required in interpreting the regression results due to the small number of observations[2], the estimated coefficients (except for petrol cost) were statistically significant. Further, the model explained over 99 per cent of variation in total VKT. The calculated Durbin-Watson statistic indicating possible serial/auto correlation was in the inconclusive region.

A statistically significant elasticity with respect to number of vehicles of approximately 0.8 was obtained. This suggests that an increase of 10 per cent in passenger cars would be associated with an 8 per cent increase in total VKT (a gradual decrease in average VKT as passenger car numbers increase). Hence the limited Australian evidence is consistent with the view noted above, namely that the trend to multiple car ownership has been associated with some decline in average VKT per vehicle. The petrol cost coefficient represents the elasticity of vehicle utilisation with respect to price. The estimated elasticity was not however, statistically significant. In contrast, the coefficients of the State dummy variables were significant reflecting differences in average VKT between States.

Average VKT models

To understand the way in which State specific variables affect average VKT would require specifying average VKT as a function of, say, an income type variable and petrol prices. Such an understanding is important due to the two views indicated above (that is, constant and declining average VKT). Unfortunately, attempts to model average VKT as a function of real average weekly earnings and petrol prices at State level failed to produce statistically significant results[3]

TABLE 3.6—ESTIMATES OF ELASTICITIES OF TOTAL VEHICLE KILOMETRES TRAVELLED WITH RESPECT TO NUMBER OF CARS AND PETROL COST[a]

Dependent variable	*Constant*	*Number of cars*	*Petrol cost*	$\bar{R}^2$	*Durbin-Watson*
Total VKT	4.19	0.80	-0.04	0.99	1.69
	(14.93)	(24.72)	(-0.89)		

a. t-values are in brackets.

1. An advantage of the use of dummy variables is to reduce the additional source of error introduced into the model through pooling of survey data.

2 Use of simultaneous equation systems with a limited number of observations can introduce simultaneity bias

3 This point will be discussed further in Chapter 4 when developing projection scenarios

CHAPTER 4—PROJECTIONS OF PASSENGER CARS

This chapter reports on the projections obtained from the empirical models of the previous chapter. Projections are provided for both car ownership and car usage at State level at five-year intervals to the year 2000. In essence, the models assume that the prevailing car ownership and usage sensitivity to various economic forces and population will continue to the turn of this century. Further, although the models do not incorporate certain other factors (such as family size, population density, car occupancy rate and community and government attitudes commented upon in Chapter 3), the influence of these factors resides in an unknown way in the dimensions of the models' parameters.

The analysis was based on two scenarios developed for the future economic environment. One scenario reflects the favourable conditions for future economic events, while the other assumes adverse circumstances, resulting in high and low growth projections respectively. Finally, comparisions are undertaken with forecasts provided earlier by the BTE (1979a) and by other organisations such as the Committee on Motor Vehicle Emissions (COMVE) and the Institute of Applied Economic and Social Research (IAESR).

SCENARIOS

To estimate road travel (total vehicle kilometres travelled) by passenger cars between 1985 and 2000, the future likely levels of the explanatory variables affecting car ownership and vehicle kilometres travelled by the car fleet need to be projected.

The first of the two scenarios reflects favourable economic and demograhpic conditions for the growth in the level of car ownership and usage (resulting in high growth projections). This scenario is rather optimistic in that it assumes there would be a decrease in the real purchase price of the motor vehicle and a significant increase in average weekly earnings, measured in real terms, over the projection period. In contrast, the second scenario reflects adverse conditions which restrict growth in the car fleet size and its usage. This scenario assumes that no changes in the purchase price of the motor vehicle will occur throughout the projection period and that increases in real average weekly earnings will be limited (resulting in low growth projections). The second scenario also assumes a slightly slower population growth than the first. The assumptions underlying these two scenarios are briefly discussed below.

Average weekly earnings

The assumed annual growth rates for different periods to the year 2000 are reported in Table 4.1 for the two scenarios. In the 'high growth' scenario, annual growth rates of average weekly earnings observed in the financial year 1980-81 and considered to represent a normal annual growth rate[1] were used for the period 1981-85. A rate of 3.5 per cent per annum was used between 1985 and 1995 and a rate of 3 per cent per annum thereafter. For the 'low growth' scenario, an annual growth rate of 1.5 per cent was assumed throughout the forecast period.

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1 In the late 1970s, the indicator of real average weekly earnings was relatively stable. This indicator rose from mid-1980 until mid-1982 and exhibited a gradual decline during 1982–83 to about the 1980–81 level (BTE 1984c).

TABLE 4.1—PROJECTED RATES OF GROWTH IN AVERAGE WEEKLY EARNINGS UNDER THE TWO SCENARIOS, 1981 TO 2000

(per cent per annum)

State of registration	*Scenario*	*1981–85*	*1985–90*	*1990–95*	*1995–2000*
New South Wales[a]	High growth	3.78	3.50	3.50	3.00
	Low growth	1.50	1.50	1.50	1.50
Victoria	High growth	3.06	3.50	3.50	3.00
	Low growth	1.50	1.50	1.50	1.50
Queensland	High growth	5.31	3.50	3.50	3.00
	Low growth	1.50	1.50	1.50	1.50
South Australia[b]	High growth	4.85	3.50	3.50	3.00
	Low growth	1.50	1.50	1.50	1.50
Western Australia	High growth	4.56	3.50	3.50	3.00
	Low growth	1.50	1.50	1.50	1.50
Tasmania	High growth	4.29	3.50	3.50	3.00
	Low growth	1.50	1.50	1.50	1.50
Australia	High growth	4.60	3.50	3.50	3.00
	Low growth	1.50	1.50	1.50	1.50

a. New South Wales includes the Australian Capital Territory
b South Australia includes the Northern Territory.

Population

The source of population projections for the States and Territories of Australia to the year 2000 is ABS (1983i). In both high and low growth scenarios (using ABS series C and A respectively), the assumed values for fertility and mortality rates are similar. However, the main difference is in net migration gains, assumed to be 125 000 persons per annum in the high growth scenario compared with 75 000 persons in the low growth scenario. The projected population growth according to series C and A (ABS 1983i) for high and low growth scenarios respectively are shown in Table 4.2.

It is assumed in the projections that a given increase in population will lead, other things being equal, to a corresponding increase in vehicle ownership. This implies that changes in the age composition of the population. and changes in household size and structure, will not significantly affect car usage per person. While these factors clearly do have some influence, it is not apparent whether the net influence on usage will be positive or negative For example, the increasing share of aged persons in the population may reduce use of the private car. On the other hand, the trend for young adults and elderly people to live separately from their close family increases the demand for vehicles and reduces the scope for ride-sharing. The latter effect is in any case likely to be picked up in part in the projections under the broad income effects. The observed decline in average family size appears likely to affect the type of vehicle used rather than VKT. These factors usually change only very slowly through time.

Real purchase price of the motor vehicle

The 'high growth' scenario assumes that there will be a reduction in the real purchase price of the motor vehicle of 2 per cent per annum between 1981 and 1985, a further reduction of 1 per cent per annum between 1985 and 1995, and that it will then remain at the same level for the remainder of the projection period. These values are based on the actual decline in the purchase price of the passenger car observed in the two periods 1961 to 1973 (2 per cent) and 1973 to 1981 (1 per cent)[1]. A less expensive vehicle in the future could result from the use of simpler vehicle design and light materials with significantly reduced weight. Examples of rationalisation include adoption of the 'world car' concept and the development of the Fiat UNO[2]. Possible changes in the structure of the local vehicle industry and its protection from imports could also affect the purchase price. By contrast, it is assumed that there will be no change in the purchase price of the vehicle in the 'low growth' scenario.

Vehicle operating cost

Vehicle operating cost was of some statistical significance in the car ownership model only in the case of Western Australia (see Table 3.5).

Petrol cost is a significant proportion of annual total running costs. In this study, petrol cost was assumed to be 60 per cent of total running costs[3].

The high growth scenario assumes that petrol prices remain constant in real terms

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1. Between 1982 and 1983, the index of new vehicle purchase price (in real terms) declined by more than 1 per cent (BTE 1984c)

2 Hester (1983) estimated that for the Fiat UNO, the total number of body components was reduced by 35 per cent and the number of spot welds by 40 per cent compared with its predecessor the Fiat 127

3. Although the proportion varies for different makes of vehicles NRMA (1983) shows that the petrol component of total running cost was between 57 and 63 per cent for five relatively small popular cars in 1983.

TABLE 4.2—PROJECTED RATES OF GROWTH IN POPULATION UNDER THE TWO SCENARIOS, 1981 TO 2000
(per cent per annum)

State of registration	*Scenario*	*1981-85*	*1985-90*	*1990-95*	*1995-2000*
New South Wales[a]	High growth	1.56	1.45	1.31	1.18
	Low growth	1.21	1.10	0.97	0.86
Victoria	High growth	1.24	1.22	1.12	0.99
	Low growth	0.92	0.91	0.82	0.69
Queensland	High growth	2.76	2.49	2.25	2.03
	Low growth	2.46	2.23	2.03	1.84
South Australia[b]	High growth	1.18	1.06	0.93	0.78
	Low growth	0.93	0.81	0.69	0.55
Western Australia	High growth	2.58	2.35	2.11	1.90
	Low growth	2.09	1.92	1.74	1.58
Tasmania	High growth	1.03	0.88	0.73	0.57
	Low growth	0.88	0.73	0.57	0.41
Australia	High growth	1.71	1.60	1.45	1.31
	Low growth	1.37	1.28	1.15	1.03

a. New South Wales includes the Australian Capital Territory.
b. South Australia includes the Northern Territory.

Source: ABS (1983i).

throughout the projection period. By contrast, in the low growth scenario[1] petrol prices are assumed to remain constant until 1985 and then to rise by 2 per cent per annum.

The other running costs of the motor vehicle (including registration, insurance, maintenance and repairs) were assumed to remain constant in real terms over the projection period.

Average vehicle kilometres travelled by passenger cars

Lack of a common trend in the different States' average VKT coupled with the lack of statistical significance of the petrol cost elasticity in Model 3 necessitated projecting average VKT at State level for the two scenarios.

The annual rates of change of average VKT in each State between 1971 and 1982 are presented in Table 4.3. The high growth scenario assumes that average VKT continues to grow in New South Wales and Queensland throughout the projection period at a rate similar to that observed in the last decade, while for the other States the actual levels of average VKT in 1982 are maintained throughout the projection period (with no growth). In contrast, the low growth scenario assumes that average VKT in New South Wales, Queensland and Tasmania will remain at the actual levels observed in 1982 throughout the projection period, while there will be an annual decline at the rates indicated in Table 4.3 in other States

Tables 4 4 and 4.5 summarise the projected average VKT for the high and low growth scenarios respectively.

PROJECTIONS

The estimated models presented in Chapter 3 and the assumed values of the explanatory variables derived in the previous section are drawn together to provide the projections for the number of passenger cars and the levels of car usage. Total VKT projections at State level are obtained by multiplying the projected number of cars by the assumed value of the average vehicle kilometres travelled by the vehicle fleet in a particular time period.

TABLE 4.3—ANNUAL RATE OF CHANGE IN AVERAGE VEHICLE KILOMETRES TRAVELLED BY STATE OF REGISTRATION, YEARS ENDING 30 SEPTEMBER 1971 TO 1982[a]

(per cent)

State of registration	*Annual rate of change*[b]
New South Wales[c]	0.3
Victoria	-0 7
Queensland	0.3
South Australia[d]	-0.6
Western Australia	-0.4
Tasmania	0.1
Australia	-0.3

a Assuming a linear trend throughout the period
b A (-) sign indicates a decline.
c New South Wales includes the Australian Capital Territory.
d South Australia includes the Northern Territory

Source. Derived from ABS (1973b and 1983l).

1 The values assumed in the low growth scenario are similar to those assumed by the Institute of Applied Economics and Social Research (1983b) in the long-term forecasts for the domestic economy.

TABLE 4.4—PROJECTED AVERAGE ANNUAL VEHICLE KILOMETRES TRAVELLED BY PASSENGER CARS UNDER THE HIGH GROWTH SCENARIO BY STATE OF REGISTRATION, 1985 TO 2000

Year ending 30 June	*New South Wales*[a]	*Victoria*	*Queensland*	*South Australia*[b]	*Western Australia*	*Tasmania*	*Australia*
1982[c]	15 454	15 066	15 508	14 868	15 500	14 362	15 270
1985	15 594	15 066	15 648	14 868	15 500	14 362	15 339
1990	15 829	15 066	15 884	14 868	15 500	14 362	15 454
1995	16 068	15 066	16 124	14 868	15 500	14 362	15 571
2000	16 310	15 066	16 367	14 868	15 500	14 362	15 688

a. New South Wales includes the Australian Capital Territory.
b South Australia includes the Northern Territory.
c. Actual unpublished preliminary figures for Survey of Motor Vehicle Usage, Twelve Months ended 30 September 1982

TABLE 4.5—PROJECTED AVERAGE ANNUAL VEHICLE KILOMETRES TRAVELLED BY PASSENGER CARS UNDER THE LOW GROWTH SCENARIO BY STATE OF REGISTRATION, 1985 TO 2000

Year ending 30 June	*New South Wales*[a]	*Victoria*	*Queensland*	*South Australia*[b]	*Western Australia*	*Tasmania*	*Australia*
1982[c]	15 454	15 066	15 508	14 868	15 500	14 362	15 270
1985	15 454	14 752	15 508	14 602	15 315	14 362	15 133
1990	15 454	14 243	15 508	14 169	15 011	14 362	14 907
1995	15 454	13 751	15 508	13 749	14 713	14 362	14 685
2000	15 454	13 277	15 508	13 342	14 421	14 362	14 466

a. New South Wales includes the Australian Capital Territory.
b South Australia includes the Northern Territory.
c Actual unpublished preliminary figures for Survey of Motor Vehicle Usage, Twelve Months ended 30 September 1982.

Projections of the number of passenger cars and the level of car ownership at five-year intervals between 1985 and 1990 under the high and low growth scenarios are reported in Tables 4.6 and 4.7 respectively. The main features of the projections are summarised below:

- In absolute terms, it is expected that there would be between 9 million and 15 million passenger vehicles on the roads in the year 2000, compared with the 1981 level of about 6 million cars.
- The ratio of the number of cars to population (the level of car ownership) will rise from 0.40 in 1981 to between 0.77 and 0.49 in the year 2000 according to the high and low growth projections respectively.
- In both sets of projections, Victoria, Western Australia and Tasmania attain levels of car ownership higher than the national average.

The high and low growth projections of total kilometres travelled by passenger cars are reported in Tables 4.8 and 4.9. For the high growth projection the total VKT for Australia will rise from 96 billion kilometres in 1981 to 242 billion kilometres in the year 2000, compared with 135 billion kilometres for the low growth projection.

The BTE did not have adequate information to separately project car usage in urban and rural areas, but anticipates that the growth in usage will be higher in urban areas because of the inelastic demand for public transport and the low cross-price elasticity between demand for the private car and public transport (Hensher and Bullock 1977). For non-urban road travel, demand appears more price elastic and growth in international and domestic air travel is expected to suppress long distance car trips (Taplin 1983). The expected high growth in urban traffic could be tempered by traffic policies (such as parking costs and access road tolls), and possibly by a significant increase in ride-sharing or switch to public transport. Evidence to date, however, suggests that these factors have had little impact on the strong growth in urban passenger car travel.

COMPARISON WITH OTHER FORECASTS

Three other sets of road travel forecasts are reported for comparison. The first set of forecasts is that derived by BTE for its 1979 Roads Report (BTE 1979a). Fleet size was estimated in two steps. For the first step, car ownership per capita was forecast as a function of disposable income per capita (BTE 1978) and price of cars. In the second step, the forecast of car ownership was multiplied by the forecast population number. Forecasts for the period between 1984 and 1999 are shown in Table 4.10. The earlier BTE study's fleet size forecast for 1984 is greater than this study's high growth projections for 1985. For the remainder of the projection period, the 1979 BTE forecasts lie between the high and low growth projections of the current study. The difference between the results of the two BTE studies relates to the approach followed and changes in the assumed growth rates of the explanatory variables.

The second set consists of projections of the number of passenger cars and total VKT by the Committee on Motor Vehicle Emissions (COMVE 1982) derived by assuming that the level of vehicle ownership remains constant to 1995 (hence, population growth becomes the sole determinant of fleet size) and that average VKT for passenger cars remains similar to the 1979 level given in the Survey of Motor Vehicle Usage (see Table 4.10). The projections obtained by COMVE tend to be closer to this study's low growth projections.

The third set of car ownership forecasts are derived from the long-term forecasts of the ratios of persons per motor vehicle (both passenger cars and light commercial vehicles) provided by the Institute of Applied Economic and Social Research (IAESR 1983a). Table 4.11 compares the projections of the BTE study with the inverse of

TABLE 4.6—PROJECTED NUMBER OF PASSENGER CARS AND ASSOCIATED CAR OWNERSHIP LEVELS UNDER THE HIGH GROWTH SCENARIO BY STATE OF REGISTRATION, 1985 TO 2000

	New South Wales[a]		Victoria		Queensland		South Australia[b]		Western Australia		Tasmania		Australia	
As at 30 June	Number ('000)	Owner-ship	Number ('000)	Owner-ship	Number ('000)	Owner-ship	Number ('000)	Owner-ship	Number ('000)	Owner-ship	Number ('000)	Owner-ship	Number ('000)	Owner-ship
1981[c]	2 111	0.39	1 633	0.41	946	0.40	595	0.41	553	0.43	183	0.43	6 021	0.40
1985	2 646	0.46	2 017	0.48	1 315	0.50	718	0.48	755	0.52	239	0.54	7 690	0.48
1990	3 341	0.53	2 618	0.59	1 753	0.59	935	0.59	1 013	0.63	302	0.64	9 962	0.58
1995	4 190	0.63	3 381	0.72	2 308	0.70	1 209	0.72	1 343	0.75	382	0.79	12 814	0.69
2000	4 963	0.70	4 132	0.84	2 802	0.77	1 408	0.81	1 652	0.84	450	0.90	15 407	0.77

a. New South Wales includes the Australian Capital Territory.
b. South Australia includes the Northern Territory.
c. Actual.

Note: Figures may not add to totals due to rounding.

TABLE 4.7—PROJECTED NUMBER OF PASSENGER CARS AND ASSOCIATED CAR OWNERSHIP LEVELS UNDER THE LOW GROWTH SCENARIO BY STATE OF REGISTRATION, 1985 TO 2000

	New South Wales[a]		Victoria		Queensland		South Australia[b]		Western Australia		Tasmania		Australia	
As at 30 June	Number ('000)	Owner-ship	Number ('000)	Owner-ship	Number ('000)	Owner-ship	Number ('000)	Owner-ship	Number ('000)	Owner-ship	Number ('000)	Owner-ship	Number ('000)	Owner-ship
1981[c]	2 111	0.39	1 633	0.41	946	0.40	595	0.41	553	0.43	183	0.43	6 021	0.40
1985	2 316	0.40	1 800	0.44	1 083	0.42	614	0.41	628	0.45	201	0.45	6 642	0 42
1990	2 587	0.43	2 001	0.47	1 268	0.44	674	0.43	718	0.46	222	0.48	7 470	0.44
1995	2 872	0.45	2 208	0.49	1 469	0.46	736	0.45	813	0.48	240	0.50	8 338	0.47
2000	3 169	0.48	2 424	0.52	1 687	0.48	798	0.48	913	0.50	262	0.53	9 254	0.49

a. New South Wales includes the Australian Capital Territory
b South Australia includes the Northern Territory.
c Actual.

Note: Figures may not add to totals due to rounding.

TABLE 4.8—PROJECTED TOTAL VEHICLE KILOMETRES TRAVELLED BY PASSENGER CARS UNDER THE HIGH GROWTH SCENARIO BY STATE OF REGISTRATION, 1985 TO 2000

(millions)

Year ending 30 June	*New South Wales*[a]	*Victoria*	*Queensland*	*South Australia*[b]	*Western Australia*	*Tasmania*	*Australia*
1982[c]	33 784	25 813	15 691	9 231	8 862	2 728	96 109
1985	41 259	30 381	20 579	10 678	11 707	3 433	118 036
1990	52 889	39 441	27 843	13 900	15 702	4 339	154 114
1995	67 325	50 941	37 217	17 973	20 823	5 491	199 770
2000	80 951	62 259	45 864	20 927	25 609	6 457	242 067

a New South Wales includes the Australian Capital Territory.
b South Australia includes the Northern Territory
c Actual

Note. Figures may not add to totals due to rounding.

TABLE 4.9—PROJECTED TOTAL VEHICLE KILOMETRES TRAVELLED BY PASSENGER CARS UNDER THE LOW GROWTH SCENARIO BY STATE OF REGISTRATION, 1985 TO 2000

(millions)

Year ending 30 June	*New South Wales*[a]	*Victoria*	*Queensland*	*South Australia*[b]	*Western Australia*	*Tasmania*	*Australia*
1982[c]	33 784	25 813	15 691	9 231	8 862	2 728	96 109
1985	35 795	26 552	16 795	8 958	9 624	2 880	100 604
1990	39 984	28 493	19 661	9 549	10 776	3 194	111 657
1995	44 379	30 365	22 784	10 112	11 962	3 450	123 052
2000	48 980	32 186	26 162	10 642	13 168	3 767	134 905

a. New South Wales includes the Australian Capital Territory
b. South Australia includes the Northern Territory.
c Actual

those of the Institute. Caution needs to be exercised in effecting comparisons between these results because the Institute forecasts refer to the total of passenger cars and light commercial vehicles.

TABLE 4.10—COMPARISON OF PROJECTIONS OF THE NUMBER OF PASSENGER CARS, 1985 TO 2000

('000)

Year	BTE 1984		COMVE	BTE 1979[a]
	High	Low		
1985	7 690	6 642	7 424	7 980
1990	9 962	7 470	8 121	9 432
1995	12 814	8 338	8 705	na
2000	15 407	9 254	na	12 579

a Figures relate to 1984, 1989 and 1999

na not available

Source. COMVE (1982) and BTE (1979a)

TABLE 4.11—COMPARISON OF FORECASTS OF CAR OWNERSHIP LEVELS, 1985 TO 2000

('000)

Year	BTE 1984		IAESR
	High	Low	
1985	0.48	0.42	na
1990	0.58	0.44	0.54
1995	0.69	0.47	0.57
2000	0.77	0.49	0.59

na not available

Source: IAESR (1983a).

CHAPTER 5—COMMERCIAL VEHICLE TRENDS

This chapter begins by identifying a number of trends in the size of the commercial vehicle fleet and its usage (distance travelled). The fleet is divided into five broad vehicle types which form the basis of much of the analysis and discussion that follows.

The second section of the chapter briefly considers the size and nature of the total Australian domestic freight task. The final section reviews two aspects of the usage of commercial vehicles in the movement of freight, relating to vehicle loading and the geographic distribution of travel.

AN OVERVIEW OF THE SIZE AND USAGE OF THE COMMERCIAL VEHICLE FLEET

The commercial vehicle fleet in Australia, consisting of a wide variety of vehicle makes and models, provides a diverse range of services to industry and government organisations as well as to private individuals. The freight movement task performed by the commercial sector ranges from the rapid intracity transportation of small loads to the movement of large heavy loads across the country. Passenger services are provided by the rapidly expanding fleet of buses and micro-buses; dual purpose vans which are able to meet the requirements of both private and business owners are becoming increasingly popular.

In the analysis of fleet sizes and vehicle usage, commercial vehicles have been divided according to their principal characteristics, and the demand for commercial vehicle services analysed for each 'vehicle type'. The classification used was largely determined by the data available.

This Paper groups commercial vehicles into five broad categories:

- open and closed light commercial vehicles, comprising all panel vans and utilities, the heavier four wheel drive vehicles such as Toyota, Nissan, Ford F100, Jeep and Landrover and a variety of other makes and models of light commercial vehicles designed primarily for the carriage of goods;
- rigid trucks;
- articulated trucks,
- other truck-type vehicles, designed for purposes other than freight carrying (for instance mobile libraries, garbage trucks, ambulances and hearses); and
- buses (all government, commercial and privately used buses and micro-buses registered principally for the conveyance of persons).

In the following section, time series data covering the period 30 June 1972 to 1982 are used to analyse trends in fleet size. The data are compiled annually by the ABS from information supplied by the motor vehicle registration authorities. While statistics have been compiled for at least the past 40 years, the present disaggregation of the commercial vehicle fleet by type of vehicle only commenced in 1972.

The availability of reliable vehicle usage data is limited to that provided by Surveys of Motor Vehicle Usage conducted by the ABS for the years ending 30 September 1971, 1976 and 1979 and preliminary results from the 1982 Survey. Thus the analysis of past trends in the size and usage of the commercial vehicle fleet is based on data from a relatively short time period. However, no other alternative sources of data currently exist.

Trends in commercial vehicle numbers

The Australian fleet

Since the end of the Second World War the number of commercial motor vehicles on register in Australia has increased steadily from just under 0.3 million vehicles in 1945 to about 1.7 million vehicles at 30 June 1982. The number of commercial vehicles on register in Australia at 30 June in each year from 1945 to the present is given in Appendix II. The data are summarised for selected years in Table 5.1 and illustrated for the whole period 1945 to 1982 in Figure 5.1.

TABLE 5.1—TOTAL NUMBER OF COMMERCIAL VEHICLES[a] ON REGISTER; AUSTRALIA, SELECTED YEARS AS AT 30 JUNE 1945 TO 1982

('000)

As at 30 June	*Number*
1945	290.5
1950	506.1
1955	654.3
1960	784.1
1965	858.0
1970	937.5
1975	1 140.2
1980	1 462.4
1981	1 544.3
1982	1 661.5

a Light commercial vehicles, rigid and articulated trucks, other truck-type vehicles and buses.

Source: ABS, personal communication.

Following a period of rapid expansion in the post-war years (with growth rates varying between 9 per cent and 15 per cent per annum), growth of the commercial vehicle fleet stabilised with rates of annual increase of between 2 and 3 per cent per annum during the latter half of the 1950s and throughout the 1960s. However, in the following decade, annual growth of the commercial fleet was considerably higher at about 5 per cent per annum, peaking at 6.6 per cent in 1976, falling slightly in the later 1970s but increasing to 7.6 per cent in the year ending 30 June 1982 (the highest annual growth rate since 1951).

The changing pattern of growth in the commercial vehicle fleet is evident in Figure 5.2 which plots annual growth in registrations against time.

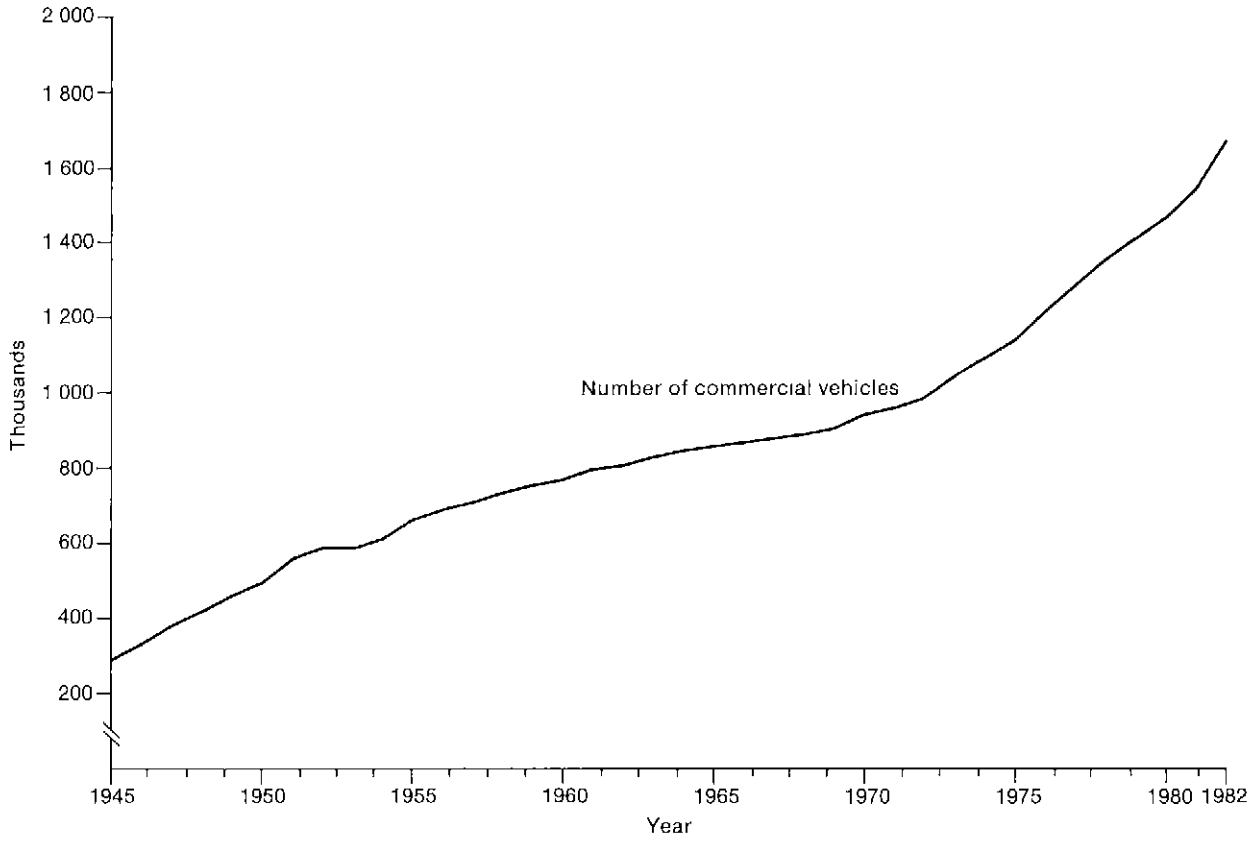
State and type of vehicle

Annual numbers of commercial vehicles registered in each Australian State and classified by the above five vehicle types for the period 30 June 1972 to 1982 (inclusive) are given in Appendix II. These data are derived from the ABS collection of motor vehicle registrations where the Australian Capital Territory and Northern Territory registrations are added to New South Wales and South Australian registrations respectively.

The Australian totals of the number of vehicles on register, classified by commercial vehicle type, are given in Table 5.2 and illustrated in Figure 5 3.

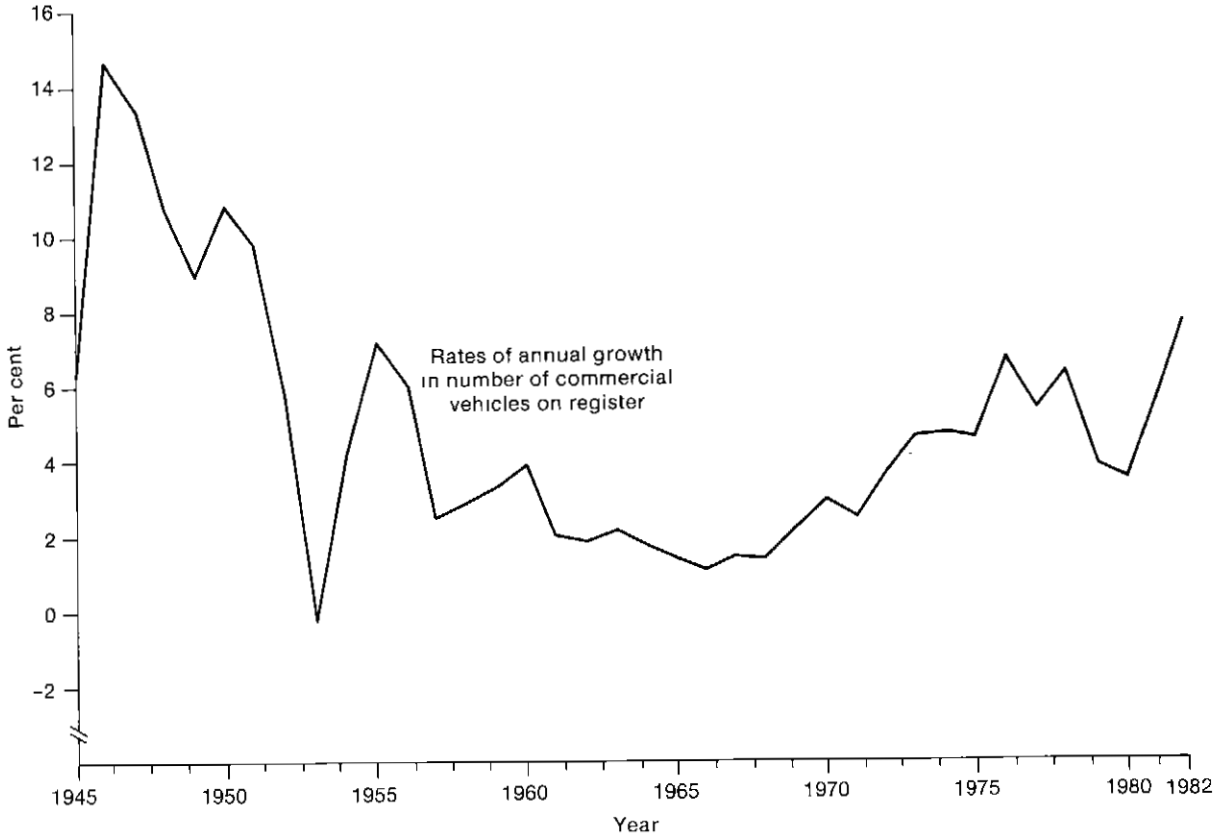
Registration statistics are subject to two important qualifications. Firstly, the change in vehicle classification procedures used by the ABS led to a break in the commercial vehicle series between June 1976 and June 1977 (refer footnotes (b) and (c) of Table 5.2).

Secondly, criteria used in the process of vehicle classification vary between the States'



Source: Table II.1

Figure 5.1—Total number of commercial vehicles on register; Australia, as at 30 June 1945 to 1982



Source Table II 1

Figure 5.2—Rates of annual growth in number of commercial vehicles on register; Australia, as at 30 June 1945 to 1982

TABLE 5.2—NUMBER AND AVERAGE RATES OF GROWTH OF THE NUMBER OF MOTOR VEHICLES ON REGISTER BY VEHICLE TYPE; AUSTRALIA, AS AT 30 JUNE 1972 TO 1982[a]

As at 30 June	Cars and station wagons	Light commercial	Rigid trucks	Articulated trucks	Other truck-type vehicles	Buses	Total commercial	Total
				Number of motor vehicles ('000)				
1972	4 147	550	378	33	10	25	996	5 143
1973	4 362	575	395	34	11	26	1 041	5 403
1974	4 604	602	413	36	12	27	1 090	5 694
1975	4 859	631	430	38	13	29	1 140	5 999
1976	5 073	672	457	41	14	31	1 215	6 288
1977[b]	5 243	794	386	40	27	33	1 280	6 523
1978	5 462	847	405	41	31	36	1 360	6 822
1979	5 657	880	421	43	32	37	1 413	7 070
1980	5 801	905	437	45	37	39	1 462	7 263
1981	6 021	957	459	47	40	42	1 544	7 565
1982	6 294	1 029	493	50	44	46	1 662	7 956
				Average annual growth (per cent)				
1972-76	5.2	5 1	4.9	5 8	8.5	5.5	5.1	5.2
1977-82	3.7	5 3	5.0	4 6	10.0	6.9	5.4	4.1
1972-82	4.3	5.2[c]	4.9[c]	5.1[c]	9.2[c]	6.4	5.3	4.5

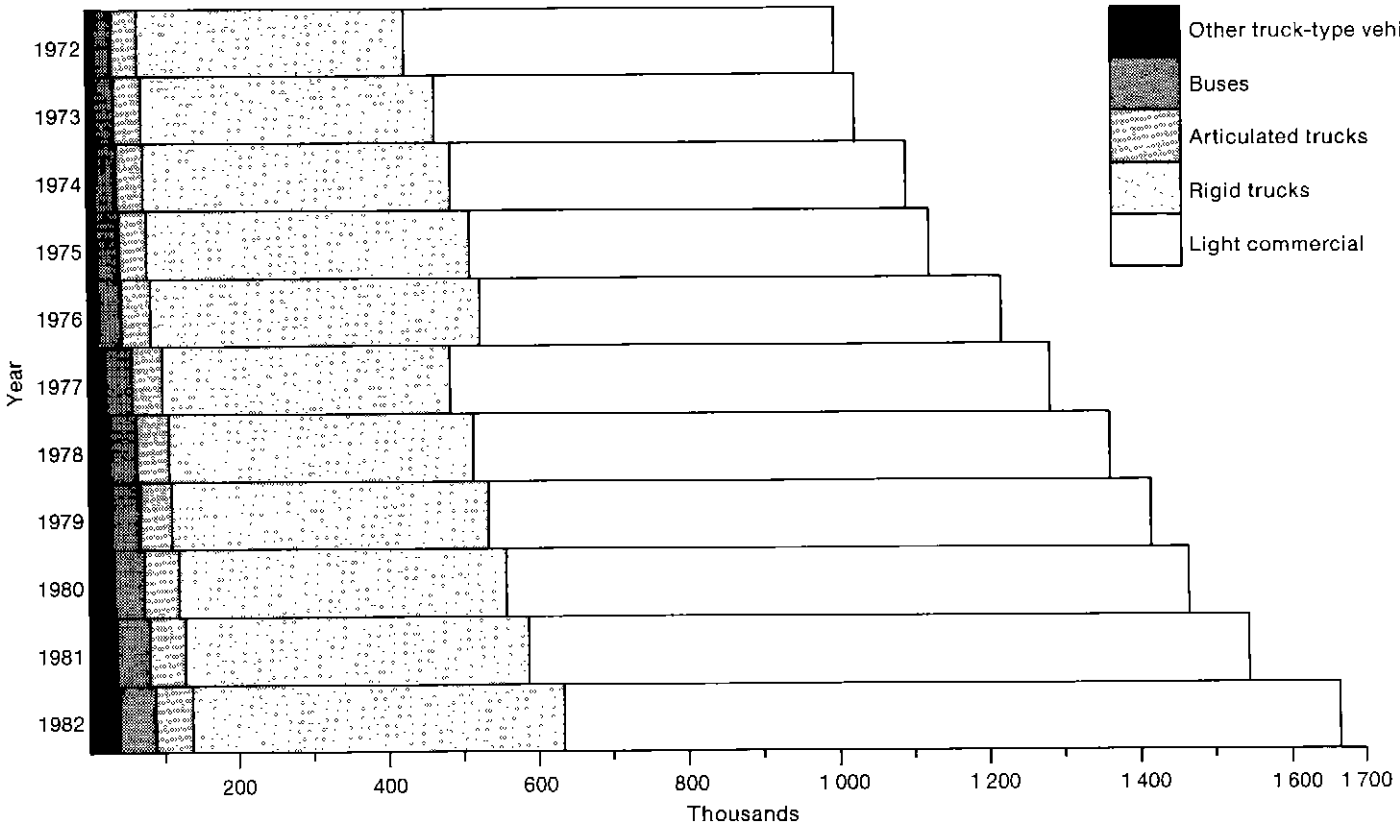
a Cars and station wagons, light commercial vehicles, rigid trucks, articulated trucks, other truck-type vehicles and buses, but excluding motor cycles and other vehicles such as tractors, plant and equipment, caravans and trailers.

b Between June 1976 and June 1977 the ABS altered its approach to classifying commercial vehicles by moving away from its own definitions of vehicle type to the adoption of vehicle type data as recorded by the registration authorities in each State and Territory. As a comparison of the 1976 and 1977 statistics reveals, the change in procedures resulted in a marked shift in the distribution of commercial vehicles by vehicle type. After allowing for some estimate of 'normal' growth in the size of each commercial vehicle fleet during the twelve months to 30 June 1977, the change in classification procedures substantially increased the number of light commercial vehicles on register but reduced the size of each of the truck fleets (including other truck type vehicles).

c. Without a detailed analysis of the classification change, the rates of growth in the size of each of the fleets of light commercial vehicles, rigid trucks, articulated trucks and other truck-type vehicles over the period 1972-82 are not directly estimable. Figures given are based on the projection of average 1972-76 rates of growth to 1977 and then changing to the average 1977-82 rates of growth thereafter

Note. Figures may not add to totals due to rounding

Sources. ABS (1983g) and personal communication.



Source. Table 5 2

Figure 5.3—Number of commercial vehicles on register by vehicle type; Australia, as at 30 June 1972 to 1982

and Territories' motor vehicle registration authorities While variation in the classification of rigid and articulated trucks is not thought to be significant, some inconsistencies in the classification of the many makes and models of light commercial-type vehicles currently available are apparent[1]. The imprecise nature of the category of light commercial vehicles should be borne in mind when considering the State registration statistics or the Australian totals given above. Estimates of the number of other truck-type vehicles on register are also subject to several sources of error and should be interpreted with caution[2].

Notwithstanding the above qualifications, it is worthy of note that the number of vehicles in each of the major categories of commercial vehicles (light commercial vehicles, rigid trucks and articulated trucks) has, since 1972, increased at an average rate of approximately 5 per cent per annum, slightly higher than the average rate of growth of 4.3 per cent per annum in passenger vehicles. The size of the light commercial and rigid truck fleets increased steadily throughout the period, while the average rate of growth in articulated trucks declined somewhat in the latter half of the period.

A notable feature of the growth in the light commercial vehicle fleet (not apparent in the truck-type categories of commercial vehicles) is the purchase and use of 'commercial' vehicles for purposes other than purely business use. In the early 1970s, a trend towards greater private ownership and utilisation of panel vans and utilities began to emerge. In response, car manufacturers gradually increased the range of vehicles produced, so that today a wide variety of makes and models of dual purpose vehicles are available[3]. These vehicles appear to be gaining increasing acceptance and popularity among both the traditional private and business vehicle owners[4].

Although only a minor sector of the commercial vehicle fleet, growth in the number of buses on register has averaged 6.4 per cent per annum during the period 30 June 1972 to 1982. This rate of growth is more than 20 per cent higher than the average growth, of approximately 5 per cent per annum, in light commercial vehicles and trucks. Such high rates of growth may be attributed to the recently increasing popularity of micro-buses among private vehicle owners.

For example, since 1980, sales of new 'large' buses (24 or more seats) have remained relatively stable at approximately 1000 vehicles per annum, while purchases of smaller buses (up to 23 seats) have increased by over 75 per cent (to over 3200 units in 1982 or about 80 per cent of total new bus registrations)[5].

Information presented in Appendix II indicates that over the past decade the

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1 For example, in the Australian Capital Territory one of the conditions for classifying a vehicle as light commercial is that its tare weight is less than 2 tonnes, but in New South Wales no such weight restriction is formally defined and used Likewise, a vehicle in the Australian Capital Territory must have seating for at least ten persons before it is classified as a micro-bus, while in New South Wales a micro-bus can be a vehicle able to seat at least one but no more than 16 persons.

2 As the smallest category of commercial vehicles, the number of other truck-type vehicles is very sensitive to State differences in registration procedures (for example in the registration of fire engines) and changes to those procedures over time, so that estimates of the number of vehicles and average rates of growth are not necessarily comparable between States

3. Increased seating capacity is a feature of some dual purpose vehicles Currently, there are at least eight models of vehicles with a seating capacity of 7 to 9 on the market. These models are Spectron (Ford), Traveller (Mazda), Shuttle (GMH), Tarago (Toyota), Express (Mitsubishi), Prairie and Urvan (Nissan), and Volkswagon Bus Depending on the State or Territory of registration, these vehicles are classified as either a light commercial vehicle or a micro-bus (see below)

4 Although the full extent of private ownership is not known, recent Surveys of Motor Vehicle Usage give some indication of the pattern of light commercial vehicle utilisation For the four survey years ended 30 September 1971, 1976, 1979 and 1982, the proportion of usage for non-business purposes increased from 33 per cent in 1971 to almost 50 per cent in both 1976 and 1979 Preliminary estimates suggest a slight drop in this proportion to 44 per cent in 1982 (ABS 1973b, 1978, 1981f and 1983l).

5 Details are given in Table II.7, Appendix II.

commercial vehicle fleets in Western Australia and Queensland have grown at average rates of 6.6 and 6.8 per cent per annum respectively, noticeably greater than the Australian average of 5.3 per cent per annum. Conversely, the commercial vehicle fleets in Victoria, South Australia and Tasmania grew at average rates of little more than 4 per cent per annum (4.3, 4.1 and 4.2 per cent respectively) while the fleet in New South Wales increased at an average rate of 5.0 per cent per annum.

Trends in commercial vehicle usage

Average annual vehicle kilometres travelled
Survey of Motor Vehicle Usage estimates of the average number of kilometres travelled per vehicle during the years ending 30 September 1971, 1976, 1979 and 1982 are given in Table 5.3. Vehicles are grouped according to vehicle type and State of registration.

Over the 11 year period (1971 to 1982) the average annual distance travelled by light commercial vehicles has remained relatively stable while a slight increase in the average utilisation of rigid trucks and a steady increase in the utilisation of articulated trucks are apparent. In 1982, the average distance travelled by rigid trucks was slightly greater than that travelled by light commercial vehicles. However, in the same year, the average distance travelled by articulated trucks was almost four times that of other commercial vehicles.

Between 1971 and 1979 the average distance travelled by buses declined slightly in all States. This appears to be the result of changes in the composition of the bus fleet, with the growth in large, highly utilised buses in government and commercially operated bus fleets being exceeded by the rapid increase in micro-bus registrations which typically have lower rates of utilisation[1].

The marked variation in kilometres travelled by other truck-type vehicles is attributed to differences between State registration and classification procedures and alterations to those procedures over time as noted above.

Total annual vehicle kilometres travelled
Estimates of the total number of kilometres travelled by all vehicles in each of the vehicle type categories previously considered, in each of the survey years ending 30 September 1971, 1976, 1979 and 1982, are given in Appendix II. The derivation of a second set of estimates, consistent with both vehicle registration data and the survey estimates of average VKT reviewed above, is also described. These derived estimates of the total number of kilometres travelled during the years ending 30 June 1972, 1977, 1980 and 1982 form the basis of much of the empirical analysis reported below.

Table 5.4 expresses the derived estimates of total kilometres travelled as average annual rates of growth for the period 30 June 1972 to 1982.

Between the financial years 1971-72 and 1981-82, the number of kilometres travelled by the Australian commercial vehicle fleet increased from just over 19 000 million to nearly 34 500 million at an average rate of 5.1 per cent per annum. Among the five commercial vehicle types, articulated trucks and other truck-type vehicles recorded the highest growth in total VKT, both at the Australian level and for each of the eastern States The high growth for articulated trucks (6.2 per cent per annum for Australia as a whole and up to 9.1 per cent per annum for Queensland) is a reflection of the steady increase during the past 10 years, in the average number of kilometres travelled by these vehicles. On the other hand, rates of growth in the

1. In 1979, privately used micro-buses numbered 27 per cent of the total bus fleet and performed 16 per cent of bus kilometres travelled. Buses in government and commercially operated bus fleets travelled an average 32 800 kilometres per year whereas privately used micro-buses travelled an average 16 600 kilometres per year (see Appendix II for further discussion and analysis of the bus fleet structure)

TABLE 5.3—AVERAGE ANNUAL VEHICLE KILOMETRES TRAVELLED BY COMMERCIAL VEHICLES BY VEHICLE TYPE AND STATE OF REGISTRATION, YEARS ENDING 30 SEPTEMBER 1971, 1976, 1979 and 1982

('000)

Vehicle type and year ending 30 September	*New South Wales*[a]	*Victoria*	*Queensland*	*South Australia*[b]	*Western Australia*	*Tasmania*	*Australia*
Light commercial[c]							
1971	17.3	15.3	13.6	15.5	19.8	13.7	16.3
1976	16 4	18.7	17.4	15.2	16.7	14.1	17.0
1979	17.1	16.8	16.4	17.2	18.7	14.6	17.0
1982p	18.2	16.6	14.6	17 0	17.4	17.0	16.7
Rigid trucks[d]							
1971	17.2	16.0	13.8	15.3	17.6	13.8	16.0
1976	16.1	16.0	15 0	14.5	17 1	15.4	15 7
1979	18.0	17.2	14.4	14.3	16.5	15.3	16 7
1982p	20.7	17.8	19.6	14.6	18.5	16.0	18.8
Articulated trucks[e]							
1971	47.7	49.2	37.3	62.7	60.7	49 4	48.3
1976	52.4	45.8	35.7	71.0	49.4	48.4	50.5
1979	59.4	61.4	47.7	77.5	51 8	57.5	59.3
1982p	63.9	65.7	52.0	76.7	63 3	61.0	63.4
Other truck-type vehicles[f]							
1971	13.4	7.6	8.7	5 8	12.1	4.5	9.5
1976	16.6	11.8	18.7	11.4	10.9	10.7	14.4
1979	15.9	10.6	12.4	14.4	12.3	8.7	12.9
1982p	23.5	7.7	13 1	9.0	7.2	6.8	12.5
Buses[g]							
1971	31.1	27.5	28.3	29.2	33.5	20.9	29.3
1976	na	na	na	na	na	na	na
1979	28.4	24.6	28.8	39.4	28.7	22 3	28.4
1982	na	na	na	na	na	na	na

TABLE 5.3(Cont)—AVERAGE ANNUAL VEHICLE KILOMETRES TRAVELLED BY COMMERCIAL VEHICLES BY VEHICLE TYPE AND STATE OF REGISTRATION, YEARS ENDING 30 SEPTEMBER 1971, 1976, 1979 and 1982

('000)

Vehicle type and year ending 30 September	*New South Wales*[a]	*Victoria*	*Queensland*	*South Australia*[b]	*Western Australia*	*Tasmania*	*Australia*
Total commercial							
1971	18.7	17.6	14.8	17.4	20.2	15.0	17.6
1976	na	na	na	na	na	na	na
1979	19.1	18.4	16.9	19.2	18.9	16.1	18.4
1982	na	na	na	na	na	na	na

a New South Wales includes the Australian Capital Territory.
b South Australia includes the Northern Territory.
c. In the 1971 Survey, utilities, panel vans, ambulances, hearses and rigid trucks with carrying capacity less than 1 ton were classified as light commercial vehicles In later surveys, vehicles were classified solely on the basis of the body-type recorded by the registration authorities.
d. The 1971 average of kilometres travelled by rigid trucks is based on distances travelled by all rigid trucks with a carrying capacity of 1 ton or more and all articulated trucks with a carrying capacity of under 8 tons.
e In 1971, the average distance travelled is calculated over all articulated trucks with a carrying capacity of 8 tons or more.
f. Ambulances and hearses, classified as light commercial vehicles in the 1971 Survey, were included as other truck-type vehicles in the later surveys. Major changes to this category were also implemented with the 1982 Survey
g. Kilometres travelled by privately used buses and bus fleets not operating at least one bus for hire and reward in 1976 are not available. Estimates for 1982 are also not available
p preliminary

na not available

Sources: ABS (1973b, 1978, 1981d, 1981e, 1981f) and unpublished preliminary figures for Survey of Motor Vehicle Usage, Twelve Months ended 30 September 1982.

TABLE 5.4—ESTIMATES OF RATES OF GROWTH IN TOTAL VEHICLE KILOMETRES TRAVELLED BY COMMERCIAL VEHICLES BY VEHICLE TYPE AND STATE OF REGISTRATION, YEARS ENDING 30 JUNE 1972 TO 1982[a]

(per cent per annum)

Vehicle type	*New South Wales*[b]	*Victoria*	*Queensland*	*South Australia*[c]	*Western Australia*	*Tasmania*	*Australia*
Light commercial	4.6	4.0	6.1	3.6	3.3	5.1	4.6
Rigid trucks	6.8	4.8	7.6	0.8	6.3	3.8	5.6
Articulated trucks	7.2	7.0	9.1	1.5	5.9	5 0	6.2
Other truck-type vehicles	7.8	20.9	10.0	18 4	5.5	24.1	11.0
Buses	4.7	5.8	6.1	5.6	4.6	4.1	5.2
Total	5.5	4.9	6.7	2.9	4.4	4.9	5.1

a Rates of growth are based on 'derived' 1972 and 1982 estimates of total VKT given in Appendix II
b. New South Wales includes the Australian Capital Territory
c. South Australia includes the Northern Territory

Source BTE estimates based on Table II 9

utilisation of light commercial vehicles and rigid trucks (4.6 and 5.6 per cent per annum respectively) are similar to the rates of growth in fleet size (estimated in Table 5.2 to be 5.2 and 4.9 per cent per annum respectively). Despite the decline in average bus usage, strong growth in registrations resulted in an average rate of growth in the total number of kilometres travelled by buses of 5.2 per cent per annum.

The total distance travelled by the fleets of commercial vehicles registered in New South Wales and Queensland increased at above average rates of 5.5 and 6.7 per cent per annum respectively. South Australia recorded the lowest increase in total commercial vehicle kilometres travelled, with growth averaging 2.9 per cent per annum. The rates of growth in the total utilisation of rigid and articulated trucks registered in South Australia may have been affected by differences between it and the other States in taxation procedures, and subsequent changes in these procedures[1].

COMMERCIAL VEHICLE FREIGHT SERVICES

The discussion of trends and characteristics of the commercial vehicle fleet continues by looking at the size and nature of the road freight task, as these are the major determinants of growth in the size of the commercial vehicle fleet and its usage of Australian roads. The road freight task has been compared recently with the freight task performed by the other major transport modes, rail, air and sea (BTE 1984b). Where relevant, conclusions from that study are used to describe characteristics of the road freight task and to highlight the role that commercial vehicles play in the movement of freight throughout Australia.

The Australian road freight task

Available data indicate that since the early 1970s, between 70 and 80 per cent of domestic freight tonnage has been transported on Australian roads[2]. Furthermore, since that time the rate of growth in the road freight task (measured in tonne-kilometres performed) has averaged more than 7 per cent per annum which far exceeds the growth in rail and sea freight activity[3]. Road transport has dominated the freight market in the movement of various types of bulk liquids and solids (such as petroleum products, sand and gravel) and non-bulk freight such as iron and steel and other manufactured goods)[4].

Trends in the road freight task

Estimates of the number of tonnes consigned and tonne-kilometres performed by light commercial vehicles, rigid trucks and articulated trucks during the years ending 30 September 1971, 1976, 1979 and 1982 are given in Appendix II. Light commercial vehicles perform only a small proportion of the total road freight task (Table II.10). Rigid trucks carry approximately two-thirds of tonnes consigned but perform only one-third of all tonne-kilometres travelled on Australian roads. This suggests that the average journey length of freight consignments on rigid trucks is significantly less than the average journey length of freight moved by articulated trucks.

Table 5.5 expresses the difference between 30 September 1971 and 1982 estimates of tonne-kilometres performed as average annual rates of growth. This table indicates

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1 Prior to the abolition of Road Maintenance Charges in 1979, companies legislation in South Australia favoured the registration of trucks in that State Consequently, registration figures for the period up to 1979 are expected to overstate the number of rigid and articulated trucks actually in use in South Australia Thus, by using an artificially inflated 1972 figure, Table 5 4 is expected to severely understate the growth in the usage of South Australian roads by trucks.

2. BTE (1984b), Table 3.1.

3. BTE (1984b), Table 3.1.

4. BTE (1984b), Tables 3 2 and 3.14

TABLE 5.5—AVERAGE ANNUAL RATES OF GROWTH IN TONNE-KILOMETRES PERFORMED BY COMMERCIAL VEHICLES BY VEHICLE TYPE AND STATE OF REGISTRATION, YEARS ENDING 30 SEPTEMBER 1971 TO 1982

(per cent per annum)

Vehicle type	*New South Wales*[a]	*Victoria*	*Queensland*	*South Australia*[b]	*Western Australia*	*Tasmania*	*Australia*
Light commercial	7.7	3.5	16.1	5.2	8.0	10.1	8.0
Rigid trucks	4.4	3.9	6.4	-0.8	4.3	3.2	3.9
Articulated trucks	8.8	8.0	12.7	10.1	7.7	10.7	9.2
Total	7.2	6.5	10.5	6.7	6.4	7.4	7.3

a New South Wales includes the Australian Capital Territory
b South Australia includes the Northern Territory

Source: BTE estimates based on Table II 10.

that over the period 1970-71 to 1981-82, tonne-kilometres performed by rigid and articulated trucks increased at average rates of 3.9 and 9.2 per cent per annum respectively, while the growth in tonne-kilometres performed by all vehicle types averaged 7.3 per cent per annum.

Relativities among the States in the average rate of growth in total tonne-kilometres performed by commercial vehicles are approximately consistent with those for total VKT given in Table 5.4. For example, commercial vehicles registered in Queensland recorded the highest average annual rate of growth in both tonne-kilometres performed and total VKT, while for the other States, growth in these indicators did not depart significantly from the respective Australian averages. In all States, an increase in the average tonnage consigned over the study period has caused growth in tonne-kilometres performed to exceed the growth in total VKT[1].

Industries served

Commercial vehicles provide a valuable freight transport service to almost all sectors of the economy[2]. Light commercial vehicles are widely used in the movement of small freight consignments, in particular for industries engaged in agricultural production, food processing and wholesale and retail trade. Rigid and articulated trucks also provide transport services to many industries, particularly those in the mining, construction and manufacturing sectors, with only limited specialisation in truck type being apparent. For example, both rigid and articulated trucks are employed in the transport of commodities such as minerals, sand, gravel, stone and earth, processed foods and a variety of manufactured goods, which account for a significant proportion of the road freight task. However, cement and concrete products also form a significant proportion of the freight task performed by rigid trucks while petroleum and petroleum products, iron, steel and other metal products are other major commodities carried by articulated trucks[3].

Some specialisation is also apparent in the size of vehicle used to transport freight. The heavier rigid and articulated trucks (with tare weights of at least 4 tonnes and 11 tonnes respectively) account for more than 70 per cent of the total number of freight tonne-kilometres performed by commercial vehicles and are used almost exclusively in the movement of minerals, sand and related commodities and certain agricultural and manufactured products[4].

IMPACT OF THE ROAD FREIGHT TASK ON COMMERCIAL VEHICLE USAGE

This final section describes the impact that the demand for freight transport has had on the usage of commercial vehicles on Australian roads. The size (freight carrying capacity) of commercial vehicles and their rate of utilisation (or load factor) are two of a large number of factors that affect the level of road travel. During the study period there has been a move towards larger rigid and articulated trucks, partly due to lifting the maximum load to 38 tonnes in 1979[5]. This trend suggests that the road freight task (measured in tonne-kilometres) should be growing at a higher rate than vehicle usage (see Tables 5.4 and 5.5).

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1 Note that, unlike the estimates of growth in total VKT given in Table 5.4, figures in Table II 10 have not been adjusted for the effects of vehicle classification changes. Nor are the estimates necessarily consistent with the vehicle registration data. Therefore, care should be taken when effecting comparisons between commercial vehicle types and between different characteristics of vehicle usage.

2 The use of 'indicators of economic activity' in the demand analysis reported below, aims at representing those sectors considered to be significant users of commercial vehicles and road transport

3. Details are provided in BTE (1984b), Tables 3.14 and 3.15.

4. Details are provided in BTE (1984b), Table 3.16.

5. For example, the proportion of heavier trucks increased from 26 per cent to 34 per cent in the rigid fleet and from 40 per cent to 50 per cent in the articulated fleet between the two years ending 30 September 1976 and 1979 (BTE 1984b).

In a number of instances, insufficient data are available to adequately relate the freight task to particular characteristics of vehicle usage. However, one aspect that has been considered, at least to some limited extent, is the utilisation of freight carrying vehicles across vehicle types and size (measured by tare weight). BTE (1984b) noted that approximately 30 per cent of the business travel by each of the categories of light commercial vehicles, rigid trucks and articulated trucks was unladen and an additional significant share was less than fully laden.

Area of operation

The Surveys of Motor Vehicle Usage provide some insight into the geographic distribution of commercial vehicle use in the provision of road transport freight services[1]. Unfortunately, the survey information (compiled from respondents, estimates of total kilometres travelled in specific areas) relates only to the following broad areas of operation:

- capital city and environs;
- provincial urban;
- rest of State; and
- interstate.

Table 5.6 describes the distribution of total vehicle kilometres travelled during the year ending 30 September 1979 by *area of operation* for each type of freight carrying vehicle fleet registered in each State.

Approximately half of the distance travelled by light commercial vehicles and rigid trucks during the survey year was in urban areas with interstate travel representing only 3 per cent or so of the total. For articulated trucks, urban use was down to under 30 per cent and other intrastate and interstate travel up to approximately 50 and 20 per cent of total travel respectively[2].

The significant differences between States mainly reflect varied geographical and population density factors. For example, Western Australia, which has no provincial urban areas[3], recorded higher than the Australian average percent in the 'rest of State' operation and less than average interstate travel. For obvious reasons, Tasmanian registered vehicles recorded negligible interstate operation. With the population of Tasmania and Queensland being less centralised in the capital cities, both States recorded a lower percentage of operation in capital city and environs.

The higher interstate trucking activity by vehicles registered in South Australia in the mid-1970s is due at least in part to the incentive to register in South Australia in an attempt to minimise road maintenance charges prior to July 1979. This is reflected in the percentages of total VKT for which South Australian registered articulated trucks recorded interstate travel of some 34 per cent in 1971, up to 54.6 per cent in 1976, and falling to 42 2 per cent in 1979. This incentive subsequently disappeared with the abandonment of road maintenance charges in July 1979.

Apart from the change in interstate activity by South Australian trucks, the disaggregation of the road freight task by area of operation varied little during the 1970s.

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1. While some indication of traffic levels is given in the road traffic counts conducted by the State Road Authorities, this information is only available for *some* roads at *certain* times, and not measured on a consistent basis in each State Hence, changes to the road network over time, the poor coverage, and the lack of regularity and consistency in the data prevent them from being used in any long term assessment of trends.

2. Similar proportions are obtained from a tabulation of total annual tonne-kilometres performed by State of registration, vehicle type and area of operation (see Table 3 13, BTE 1984b).

3. Provincial urban centres are defined as centres not included in capital cities having population greater than 40 000 persons in the 1971 Population and Housing Census.

TABLE 5.6—TOTAL VEHICLE KILOMETRES TRAVELLED BY COMMERCIAL VEHICLES BY VEHICLE TYPE, STATE OF REGISTRATION AND AREA OF OPERATION, YEAR ENDING 30 SEPTEMBER 1979

(per cent)

Vehicle type and area of operation	New South Wales[a]	Victoria	Queensland	South Australia[b]	Western Australia	Tasmania	Australia
Light commercial vehicles							
Capital city and environs	53.5	54.4	34.9	43.9	44.9	32.4	47.1
Provincial urban	15.1	6.7	18.6	2.6	–	9.6	10.8
Rest of State	27.2	35.2	44.2	50.2	53.5	57.6	38.9
Interstate	4.2	3.7	2.4	3.3	1.6	0.4	3.2
Total ('000)	5 177 358	3 307 329	3 460 470	1 430 191	2 118 574	434 046	15 927 969
Rigid trucks							
Capital city and environs	47.9	54.6	37.7	44.6	43.4	27.0	47.0
Provincial urban	10.6	7.8	10.3	1.5	–	10.4	7.7
Rest of State	38.8	34.6	48.9	49.9	56.4	62.2	42.6
Interstate	2.8	3.0	3.0	4.0	0.1	0.3	2.6
Total ('000)	2 227 548	1 538 930	687 902	502 729	713 558	166 539	5 837 207
Articulated trucks							
Capital city and environs	22.3	22.3	16.6	12.3	22.8	12.2	19.8
Provincial urban	13.4	4.9	7.5	4.9	–	7.9	8.0
Rest of State	45.2	44.6	59.0	40.7	71.1	79.7	49.3
Interstate	19.2	28.1	16.9	42.2	6.1	0.2	22.9
Total ('000)	946 487	646 645	337 555	391 981	202 791	81 981	2 607 439

a New South Wales includes the Australian Capital Territory.
b South Australia includes the Northern Territory

– nil or rounded to zero

Note: Percentages may not add to 100 and State totals may not add to Australian totals due to rounding

Source. ABS (1981f)

Type of operation

A similar disaggregation of the commercial vehicle fleet's activities is by the main type of operation in which the vehicle was used. In the 1979 Survey of Motor Vehicle Usage, respondents were asked to indicate in which of the following *main type of operation* their vehicle was used:

- within capital city of State of registration;
- between capital city and the rest of the State of registration;
- outside capital city but within the rest of the State of registration, either within 80 km of base, or beyond 80 km of base,
- intercapital, and
- other interstate from State of registration, either within 80 km of base, or beyond 80 km of base.

For example, a vehicle which is based outside of a capital city and which does mostly short distance trips within the State of registration would have as its *main type of operation,* intrastate travel outside of the capital city but within 80 kilometres of its base. Table 5.7 describes the distribution of total business travel by freight carrying commercial vehicles among various *main types of operation* for the year ending 30 September 1979.

Note that while a vehicle has only one *main type of operation* it may have travelled in several *areas of operation* (as given in Table 5.6) during the survey year. Therefore

TABLE 5.7—TOTAL BUSINESS KILOMETRES TRAVELLED BY COMMERCIAL VEHICLES BY VEHICLE TYPE AND MAIN TYPE OF OPERATION, YEAR ENDING 30 SEPTEMBER 1979[a]

(million kilometres)

Main type of operation	*Light commercial vehicles*	*Rigid trucks*	*Articulated trucks*
Intrastate travel			
Within capital city	3 964	2 270	308
Between capital city and rest of State	585	396	461
Outside of capital city within 80 km of base	3 354	2 062	432
Outside capital city beyond 80 km of base	770	818	577
Interstate travel			
Intercapital	11	41	377
Other interstate within 80 km of base	50	40	19
Other interstate beyond 80 km on base	25	78	431
Australian total	8 760	5 705	2 605

a Business travel is all travel for business purposes by all vehicles (including those used mostly for private purposes).

Note Figures may not add to totals due to rounding.

Source: ABS (1981f)

a significant proportion of the travel reported in the cells of Table 5.7 may have been undertaken in areas outside that defined by the main type of operation.

Table 5.7 indicates that, as might be expected, most light commercial vehicles and rigid trucks do most of their business travel within relatively close proximity to their base. Rigid trucks venture further afield than light commercial vehicles but not as far as articulated trucks. Over 30 per cent of the business travel by articulated trucks is by vehicles used mostly for long distance, interstate travel.

CHAPTER 6—MARKET FORCES AND EMPIRICAL ANALYSIS

Previous discussion noted the importance of road transport in the movement of freight and the extent to which characteristics of the commercial vehicle fleet are influenced by this task Such characteristics reflect the derived nature of demand for commercial vehicle services. This chapter reports on the results of the empirical analyses undertaken to identify the main factors affecting both the number of vehicles registered by vehicle type and total kilometres travelled, and provides the basis for projections of road travel. The chapter starts by discussing market forces (demand and supply factors) as they affect the number and usage of the three major categories of commercial vehicles and buses.

In modelling the number of vehicles on register, no one general model proved to be applicable to all categories of vehicle type. Hence, one type of model was developed for the three major categories of light commercial vehicles, rigid trucks and articulated trucks, and a second type of model was developed for the minor categories of other truck-type vehicles and buses. The bus fleet was considered both in total and at a more disaggregate level defined by usage characteristics. Separate models of fleet size were developed for each State and for Australia as a whole.

The relationship between the number of commercial vehicles on register and total kilometres travelled was investigated. Individual models for total kilometres travelled were estimated and comparisons were effected between parameter estimates by vehicle type.

MARKET FORCES

Where relevant, demand and supply factors are discussed as they affect the number and usage of light commercial vehicles and the combined group of rigid and articulated trucks. With the primary role of buses being in the transport of people rather than freight, factors affecting the size of the bus fleet and the level of its utilisation are considered separately[1].

Demand factors for major categories

Factors such as the level and composition of economic activity, the location of raw material supplies and goods markets, costs of transport (the freight rates of road and other modes reflecting possible intermodal and intra-mode competition), quality of service and individual's preferences affect the demand for commercial vehicle services. Some of these factors have already been considered in connection with the demand for passenger vehicles. Others are discussed below where sufficient data are available.

Tastes and leisure activities

As noted earlier, a feature of the growth in the light commercial vehicle fleet is the purchase and use of 'commercial' vehicles for purposes other than purely business

1. The category of other truck-type vehicles is not included in this analysis for several reasons Firstly, the number of other truck-type vehicles on register is only a very small proportion of the total commercial vehicle fleet (less than 3 per cent in 1982). Secondly, data describing the diversity of functions performed by these vehicles are generally not available Finally, it is postulated that both the size and usage of this category depends mainly on social and demographic factors rather than economic market forces However, other truck-type vehicles are explicitly taken into consideration later in this chapter

use. Between the two survey years ending 30 September 1971 and 1982, use of light commercial vehicles for business purposes declined from 67 per cent to 56 per cent of total VKT. Changes in tastes and leisure activities, such as the growth in off-road travel, tourism and hobby farming, have led a wide cross-section of the travelling public to seek a more versatile type of vehicle than the utility, panel van or traditional family car. In addition, increasing costs of vehicle purchase and operation, particularly fuel costs, have encouraged both business and private vehicle owners to examine more closely their transport requirements. As a result, the smaller, more fuel efficient vehicle, able to perform a wider variety of tasks, is increasing in acceptance and popularity among both the traditional private and business owners. Such shifts in consumer demand have prompted vehicle manufacturers to produce the wide range of makes and models of light commercial vehicles available today. Many of the family van-type models in this range are cheaper to buy (partly because they are not subject to import quotas) and to operate than most large passenger sedans.

Economic activity and social structure

Available information does not allow a clear identification of the relationship between total economic activity (including exports and imports and the pattern of internal trade) and the demand for freight services (BTE 1981). This lack of clear identification may be a reflection of the expected leads and lags in the relationships due to the derived nature of demand. However, increased economic activity, in sectors such as construction, commercial development, retailing, agricultural production, mining and manufacturing[1], during the 1970s and early 1980s, has provided a direct stimulus to commercial vehicle numbers and their usage. At the same time, increases in population and employment and growth in personal incomes have led to greater use of passenger carrying commercial vehicles for travel to and from work and for other private purposes[2].

Freight rates

The cost of using a particular freight service and the relative appeal of any other competing service affects the degree to which the service is utilised. Trends in road, rail, air and sea freight rates between 1971 and 1982 are shown in Figure 6.1. During the 1970s, rates paid to freight forwarders[3], expressed in real terms, remained relatively stable until 1979. However, in recent years the rate of increase in road freight rates has escalated, leading to a more than doubling of rates between 1971 and 1982. Trends in the freight rates (prices) of the other transport modes are also relevant. Although domestic airline freight rates declined up to mid-1977, they have shown a similar trend to that of road rates since the early 1980s. Sea freight rates displayed a steadier rising trend than road rates, stabilising in the late 1970s and then increasing slightly in the 1980s. Indices of rail freight rates for interstate and intrastate movements have only been calculated since mid-1975 and have remained steady into the 1980s.

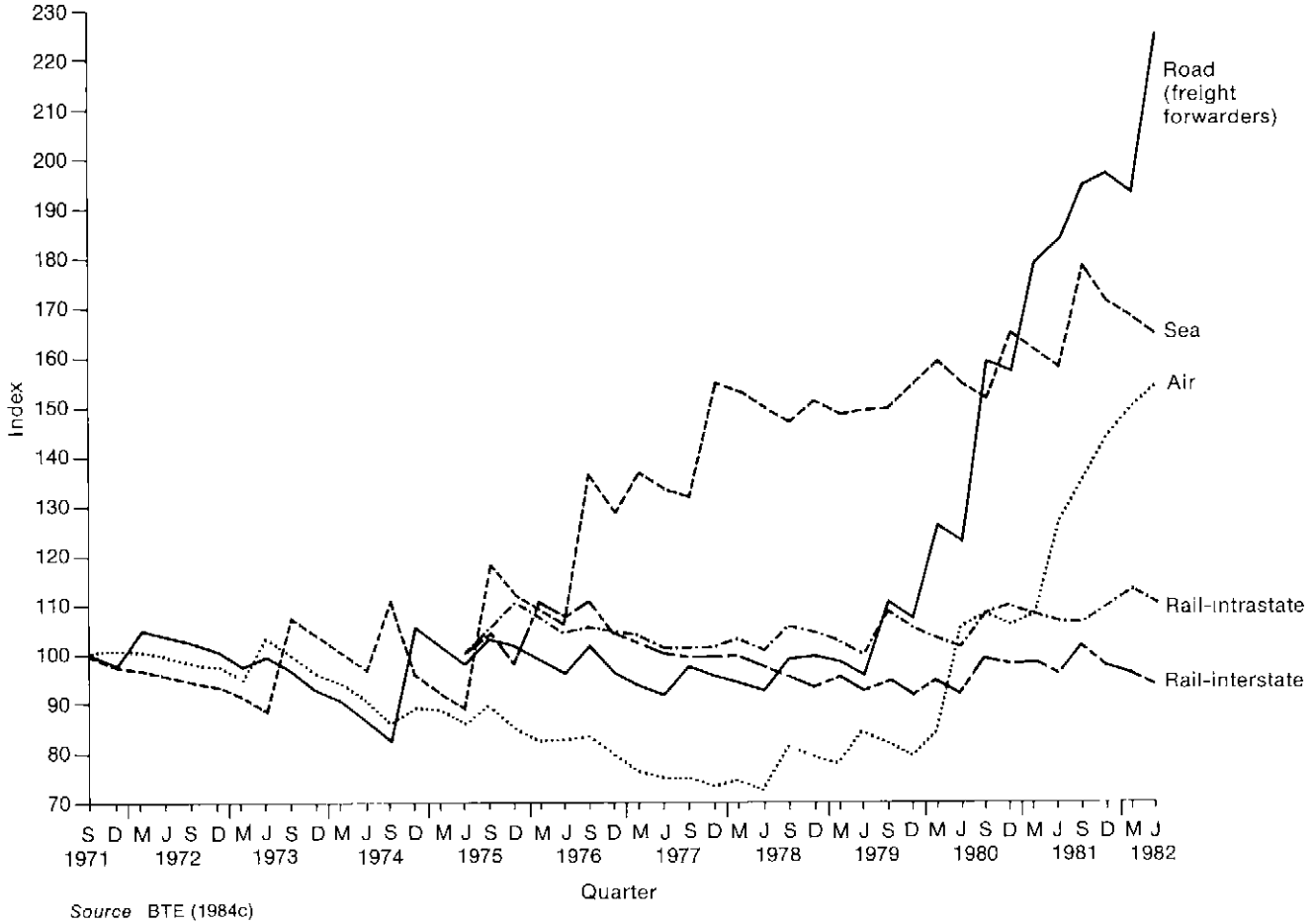
Quality of service

For transport modes in general, quality of service is a multi-dimensional concept which embraces such attributes as line-haul transit time, convenience of time of departure, reliability, availability of capacity, frequency of service, avoidance of

1. The use of these sectors to develop a broad indicator of economic activity at State level is further considered in the empirical analysis reported below

2. As noted earlier, during the study period (1972-1981), real Gross Domestic Product per head increased at an average rate of 1.5 per cent per annum and real average weekly earnings increased at an average rate of 1 8 per cent per annum. Population and civilian employment increased at average rates of 1.3 and 1 4 per cent per annum respectively (ABS 1983d)

3. These intercity scheduled rates should not be interpreted as being representative of the actual rates paid to freight forwarders. In practice, most freight forwarders charge less for regular or large consignments. Further, these rates are different from the minimum rates paid to sub-contractors which in turn vary according to route, commodity carried and other factors. Annual rates paid to sub-contractors declined slightly in real terms since 1977 (BTE 1979b and 1984c).



Source BTE (1984c)

Figure 6.1—Indices of domestic freight rates (in real terms), September quarter 1971 to June quarter 1982

damage and loss or theft, and communication with respect to problems. Available information (BTE 1984b) suggests that the rating of these attributes by users depends on the type of commodity consigned and that service attributes might outweigh price factors in the choice of transport mode. For example, some companies divide their traffic between rail and road in accordance with their assessment of the relative advantages of lower freight rates with rail, against the faster delivery with road.

Intermodal competition

During the year ending 30 September 1982 tonne-kilometres performed by road, rail and sea modes throughout Australia amounted to about 27 per cent, 29 per cent and 44 per cent of total respectively while tonne-kilometres performed by air was negligible (BTE 1984b). The road freight industry faces competition from rail in certain traffic (mostly non-bulk commodities) on intercapital city routes, although this is thought to be a minor part of total freight traffic.

In general, each transport mode seems to have specialised in those traffics where it has an advantage. This is illustrated by the recent rationalisation of the railways' freight activities with the carriage of more bulk commodities and diverting of less-than-car load and general merchandise freight to road. On the other hand, changes have been taking place in air and road transport industries to meet the demand for fast overnight freight services.

Supply factors for major categories

The supply of light commercial vehicles' services is influenced in a similar manner by several of the factors already mentioned in the passenger car segment. The supply of transport services provided by rigid and articulated trucks is particularly affected by regulation, and truck purchase and operation costs.

Regulation

Commonwealth and State governments' regulations and taxes influence in various ways the conditions under which transport services are provided. Since the Hughes and Vale case of 1954 the main impact on interstate traffic has been road maintenance charges (RMCs), which were introduced by all States except Tasmania. These charges distorted truck fleet composition because vehicles under 4 or 8 tonnes capacity (depending on the States) were exempt from payment of the charges and their collection was subject to avoidance and evasion. As a result of the 1979 blockades, the RMCs were abandoned by all States.

At the intrastate level, the framework of State regulations aimed mainly at protecting the railways has now almost all been dismantled. Annual registration charges still exist but all States except Tasmania have deregulated or are in the process of doing so.

Governments regulate the activities of trucks in other ways, including legislation and control of consumer affairs, emission standards, cleanliness (for food transport), flammable liquids transport, driving hours, and vehicle weight and load limits.

Weight and load limits exist in all States and the Northern Territory[1]. Although not uniform across the States, the maximum weight limit was increased, across the board, from 36 to 38 tonnes gross vehicle weight in 1979, thus enabling more freight to be carried legally on heavier trucks. This change has no doubt encouraged the trend towards upsizing of trucks. With respect to the average load carried, data for the period since 1979 are not available, but the average load carried by rigid trucks increased from 3.0 tonnes in 1976 to 3.4 tonnes in 1979, while articulated trucks' average load increased from 13.9 tonnes in 1976 to 15.0 tonnes in 1979 (ABS 1978 and 1981f).

1 The Australian Capital Territory currently has no limits

Higher weight limits along with the abolition of road maintenance charges have reduced the relative contribution of heavy trucks to the cost of damage imposed on Australian roads (BTE 1984b)[1]. If governments were to increase the level of cost recovery from heavy vehicles, costs could rise significantly. Depending upon the methods used to recover costs, various vehicle classes could be differentially affected, which in turn could influence the vehicle fleet composition[2].

Truck purchase and operation costs

The costs of buying and running commercial vehicles include lease payments, insurance, registration, administration, sundry equipment, fuel, tyres, maintenance, and in some cases, wages[3].

Government policy affects all of these, directly or otherwise Variations to investment allowances and allowable rates of depreciation can considerably alter the cost of buying a truck. Taxation policies include Commonwealth taxes on fuel, oil, tyres and spare parts, and State fuel levies.

For example, fuel is a major expense[4] In Australia, the price of auto distillate was fairly stable in real terms from 1964 to mid-1978. From then until mid-1980 the price rose markedly, since which time the price has stabilised (BTE 1984c). Apart from a temporary increase in the index of vehicle purchase price (measured in real terms) in the mid-1970s, the index declined between the two financial years 1972 and 1982[5].

Buses

A number of factors are likely to have contributed to the growth in bus ownership and utilisation described earlier. Population and increased urban development have had a major impact on the type of service provided by government bus fleets and the level of patronage received. In addition, increases in the private and social costs of private motoring have in many cities led to the implementation of government policies to introduce and/or promote the use of public transport.

In many outer urban and country areas buses provide a valuable local service as well as a vital transport link to regional centres and capital cities. Over longer distances, bus operators are able to provide a reliable transport service more quickly (in terms of travel times) than the railways and at considerably less cost than the airlines. Operating on a smaller scale with lower fixed costs than the railways and airlines, bus companies also have the advantage of being able to detect more quickly changes in consumer demand and adjust their services accordingly.

The trend towards greater private ownership of micro-buses is analagous to the move towards similar types of dual purpose vehicles in the light commercial category. Again, changes in consumers' tastes and leisure activities have led to the requirement for a more versatile vehicle with emphasis on comfort of ride and seating and luggage space.

MODELLING CONSIDERATIONS

A common restriction on the development of a comprehensive demand model is data availability. Hence this section attempts to review briefly some of the data problems encountered and features of the models consequently developed. Data

1 Light commercial vehicles, along with passenger cars, cause avoidable road pavements costs which are too small to be satisfactorily indentified.

2 For example, heavy vehicles impose costs that are more than proportional to either their weight or their fuel consumption

3. For a more detailed discussion of these factors see BTE (1980)

4 Estimated to be about 30 per cent of the total cost of the long distance owner-driver operation of a six-axle articulated vehicle travelling 150 000 kilometres per year as at April 1980 (BTE 190)

5. ABS, personal communication

limitations and the requirement for long-term projections necessitated the development of predictive models of the vehicle stock and its usage[1].

The demand for commercial vehicles is determined in the first instance by the expected profitability of the freight services provided by the vehicles. Profitability depends on the one hand on the level of economic activity and the freight rates for road and other competing transport modes, and on the other hand on the cost of vehicle purchase and operation. Due to data limitations relating to road freight rates indicated earlier, the developed models concentrate on the level of economic activity and the cost elements only. This approach assumes that past relativities between freight rates for the different transport modes will remain unaltered.

The vehicle stock was postulated to depend upon the level of economic activity and the cost of vehicle purchase. For total VKT, a similar approach to that adopted for the passenger car segment was followed. Hence, distance travelled was regarded as a function of the size of the fleet and cost of operation.

For each State, models of vehicles on register were estimated for each of the five types of commercial vehicles, using the annual registration data given in Appendix II. In estimating models of kilometres travelled by the three major vehicle types (light commercial vehicles, rigid trucks and articulated trucks) derived estimates of VKT were pooled across States and dummy variables used to allow for State differences in vehicle utilisation[2]. These models were estimated from the estimates of vehicle kilometres travelled derived in Appendix II. For the minor categories of other truck-type vehicles and buses, it was not possible to develop any reliable models of vehicle utilisation. In these categories, 'point' estimates of average vehicle utilisation in 1979 were used to link the number of vehicles with total kilometres travelled.

NUMBER OF VEHICLES

Light commercial vehicles, rigid trucks and articulated trucks

Since models of the number of vehicles on register were to be estimated for each State by vehicle type, the values of variables selected to describe the cost factors (representing constraints on supply imposed by the costs of purchasing and operating a vehicle) and the income component of demand needed to be obtained at a similar level of disaggregation. Consequently, 'separate' series of costs (that is, for each State and vehicle type) were, so far as possible, compiled from data describing changes in the cost of vehicle purchase and operation over the study period (1972 to 1982). However, a broad indicator of the 'level of economic activity' was not readily available at the State level. Therefore, it was necessary to derive, for each State, an indicator of economic activity from the industry data published by the ABS[3]. Sectors of the economy considered to be significant users of commercial vehicles and road transport were represented in the indicator. Note that this procedure did not result in the derivation of a general indicator of overall growth in the State's economy but simply an indicator of economic activity relevant to road transport.

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1 Alternative explanatory models attribute changes in the dependent variable to variation in specific independent/explanatory factors and are valid only over the range of the independent variables. In contrast, in a predictive model the stability of hypothesised relationships over time becomes important.

2 The condition of parallelism imposed by pooling data implies uniformity between the States in the relationship of kilometres travelled with number of vehicles (and other independent variables). This introduces an additional source of error to the models. However the error incurred by this procedure is not considered to be significant due to the lack of consistency between States in changes in average VKT over time (see Table 5.3).

3. The derivation of indicators which summarized the industry data was necessary to enable the characteristics of vehicle ownership by a wide cross section of the economy to be considered, while at the same time avoiding the modelling problems of multicollinearity and insufficient degrees of freedom

To achieve these objectives six variables were used in the compilation of the indicators of economic activity These variables (to be referred to as 'production variables') were drawn from the following sectors and were defined as.

- Wholesale and retail trade: value of retail sales (ABS 1983j).
- Agricultural production: gross value of farm production (ABS 1983b).
- Mining: value of minerals and construction materials produced (ABS 1983f).
- Manufacturing: value added in manufacturing (ABS 1983e).
- Building industry: value of work done on dwellings (new houses and alterations) (ABS 1983c and 1983h)
- Commercial development: value of work done on other buildings (ABS 1982 and 1983c).

Separate indicators of economic activity were derived for each type of vehicle fleet within each State and for Australia as linear combinations of the above six 'production variables'[1]. Step-wise regression was used to indicate which 'production variables' figured significantly in the indicators of economic activity (see Table 6 1). Variables in brackets are secondary production variables which as noted in Appendix III, also had a detectable influence on vehicle registrations and may be regarded as a less important component of the economic indicator.

As anticipated on *a priori* grounds, greater variation in the composition of the indicators is apparent across States than across vehicle types. Given the minor statistical significance of the secondary 'production variables', and the similarity of the 'production variables' affecting the three major categories of commercial vehicles, a single indicator of economic activity was derived for each State. Activity in industries related to the retailing sector and the minerals and construction material producing sector has consistently affected vehicle registrations of all vehicle types in most States. Also important in most States is the level of building activity and, to a lesser degree, agricultural production.

For each State and type of vehicle, the indicator of economic activity was derived as the sum of the relevant 'production variables' (as given in Table 6.1). For the period between financial years 1971-72 and 1981-82, the average rate of growth in the road transport related indicators of economic activity for the three vehicle types were highest in Queensland and Western Australia (4 3 per cent and 3.5 per cent per annum respectively), followed by 2.7 per cent for New South Wales, 2.2 per cent for Victoria and only 1.5 per cent in South Australia. In Tasmania the indicator increased at an average rate of 3.1 per cent per annum between 1971-72 and 1980-81 and then fell sharply in 1981-82 due to a contraction of several influential sectors of the economy.

Model specification

For each State the following form of model was developed[2] for each of the three major categories of commercial vehicles.

Number of vehicles on register = f (indicator of economic activity, cost of vehicle purchase, cost of vehicle operation, dummy variable for ABS's 1976 reclassification of commercial vehicles). **Model 4**

1. For an exposition of the process followed in deriving the economic activity indicator see Appendix III

2 As noted above, the secondary production variables are considered to be a less significant opponent of the indicator of economic activity and so are excluded from the formulation of Model 4.

TABLE 6.1—VARIABLES[a] INCLUDED IN INDICATORS OF ECONOMIC ACTIVITY BY STATE

Vehicle type	*New South Wales*[b]	*Victoria*	*Queensland*	*South Australia*[c]	*Western Australia*	*Tasmania*	*Australia*
Light commercial vehicles	RRS RMCM	RRS RMCM (RFP) (RHB)	RRS RMCM RVAM ROB	RRS RVAM	RRS RMCM RVAM	RRS ROB	RRS RMCM (RFP)
Rigid trucks	RRS RMCM RHB (RFP)	RRS RMCM (RFP) (RHB)	RRS RMCM RVAM ROB	RRS RVAM	RRS RMCM RVAM	RRS ROB	RRS RMCM (RFP)
Articulated trucks	RRS RMCM RHB	RRS RMCM (RFP) (RHB)	RRS RMCM RVAM ROB	RRS RVAM RHB ROB	RRS RMCM RVAM	RRS ROB	RRS RMCM (RFP)

a. Variables, expressed in real terms, are defined as:

RRS	Value of retail sales
RMCM	Value of minerals and construction materials produced
RVAM	Value added in manufacturing.
RHB	Value of work done on dwellings.
ROB	Value of work done on other buildings
RFP	Gross value of farm production.

b New South Wales includes the Australian Capital Territory.

c South Australia includes the Northern Territory

Models were estimated in their logarithmic form by the method of ordinary least-squares. The coefficients of the economic activity indicator, vehicle purchase cost and vehicle operation cost variables, represent income, vehicle purchase price and operating cost elasticities of demand respectively, while estimates of the dummy variable coefficient describe the effect of ABS classification changes on the vehicle registration data[1].

Results

Model 4 was estimated for each State (plus total Australia) by vehicle type combination using time-series data from 1971-72 to 1980-81. That is a total of 21 separate regressions, with each yielding different estimates of the coefficients of the explanatory variables. The results are given in Appendix IV and discussed below.

Income effects

Estimates of the coefficient of the indicator of economic activity in Model 4, approximating income elasticities of vehicle registrations, are summarized in Table 6.2.

Estimates of income elasticities were statistically significant (at the 95 per cent level of significance) in all models. Together with the constant and dummy variable term in Model 4, the indicator of economic activity generally described at least 95 per cent of the variance in the vehicle registration data.

The above elasticity estimates are relatively uniform across vehicle types (with no discernible difference at the national level) but vary between States. Higher than average (total Australia) elasticities were recorded in New South Wales, Victoria and Western Australia, while demand in South Australia and Tasmania was relatively inelastic with respect to the economic activity indicators. The situation in Queensland is somewhat surprising but may be attributed to lower absolute income levels despite higher than average rates of economic growth.

The Australian fleets of light commercial vehicles, rigid trucks and articulated trucks were also modelled by Model 4 with the indicator of economic activity replaced by the real value of Gross Domestic Product (GDP). Estimates of income elasticities obtained in these regressions varied between 1.5 and 1.6 (compared to the estimates of 1.2 given above), further suggesting that the size of the three major Australian commercial vehicle fleets is sensitive to changes in income.

Price effects

While the dominant dependancy of vehicle ownership on income has been clearly identified, the extent to which changing vehicle costs affect demand could not be estimated with confidence. The failure of Model 4 to provide statistically significant estimates of purchase price and operating cost elasticities is felt to be largely due to the lack of sufficiently detailed historical data describing changes in vehicle purchase and operating costs (particularly for the categories of rigid and articulated trucks). Also, the indirect transmission of purchase price and operating cost effects through freight rates with various lags obscures this relationship.

To investigate further the effects of income and freight rates on the size and usage of the commercial vehicle fleet, an empirical analysis of the long distance road freight sector was undertaken (see Appendix V). The number of tonnes consigned by road

1. The dummy variable coefficient of Model 4 estimates the proportion of each vehicle fleet which, according to current ABS procedures, has been correctly classified. During the latter years of the study period (1977 and thereafter, when, as defined above, the dummy variable has zero value) no adjustment to the vehicle registration data is necessary However in preceding years (when it equals one) a negative estimate of its coefficient indicates that to achieve consistency with latter statistics, a downwards revision of pre-1977 data is required Further, the larger the magnitude or absolute value of the coefficient, the greater the effect of the 1976 classification changes on the size of the corresponding vehicle fleet

TABLE 6.2—ESTIMATES OF ELASTICITIES OF COMMERCIAL VEHICLES ON REGISTER WITH RESPECT TO INDICATORS OF ECONOMIC ACTIVITY BY STATE OF REGISTRATION

('000)

Vehicle type	New South Wales[a]	Victoria	Queensland	South Australia[b]	Western Australia	Tasmania	Australia
Light commercial	1.2	1.6	1.0	1.0	1.3	0.6	1.2
Rigid trucks	1.5	1.7	0.8	0.6	1.5	0.5	1.2
Articulated trucks	1.4	1.6	1.0	0.7	1.4	0.7	1.2

a New South Wales includes the Australian Capital Territory
b. South Australia includes the Northern Territory.

on selected interstate routes was modelled as a function of indices of road and rail freight rates and the level of real Gross Domestic Product (GDP) over the period between September 1971 and June 1981. The results are in general agreement with the above and suggest that the interstate road freight task is relatively responsive to changes in income (with estimated income elasticities varying between 1.4 and 1.8). The own-price elasticity (road freight rates) was inelastic (with estimated price elasticities ranging between -0.3 and -0.4). Slightly higher estimates were obtained with respect to the ratio of road to rail freight rates indicating some interaction between tonnes consigned by road and rail freight rates.

Vehicle classification changes

Estimates of the coefficient of the dummy variable in Model 4 were statistically significant in all models of the number of light commercial vehicles and rigid trucks on register and all but three of the models of the number of articulated trucks on register[1].

Other truck-type vehicles and buses

Model specification

Compared with the types of commercial vehicles considered earlier, other truck-type vehicles and buses provide special transport services which are probably not directly related to broad areas of economic activity. Therefore, when formulating a model of other truck-type vehicle and bus registrations, Model 4 (or a form similar to it) was considered inappropriate. Indeed, it was difficult to perceive what might be the one or two most significant determinants of vehicles numbers (whether they be related to income, price or some other economic and social factors) that might be included in a demand model.

Therefore, the number of the other truck-type vehicles and total buses on register, per head of population, was modelled by a simple function of time and the dummy variable reflecting changes in ABS vehicle classifications (other truck-type vehicles only). That is:

Fleet size per 1000 persons = f (time, dummy variable). **Model 5**

As before, the model was estimated using annual data over the study period by the method of ordinary least-squares, for each State (plus total Australia) by vehicle type Estimates of the coefficients describe the average annual increase in the number of vehicles on register per 1000 persons in the population and the effect of ABS classification changes on vehicle registrations respectively.

Results

Results of the estimation of models of the number of the other truck-type vehicles and buses registered in each State are given in Appendix IV and briefly described in the following

Other truck-type vehicles

Estimates of the coefficient describing the average annual increase in vehicles per 1000 population were statistically significant in all models. Due to the differences between the States in the definition of other truck-type vehicles and the small size of these vehicle fleets (see Chapter 5), rates of vehicle registrations (number of vehicles per 1000 population) and estimates of their average annual increase were found to vary markedly between the States as Table 6.3 indicates.

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1 For articulated trucks the estimated coefficients of the dummy variable were non-significant in the New South Wales, Western Australia and Australian fleet models That is, proportionate to the size of each fleet, classification changes generally had less of an impact on articulated trucks than on light commercial vehicles and rigid trucks

TABLE 6.3—RATES AND AVERAGE ANNUAL GROWTH IN THE RATES OF OTHER TRUCK-TYPE VEHICLE REGISTRATIONS BY STATE OF REGISTRATION, AS AT 30 JUNE 1972 TO 1981[a]

As at 30 June	*New South Wales*[b]	*Victoria*	*Queensland*	*South Australia*[c]	*Western Australia*	*Tasmania*	*Australia*
Rates[d]							
1972	1.5	0.7	1.2	2.1	3.4	1.2	1.4
1981	2.1	2.4	1.6	4.0	4.7	4.4	2.6
Average annual growth 1972-81[e]	0.06	0.19	0.04	0.22	0.14	0.35	0.13

a. The rate of other truck-type vehicle registrations is defined as the number of other truck-type vehicles on register per 1000 population
b. New South Wales includes the Australian Capital Territory
c. South Australia includes the Northern Territory
d. Adjusted to conform to post-1976 classification of vehicle type.
e. Estimates of the coefficient of time, indicating the average increase in the number of vehicles per 1000 population per year

Estimates of the coefficient of the dummy variable were statistically significant in the models for all States except Victoria. The negative sign of each estimate indicated that the classification changes led to a reduction in fleet size in 1977.

Buses

Estimates of the coefficient describing the average annual increase in buses per 1000 population were statistically significant in all models. Rates of bus registration at 30 June 1972 and 30 June 1981, together with estimates of their average annual increase are given in Table 6.4.

Subject to the deficiencies in the registration data, it may be noted that among the States, Western Australia and Tasmania recorded, since 1972, the greatest increase in the rate of bus registrations. Meanwhile, South Australia has recorded the lowest increase while rates in the three eastern mainland States increased almost uniformly.

COMMERCIAL VEHICLE USAGE

Light commercial vehicles, rigid trucks and articulated trucks

Model specification

As discussed previously, models of vehicle kilometres travelled (VKT) included as independent or explanatory variables the number of vehicles on register (as modelled above) and costs of vehicle operation[1]. Furthermore, to improve the reliability of coefficient estimates, it was necessary to pool the available data from four Surveys of Motor Vehicle Usage across States. To reduce the error due to pooling of data, five dummy variables were added to the VKT model (reflecting differences between the States in the average number of vehicle kilometres travelled).

Consequently, the total number of kilometres travelled by vehicles registered in each State is described by:

VKT = f (number of vehicles on register, index of operating costs, State dummy variables). **Model 6**

Models were estimated in their logarithmic form by the method of ordinary least-squares. An estimate of the coefficient of the number of vehicles on register greater than one would imply an increase in average number of kilometres travelled per vehicle as the number of vehicles on register increased. The coefficients of the State dummy variables indicate State differences in average VKT, while the coefficient of operating costs estimates the elasticity of vehicle utilization with respect to these costs.

The coefficients of the number of vehicles and operating costs describe the average relationship between these independent variables and VKT, over all States. Unlike the model of vehicles on register, the coefficients of the independent variables are, through the pooling of data, assumed to be uniform across States.

Results

Model 6 was estimated for each of the three major vehicle types (light commerical vehicles, rigid trucks and articulated trucks). The results are given in Appendix IV and estimates of the coefficients are commented upon below.

Vehicles on register

Estimates of the coefficient of vehicles on register were statistically significant in all models of VKT. In each case, estimates took values slightly greater than unity

1. A possible alternative approach would be to project the future road freight task (particularly commodity flows between regions) and then assess its impact on commercial vehicle usage

TABLE 6.4—RATES AND AVERAGE ANNUAL GROWTH IN THE RATES OF BUS REGISTRATIONS[a] BY STATE OF REGISTRATION, AS AT 30 JUNE 1972 TO 1981

As at 30 June	*New South Wales*[b]	*Victoria*	*Queensland*	*South Australia*[c]	*Western Australia*	*Tasmania*	*Australia*
Rates							
1972	1.9	1.5	1.8	2.3	2.5	3.6	1.9
1981	2.8	2.5	2.6	2.7	3.7	4.7	2.8
Average annual growth 1972–81[d]	0.10	0.11	0.10	0.05	0.16	0.15	0.11

a The rate of bus registrations is defined as the number of buses on register per 1000 population
b. New South Wales includes the Australian Capital Territory
c South Australia includes the Northern Territory.
d. Estimates of the coefficient of time, indicating the average increase in the number of vehicles per 1000 population per year.

indicating the percentage growth in VKT to be, on average, slightly greater than the percentage change in vehicles on register. The model of kilometres travelled by articulated trucks has the largest estimated coefficient. The models of kilometres travelled by light commercial vehicles and rigid trucks also indicate an increase in average VKT but at a slower rate.

Price effects

The extent to which changing operating costs affect the demand for vehicle services was not significant in a statistical sense. This is felt to be largely due to the lack of sufficiently detailed and accurate cost data and the indirect transmission of cost effects through freight rates noted earlier

Other truck-type vehicles and buses

As noted earlier in this chapter, it was not possible to develop any reliable models of kilometres travelled by other truck-type vehicles and buses. In the former category, average vehicle utilisation increased dramatically between 1971 and 1976 as a result of changes in vehicle classification criteria and perhaps coverage of the two relevant Surveys of Motor Vehicle Usage. Therefore estimates of VKT were not consistent between surveys and so could not be described by a model of the above form.

Similarly, data describing the utilisation of privately used buses is only available for the year ending 30 September 1979. Furthermore, a number of inconsistencies between the classifications used in the 1971 and 1979 Surveys of Bus Fleet Operations are apparent.

In the absence of any formal model, the following chapter derives forecasts of kilometres travelled by other truck-type vehicles and buses using model 5 above and the most recently available joint estimates of average vehicle utilisation.

CHAPTER 7—PROJECTIONS OF COMMERCIAL VEHICLES

In order to establish the likely levels of future commercial vehicle fleet size and usage from the estimated relationships discussed in the preceding chapter, it was necessary to project those factors which were found to influence demand. The values assigned to these explanatory variables in this study were estimated from past data and the projections produced by other organisations such as the Australian Bureau of Statistics and the Institute of Applied Economic and Social Research (IAESR).

While based upon the best information available at the time of preparation, recent significant changes in the economic environment are likely to have increased the error associated with the projections in the relatively short term period to 1985. However, a return to the trends modelled on ten or more years of historic data is anticipated in the longer term.

Three sets of projections of commercial vehicle fleet size and kilometres travelled were generated (namely high, median and low growth projections) for each of the vehicle types defined previously and for vehicles registered in each of the six States of Australia[1]. The variation between the three sets of projections is due to differences in the assumptions underlying the future growth in economic activity related to road transport. A comparison of the different results indicates the extent to which the projections are sensitive to changes in the future values of the explanatory (independent) variables.

SCENARIOS

This section outlines the projected levels of the road transport related indicators of economic activity and population used in projecting commercial vehicle fleet size and kilometres travelled. Since vehicle purchase and operating costs were not statistically significant in fleet size and VKT models, no projection of cost elements was undertaken.

Indicators of economic activity

As described in Chapter 6, each State's indicator of economic activity was derived from two or more of the six 'production variables' reflecting activity in selected sectors of the economy. Therefore projections of each indicator were calculated from an assessment of future growth in each of the relevant sectors.

In general, the median projections (regarded to be the most likely) are characterised by somewhat lower rates of average annual growth in the early 1980s. Later in the decade a return to higher rates of growth, similar to those experienced during the 10 year period from 1972 to 1982, is anticipated. Such rates of economic growth are expected to be maintained during the early 1990s and slowly decline thereafter.

High and low growth scenarios of the values of the economic indicator follow the same pattern over time but are based on periods of high and low growth in the 1970s. For example, during the period 1971-72 to 1981-82, the indicator of economic activity in Queensland increased at an average rate of 4.3 per cent per annum. However, between the two financial years ending in 1972 and 1977 the indicator

1. With the exception of the two minor categories of other truck-type vehicles and buses, where only median projections at the State level were developed

TABLE 7.2—PROJECTED NUMBER OF COMMERCIAL VEHICLES BY STATE OF REGISTRATION, 1985 TO 2000

('000)

As at 30 June	*New South Wales*[b]	*Victoria*	*Queensland*	*South Australia*[c]	*Western Australia*	*Tasmania*	*Australia*
1972[d]	358.9	252.6	205.7	120 8	120.3	37.6	1 095.9
1982[e]	552.5	366.4	343.3	151.0	197.4	50.8	1 661.5
High growth projections[f]							
1985	622.9	405.4	392.8	160.8	231.3	54.8	1 868.0
1990	787.0	498.5	502.3	181.8	313.8	62.6	2 346.0
1995	976.0	602.0	638.6	203.9	412.4	70.7	2 903.5
2000	1 173.7	714.8	787.2	225.7	514.6	78.4	3 494.2
Median growth projections[g]							
1985	606.3	400.1	383.7	158.2	226.2	54.0	1 828.4
1990	736.9	480.9	472.0	174.1	295.1	60.3	2 219.4
1995	880.8	568.3	577.2	189.9	373.1	66.6	2 655.8
2000	1 021.2	660.4	684.1	204.6	449.3	72.2	3 091.4
Low growth projections[h]							
1985	596.1	394.7	374.7	155.5	221.2	53.3	1 795.5
1990	700.6	464.4	443.0	166.6	278.6	58.0	2 111.2
1995	807.5	536.6	520.9	176.9	339.7	62.6	2 444.1
2000	902.3	609.8	593.7	185.7	393.3	66.3	2 750.9

a New South Wales includes the Australian Capital Territory.
b. South Australia includes the Northern Territory.
c. State figures may not add to the Australian total due to rounding.
d. Vehicles on register adjusted to conform to post-1976 classifications of vehicle type.
e. Actual.
f. The sum of high projections of light commercial vehicles, rigid trucks and articulated trucks and median projections of other truck-type vehicles and buses
g The sum of median projections for each vehicle type.
h. The sum of low projections of light commercial vehicle, rigid trucks and articulated trucks and median projections of other truck-type vehicles and buses.

TABLE 7.3—PROJECTED RATES OF GROWTH IN THE NUMBER OF COMMERCIAL VEHICLES BY STATE OF REGISTRATION, 1982 TO 2000

(per cent per annum)

Year ending 30 June	*New South Wales*[a]	*Victoria*	*Queensland*	*South Australia*[b]	*Western Australia*	*Tasmania*	*Australia*
1972-82[c]	4.4	3.8	5.3	2.3	5.1	3.1	4.2
High growth projections[d]							
1982-85	4.1	3.4	4.6	2.1	5.4	2.6	4.0
1985-90	4.8	4.2	5.0	2.5	6.3	2.7	4.7
1990-95	4.4	3.8	4.9	2.3	5.6	2.5	4.4
1995-2000	3.8	3.5	4.3	2.1	4.5	2.1	3.8
Median growth projections[e]							
1982-85	3.1	3.0	3.8	1.6	4.6	2.1	3.2
1985-90	4.0	3.7	4.2	1.9	5.5	2.2	4.0
1990-95	3.6	3.4	4.1	1.8	4.8	2.0	3.7
1995-2000	3.0	3.0	3.5	1.5	3.8	1.6	3.1
Low growth projections[f]							
1982-85	2.6	2.5	3.0	1.0	3.9	1.6	2.6
1985-90	3.3	3.3	3.4	1.4	4.7	1.7	3.3
1990-95	2.9	2.9	3.3	1.2	4.0	1.5	3.0
1995-2000	2.2	2.6	2.7	1.0	3.0	1.2	2.4

a. New South Wales includes the Australian Capital Territory
b. South Australia includes the Northern Territory
c Actual
d Calculated from the sum of high growth projections of light commercial vehicles, rigid trucks and articulated trucks and median growth projections of other truck-type vehicles and buses.
e Calculated from the sum of median growth projections for each vehicle type.
f. Calculated from the sum of low growth projections of light commercial vehicles, rigid trucks and articulated trucks and median projections of other truck-type vehicles and buses

Rates of average annual growth calculated from the projections of vehicles on register vary over time according to the anticipated changes in the economic environment described above. Consistent with past trends, it is anticipated that future growth in fleets of commercial vehicles will be greatest in Queensland and Western Australia and least in South Australia and Tasmania. The comparatively high growth projections for Queensland and Western Australia are attributable to relatively high growth in the respective indicators of economic activity (see Table 7.1) and for Western Australia, in addition, relatively high estimates of income elasticities (see Table 6.2). In contrast, growth in the indicator of economic activity for South Australia is below that of the other States, and the number of commercial vehicles registered in that State, and in Tasmania, is relatively inelastic with respect to income. Between the two extremes, projected growth in the size of the New South Wales and Victorian registered fleets is the consequence of moderate growth in the corresponding indicators of economic activity and relatively elastic demand with respect to income.

Average vehicle kilometres travelled

Projections of average annual kilometres travelled (average VKT) by vehicles registered in each State and of each commercial vehicle type, are given in Tables VI.9 to VI.13 of Appendix VI. These are based on provisional 1982 estimates from the Survey of Motor Vehicle Usage and the models of total VKT described in Chapter 6. The following assumptions for each commercial vehicle type were employed in deriving high, median and low growth projections of average VKT.

Light commercial vehicles
High projections of average VKT were based on preliminary 1982 estimates and the growth in average VKT indicated by the regression of vehicles on register on total VKT (Model 6 of Chapter 6). Median projections assume a future growth rate in average VKT equal to half that of the high projections, while constant average VKT (equal to the 1982 preliminary estimates) throughout the projection period forms the low growth projections.

Rigid trucks
Projections of average kilometres travelled by rigid trucks were derived in the same way as projections of average kilometres travelled by light commercial vehicles.

Articulated trucks
As with previous vehicle types, high growth projections of average kilometres travelled by articulated trucks were calculated from the model of total VKT given in Chapter 6. However, in keeping with the higher rate of growth in average VKT experienced during the last 12 years, median and low growth projections of average kilometres travelled by articulated trucks assume growth rates equal to two-thirds and one-third respectively of those in the high growth projections.

Other truck-type vehicles
Due to changes to the definition of other truck-type vehicles with each Survey of Motor Vehicle Usage it was not possible to obtain reliable estimates of the likely variation in average kilometres travelled by these vehicles. Therefore a single projection of average VKT remaining constant throughout the projection period was adopted. That is, estimates of average VKT were drawn from the 1979 Survey as given in Table 5.3[1].

Buses
As with other truck-type vehicles it was not possible to assess the likely variation in average kilometres travelled by buses. Therefore, projections of constant average

1. The 1979 Survey estimates of average VKT were preferred to those derived from the 1982 Survey as changes in vehicle classifications implemented with that survey appeared to have had a significant impact on this category of vehicles

VKT were assumed and estimates obtained from the most recent data available (see Table II.6).

Total commercial vehicles
Projections of the average number of kilometres travelled for all commercial vehicles (given in Table 7.4) were calculated from projections of total kilometres travelled by commercial vehicles (to be stated in Table 7.5 to follow) and projections of the total number of commercial vehicles on register (Table 7.2).

Table 7.4 suggests that the average annual distance travelled by commercial vehicles will increase only marginally (if at all) between now and the year 2000. The rate of increase is expected to be slightly higher for vehicles registered in New South Wales and Western Australia than for vehicles registered in the other States, while even the high projections predict little change in the average number of kilometres travelled by commercial vehicles registered in South Australia and Tasmania.

Relative stability in average VKT is expected to be a characteristic of most types of commercial vehicles. Only for articulated trucks is the average rate of utilisation expected to increase significantly above current levels. Appendix Table VI.11 projects a steady increase in the average annual number of kilometres travelled by articulated trucks up to a level, which in the year 2000, will be between 10 and 32 per cent higher than in 1982.

Conversely, the average annual distance travelled by buses is projected to decline (see Table VI.13). However, this trend is entirely due to continued changes in the composition of the bus fleet with an even greater prominence of privately used micro-buses.

Total vehicle kilometres travelled

Projections of total annual kilometres travelled by commercial vehicles registered in each State by vehicle type, and corresponding rates of average annual growth, are given in Tables VI.14 to VI.21 of Appendix VI. These are based on the projections of vehicles on register given in the Appendix and assumptions about average VKT described above. That is, projections of total kilometres travelled by light commercial vehicles, rigid trucks and articulated trucks were derived from Model 6 of Chapter 6 while projections of total kilometres travelled by other truck-type vehicles and buses assumed constant average annual VKT. Again, only one set of projections for each of other truck-type vehicles and buses were derived due to the model and data deficiencies described above.

The projections of total kilometres travelled by all commercial vehicles on register in each State are the summation of the five vehicle type projections given in Appendix VI and summarised in Table 7.5. Average rates of growth in total VKT are given in Table 7.6.

Compared with an average rate of growth of 5.1 per cent per annum between 1972 and 1982, the total number of kilometres travelled by commercial vehicles is projected to increase at an average rate of between 2.9 and 4.8 per cent per annum to the year 2000. Projected rates of growth in total VKT over time closely follow the projections of the number of vehicles on register described above. As a result, above average rates of growth are projected for the total number of kilometres travelled by commercial vehicles registered in Queensland and Western Australia.

Appendix VI sets out projected rates of growth in total VKT for the five vehicle types identified. To the year 2000, projected average annual rates of growth in total VKT vary:

- between 2.7 and 4.5 per cent per annum for light commercial vehicles (compared with 4.6 per cent per annum between 1972 and 1982),

- between 2.9 and 5.2 per cent per annum for rigid trucks (5.6 per cent per annum historically);
- between 3.3 and 5.8 per cent per annum for articulated trucks (6.2 per cent per annum historically);
- about 4.7 per cent per annum for other truck-type vehicles (11.7 per cent per annum historically); and
- about 3.4 per cent per annum for buses (5.2 per cent per annum historically).

TABLE 7.4—PROJECTED AVERAGE ANNUAL VEHICLE KILOMETRES TRAVELLED BY TOTAL COMMERCIAL VEHICLES BY STATE OF REGISTRATION, 1985 TO 2000[a]

(millions)

Year ending 30 June	*New South Wales*[b]	*Victoria*	*Queensland*	*South Australia*[c]	*Western Australia*	*Tasmania*	*Australia*
1972[d]	18.6	16.9	14.4	17.6	20.2	15.0	17.4
1982[d]	20.6	18.7	16.6	18.7	19.0	17.9	18.9
High growth projections							
1985	21.0	18.9	16.8	18.8	19.4	18.0	19.2
1990	21.7	19.5	17.2	18.9	20.2	18.2	19.8
1995	22.5	20.0	17.7	19.1	21.0	18.4	20.4
2000	23.2	20.5	18.1	19.2	21.7	18.6	20.9
Median growth projections							
1985	20.8	18.8	16.7	18.7	19.2	17.9	19.0
1990	21.2	19.1	16.9	18.8	19.6	18.0	19.3
1995	21.6	19.3	17.1	18.8	20.0	18.0	19.6
2000	21.9	19.6	17.3	18.9	20.4	18.1	19.9
Low growth projections[e]							
1985-2000	20.6	18.7	16.6	18.7	19.0	17.9	18.9

a. Calculated from projections of number of vehicles on register and total VKT given in Tables 7.2 and 7.5 respectively
b. New South Wales includes the Australian Capital Territory
c. South Australia includes the Northern Territory
d. Survey estimates.
e Since for each commercial vehicle type except articulated trucks low growth projections assume constant average VKT, the low projections for total commercial vehicles is for average VKT to remain approximately constant at the 1982 level

TABLE 7.5—PROJECTED TOTAL VEHICLE KILOMETRES TRAVELLED BY TOTAL COMMERCIAL VEHICLES BY STATE OF REGISTRATION, 1985 TO 2000

(millions)

Year ending 30 June	*New South Wales*[a]	*Victoria*	*Queensland*	*South Australia*[b]	*Western Australia*	*Tasmania*	*Australia*[c]
1972[d]	6 662	4 265	2 972	2 129	2 430	563	19 021
1982[d]	11 383	6 865	5 686	2 821	3 748	911	31 414
High growth projections[e]							
1985	13 058	7 681	6 595	3 016	4 479	989	35 815
1990	17 084	9 708	8 652	3 441	6 337	1 141	46 362
1995	21 931	12 029	11 285	3 889	8 661	1 303	59 098
2000	27 187	14 645	14 237	4 336	11 167	1 461	73 033
Median growth projections[f]							
1985	12 591	7 530	6 399	2 959	4 338	969	34 785
1990	15 596	9 171	7 975	3 268	5 789	1 086	42 884
1995	18 999	10 983	9 885	3 575	7 477	1 202	52 122
2000	22 407	12 935	11 865	3 861	9 168	1 307	61 543
Low growth projections[g]							
1985	12 285	7 376	6 215	2 898	4 201	950	33 922
1990	14 485	8 671	7 353	3 101	5 306	1 029	39 944
1995	16 753	10 023	8 654	3 286	6 488	1 105	46 310
2000	18 776	11 398	9 878	3 443	7 529	1 164	52 188

a New South Wales includes the Australian Capital Territory
b. South Australia includes the Northern Territory
c State figures may not add to the Australian total due to rounding
d. The sum of estimates of kilometres travelled by each vehicle type. The 1982 figure includes projections of kilometres travelled by other truck-type vehicles and buses
e. The sum of high growth projections of kilometres travelled by light commercial vehicles, rigid trucks and articulated trucks and median projections of kilometres travelled by other truck-type vehicles and buses.
f The sum of median projections of kilometres travelled by each vehicle type.
g. The sum of low growth projections of kilometres travelled by light commercial vehicles, rigid trucks and articulated trucks and median projections of kilometres travelled by other truck-type vehicles and buses.

TABLE 7.6—PROJECTED RATES OF GROWTH IN TOTAL VEHICLE KILOMETRES TRAVELLED BY TOTAL COMMERCIAL VEHICLES BY STATE OF REGISTRATION, 1982 TO 2000[a]

(per cent per annum)

Year ending 30 June	*New South Wales*[b]	*Victoria*	*Queensland*	*South Australia*[c]	*Western Australia*	*Tasmania*	*Australia*
1972-82[d]	5.5	4.9	6.7	2.9	4.4	4.9	5.1
High growth projections							
1982-85	4.7	3.8	5.1	2.3	6.1	2.8	4.5
1985-90	5.5	4.8	5.6	2.7	7.2	2.9	5.3
1990-95	5.1	4.4	5.5	2.5	6.4	2.7	5.0
1995-2000	4.4	4.0	4.8	2.2	5.2	2.3	4.3
Median growth projections							
1982-85	3.4	3.1	4.0	1.6	5.0	2.1	3.5
1985-90	4.4	4.0	4.5	2.0	5 9	2.3	4.3
1990-95	4.0	3.7	4.4	1.8	5.3	2.1	4.0
1995-2000	3.4	3.3	3.7	1.6	4.2	1.7	3.4
Low growth projections							
1982-85	2.6	2.4	3.0	0.9	3.9	1.4	2.6
1985-90	3.3	3 3	3.4	1.4	4.8	1.6	3.3
1990-95	3.0	2.9	3.3	1.2	4.1	1.4	3.0
1995-2000	2.3	2.6	2.7	0.9	3.0	1.0	2.4

a. Calculated from Table 7.5.
b. New South Wales includes the Australian Capital Territory.
c. South Australia includes the Northern Territory.
d. Estimates

CHAPTER 8—CONCLUDING REMARKS

The preceding chapters of this Paper have identified past trends in the size and usage of the vehicle fleet (both passenger and commercial segments) and developed projections of future demand, for Australia and each of the States. This chapter contains concluding remarks relating to the study as a whole in an attempt to bring together the main findings relating to the two road travel segments.

The numbers of passenger cars and commercial vehicles on register in Australia have been steadily increasing since the end of the Second World War reaching about 6.3 million passenger cars and 1.7 million commercial vehicles in 1981-82. Between 30 June 1972 and 1982, annual growth rates in the passenger car and commercial vehicle fleets averaged 4.3 per cent and 5.3 per cent respectively. Consequently, the commercial vehicle share of the total vehicle fleet increased slightly from about 19.5 per cent at the beginning of the period to just under 21 per cent at the end of it. Annual growth rates in these two fleets varied between the States during the study period. In general, annual growth rates in the passenger car and commercial vehicle fleets were highest in Queensland and Western Australia and lowest in South Australia and Tasmania.

For the commercial vehicle fleet (light commercial vehicles, rigid trucks, articulated trucks, other truck type vehicles and buses), there is, however, no evidence of any consistent growth in one vehicle type relative to another. The recent growth in new models in the light commercial range and the up-sizing of trucks seem to have occurred as a result of significant substitution within each of the five broad vehicle types rather than between types.

Total vehicle kilometres travelled (VKT) by passenger cars increased from less than 64 billion to over 96 billion between the two Survey of Motor Vehicle Usage years of 1971 and 1982 (an average annual growth rate of 3.8 per cent). Queensland recorded the highest growth in total VKT of all States, over 6 per cent per annum between 1971 and 1982. The lowest annual growth rates in total VKT for this period occurred in Victoria and South Australia (3 per cent each). It is important to note that while long distance travel is an important characteristic of the Australian way of life, short trips in urban areas comprise by far the major part of passenger car usage. The four Surveys of Motor Vehicle Usage in 1971, 1976, 1979 and 1982 consistently showed that passenger car travel within the urban areas (capital cities and provincial urban areas) accounted for about two-thirds of total travel, while only five per cent of car travel was outside the State of registration. Between the survey years of 1971 and 1979 private travel accounted for 57 per cent of VKT, business and paid work trips for 23 per cent and the remainder for unpaid work trips There appears, however, to be substantial private use of business registered cars.

Total vehicle kilometres travelled by the commercial vehicle fleet in Australia increased from about 19 billion in 1971-72, to more than 31 billion in 1981-82 (an average annual growth rate of nearly 5.1 per cent for the period). The highest average annual growth rate in total VKT was nearly 7 per cent recorded in Queensland, while the lowest was just under 3 per cent in South Australia. Utilisation of vehicles was generally higher for larger sized vehicles. The most notable increase in utilisation was for articulated trucks; average VKT for this type of vehicle rose from about 48 000 km in 1971 to more than 63 000 km in 1982. Disaggregation of the road freight task by area of operation varied little during the 1970s. Approximately half of the distance

travelled by light commercial vehicles and rigid trucks and about 30 per cent by articulated trucks was in urban areas.

For each of the two segments of road travel (passenger and commercial vehicles), aggregate demand models were estimated. Car ownership or the number of vehicles on register at the State level was modelled as a function of the purchase price and operating costs (including petrol) of the vehicle and a proxy for income. The method of ordinary least-squares was used to estimate elasticities of these variables using time-series data between 30 June 1963 and 1981 for the passenger car fleet, and between the financial years 1970-71 and 1980-81 for the commercial fleet. The second component of road travel (total vehicle kilometres travelled) was regarded as being determined by the fleet size, operating costs and State differences in average VKT. Again the ordinary least-squares method was used to estimate the parameters of this model by pooling the information provided by the ABS Surveys of Motor Vehicle Usage of 1971, 1976, 1979 and 1982.

The following conclusions can be drawn from the above empirical analyses:

- There is a need for greater emphasis to be given to modelling fleet usage (VKT), rather than modelling fleet size only. The approach followed represents a move towards this objective as it takes account of the simultaneous effect of fleet size and its usage.
- For passenger car fleet size, the estimated price elasticities of demand were less than unity in all States except Queensland. This implies that a given reduction in real car purchase price will result in a less than proportional increase in car ownership. For the major categories of commercial vehicles the models failed to provide statistically significant estimates of price and operating cost elasticities of demand.
- Estimates of the elasticity of the size of the passenger vehicle fleet with respect to income were less than one (inelastic) in all States except Victoria and Tasmania. By contrast, estimates of income elasticities for the major categories of commercial vehicles were generally greater than unity indicating strong sensitivity to changes in economic activity and production.
- For vehicle usage (VKT) models, the estimated coefficients of fleet size were statistically significant. For the number of passenger cars on register a coefficient of 0.8 was obtained. This suggests that an increase of 10 per cent in car numbers would be associated with an 8 per cent increase in total VKT (a decrease in average VKT as fleet size increases). For the major categories of commercial vehicles the estimates took values slightly greater than unity indicating the percentage growth in total VKT to be, on average, slightly greater than the percentage change in vehicles on register.

A model which was developed for non-bulk road freight movements on intercapital city routes between 1971 and 1981, showed that the demand response to road freight rates was inelastic. Slightly higher estimates of the price elasticity were obtained with respect to the ratio of road/rail freight rates indicating tonnes consigned to be fractionally more responsive to changes in this ratio than in the road freight rate only.

Different values were assigned to the explanatory variables in the projection period between 1985 and 2000, resulting in two scenarios (high growth and low growth) and two corresponding sets of projections (high and low respectively). Future vehicle ownership and its usage are expected to lie well within the two extremes of the high and low projections as they represent the cumulative effects of assuming that all the explanatory variables would change in a manner favourable (high growth) or unfavourable (low growth) to vehicle use.

Details of the high and low growth projections of total VKT by vehicle type and

their corresponding growth rates are summarised in Tables 8.1 to 8.4; for comparison, these tables include actual total VKT and growth rates in recent years. These rates are illustrated in Figure 8.1.

The results of the two sets of projections can be summarised as follows:

- A continued growth in road travel is expected over the projection period. The growth rates are expected to be higher in early years of the projection period (up to 1990) than in later years. This reflects a tapering-off in growth rates at higher levels of activity towards the end of this century.
- Utilisation levels of commercial vehicles (particularly articulated trucks) are anticipated to increase up to the year 2000.
- Passenger car ownership rates vary between States, particularly in the high growth scenario. For the high projections, car ownership rates by the year 2000 for Australia as a whole are expected to be similar to those currently prevailing in those States of the USA with the highest car ownership rates (about 0.7 vehicles per person).

The BTE did not have adequate information to separately project usage in urban and rural areas, but it is anticipated that the growth rate in usage will be higher in urban areas. The study revealed that for passenger cars, the price and income elasticities are usually less than unity. The cross-price elasticity between the demand for the private car and public transport is low indicating low rates of substitution between these two transport modes. For long-distance non-urban road travel, demand for air travel (both overseas and domestic) is responsive to price and income, and may become an increasingly important substitute for long distance road travel

TABLE 8 1—PROJECTED TOTAL VEHICLE KILOMETRES TRAVELLED BY COMMERCIAL VEHICLES BY VEHICLE TYPE AND STATE OF REGISTRATION UNDER THE HIGH GROWTH SCENARIO, 1982 TO 2000

(millions)

Vehicle type and year ending 30 June	*New South Wales*[a]	*Victoria*	*Queensland*	*South Australia*[b]	*Western Australia*	*Tasmania*	*Australia*
Cars and station wagons							
1982[c]	33 784	25 813	15 691	9 231	8 862	2 728	96 109
1985	41 259	30 381	20 579	10 678	11 707	3 433	118 036
1990	52 889	39 441	27 843	13 900	15 702	4 339	154 114
1995	67 325	50 941	37 217	17 973	20 823	5 491	199 770
2000	80 951	62 259	45 864	20 927	25 609	6 457	242 067
Light commercial vehicles							
1982[d]	6 182	3 012	3 887	1 557	2 041	557	17 237
1985	6 946	3 357	4 511	1 673	2 401	600	19 488
1990	8 761	4 167	5 927	1 935	3 302	685	24 777
1995	10 841	5 081	7 748	2 216	4 391	773	31 050
2000	12 997	6 090	9 779	2 497	5 525	858	37 746
Rigid trucks							
1982[d]	3 432	2 666	1 112	637	1 185	199	9 231
1985	4 052	2 964	1 259	665	1 443	214	10 597
1990	5 594	3 773	1 582	727	2 125	243	14 044
1995	7 522	4 708	1 979	790	3 004	274	18 277
2000	9 694	5 767	2 404	850	3 970	304	22 989
Articulated trucks							
1982[d]	1 110	802	458	391	304	92	3 157
1985	1 319	914	555	416	380	103	3 687
1990	1 847	1 210	796	471	588	126	5 038
1995	2 533	1 561	1 125	528	869	153	6 769
2000	3 300	1 983	1 524	585	1 191	180	8 763

TABLE 8 1(Cont)—PROJECTED TOTAL VEHICLE KILOMETRES TRAVELLED BY COMMERCIAL VEHICLES BY VEHICLE TYPE AND STATE OF REGISTRATION UNDER THE HIGH GROWTH SCENARIO, 1982 TO 2000

(millions)

Vehicle type and year ending 30 June	*New South Wales*[a]	*Victoria*	*Queensland*	*South Australia*[b]	*Western Australia*	*Tasmania*	*Australia*
Other truck-type vehicles							
1982[e]	212	124	55	85	76	19	570
1985	239	153	69	102	90	24	676
1990	286	207	95	133	114	32	867
1995	339	265	126	166	142	41	1 077
2000	393	327	161	199	172	49	1 301
Buses[c]							
1982	448	261	175	151	142	44	1 219
1985	501	293	202	159	165	48	1 367
1990	596	351	252	175	208	55	1 636
1995	696	413	307	190	256	63	1 925
2000	803	478	369	205	309	70	2 234
Total							
1982	45 167	32 678	21 377	12 052	12 610	3 639	127 524
1985	54 315	39 062	27 174	13 694	16 186	4 421	154 851
1990	69 973	49 149	36 495	17 341	22 038	5 480	200 475
1995	89 171	62 969	48 503	21 862	29 484	6 794	258 783
2000	108						
	138	81 207	60 101	25 263	36 776	7 919	319 404

a. New South Wales includes the Australian Capital Territory.
b South Australia includes the Northern Territory.
c Actual (ABS 1983l)
d. Estimates derived from ABS, unpublished preliminary figures for Survey of Motor Vehicle Usage, Twelve Months ended 30 September 1982.
e. Based on median projections (see Chapter 7)

Note: Figures may not add to totals due to rounding.

TABLE 8.2—PROJECTED RATES OF GROWTH IN TOTAL VEHICLE KILOMETRES TRAVELLED BY COMMERCIAL VEHICLES BY VEHICLE TYPE AND STATE OF REGISTRATION UNDER THE HIGH GROWTH SCENARIO, 1982 TO 2000

(per cent per annum)

Vehicle type and year ending 30 June	*New South Wales*[a]	*Victoria*	*Queensland*	*South Australia*[b]	*Western Australia*	*Tasmania*	*Australia*
Cars and station wagons							
1971-82[c]	3.5	3.0	6.1	3.0	4.6	3.8	3.8
1982-85	6.9	5.6	9.5	5.0	9.7	8.0	7.1
1985-90	5.1	5.4	6.2	5.4	6.0	4.8	5.5
1990-95	4.9	5.3	6.0	5.3	5.8	4.8	3.3
1995-2000	3.8	4.1	4 3	3.1	4.2	3.3	3.9
Light commercial vehicles							
1972-82[c]	4.6	4.0	6.1	3.6	3.3	5.1	4.6
1982-85	4.0	3.7	5.1	2.4	5.6	2.5	4.2
1985-90	4.8	4.4	5.6	2.9	6.6	2.7	4.9
1990-95	4.4	4.0	5.5	2.8	5.9	2.4	4.6
1995-2000	3.7	3.7	4.8	2.4	4.7	2.1	4.0
Rigid trucks							
1972-82[c]	6.8	4.8	7.6	0.8	6.3	3.8	5.6
1982-85	5.7	3.6	4.2	1.5	6.8	2.5	4.7
1985-90	6.7	4.9	4.7	1.8	8.0	2.6	5.8
1990-95	6.1	4.5	4.6	1.7	7.2	2.5	5.4
1995-2000	5.2	4.1	4.0	1.5	5.7	2.1	4.7
Articulated trucks							
1972-82[c]	7.2	7.0	9.1	1.5	5.9	5.0	6 2
1982-85	5.9	4.4	6.6	2.0	7.7	3.9	5.3
1985-90	7.0	5.8	7.5	2.5	9.1	4.3	6.4
1990-95	6.5	5.2	7.2	2.3	8.1	3.9	6.1
1995-2000	5.4	4.9	6.3	2.0	6.5	3.3	5.3

TABLE 8.2(Cont)—PROJECTED RATES OF GROWTH IN TOTAL VEHICLE KILOMETRES TRAVELLED BY COMMERCIAL VEHICLES BY VEHICLE TYPE AND STATE OF REGISTRATION UNDER THE HIGH GROWTH SCENARIO, 1982 TO 2000

(per cent per annum)

Vehicle type and year ending 30 June	*New South Wales*[a]	*Victoria*	*Queensland*	*South Australia*[b]	*Western Australia*	*Tasmania*	*Australia*
Other truck-type vehicles[d]							
1972-80[c]	7.1	25.1	9.4	21.6	6.0	29.5	11.7
1980-85	6.8	6.6	9.6	6.4	4.7	6.5	6.7
1985-90	3.7	6.1	6.8	5.4	5.0	6.1	5.1
1990-95	3.4	5.1	5.8	4.5	4.4	4.8	4.4
1995-2000	3.0	4.3	5.0	3.8	4.0	4.0	3.9
Buses[d]							
1972-80[c]	4.5	5.3	5.7	7 3	4.6	5.4	5.2
1980-85	4.4	5.5	6.1	0.7	5.0	1.3	4.4
1985-90	3.5	3.7	4.5	1.9	4.7	2.9	3.6
1990-95	3.2	3.3	4.1	1.7	4.2	2.6	3.3
1995-2000	2.9	3.0	3.7	1.5	3.8	2.3	3.0
Total							
1982-85	6.3	6.1	8.3	4.1	8.7	6.7	6.7
1985-90	5.2	4.7	6.1	4.8	6.4	4.4	5.3
1990-95	5.0	5.1	5.9	4.7	6.0	4.4	5.2
1995-2000	3.9	5 2	4.4	2.9	4.5	3.1	4.3

a. New South Wales includes the Australian Capital Territory
b. South Australia includes the Northern Territory.
c. Actual
d. Based on median projections (see Chapter 7)

TABLE 8.3—PROJECTED TOTAL VEHICLE KILOMETRES TRAVELLED BY COMMERCIAL VEHICLES BY VEHICLE TYPE AND STATE OF REGISTRATION UNDER THE LOW GROWTH SCENARIO, 1982 TO 2000

(millions)

Vehicle type and year ending 30 June	*New South Wales*[a]	*Victoria*	*Queensland*	*South Australia*[b]	*Western Australia*	*Tasmania*	*Australia*
Cars and station wagons							
1982[c]	33 784	25 813	15 691	9 231	8 862	2 728	96 109
1985	35 795	26 552	16 795	8 958	9 624	2 880	100 604
1990	39 984	28 493	19 661	9 549	10 776	3 194	111 657
1995	44 379	30 365	22 784	10 112	11 962	3 450	123 052
2000	48 980	32 186	26 162	10 642	13 168	3 767	134 905
Light commercial vehicles							
1982[d]	6 182	3 012	3 887	1 557	2 041	557	17 237
1985	6 588	3 237	4 250	1 591	2 267	576	18 509
1990	7 613	3 770	5 030	1 700	2 824	617	21 554
1995	8 640	4 321	5 926	1 797	3 409	655	24 748
2000	9 517	4 874	6 754	1 872	3 906	682	27 605
Rigid trucks							
1982[d]	3 432	2 666	1 112	637	1 185	199	9 231
1985	3 743	2 828	1 186	645	1 332	205	9 939
1990	4 508	3 310	1 350	670	1 702	218	11 758
1995	5 310	3 802	1 531	691	2 098	230	13 662
2000	6 028	4 300	1 691	707	2 442	238	15 406
Articulated trucks							
1982[d]	1 110	802	458	391	304	92	3 157
1985	1 213	865	509	400	347	97	3 431
1990	1 482	1 033	626	423	458	107	4 129
1995	1 768	1 222	764	443	584	117	4 898
2000	2 035	1 419	903	460	700	125	5 642

TABLE 8.3(Cont)—PROJECTED TOTAL VEHICLE KILOMETRES TRAVELLED BY COMMERCIAL VEHICLES BY VEHICLE TYPE AND STATE OF REGISTRATION UNDER THE LOW GROWTH SCENARIO, 1982 TO 2000

(millions)

Vehicle type and year ending 30 June	*New South Wales*[a]	*Victoria*	*Queensland*	*South Australia*[b]	*Western Australia*	*Tasmania*	*Australia*
Other truck-type vehicles[e]							
1982	212	124	55	85	76	19	570
1985	239	153	69	102	90	24	676
1990	286	207	95	133	114	32	867
1995	339	265	126	166	142	41	1 077
2000	393	327	161	199	172	49	1 301
Buses[e]							
1982	448	261	175	151	142	44	1 219
1985	501	293	202	159	165	48	1 367
1990	596	351	252	175	208	55	1 636
1995	696	413	307	190	256	63	1 925
2000	803	478	369	205	309	70	2 234
Total							
1982	45 167	32 678	21 377	12 052	12 610	3 639	127 524
1985	48 078	33 928	23 011	11 856	13 824	3 829	134 526
1990	54 469	37 164	27 014	12 649	16 082	4 221	151 599
1995	61 133	40 388	31 439	13 399	18 450	4 555	169 363
2000	67 756	43 584	34 518	14 085	20 697	4 932	185 571

a. New South Wales includes the Australian Capital Territory.
b. South Australia includes the Northern Territory.
c. Actual (ABS 1983i)
d. Estimates derived from ABS, unpublished preliminary figures for Survey of Motor Vehicle Usage, Twelve Months ended 30 September 1982.
e. Based on median projections (see Chapter 7)

Note: Figures may not add to totals due to rounding.

TABLE 8.4—PROJECTED RATES OF GROWTH IN TOTAL VEHICLE KILOMETRES TRAVELLED BY COMMERCIAL VEHICLES BY VEHICLE TYPE AND STATE OF REGISTRATION UNDER THE LOW GROWTH SCENARIO, 1982 TO 2000

(per cent per annum)

Vehicle type and year ending 30 June	*New South Wales*[a]	*Victoria*	*Queensland*	*South Australia*[b]	*Western Australia*	*Tasmania*	*Australia*
Cars and station wagons							
1971-82[c]	3.5	3.0	6.1	3.0	4.6	3.8	3.8
1982-85	1.9	0.9	2.3	-1.0	2.8	1.8	1.5
1985-90	2.2	1.4	3.2	1.3	2.3	2.1	2.1
1990-95	2.1	1.3	3.0	1.2	2.1	1.6	2.0
1995-2000	2.0	1.2	2.8	1.0	1.9	1.8	1.9
Light commercial vehicles							
1972-82[c]	4.6	4.0	6.1	3.6	3.3	5.1	4.6
1982-85	2.1	2.4	3.0	0.7	3.6	1.1	2.4
1985-90	2.9	3.1	3.4	1.3	4.5	1.4	3.1
1990-95	2.6	2.8	3.3	1.1	3.8	1.2	2.8
1995-2000	2.0	2.4	2.6	0.8	2.8	0.8	2.2
Rigid trucks							
1972-82[c]	6.8	4.8	7.6	0.8	6.3	3.8	5.6
1982-85	2.9	2.0	2.2	0.4	4.0	1.0	2.5
1985-90	3.8	3.2	2.6	0.7	5.0	1.2	3.4
1990-95	3.3	2.8	2.5	0.6	4.3	1.1	3.0
1995-2000	2.6	2.5	2.0	0.5	3.1	0.7	2.4
Articulated trucks							
1972-82[c]	7.2	7.0	9.1	1.5	5.9	5.0	6.2
1982-85	3.0	2.6	3.6	0.7	4.5	1.8	2.8
1985-90	4.1	3.6	4.2	1.1	5.7	2.1	3.8
1990-95	3.6	3.4	4.0	1.0	5.0	1.8	3.5
1995-2000	2.9	3.0	3.4	0.7	3.7	1.4	2 9

TABLE 8.4(Cont)—PROJECTED RATES OF GROWTH IN TOTAL VEHICLE KILOMETRES TRAVELLED BY COMMERCIAL VEHICLES BY VEHICLE TYPE AND STATE OF REGISTRATION UNDER THE LOW GROWTH SCENARIO, 1982 TO 2000

(per cent per annum)

Vehicle type and year ending 30 June	*New South Wales*[a]	*Victoria*	*Queensland*	*South Australia*[b]	*Western Australia*	*Tasmania*	*Australia*
Other truck-type vehicles[d]							
1972-80[c]	7.1	25.1	9.4	21.6	6.0	29.5	11.7
1980-85	6.8	6.6	9.6	6.4	4.7	6.5	6.7
1985-90	3.7	6.1	6.8	5.4	5.0	6.1	5.1
1990-95	3.4	5.1	5.8	4.5	4.4	4.8	4.4
1995-2000	3.0	4.3	5.0	3.8	4.0	4.0	3.9
Buses[d]							
1972-80[c]	4.5	5.3	5.7	7.3	4 6	5.4	5.2
1980-85	4.4	5.5	6.1	0.7	5.0	1.3	4.4
1985-90	3.5	3.7	4.5	1.9	4.7	2.9	3.6
1990-95	3.2	3.3	4.1	1.7	4.2	2.6	3.3
1995-2000	2.9	3.0	3.7	1.5	3.8	2.3	3.0
Total							
1982-85	2.1	1.3	2.5	-0.8	3.1	1.7	1.8
1985-90	2.5	1.8	3.3	1.3	3.1	2.0	2.4
1990-95	2.3	1.7	3.1	1.2	2.8	1.5	2.2
1995-2000	2.1	1.5	1.9	1.0	2.3	1.6	1.8

a New South Wales includes the Australian Capital Territory
b South Australia includes the Northern Territory.
c Actual.
d Based on median projections (see Chapter 7).

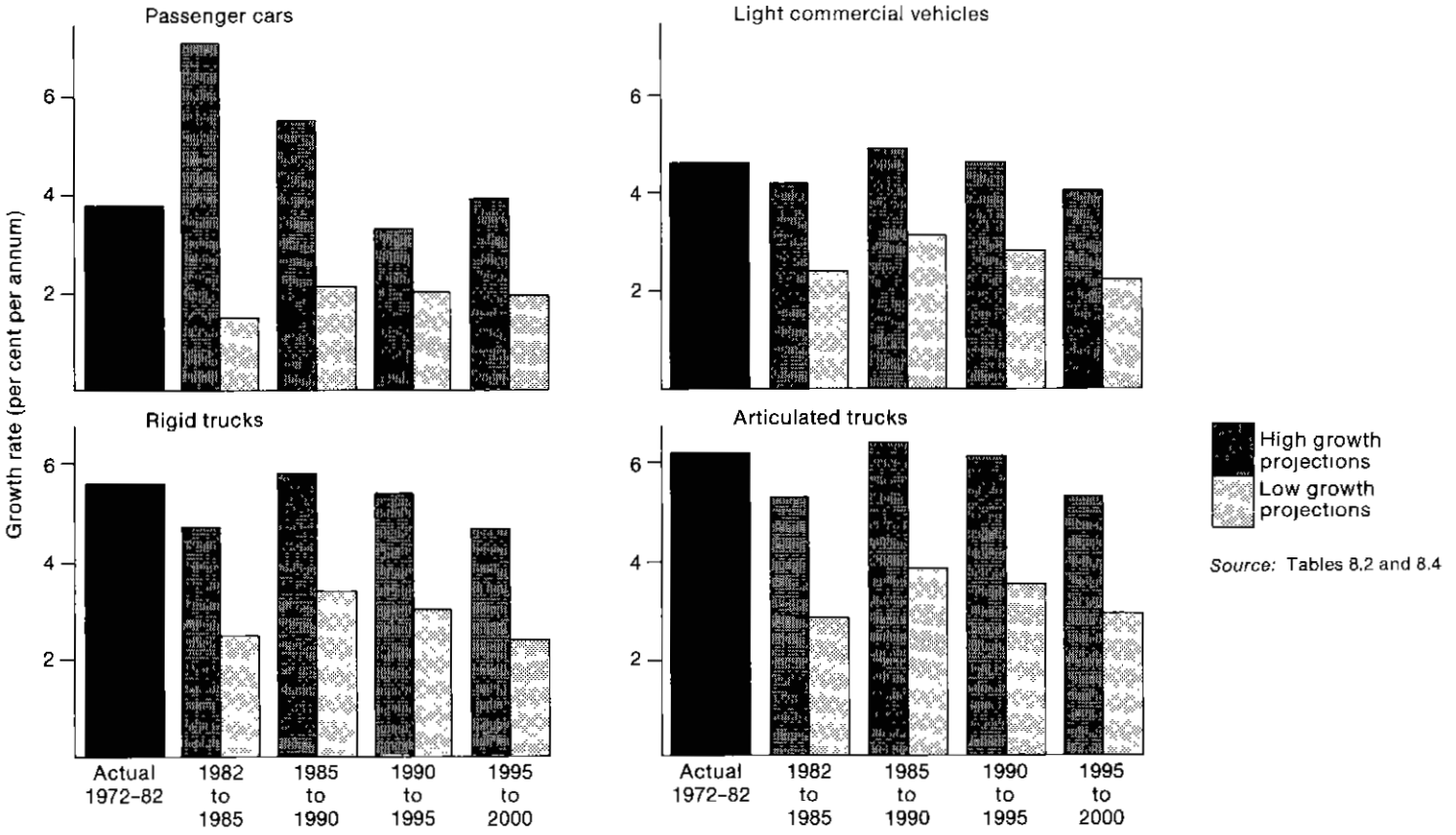

Figure 8.1—Projected rates of growth in total vehicle kilometres travelled by passenger cars, light commercial vehicles, rigid trucks and articulated trucks; Australia, 1982 to 2000

APPENDIX I—SOME IMPORTANT CHARACTERISTICS OF THE AUSTRALIAN POPULATION AND CAR OWNERSHIP (1976 AND 1981)

This appendix contains a number of detailed tables reporting some important characteristics of the Australian population and car ownership by State using the 1976 and 1981 Censuses of Population and Housing data. The information provided in these tables was used to support inferences made about specific issues of the passenger car segment.

TABLE I.2—SUMMARY OF 1976 AND 1981 CENSUS DATA, VICTORIA

Characteristic	Melbourne		South Gippsland		North		Murray and West		Geelong		East Gippsland		Total	
	1976	*1981*	*1976*	*1981*	*1976*	*1981*	*1976*	*1981*	*1976*	*1981*	*1976*	*1981*	*1976*	*1981*
Total population	2 638 173	2 762 521	117 609	129 693	192 920	206 775	463 393	483 346	181 007	192 195	52 174	55 813	3 471 648	3 830 343
Population above 15 years	1 936 391	2 090 876	81 493	92 757	133 840	147 997	329 740	353 919	129 787	142 278	36 648	40 593	2 647 899	2 868 420
Number of households	823 656	904 868	34 270	39 375	54 878	62 370	137 780	152 353	55 096	62 314	15 604	17 657	1 121 284	1 238 937
Number of households having[a]														
No cars	141 582	135 381	3 248	3 390	5 576	5 493	16 372	15 973	7 022	7 215	1 596	1 516	175 396	168 968
One car	374 662	389 029	16 826	16 311	25 844	25 985	60 914	61 385	26 152	27 436	7 652	7 804	512 050	527 958
Two or more cars	272 498	349 415	13 180	18 636	22 172	29 414	57 010	71 720	20 422	26 294	5 970	7 829	391 252	503 308
Not stated	35 106	31 041	1 022	1 036	1 306	1 478	3 544	3 287	1 516	1 367	386	508	42 880	38 717
Number of people														
In workforce	1 215 382	1 306 450	51 086	59 435	84 501	93 024	196 203	120 448	75 024	82 032	22 162	24 211	1 644 358	1 775 600
Unemployed	43 198	70 847	2 342	2 402	4 326	5 444	9 127	13 300	4 253	6 118	1 099	1 471	64 345	99 582

TABLE I.2(Cont)—SUMMARY OF 1976 AND 1981 CENSUS DATA, VICTORIA

Characteristic	Melbourne		South Gippsland		North		Murray and West		Geelong		East Gippsland		Total	
	1976	1981	1976	1981	1976	1981	1976	1981	1976	1981	1976	1981	1976	1981
Population density (persons per km^2)	238 5	249.7	11 1	12.3	4 7	5 0	3 7	3 8	22.2	23.5	1.7	1.9	15 3	16.8
Number of cars per person[b]	0.35	0 39	0.37	0.41	0.36	0.41	0.38	0.42	0.37	0.42	0.38	0.42	0 37	0 40
Number of cars per household[b]	1.12	1.20	1.26	1.36	1 28	1.36	1.27	1.34	1.22	1.28	1 26	1.33	1.15	1.24

a. These figures relate to the number of cars for occupied private dwellings only.
b. Households with two or more cars are assumed to have only two cars for the purpose of calculating car ownership levels Households not stating their level of car ownership are not taken into account in the calculations

Source· ABS, Censuses of Population and Housing, 1976 and 1981, Local Government Areas Summary File on magnetic tape.

TABLE I.3—SUMMARY OF 1976 AND 1981 CENSUS DATA, QUEENSLAND

	Brisbane/ Gold Coast		*Darling Downs and Wide Bay-Burnett*		*South-west*		*Fitzroy/Mackay/ Townsville*		*Northern*		*Total*	
Characteristic	*1976*	*1981*	*1976*	*1981*	*1976*	*1981*	*1976*	*1981*	*1976*	*1981*	*1976*	*1981*
Total Population	1 170 980	1 360 970	307 409	312 227	82 957	81 296	348 893	392 069	124 661	146 084	2 034 900	2 292 646
Population above 15 years	856 155	1 028 696	218 263	228 162	56 125	57 854	245 095	284 703	87 601	106 097	1 463 239	1 705 512
Number of households	360 228	436 614	89 230	93 860	21 352	21 095	94 200	107 774	32 948	38 878	597 958	698 221
Number of households[a] having												
No cars	55 594	59 121	10 962	10 146	2 808	2 414	11 198	10 608	5 072	5 010	85 634	87 299
One car	166 238	189 747	41 632	39 785	9 782	8 234	43 570	44 737	15 106	16 251	276 328	298 754
Two or more cars	123 822	175 347	34 150	41 762	7 728	9 265	36 114	48 796	11 292	15 654	213 106	290 824
Not stated	14 672	12 414	2 528	2 167	1 036	1 185	3 344	3 633	1 492	1 965	23 072	21 364
Number of people												
In work-force	504 640	599 385	128 651	132 968	38 727	28 935	151 795	177 944	52 967	62 867	876 780	1 012 099
Unemployed	23 718	36 909	5 328	7 141	1 750	1 731	5 938	9 845	3 538	4 683	40 272	60 309
Population density (persons per km^2)	55 0	63 9	2 1	2 2	0.1	0.1	1 2	1.3	0.5	0.5	1.2	1 3
Number of cars per person[b]	0 35	0 40	0 36	0.39	0.30	0 33	0 33	0.36	0.30	0 33	0 35	0 38
Number of cars per household[b]	1.15	1 24	1.23	1.31	1 18	1 27	1 23	1.32	1.14	1 22	1 17	1.26

a. These figures relate to the number of cars for occupied private dwellings only

b Households with two or more cars are assumed to have only two cars for the purpose of calculating car ownership levels Households not stating their level of car ownership are not taken into account in the calculations

Source. ABS, Censuses of Population and Housing, 1976 and 1981, Local Government Areas Summary File on magnetic tape.

TABLE I.4—SUMMARY OF 1976 AND 1981 CENSUS DATA, SOUTH AUSTRALIA AND THE NORTHERN TERRITORY

Character-istic	Adelaide		Mid-north		Murray and South-east		Eyre		Remainder of South Australia		Northern Territory		Total	
	1976	1981	1976	1981	1976	1981	1976	1981	1976	1981	1976	1981	1976	1981
Total population	900 434	931 886	53 684	55 443	175 826	186 940	32 466	33 138	80 983	76 675	97 090	123 324	1 340 483	1 407 406
Population above 15 years	671 980	720 014	38 475	41 184	124 945	137 250	22 361	23 359	55 714	55 717	65 104	84 887	978 579	1 062 411
Number of households	289 274	320 168	16 536	18 169	53 174	60 367	9 076	10 081	22 352	23 364	22 862	29 043	413 274	461 192
Number of households[a] having														
No cars	43 158	46 077	1 674	1 650	4 142	4 083	710	709	2 622	2 912	3 955	4 181	56 261	59 612
One car	139 144	149 466	7 358	7 857	22 700	24 608	3 654	3 834	11 358	11 096	9 094	11 782	193 308	208 643
Two or more cars	100 126	117 543	7 204	8 303	25 350	30 591	4 514	5 314	7 596	8 811	7 269	10 470	152 059	181 032
Not stated	6 922	7 079	306	358	992	1 080	200	214	784	546	2 567	2 615	11 771	11 892
Number of people														
In work-force	408 881	428 790	23 940	24 980	81 646	87 993	15 633	15 745	36 007	35 607	44 527	58 740	610 634	651 855
Unemployed	14 655	35 630	629	1 429	2 367	4 793	404	920	1 494	2 754	1 452	2 862	21 001	48 388

TABLE I.4(Cont)—SUMMARY OF 1976 AND 1981 CENSUS DATA, SOUTH AUSTRALIA AND THE NORTHERN TERRITORY

Character-istic	Adelaide		Mid-north		Murray and South-east		Eyre		Remainder of South Australia		Northern Territory		Total	
	1976	1981	1976	1981	1976	1981	1976	1981	1976	1981	1976	1981	1976	1981
Population density (persons per km^2)	388 1	401.7	1.3	1.3	2 7	2.9	0 8	0.8	0.1	0 1	0.1	0.1	0 6	0.6
Number of cars per person[b]	0 38	0.41	0.40	0.44	0.41	0 46	0.39	0.44	0.33	0.37	0.24	0.26	0.37	0.41
Number of cars per household[b]	1.17	1.20	1.31	1.34	1.38	1 42	1.40	1 43	1.19	1.23	1.03	1.13	1.20	1.24

a. These figures relate to the number of cars for *occupied private dwellings only*.

b. Households with two or more cars are assumed to have only two cars for the purpose of calculating car ownership levels. Households not stating their level of car ownership are not taken into account in the calculations.

Source: ABS, Censuses of Population and Housing, 1976 and 1981, Local Government Areas Summary File on magnetic tape.

TABLE I.5—SUMMARY OF 1976 AND 1981 CENSUS DATA, WESTERN AUSTRALIA

Characteristic	Perth		South-west		Pilbara		Kimberly		Goldfields and Midlands		Total	
	1976	1981	1976	1981	1976	1981	1976	1981	1976	1981	1976	1981
Total population	805 744	898 918	228 675	247 462	38 687	47 284	15 130	19 296	53 953	58 596	1 142 171	1 271 556
Population above 15 years	585 277	673 057	157 628	176 532	26 749	33 443	10 178	13 568	36 874	41 937	816 706	938 537
Number of households	248 486	298 134	65 354	75 945	7 196	10 577	2 318	3 578	13 304	15 388	336 658	403 622
Number of households[a] having												
No cars	33 188	35 878	5 322	5 405	510	630	584	1 056	1 750	1 920	41 354	44 889
One car	111 230	123 902	27 648	28 887	3 996	4 928	880	1 179	6 264	6 276	150 018	165 172
Two or more cars	97 838	131 448	30 854	39 984	2 328	4 548	694	1 038	4 830	6 530	136 544	183 548
Not stated	6 292	6 905	1 564	1 650	364	471	164	305	468	662	8 852	9 993
Number of people												
In work-force	357 309	414 883	104 223	114 184	20 597	24 704	6 304	8 647	23 578	27 479	512 011	589 897
Unemployed	15 729	28 128	2 838	5 532	600	1 252	322	562	810	1 559	20 299	37 033

APPENDIX II—TRENDS AND CHARACTERISTICS OF THE COMMERCIAL VEHICLE FLEET: SUPPLEMENTARY STATISTICAL TABLES

This appendix includes a number of the more detailed tables referred to in Chapter 5. Some of these tables were used in the empirical analyses described in Chapter 6 and others were used to support inferences made in Chapter 5 about specific aspects of the commercial vehicle fleet.

The first part of the appendix gives detailed vehicle registration statistics used in the empirical analyses of commercial vehicle fleet size. The structure of the bus fleet is then considered followed by a description of 'derived' estimates of total vehicle kilometres travelled used in the analyses of commercial vehicle usage. Finally, a table of tonnes consigned and tonne-kilometres performed, summarises the size of the road freight task performed by commercial vehicles since the early 1970s. For a discussion of the contents of the tables, see Chapter 5.

COMMERCIAL VEHICLE REGISTRATIONS

Tables II.1. and II.2 describe the number of commercial vehicles on register for Australia between 1944-45 and 1981-82 and commercial vehicles on register by State of registration between 1971-72 and 1981-82.

THE STRUCTURE OF THE BUS FLEET

The discussion in Chapter 5 indicated that the bus fleet was rapidly changing both in size and structure. In particular, the discussion attributed the decline in average bus utilisation to the rapid increase in micro-bus registrations, on the premise that micro-buses have lower rates of utilisation than the larger buses in government and commercially operated bus fleets. This section presents a selection of statistics which support these observations.

The bus fleet may be disaggregated into three categories:

- buses used in fleets operated by government and municipal authorities;
- buses used in other commercially operated fleets; and
- privately used micro-buses.

Tables II.3 and II.4 describe the number of buses operated by government and municipal authorities and the total distance travelled by these vehicles during the period 1968-69 to 1978-79. These figures were used to derive the estimates of average annual kilometres travelled per bus given in Table II.5.

Tables II.3 and II.4 indicate that, relative to the growth in other commercial vehicle types, the size and usage of government bus fleets has increased only slowly. Between 1969 and 1979, the number of buses and the total distance travelled by government buses both increased by approximately 20 per cent. However, Table II.5 indicates a higher average annual utilisation than most other commercial vehicles with the annual distance travelled by government buses varying between 30 000 and 50 000 kilometres per vehicle.

Unfortunately, statistics describing the utilisation of buses used in other commercial fleets and privately used micro-buses, are less readily available. Some estimates

have been obtained from the 1979 Survey of Motor Vehicle Usage which, together with the corresponding 1979 figures from Tables II.3 to II.5, are given in Table II.6.

At 30 September 1979, privately used micro-buses represented 27 per cent of the total bus fleet. While buses in government and commercially operated bus fleets travelled an average 32 800 kilometres in 1979, privately used micro-buses travelled an average 16 600 kilometres. The lower private usage of micro-buses is comparable with the average utilisation of 17 000 kilometres per annum of other light commercial vehicles (see Table 5.3).

TABLE II.1—TOTAL NUMBER OF COMMERCIAL VEHICLES ON REGISTER; AUSTRALIA, AS AT 30 JUNE 1945 TO 1982[a]

As at 30 June	*Number ('000)*	*Annual growth (per cent)*
1945	290.5	6.1
1946	333.1	14.7
1947	377.9	13.4
1948	418.8	10.8
1949	456.7	9.0
1950	506.1	10.8
1951	555.4	9.7
1952	587.6	5.8
1953	586.6	-0.2
1954	611.2	4.2
1955	654.3	7.1
1956	693.2	6.0
1957	710.3	2.5
1958	731.0	2.9
1959	755.0	3.3
1960	784.1	3.9
1961	800.0	2.0
1962	814.6	1.8
1963	832.1	2.1
1964	846.2	1.7
1965	858.0	1.4
1966	867.8	1.1
1967	880.0	1.4
1968	891.8	1.3
1969	911.4	2.2
1970	937.5	2.9
1971	961.1	2.5
1972	995.7	3.6
1973	1 041.1	4.6
1974	1 090.1	4.7
1975	1 140.2	4.6
1976	1 215.0	6.6
1977	1 279.6	5.3
1978	1 359.9	6.3
1979	1 412.7	3.9
1980	1 462.4	3.5
1981	1 544.3	5.6
1982	1 661.5	7.6

a Light commercial vehicles, rigid trucks, articulated trucks, other truck-type vehicles and buses

Source: ABS, personal communication

TABLE II.2—NUMBER OF COMMERCIAL VEHICLES ON REGISTER BY VEHICLE TYPE BY STATE OF REGISTRATION, AS AT 30 JUNE 1972 TO 1982

('000)

As at 30 June	New South Wales[a]	Victoria	Queensland	South Australia[b]	Western Australia	Tasmania	Australia
1972							
Light commercial	179.7	139.8	105.4	48.9	57.0	18.7	549.5
Rigid trucks	134.1	81.3	63.6	45.1	41.0	12.8	377.9
Articulated trucks	11.7	9 6	4.7	3.3	2.8	0.8	32.7
Other trucks	3.3	3.5	0.5	1.9	1.1	0.1	10.4
Buses	9.1	5.4	3.4	3.0	2.7	1.4	25.0
Total	337.9	239.6	177.6	102.2	104.6	33.8	995.7
1973							
Light commercial	189.1	146.1	111.2	50.8	58.5	19.2	574.9
Rigid trucks	141.1	84.9	67.1	46.4	42.0	13.1	394.6
Articulated trucks	12.2	10.0	5.0	3.5	2.8	0.8	34 3
Other trucks	3.5	3.7	0.4	2.2	1.3	0.1	11.2
Buses	9.8	5.8	3.3	3 0	2.8	1.4	26.1
Total	355.7	250 5	187.0	105.9	107.4	34.8	1 041.1
1974							
Light commercial	196.7	154.2	116.8	53.1	61.5	19.6	601.9
Rigid trucks	146.8	89.6	70.5	48.0	44.3	13.4	412.6
Articulated trucks	12.7	10.6	5.2	3.9	3.0	0.8	36.2
Other trucks	3.6	3.9	0.6	2.5	1.3	0.1	12.0
Buses	10.5	6.3	3.4	3.2	2.6	1.4	27.4
Total	370.3	264.6	196.5	110.7	112.7	35.3	1 090.1

TABLE II.2(Cont)—NUMBER OF COMMERCIAL VEHICLES ON REGISTER BY VEHICLE TYPE BY STATE OF REGISTRATION, AS AT 30 JUNE 1972 TO 1982

('000)

As at 30 June	New South Wales[a]	Victoria	Queensland	South Australia[b]	Western Australia	Tasmania	Australia
1975							
Light commercial	204.5	163.5	119.0	55.1	68.3	20.2	630.6
Rigid trucks	152.4	95.0	71.8	47.7	49.1	13.9	429.9
Articulated trucks	13.3	11.2	5.3	3.9	3.3	0.9	37.9
Other trucks	3.7	4.2	0.6	3.0	1.4	0.1	13.0
Buses	11.3	6.7	3.3	3.2	2.9	1.5	28.9
Total	385.2	280.6	200.0	112.9	125.0	36.6	1 140.2
1976							
Light commercial	211.5	170.5	134.1	58.0	76.4	21.5	672.0
Rigid trucks	157.6	99.1	80.9	49.3	55.0	14.8	456.7
Articulated trucks	13.6	11.7	6.0	5.0	3.7	0.9	40.9
Other trucks	3.9	4.3	0.7	3.7	1.6	0.2	14.4
Buses	11.9	7.2	3.5	3.4	3.3	1.7	31.0
Total	398.5	292.8	225.2	119.4	139.0	39.1	1 215.0
1977							
Light commercial	261.1	156.2	181.1	74.8	94.4	26.0	793.6
Rigid trucks	122.5	120.1	45.6	40.1	46.8	10.5	385.6
Articulated trucks	13.3	9.7	6.1	6.1	3.7	1.2	40.1
Other trucks	8.6	5.2	3.1	4.5	4.6	1.1	27.1
Buses	12.5	7.7	3.9	3.6	3.8	1.7	33.2
Total	418.0	298.9	239.8	129.1	153.3	40.5	1 279.6

TABLE II.2(Cont)—NUMBER OF COMMERCIAL VEHICLES ON REGISTER BY VEHICLE TYPE BY STATE OF REGISTRATION, AS AT 30 JUNE 1972 TO 1982

('000)

As at 30 June	New South Wales[a]	Victoria	Queensland	South Australia[b]	Western Australia	Tasmania	Australia
1978							
Light commercial	275.9	166.2	196.7	78.8	102.6	26 4	846.6
Rigid trucks	128.0	127.2	47.2	40.6	51.2	10.6	404.6
Articulated trucks	13.6	10.2	6.4	6.0	3.9	1.3	41.4
Other trucks	10.2	6.3	3.3	5 1	5.3	1.1	31.4
Buses	13.4	8.5	4.4	3.7	4.1	1.8	35.9
Total	441.1	318.4	258.0	134.2	167.1	41.2	1 359.9
1979							
Light commercial	286.1	170.6	208.9	80.4	106.3	27.3	879.7
Rigid trucks	135.2	131.9	48.6	40.5	53.9	10.9	420.9
Articulated trucks	14.5	10.6	6.9	5.3	4.0	1.4	42.8
Other trucks	10.2	6.2	3.2	5.1	5.6	1.4	31.8
Buses	13.8	8.9	4.8	3.7	4.3	1.9	37.4
Total	459.8	328.2	272.4	135.0	174.1	42 9 1	412.7
1980							
Light commercial	292.5	166.0	225.0	81.8	109.3	30.3	904.8
Rigid trucks	146.5	130.5	50.1	41.7	56.1	11.8	436.5
Articulated trucks	16.2	10.5	7.5	4.8	4.3	1.4	44.7
Other trucks	10.8	10.1	3.5	5.2	5.8	2.0	37.4
Buses	14.2	9.1	5.2	3.9	4.5	2.0	39.0
Total	480.2	326.2	291.3	137.4	180.0	47.5	1 462.4

TABLE II.2(Cont)—NUMBER OF COMMERCIAL VEHICLES ON REGISTER BY VEHICLE TYPE BY STATE OF REGISTRATION, AS AT 30 JUNE 1972 TO 1982

('000)

As at 30 June	New South Wales[a]	Victoria	Queensland	South Australia[b]	Western Australia	Tasmania	Australia
1981							
Light commercial	308.7	170.9	246.6	86.5	113.0	31.0	956.7
Rigid trucks	154.5	136.8	53.4	43.1	59.2	12.0	458.9
Articulated trucks	16.6	11.1	8.2	4.9	4.5	1.4	46.7
Other trucks	11.7	10.5	4.0	5.6	6.1	2.1	39.9
Buses	15.5	9.9	5.9	3.9	4.8	2.0	42.0
Total	507.0	339.2	318.1	144.0	187.6	48.5	1 544.3
1982							
Light commercial	339.2	181.4	266.8	91.4	117.3	32.7	1 028.7
Rigid trucks	165.6	149.5	56.6	44.7	64.1	12.4	492.9
Articulated trucks	17.4	12.2	8.8	5.1	4.8	1.5	49.8
Other trucks	13.3	11.7	4 4	5.9	6.2	2.2	43.7
Buses	17.0	11.5	6.7	3.9	5.1	2.0	46.3
Total	552.5	366.4	343.3	151.0	197.4	50.8	1 661.5

a. New South Wales includes the Australian Capital Territory
b South Australia includes the Northern Territory

Note Figures may not add to totals due to rounding

Source. ABS, personal communication

TABLE II.3--NUMBER OF BUSES OPERATED BY GOVERNMENT AND MUNICIPAL AUTHORITIES BY STATE OR TERRITORY, AS AT 30 JUNE 1969 TO 1979[a]

As at 30 June	New South Wales	Victoria	Queensland	South Australia	Western Australia	Tasmania	Northern Territory	Australian Capital Territory	Australia
1969	1 777	283	663	333	726	274	25	129	4 210
1970	1 815	277	703	344	772	278	28	128	4 345
1971	1 890	273	666	376	795	283	24	152	4 459
1972	1 864	272	607	396	823	283	29	163	4 437
1973	1 850	272	602	376	855	283	28	176	4 442
1974	1 824	272	610	659[b]	852	286	28	230	4 761
1975	1 854	295	610	683	861	302	29	280	4 914
1976	1 854	279	552	715[c]	884	315	33	363	4 995
1977	1 708	279	565	723	903	304	31	384	4 897
1978	1 738	305	576	817	923	300	31	360	5 050
1979	1 719	299	572	838	933	304	31	374	5 070

a Includes stock held in reserve or idle.
b Increase due to Metropolitan Transport Trust takeover of all but three private metropolitan bus companies.
c. Increase due to Bus and Tram Division (formerly Metropolitan Transport Trust) of the State Transport Authority takeover of a further two private bus companies

Source ABS (1981d)

TABLE II.4—TOTAL VEHICLE KILOMETRES TRAVELLED BY BUSES OPERATED BY GOVERNMENT AND MUNICIPAL AUTHORITIES BY STATE OR TERRITORY, YEARS ENDING 30 JUNE 1969 TO 1979

('000)

Year ending 30 June	*New South Wales*	*Victoria*	*Queensland*	*South Australia*	*Western Australia*	*Tasmania*	*Northern Territory*	*Australian Capital Territory*	*Australia*
1969	72 573	11 425	14 920	16 515	34 572	8 436	1 205	4 584	164 230
1970	71 735	11 142	23 768	16 478	37 345	8 739	1 094	5 021	175 322
1971	71 510	11 294	22 891	16 712	39 254	8 766	1 215	5 407	177 049
1972	65 747	11 190	21 123	16 663	40 127	8 647	1 239	6 033	170 769
1973	67 024	11 882	20 809	16 794	40 023	8 382	1 179	6 774	172 867
1974	67 052	11 923	20 836	21 799[a]	40 163	8 618	1 312	7 999	179 702
1975	65 900	12 027	19 790	30 819	41 000	9 145	929	8 453	188 063
1976	63 908	12 681	19 061	32 513[b]	41 533	9 487	1 032	9 896	190 131
1977	63 028	12 762	19 303	33 772	41 800	9 617	920	10 800	192 002
1978	63 468	12 874	20 452	35 075	42 171	9 872	949	12 800	197 661
1979	65 181	12 879	20 749	36 634	42 048	9 562	1 149	13 491	201 693

a. Increase due to Metropolitan Transport Trust takeover of *all but three private metropolitan bus companies.*
b. Increase due to Bus and Tram Division (formerly Metropolitan Transport Trust) of the State Transport Authority takeover of a further two private bus companies.

Source: ABS (1981d).

TABLE II.5—AVERAGE ANNUAL VEHICLE KILOMETRES TRAVELLED BY BUSES OPERATED BY GOVERNMENT AND MUNICIPAL AUTHORITIES BY STATE OR TERRITORY, YEARS ENDING 30 JUNE 1969 TO 1979

('000)

Year ending 30 June	*New South Wales*	*Victoria*	*Queensland*	*South Australia*	*Western Australia*	*Tasmania*	*Northern Territory*	*Australian Capital Territory*	*Australia*
1969	40.8	40.4	22.5	49.6	47.6	30.8	48.2	35.5	39.0
1970	39.5	40.2	33.8	47.9	48.3	31.4	39.1	39.2	40.4
1971	37.8	41.4	34.4	44.4	49.4	31.0	50.6	35.6	39.7
1972	35.3	41.1	34.8	42.1	48.8	30.6	42.7	37.0	38.5
1973	36.2	43.7	34.6	44.7	46.8	29.6	42.1	38.5	38.9
1974	36.8	43.8	34.2	33.1[a]	47.1	30.1	46.9	34.8	37.7
1975	35.5	40.8	32.4	45.1	47.6	30.3	32.0	30.2	38.3
1976	34.5	45.5	34.5	45.5	47.0	30.1	31.3	27.3	38.1
1977	36.9	45.7	34.2	46.7	46.3	31.6	29.7	28.1	39.2
1978	36.5	42.2	35.5	42.9	45.7	32.9	30.6	35.6	39.1
1979	37.9	43.1	36.3	43.7	45.1	31.5	37.1	36.1	39.8

a. Attributed to Metropolitan Transport Trust takeover of all but three private metropolitan bus companies

Sources: Tables II.3 and II.4.

TABLE II.6—BUS USAGE BY FLEET TYPE BY STATE OR TERRITORY, 1979[a]

Fleet type	*New South Wales*	*Victoria*	*Queensland*	*South Australia*	*Western Australia*	*Tasmania*	*Northern Territory*	*Australian Capital Territory*	*Australia*
Total annual kilometres (millions)									
Commercial	227.1	149.2	98.7	83.4	59.4	23.3	7.9	5.1	654.2
Government	65.2	12.9	20.7	36.6	42.0	9.6	1.1	13.5	201.7
Private	59.5	48.1	14.4	13.7	14.9	6.8	0.1	5.1	162.7
Total	351.8	210.2	133.8	133.7	116.3	39.7	9.1	23.7	1018.1
Number of buses									
Commercial	7 327	5 215	3 206	1 611	2 269	1 008	235	112	20 983
Government	1 719	299	572	838	933	304	31	374	5 070
Private	3 420	3 025	873	895	847	466	11	277	9 814
Total	12 466	8 539	4 651	3 344	4 049	1 778	277	763	35 867
Average annual kilometres ('000)									
Commercial	31.1	28.8	31.2	51.8	26.6	23.2	34.7	45.4	31.4
Government	37.9	43.1	36.3	43.7	45.1	31.5	37.1	36.1	39.8
Private	17.4	15.9	16.5	15.3	17.6	14.6	8.6	18.3	16.6
Overall average	28.2	24.6	28.8	40.0	28.7	22.3	33.0	31.0	28.4

a Buses have been categorised according to usage
- Commercial—buses used for commercial purposes excluding all buses operated by government or municipal authorities;
- Government—buses operated by government and municipal authorities; and
- Private—privately used micro-buses Statistics for the commercial and private fleet types relate to the year ending 30 September 1979, while statistics for government buses are for the year ending 30 June 1979.

Note: Figures may not add to totals due to rounding

Sources: ABS (1981d and 1981e).

Finally, a trend towards the purchase of micro-buses for private purposes is supported by the following table describing recent levels of new bus registrations.

Table II.7 indicates that, since 1980, purchases of 'large' buses (24 or more seats) have declined while purchases of smaller buses have almost doubled (to more than 3200 vehicles per annum or approximately 80 per cent of total new bus registrations).

Consequently, the combination of high rates of new micro-bus sales and low rates of utilisation have led to a gradual reduction in the average utilisation of the total bus fleet. Further reductions are likely should the trend towards greater private ownership of micro-buses be maintained

TABLE II.7—NEW BUS REGISTRATIONS BY SEATING CAPACITY, YEARS ENDING 31 DECEMBER 1980 TO 1982

Year ending 31 December	*Buses with up to 23 seats*	*Buses with 24 or more seats*	*Total bus registrations*
1980	1 854	1 067	2 921
1981	2 534	830	3 364
1982	3 236	896	4 132

Source: ADAPS, reported in Truck and Bus Transportation (1983)

TOTAL VEHICLE KILOMETRES TRAVELLED BY COMMERCIAL VEHICLES

This section derives estimates of total vehicle kilometres travelled, classified by type of commercial vehicle and state of registration, that are consistent with the vehicle registration data reported in Table II.2, and Survey of Motor Vehicle Usage estimates of average annual kilometres travelled given in Table 5.3. These estimates enable the empirical analyses of the number of vehicles on register to be linked with analyses of total vehicle kilometres travelled described in Chapter 6.

Survey estimates of the total number of kilometres travelled by all vehicles in each of the categories of light commercial, rigid trucks, articulated trucks, other truck-type vehicles and buses during the four years ending 30 September 1971, 1976, 1979 and 1982, are given in Table II.8.

Caution needs to be exercised when comparing estimates from one Survey with another. A comparison of Table II.8 with the vehicle registration data given above reveals significant differences between movements in total VKT and the number of vehicles on register. For example, the 1982 preliminary estimate of total kilometres travelled by light commercial vehicles registered in Western Australia is 10 per cent lower than the 1979 estimate. However, over the same three year period the number of light commercial vehicles registered in Western Australia increased by 10 per cent.

While differences of this nature may be partly due to actual changes in vehicle usage (such as changes in the average distance travelled per vehicle and the number of vehicles used in States other than their State of registration) many of the inconsistencies between survey estimates of total VKT and vehicle registration data appear to be due to the introduction of changes to the vehicle classifications used. Previous discussion has referred to a major reclassification of the vehicle registration data undertaken in 1976. However, it is also apparent that with each successive Survey, a number of changes to the vehicle classifications used in the Survey have been implemented. Generally these have had a relatively minor effect on the major commercial vehicle categories. However, Table II.8 indicates that the effect on the category of other truck-type vehicles has been much more significant. In either case, it is important to realise that the above estimates of total kilometres travelled from different survey years are not necessary comparable.

TABLE II.8—TOTAL VEHICLE KILOMETRES TRAVELLED BY COMMERCIAL VEHICLES BY VEHICLE TYPE AND STATE OF REGISTRATION, YEARS ENDING 30 SEPTEMBER 1971, 1976, 1979 AND 1982

(millions)

Year ending 30 September	*New South Wales*[a]	*Victoria*	*Queensland*	*South Australia*[b]	*Western Australia*	*Tasmania*	*Australia*
Light commercial[c]							
1971	2 966.2	2 085.9	1 397.4	754.3	1 113.5	249.9	8 567.3
1976	4 038.5	3 311.9	2 021.5	1 089.5	1 477.3	351.2	12 289.9
1979	5 177.4	3 307.3	3 460.5	1 430.2	2 118.6	434.0	15 928.0
1982p	5 801.7	3 480.1	3 686.2	1 499.5	1 913.0	570.8	16 951.2
Rigid trucks[d]							
1971	2 175.2	1 374.5	857.3	703.2	715.9	175.4	6 001.4
1976	1 875.4	1 379.7	1 352.2	551.2	724.8	148.5	6 031.8
1979	2 227.5	1 538.9	687.9	502.7	713.6	166.5	5 837.2
1982p	3 298.9	1 909.7	1 303.3	634.9	1 073.3	197.2	8 417.2
Articulated trucks[e]							
1971	533.9	462.2	171.7	200.7	164.0	39.5	1 572.1
1976	693.4	484.7	202.3	387.8	167.0	69.7	2 005.0
1979	946.5	646.6	337.6	392.0	202.8	82.0	2 607.4
1982p	1 031.1	757.5	449.6	400.5	275.2	85.5	2 999.5
Other truck-type vehicles[f]							
1971	41.8	25.6	7.0	7.0	12.1	1.0	94.4
1976	129.2	66.4	122.7	41.9	45.4	14.5	420.2
1979	149.9	105.6	40.6	74.8	65.7	20.3	456.9
1982p	112.0	47.9	32.5	26.7	13.5	4.5	237.1
Buses[g]							
1971	242.7	139.0	94.6	78.9	73.9	27.5	656.8
1976	na	na	na	na	na	na	na
1979	375.5	210.2	133.8	142.8	116.3	39.7	1 018.1
1982	na	na	na	na	na	na	na

TABLE II.8(Cont)—TOTAL VEHICLE KILOMETRES TRAVELLED BY COMMERCIAL VEHICLES BY VEHICLE TYPE AND STATE OF REGISTRATION, YEARS ENDING 30 SEPTEMBER 1971, 1976, 1979 AND 1982

(millions)

Year ending 30 September	*New South Wales*[a]	*Victoria*	*Queensland*	*South Australia*[b]	*Western Australia*	*Tasmania*	*Australia*
Total commercial							
1971	5 959.8	4 087.2	2 528.0	1 744.1	2 079.4	493.3	16 892.0
1976	na	na	na	na	na	na	na
1979	8 876.8	5 808.6	4 660.4	2 542.5	3 217.0	742.6	25 847.5
1982	na	na	na	na	na	na	na

a New South Wales includes the Australian Capital Territory.
b South Australia includes the Northern Territory
c In the 1971 survey, utilities, panel vans, ambulances, hearses and rigid trucks with carrying capacity less than 1 ton were classified as light commercial vehicles In later surveys, vehicles were classified solely on the basis of the body type recorded by the registration authorities.
d. The 1971 average of kilometres travelled by rigid trucks is based on distances travelled by all rigid trucks with a carrying capacity of 1 ton or more and all articulated trucks with a carrying capacity of under 8 tons
e In 1971, the average distance travelled is calculated over all articulated trucks with a carrying capacity of 8 tons or more.
f Ambulances and hearses, classified as light commercial vehicles in the 1971 survey, were included as other truck-type vehicles in the later surveys. Major changes to this category were also implemented with the 1982 Survey.
g. Kilometres travelled by privately used buses and bus fleets not operating at least one bus for hire and reward in 1976 are not available Estimates for 1982 are also not available.
p. preliminary
na not available

Sources· ABS (1973b, 1978, 1981d, 1981e, 1981f) and unpublished preliminary figures for Survey of Motor Vehicle Usage, Twelve Months ended 30 September 1982

In addition to the lack of consistency over time, Surveys of Motor Vehicle Usage yield estimates of the number of vehicles in use which are often significantly different from the number of vehicles on register, and relate to the year ending 30 September rather than to the year ending 30 June, as do the vehicle registration data.

Therefore, a second set of estimates of total VKT was derived. These were calculated as the product of the number of vehicles on registers at 30 June 1972, 1977, 1980 and 1982[1] and Survey estimates of average vehicle kilometres travelled during the years ending 30 September 1971, 1976, 1979 and 1982 respectively.

This procedure, based on vehicle registration data rather than survey estimates of vehicles in use, was repeated for each type of vehicle fleet registered in each State. In this manner, estimates of total VKT were derived which reflected both the average level of vehicle usage and the number of vehicles on register. To achieve consistency with the 1977, 1980 and 1982 estimates of total VKT, the numbers of vehicles on registers at 30 June 1972 were adjusted so as to conform with the vehicle classifications introduced in 1976.

'Derived' estimates of the total number of kilometres travelled during the years ended 30 June 1972, 1977, 1980 and 1982 are given in Table II.9.

THE AUSTRALIAN ROAD FREIGHT TASK

Table II.10 indicates the number of tonnes consigned and tonne-kilometres performed by commercial vehicles, classified by vehicle type and State of registration during the years ending 30 September 1971, 1976, 1979 and 1982.

1. At the time of writing, the numbers of various commercial vehicle types on register at 30 June 1983 were not available.

TABLE II.9—ESTIMATES OF TOTAL VEHICLE KILOMETRES TRAVELLED BY COMMERCIAL VEHICLES BY VEHICLE TYPE AND STATE OF REGISTRATION, YEARS ENDING 30 JUNE 1972, 1977, 1980 AND 1982

(millions)

Year ending 30 June	*New South Wales*[a]	*Victoria*	*Queensland*	*South Australia*[b]	*Western Australia*	*Tasmania*	*Australia*[c]
Light commercial							
1972[d]	3 938.0	2 025.8	2 127.1	1 098.4	1 481.1	337.5	11 007.9
1977	4 294.5	2 924.5	3 153.9	1 139.6	1 577.5	366.1	13 456.1
1980	4 982.2	2 785.9	3 663.1	1 417.8	2 041.1	443.2	15 333.3
1982p	6 182.4	3 012.3	3 887 0	1 557 3	2 040.5	557.4	17 236.9
Rigid trucks							
1972[d]	1 783.5	1 664.2	536.0	588.6	642.0	136.6	5 350.9
1977	1 968.2	1 924.7	682.0	583.8	800.1	161.4	6 120.2
1980	2 637.0	2 238.2	721.4	596.1	924.1	181.0	7 297.8
1982p	3 432 1	2 666.1	1 111.6	636.9	1 184.9	198.9	9 230.5
Articulated trucks							
1972[d]	557.8	408.2	192.3	338.7	171.9	56.3	1 725.2
1977	697.6	446.8	219.8	433.2	183.3	58.1	2 038.8
1980	962.1	644.4	357.9	371.8	222.7	80.5	2 639.4
1982[e]	1 110.2	801.9	457.9	391.4	303.9	91.5	3 156.8
Other truck-type vehicles							
1972[d]	99.4	18.6	21.1	15.7	44.6	2.2	201.6
1977	142.8	61.4	58.0	51.5	50.1	11.8	375.6
1980	171.6	111.3	43.4	75.0	71.3	17.4	490.0
1982[e]	211.5	124.0	54.6	85.0	76.3	19.1	570.4
Buses[f]							
1972	283.0	148.5	96.2	87.6	90.5	29.3	735.1
1977	na	na	na	na	na	na	na
1980	403.3	223 9	149.8	153.7	129.2	44.6	1 104.5
1982[e]	447.6	260.5	174.5	150.9	141.7	44.0	1 219.2

TABLE II.9(Cont)—ESTIMATES OF TOTAL VEHICLE KILOMETRES TRAVELLED BY COMMERCIAL VEHICLES BY VEHICLE TYPE AND STATE OF REGISTRATION, YEARS ENDING 30 JUNE 1972, 1977, 1980 AND 1982

(millions)

Year ending 30 June	*New South Wales*[a]	*Victoria*	*Queensland*	*South Australia*[b]	*Western Australia*	*Tasmania*	*Australia*[c]
Total commercial[g]							
1972[d]	6 661.7	4 265.3	2 972.7	2 129.0	2 430.1	561.9	19 020.7
1977	na	na	na	na	na	na	na
1980	9 156.2	6 003.7	4 935.6	2 614.4	3 388.4	766.7	26 865.0
1982p	11 383.8	6 864.8	5 685.6	2 821.5	3 747.3	910.9	31 413.8

a New South Wales includes the Australian Capital Territory.
b. South Australia includes the Northern Territory
c Australian kilometres travelled are the sum of the six State estimates.
d. Adjusted estimate based on an estimate of the number of vehicles on register adjusted to conform to post-1976 classifications of vehicle type.
e. Estimate obtained from the analysis discussed in this Paper (see Chapter 7 and Tables VI.20 and VI.21 in Appendix VI).
f. The size of the bus fleet was not significantly altered by the classification changes implemented in 1976. Hence, an adjustment to the estimates of kilometres travelled by buses during the year ending 30 June 1972 was not required.
g. Total commercial vehicle kilometres travelled are the sum of the five vehicle-type estimates.
p preliminary
na not available

Note: Figures may not add to totals due to rounding.

Source: BTE estimates.

TABLE II.10—TONNES CONSIGNED AND TONNE-KILOMETRES PERFORMED BY VEHICLE TYPE AND STATE OF REGISTRATION, YEARS ENDING 30 SEPTEMBER 1971, 1976, 1979 AND 1982

State of registration and vehicle type	Tonnes (millions)				Tonne-kilometres (millions)			
	1971	1976	1979	1982	1971	1976	1979	1982
New South Wales[a]								
Light commercial	12	18	17	na	385	535	640	867
Rigid trucks	183	161	192	na	3 859	4 036	4 643	6 215
Articulated trucks	65	89	122	na	5 408	7 912	11 508	13 708
Total	261	268	331	315	9 652	12 483	16 790	20 790
Victoria								
Light commercial	8	13	18	na	286	460	438	419
Rigid trucks	106	98	120	na	2 408	2 715	3 499	3 664
Articulated trucks	52	44	60	na	4 173	4 974	7 542	9 699
Total	167	155	197	174	6 867	8 149	11 480	13 782
Queensland								
Light commercial	4	4	16	na	113	200	647	583
Rigid trucks	78	88	87	na	1 343	1 683	1 959	2 651
Articulated trucks	21	32	43	na	1 506	1 980	3 983	5 619
Total	103	124	146	217	2 961	3 862	6 590	8 853
South Australia[b]								
Light commercial	2	5	7	na	98	163	186	171
Rigid trucks	67	60	58	na	1 640	1 475	1 485	1 498
Articulated trucks	17	24	32	na	2 229	5 762	5 534	6 393
Total	87	89	97	98	3 967	7 400	7 205	8 062
Western Australia								
Light commercial	3	6	8	na	132	189	261	308
Rigid trucks	57	60	74	na	1 360	1 787	1 965	2 177
Articulated trucks	20	22	25	na	1 719	1 735	2 425	3 881
Total	80	88	106	113	3 211	3 710	4 652	6 366

TABLE II.10(Cont)—TONNES CONSIGNED AND TONNE-KILOMETRES PERFORMED BY VEHICLE TYPE AND STATE OF REGISTRATION, YEARS ENDING 30 SEPTEMBER 1971, 1976, 1979 AND 1982

State of registration and vehicle type	*Tonnes (millions)*				*Tonne-kilometres (millions)*			
	1971	*1976*	*1979*	*1982*	*1971*	*1976*	*1979*	*1982*
Tasmania								
Light commercial	1	1	2	na	24	30	59	69
Rigid trucks	16	19	20	na	350	389	452	495
Articulated trucks	7	12	14	na	313	677	896	949
Total	24	32	35	33	687	1 095	1 407	1 513
Australia								
Light commercial	31	48	66	na	1 038	1 576	2 232	2 418
Rigid trucks	508	486	550	na	10 960	12 084	14 004	16 701
Articulated trucks	182	223	296	na	15 347	23 040	31 888	40 248
Total	721	756	913	950	27 344	36 701	48 124	59 367

a. New South Wales includes the Australian Capital Territory
b South Australia includes the Northern Territory.
na not available

Note Figures may not add to totals due to rounding.

Sources. ABS (1973b, 1978, 1981f and 1983l).

APPENDIX III—DERIVATION OF THE ECONOMIC ACTIVITY INDICATOR

Several techniques of summarising the six 'production variables' (value of retail sales, farm production, work done on dwellings and other buildings, minerals and construction materials, plus value added in manufacturing) were considered and applied to the data in each State.

In the first instance, factor analysis was used. It provided a good summary of the data in the first two factors (linear combinations of the 'production variables'). These two factors generally explained between 80 and 90 per cent of the total variability in the data. However, while able to explain a large proportion of the information in the data, 'production factors' did not correlate well with vehicles on register That is, although providing a good summary of the data, factors failed to isolate those aspects of activity in the six sectors which had an impact on the size of the commercial vehicle fleet Each 'production variable' is an aggregate measure of activity in the corresponding sector and hence is influenced by changes in a variety of social and economic conditions. Therefore, changes in its value are the net outcome of a large number of interacting effects, so that the variable contains a wealth of information, much of which is irrelevant to that sector's usage of road transport. Hence, the 'production factors' estimated by factor analysis were not considered suitable for inclusion in models of vehicles on register as indicators of economic activity.

A second approach to combining the variables used canonical correlation analysis to give further insight into the relationship between the level of economic activity and vehicles on register. In general, a canonical correlation analysis considers the relationship between two sets of variables, one of which may be dependent on the other but not necessarily so. The analysis derives linear combinations (canonical variates) of the variables in each set such that the (canonical) correlation between the variates is maximised. In this study, the first canonical variate was derived from the six 'production variables' while the second variate represented the number of vehicles on register.

Unlike factor analysis, canonical correlation analysis does not attempt to summarise the total information content of the 'production variables'. Rather, the canonical variate attempts to explain as much as possible of the variance in vehicles on register, using only that part of the information contained in each 'production variable' which is relevant to road transport (as measured by changes in vehicle fleet size). That is, a linear combination (or canonical variate) of the six 'production variables' was derived which best fitted vehicles on register. The estimated coefficients of the variate indicate the relative weightings to be given to each 'production variable' (the degree of influence exerted by each sector on the size of the commercial vehicle fleet).

The canonical variates generally accounted for almost all (92 to 99 per cent) of the variance in vehicles on register. The number and type of 'production variables' with significant weightings varied between States. While providing some insight into the relationship between the 'production variables', the canonical variate failed to recognise the impact of ABS vehicle classification changes and cost factors on fleet size Nevertheless, the analysis gave an indication of how suitable linear functions of the 'production variables' might be derived and used in a regression model.

Finally, the procedure of stepwise regression, with vehicles on register as the dependent variable, was used to develop the required indicator of economic activity.

Building up from the most general model (describing the number of vehicles on register by its average level during the study period), the effect of the ABS classification change on the registration data was removed by the addition of a dummy variable (taking a positive value for the years 1972 to 1976, but having a zero value thereafter). The variance in vehicles on register left unexplained by this simple two part model was then calculated. Those 'production variables' which gave a statistically significant fit to this 'residual' were then combined to form the indicator of economic activity for the corresponding State and vehicle type. The indicator formed by this process is conceptually similar to the production factors described above, although, like the canonical variates, more selective use is made of the information contained in the 'production variables'.

The above procedure was continued to complete the formulation of a model of vehicles on register. That is, following the stepwise inclusion of the dummy variable and derived indicator of economic activity, the residual variance in vehicles on register was again calculated. Any of the production variables not represented in the indicator and variables describing vehicle purchase and operating costs were added to the model if they explained a significant proportion of the model's residual. The process was repeated until the residual was reduced to the extent that no further statistically significant explanatory variables existed.

Variables added to the model in this second stage of development have been termed 'secondary variables'. The few secondary production variables added to the models explained only a very small proportion (1 to 2 per cent) of the variance in the number of vehicles on register.

APPENDIX IV—ESTIMATION OF COMMERCIAL VEHICLE DEMAND MODELS

This appendix presents the statistical results obtained from the estimation of empirical models described in Chapter 6. These results were used to derive the forecasts included in this Paper. The models attempted to represent the functional relationship between the demand for road travel for commercial purposes (indicated by the number of commercial vehicles on register or total kilometres travelled by commercial vehicles) and income/production levels, population and vehicle purchase and operating costs. Results from the estimation of three forms of model discussed in Chapter 6 are given in this appendix[1]. These relate:

- an indicator of economic activity and an index of average vehicle purchase costs to the number of light commercial vehicles, rigid trucks or articulated trucks on register (Model 4 of Chapter 6);
- population and a time dependent variable t (representing changes in 'community' income) to the number of buses or other truck-type vehicles on register (Model 5 of Chapter 6); and
- the number of vehicles and an index of average vehicle operating costs to total kilometres travelled by light commercial vehicles, rigid trucks and articulated trucks (Model 6 of Chapter 6).

Except for buses, models of the number of vehicles on register also included a dummy variable to reflect changes in ABS vehicle classification procedures introduced in 1976.

Models of the number of vehicles on register were estimated for each State and Australia, from 10 years of time-series data covering the period 30 June 1972 to 1981 inclusive. While also yielding estimates at the State level, models of total VKT were estimated from pooled data, namely, estimates of total kilometres travelled by vehicles registered in each of the six States of Australia during 4 years between 1972 and 1982. VKT models were estimated separately for each of the three major types of commercial vehicles (light commercial vehicles, rigid trucks and articulated trucks) using the estimates of total VKT derived in Appendix II (see Table II.9).

The equations developed from each of these three forms of model are presented below[2]. The following abbreviations are used:

LCV	the number of light commercial vehicles on register ('000),
RT	the number of rigid trucks on register ('000),
AT	the number of articulated trucks on register,
OTTV	the number of other truck-type vehicles on register,
BU	the number of buses on register,
VLCV	the total number of kilometres travelled by light commercial vehicles (millions),

1. Estimation results for the other model described in this Paper, relating to long distance road freight, are given in Table V.1

2. The values in brackets indicate the significance of coefficient estimates (or in repeated samples, the probability of coefficient estimates being statistically significant). Each gives the upper tail probability associated with the 't' statistic equal to the absolute value of the coefficient estimate divided by its standard error. R^2 is a measure of the explanatory power of the equations.

VRT	the total number of kilometres travelled by rigid trucks (millions),
VAT	the total number of kilometres travelled by articulated trucks (millions),
DV	a dummy variable with value one for the first 5 years of the estimation period and zero thereafter,
I_X	a dummy variable taking the value one in State 'X' and zero elsewhere,
t	the 't'th year in the estimation period (t=1 in 1972),
IEA_X	the indicator of economic activity for State 'X',
RFP	the gross value of farm production (1979-80 $m),
RHB	the value of work done on dwellings (1979-80 $m),
POP	the size of the population ('000 persons),
NSW	New South Wales
VIC	Victoria
QLD	Queensland
SA	South Australia
WA	Western Australia
TAS	Tasmania
AUST	Australia

NUMBER OF VEHICLES ON REGISTER

Light commercial vehicles

NSW: $\ln LCV = \underset{(.001)}{-5.83} - \underset{(.000)}{0.25}\ DV + \underset{(.000)}{1.22}\ \ln IEA_{NSW},\ R^2 = 0.99$

VIC: $\ln LCV = \underset{(.000)}{-15.46} + \underset{(0.014)}{0.06}\ DV + \underset{(.000)}{1.62}\ \ln IEA_{VIC} + \underset{(.001)}{0.53}\ \ln RFP + \underset{(.002)}{0.30}\ \ln RHB,\ R^2 = 0.98$

QLD: $\ln LCV = \underset{(.159)}{-3.59} - \underset{(.000)}{0.44}\ DV + \underset{(.006)}{0.98}\ \ln IEA_{QLD},\ R^2 = 0.97$

SA: $\ln LCV = \underset{(.109)}{-4.22} - \underset{(.000)}{0.39}\ DV + \underset{(.007)}{1\ 02}\ \ln IEA_{SA},\ R^2 = 0.98$

WA: $\ln LCV = \underset{(.014)}{-6.72} - \underset{(.001)}{0.28}\ DV + \underset{(.001)}{1.31}\ \ln IEA_{WA},\ R^2 = 0.98$

TAS: $\ln LCV = \underset{(.239)}{-3.01} - \underset{(.000)}{0.27}\ DV + \underset{(.030)}{0.56}\ \ln IEA_{TAS},\ R^2 = 0.95$

AUST: $\ln LCV = \underset{(.008)}{-7.70} - \underset{(.000)}{0.21}\ DV + \underset{(.000)}{1.22}\ \ln IEA_{AUST} + \underset{(.082)}{0.18}\ \ln RFP,\ R^2 = 0.99$

Rigid trucks

NSW: $\ln RT = \underset{(.001)}{-11\ 02} + \underset{(.000)}{0.24}\ DV + \underset{(.000)}{1.51}\ \ln IEA_{NSW} + \underset{(.068)}{0.18}\ \ln RFP,\ R^2 = 0.96$

VIC: $\ln RT = \underset{(.002)}{-15.14} - \underset{(.000)}{0.24}\ DV + \underset{(.000)}{1.66}\ \ln IEA_{VIC} + \underset{(.004)}{0.47}\ \ln RFP + \underset{(.024)}{0.21}\ \ln RHB,\ R^2 = 0.99$

QLD: $\ln RT = \underset{(.075)}{-2.96} + \underset{(.000)}{0.48}\ DV + \underset{(.002)}{0.75}\ \ln IEA_{QLD},\ R^2 = 0.97$

SA. $\ln RT = \underset{(.337)}{-1.08} + \underset{(.000)}{0.15}\ DV + \underset{(.003)}{0.57}\ \ln IEA_{SA},\ R^2 = 0.96$

WA: $\ln RT = \underset{(.003)}{-8.67} + \underset{(.078)}{0.10}\ DV + \underset{(.000)}{1.46}\ \ln IEA_{WA},\ R^2 = 0.91$

TAS: $\ln RT = \underset{(.127)}{-3.33} + \underset{(.000)}{0.27}\ DV + \underset{(.020)}{0.51}\ \ln IEA_{TAS},\ R^2 = 0.90$

AUST: $\ln RT = \underset{(.007)}{-7.51} + \underset{(.003)}{0.13}\ DV + \underset{(.000)}{1.16}\ \ln IEA_{AUST} + \underset{(.109)}{0.15}\ \ln RFP,\ R^2 = 0.91$

Articulated trucks

NSW: $\ln AT = \underset{(.093)}{-3.63} - \underset{(.425)}{0.02}\ DV + \underset{(.000)}{1.39}\ \ln IEA_{NSW},\ R^2 = 0.94$

VIC: $\ln AT = \underset{(.013)}{-10.42} + \underset{(.002)}{0.14}\ DV + \underset{(.000)}{1.65}\ \ln IEA_{VIC} + \underset{(.038)}{0.20}\ \ln RHB + \underset{(.007)}{0.45}\ \ln RFP,\ R^2 = 0.94$

QLD: $\ln AT = \underset{(.939)}{-0.18} - \underset{(.034)}{0.14}\ DV + \underset{(.005)}{0.99}\ \ln IEA_{QLD},\ R^2 = 0.91$

SA: $\ln AT = \underset{(.006)}{-5.01} - \underset{(.000)}{0.44}\ DV + \underset{(.000)}{0.67}\ \ln IEA_{SA},\ R^2 = 0.96$

WA: $\ln AT = \underset{(.064)}{-3.78} - \underset{(.376)}{0.04}\ DV + \underset{(.000)}{1.40}\ \ln IEA_{WA},\ R^2 = 0.96$

TAS: $\ln AT = \underset{(.737)}{-0.51} - \underset{(.000)}{0.37}\ DV + \underset{(.001)}{0.68}\ \ln IEA_{TAS},\ R^2 = 0.99$

AUST: $\ln AT = \underset{(.071)}{-3.86} - \underset{(.622)}{0.01}\ DV + \underset{(.000)}{1.22}\ \ln IEA_{AUST} + \underset{(.053)}{0.19}\ \ln RFP,\ R^2 = 0.97$

Other truck-type vehicles

NSW: $\frac{OTTV}{POP} = \underset{(.000)}{1.45} - \underset{(.000)}{0.92}\ DV + \underset{(.016)}{0.061}\,t,\ R^2 = 0.99$

VIC: $\frac{OTTV}{POP} = \underset{(.040)}{0.50} + \underset{(.000)}{0.19}\,t,\ R^2 = 0.80$

QLD: $\frac{OTTV}{POP} = \underset{(.000)}{1.21} - \underset{(.000)}{1.06}\ DV + \underset{(.021)}{0.041}\,t,\ R^2 = 0.99$

SA: $\frac{OTTV}{POP} = \underset{(.001)}{1.87} - \underset{(.060)}{0.53}\ DV + \underset{(.001)}{0.218}\,t,\ R^2 = 0.97$

WA: $\frac{OTTV}{POP} = \underset{(.000)}{3.31} - \underset{(.000)}{2.53}\ DV + \underset{(.005)}{0.136}\,t,\ R^2 = 0.99$

TAS: $\frac{OTTV}{POP} = \underset{(.449)}{0.86} - \underset{(.068)}{1.61}\ DV + \underset{(.031)}{0.351}\,t,\ R^2 = 0.93$

AUST: $\frac{OTTV}{POP} = \underset{(.001)}{1.32} - \underset{(.002)}{0.79}\ DV + \underset{(.003)}{0.125}\,t,\ R^2 = 0.98$

Buses

NSW: $\frac{BU}{POP} = \underset{(.000)}{1.78} + \underset{(.000)}{0.104}\,t,\ R^2 = 0.99$

VIC: $\frac{BU}{POP} = \underset{(.000)}{1.38} + \underset{(.000)}{0.113}\ t,\ R^2 = 0.99$

QLD: $\frac{BU}{POP} = \underset{(.000)}{1.40} + \underset{(.000)}{0.096}\ t,\ R^2 = 0.77$

SA: $\frac{BU}{POP} = \underset{(.000)}{2.22} + \underset{(.000)}{0.054}\ t,\ R^2 = 0.94$

WA: $\frac{BU}{POP} = \underset{(.000)}{2.13} + \underset{(.000)}{0.158}\ t,\ R^2 = 0.90$

TAS: $\frac{BU}{POP} = \underset{(.000)}{3.25} + \underset{(.000)}{0.154}\ t,\ R^2 = 0.93$

AUST: $\frac{BU}{POP} = \underset{(.000)}{1.73} + \underset{(.000)}{0.107}\ t,\ R^2 = 0.99$

TOTAL VEHICLE KILOMETRES TRAVELLED

Light commercial vehicles

$$\ln VLCV = \underset{(.000)}{2.413} + \underset{(.854)}{0.01}\ I_{VIC} - \underset{(.180)}{0.09}\ I_{QLD} + \underset{(.701)}{0.04}\ I_{SA} + \underset{(.168)}{0.13}\ I_{WA} + \underset{(.877)}{0.03}\ I_{TAS} + \underset{(.000)}{1.078}\ \ln LCV,\ R^2 = 0.99$$

Rigid trucks

$$\ln VRT = \underset{(.005)}{2.011} - \underset{(.592)}{0.04}\ I_{VIC} + \underset{(.835)}{0.03}\ I_{QLD} + \underset{(.976)}{0.01}\ I_{SA} + \underset{(.310)}{0.15}\ I_{WA} + \underset{(.417)}{0.27}\ I_{TAS} + \underset{(.000)}{1.177}\ \ln RT,\ R^2 = 0.99$$

Articulated trucks

$$\ln VAT = \underset{(.000)}{2.975} + \underset{(.187)}{0.12}\ I_{VIC} + \underset{(.709)}{0.04}\ I_{QLD} + \underset{(.000)}{0.69}\ I_{SA} + \underset{(.006)}{0.53}\ I_{WA} + \underset{(.004)}{0.94}\ I_{TAS} + \underset{(.000)}{1.390}\ \ln AT,\ R^2 = 0.99$$

APPENDIX V—INTERCAPITAL CITY NON-BULK ROAD FREIGHT MODELS

The intercapital city non-bulk road freight task is an important component of the total road freight task performed by heavy commercial vehicles. In 1982 approximately one-fifth of all road tonne-kilometres were performed on interstate routes (ABS 1983l) This appendix presents empirical models for this type of road freight, which indicate the effects of changes in income and road and rail freight rates on the number of tonnes consigned.

MODEL(S) SPECIFICATION

The main objective is to model tonnes of non-bulk freight consigned between 10 pairs of five capital cities[1] (Sydney, Melbourne, Brisbane, Adelaide and Perth). Freight movements to and from Tasmania's capital city were excluded in view of the multimodal nature of the journey. Similarly, freight movements to and from the cities of Darwin and Canberra were not taken into account because of their minor nature

In view of the relatively small amount of freight transported between Perth and the other four capitals, and between Brisbane and Adelaide, two models were specified. The first applies to the five major city pairs[2], while the second relates to the total 10 city pairs[3].

Tonnes of non-bulk freight consigned between capital cities may depend on several factors such as road freight rates (reflecting the effect of the service's own price), rail freight rates (to take account of intermodal competition), and other economic and demographic factors such as the level of economic activity and population.

The road freight rate (or the ratio of road/rail freight rates), and gross domestic product, both expressed in real terms, were the only two independent variables considered in the empirical work reported below apart from three dummy variables reflecting seasonal variations in tonnes consigned[4]. An index of road freight rates was derived from the published rates of major freight forwarders for a 10 000 kg consignment of door-to-door interstate freight over various routes (BTE 1984c). The rail freight index was derived from the published rates for a forwarding agent for a van from Melbourne to Sydney (Vic Rail, personal communication).

Models of the following form were specified[5]:

Tonnes consigned = f (road freight rate, gross domestic product, seasonal dummy variables) **Model 7**

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1. Data were obtained from an ABS unpublished developmental collection, which covered contractors who moved a total of 10 000 tonnes or more per annum at the commencement of the collection
2. These city pairs are: Sydney-Melbourne, Sydney-Brisbane, Sydney-Adelaide, Melbourne-Brisbane and Melbourne-Adelaide.
3. In addition to the above city pairs, the following pairs were included: Sydney-Perth, Melbourne-Perth, Brisbane-Adelaide, Brisbane-Perth and Adelaide-Perth.
4. Note that while the use of the road/rail freight rates index avoids the difficulties of estimating each effect separately (caused by high correlation between road and rail freight rates), this practice implies that elasticities of tonnes consigned with respect to road and rail freight rates are of the same magnitude That is, a 1 per cent fall in road freight rates has the same effect as 1 per cent increase in rail freight rates on tonnes consigned by road. This may or may not be the case.
5. For earlier BTE models of this form, see Smith (1977) and BTE (1979b).

APPENDIX VI—COMMERCIAL VEHICLE PROJECTIONS

This appendix presents projections to the year 2000, of the number of commercial vehicles on register, and average and total vehicle kilometres travelled (VKT), as described in Chapter 7. The projections are defined by vehicles' State of registration and are given for each vehicle type. Furthermore, to facilitate comparisons between States and over time, rates of average annual growth have been derived from each of the projections of the number of vehicles on register and total VKT.

The contents of this appendix are ordered as follows, with the numbers of separate tables of growth rates given in brackets.

		Table Number(s)	*Vehicle Type*
Part A.	Number of vehicles on register	VI.1 (VI.2)	Light commercial vehicles
		VI.3 (VI.4)	Rigid trucks
		VI.5 (VI.6)	Articulated trucks
		VI.7	Other truck-type vehicles
		VI.8	Buses
Part B.	Average VKT	VI.9	Light commercial vehicles
		VI.10	Rigid trucks
		VI.11	Articulated trucks
		VI 12	Other truck-type vehicles
		VI.13	Buses
Part C.	Total	VI.14 (VI.15)	Light commercial vehicles
		VI.16 (VI.17)	Rigid trucks
		VI.18 (VI.19)	Articulated trucks
		VI.20	Other truck-type vehicles
		VI.21	Buses

Projections of the total number of commercial vehicles on register and total kilometres travelled by commercial vehicles obtained by adding together the tables in Parts A and C respectively, are given in Chapter 7 (Tables 7.2 and 7.5). These were subsequently used to obtain projections of average kilometres travelled per commercial vehicle (Table 7.4).

PART A—NUMBER OF VEHICLES ON REGISTER

TABLE VI.1—PROJECTED NUMBER OF LIGHT COMMERCIAL VEHICLES BY STATE OF REGISTRATION, 1985 TO 2000

('000)

As at 30 June	New South Wales[a]	Victoria	Queensland	South Australia[b]	Western Australia	Tasmania	Australia
1972[c]	227.0	132.4	155.9	71.2	74.6	24.7	685.8
1982[d]	339.2	181.4	266.8	91.4	117.3	32.7	1 028.7
High growth projections							
1985	377.9	200.6	306.3	97.7	136.4	35.0	1 153.9
1990	468.7	245.1	394.6	111.8	183.3	39.6	1 443.1
1995	571.1	294.6	505.9	126.8	238.8	44.3	1 781.5
2000	675.7	348.5	627.8	141.6	295.5	48.8	2 137.9
Median growth projections							
1985	369.9	197.8	298.6	95.7	133.3	34.4	1 129.7
1990	442.8	235.9	369.0	105.8	172.2	37.9	1 363.6
1995	520.8	276.9	453.7	115.8	215.6	41.4	1 624.2
2000	594.4	320.2	539.6	124.9	257.4	44.3	1 880.8
Low growth projections							
1985	362.0	195.0	291.1	93.6	130.3	33.9	1 105.9
1990	418.3	227.1	344.5	100.0	162.3	36.3	1 288.5
1995	474.7	260.3	405.9	105.7	195.9	38.5	1 481.0
2000	522.9	293.6	462.6	110.1	224.5	40.1	1 653.8

a. New South Wales includes the Australian Capital Territory
b. South Australia includes the Northern Territory
c Vehicles on register adjusted to conform to post-1976 classifications of vehicle type.
d Actual.

TABLE VI.2—PROJECTED RATES OF GROWTH IN THE NUMBER OF LIGHT COMMERCIAL VEHICLES BY STATE OF REGISTRATION, 1982 TO 2000

(per cent per annum)

Year ending 30 June	*New South Wales*[a]	*Victoria*	*Queensland*	*South Australia*[b]	*Western Australia*	*Tasmania*	*Australia*
1972-82[c]	4.1	3.2	5.5	2.5	4.6	2.8	4.1
High growth projections							
1982-85	3.7	3.4	4.7	2.2	5.2	2.3	3.9
1985-90	4.4	4.1	5.2	2.7	6.1	2.5	4.6
1990-95	4.0	3.8	5.1	2.5	5.4	2.3	4.3
1995-2000	3.4	3.4	4.4	2.2	4.4	1.9	3.7
Median growth projections							
1982-85	2.9	2.9	3.8	1.5	4.4	1.7	3.2
1985-90	3.7	3.6	4.3	2.0	5.3	2.0	3.8
1990-95	3.3	3.3	4.2	1.8	4.6	1.8	3.6
1995-2000	2.7	2.9	3.5	1.5	3.6	1.4	3.0
Low growth projections							
1982-85	2.2	2.4	2.9	0.8	3.6	1.2	2.4
1985-90	2.9	3.1	3.4	1 3	4.5	1.4	3.1
1990-95	2.6	2.8	3.3	1.1	3.8	1.2	2.8
1995-2000	2.0	2.4	2.6	0.8	2.8	0.8	2.2

a. New South Wales includes the Australian Capital Territory.
b. South Australia includes the Northern Territory
c. Actual

TABLE VI.3—PROJECTED NUMBER OF RIGID TRUCKS BY STATE OF REGISTRATION, 1985 TO 2000

('000)

As at 30 June	New South Wales[a]	Victoria	Queensland	South Australia[b]	Western Australia	Tasmania	Australia
1972[c]	103.7	104.0	38.8	38.5	36.5	9.9	331.4
1982[d]	165.6	149.5	56.6	44.7	64.1	12.4	492.9
High growth projections							
1985	190.7	163.6	62.9	46.4	75.8	13.2	552.6
1990	250.8	200.8	76.4	50.0	105.3	14.7	698.0
1995	322.6	242.4	92.4	53.7	141.3	16.3	868.7
2000	400.2	288.0	109.0	57.1	179.1	17.8	1 051.2
Median growth projections							
1985	182.9	161.3	61.7	45.8	73.9	13.0	538.6
1990	228.6	193.1	72.6	48.5	98.2	14.2	655.2
1995	281.4	227.6	85.0	51.0	126.2	15.3	786.5
2000	334.7	263.8	97.1	53.2	153.6	16.3	918.7
Low growth projections							
1985	180.8	158.9	60.5	45.3	72.0	12.8	530.3
1990	217.8	186.0	68.9	47.0	92.0	13.6	625.3
1995	256.5	213.6	78.1	48.5	113.4	14.4	724.5
2000	291.2	241.6	86.3	49.6	132.0	14.9	815.6

a New South Wales includes the Australian Capital Territory.
b. South Australia includes the Northern Territory.
c. Vehicles on register adjusted to conform to post-1976 classifications of vehicle type.
d. Actual.

TABLE VI.4—PROJECTED RATES OF GROWTH IN THE NUMBER OF RIGID TRUCKS BY STATE OF REGISTRATION, 1982 TO 2000

(per cent per annum)

Year ending 30 June	*New South Wales*[a]	*Victoria*	*Queensland*	*South Australia*[b]	*Western Australia*	*Tasmania*	*Australia*
1972-82[c]	4.8	3.7	3.8	1.5	5.8	2.3	4.0
High growth projections							
1982-85	4.8	3.1	3.6	1.2	5.8	2.1	3.9
1985-90	5.6	4.2	4.0	1.5	6 8	2.3	4.8
1990-95	5.2	3.8	3.9	1.4	6.1	2.1	4.5
1995-2000	4.4	3.5	3.4	1.2	4.9	1.8	3.9
Median growth projections							
1982-85	3.4	2.6	2.9	0.8	4.9	1.6	3.0
1985-90	4.6	3.7	3.3	1.1	5.9	1.8	4.0
1990-95	4.2	3.3	3.2	1.0	5.1	1.6	3.7
1995-2000	3.5	3.0	2 7	0.9	4.0	1.3	3.2
Low growth projections							
1982-85	3.0	2.1	2.2	0.5	4.0	1.1	2.5
1985-90	3.8	3.2	2.6	0.7	5.0	1.3	3.4
1990-95	3.3	2.8	2.5	0.6	4 3	1.1	3.0
1995-2000	2.6	2.5	2.0	0.5	3.1	0.8	2.4

a New South Wales includes the Australian Capital Territory.
b South Australia includes the Northern Territory
c Actual.

TABLE VI.5—PROJECTED NUMBER OF ARTICULATED TRUCKS BY STATE OF REGISTRATION, 1985 TO 2000

('000)

As at 30 June	*New South Wales*[a]	*Victoria*	*Queensland*	*South Australia*[b]	*Western Australia*	*Tasmania*	*Australia*
1972[c]	11.7	8.3	5.2	5.4	2.8	1.1	34.5
1982[d]	17.4	12.2	8.8	5.1	4.8	1.5	49.8
High growth projections							
1985	19.7	13.4	10.1	5.3	5.6	1.6	55.7
1990	25.1	16.4	13.1	5.8	7.7	1.9	70.0
1995	31.5	19.7	16.8	6.3	10.2	2.2	86.7
2000	38.1	23.4	20.9	6.8	12.8	2.4	104.4
Median growth projections							
1985	18.9	13.2	9.9	5.3	5.5	1.6	54.3
1990	23.1	15.7	12.2	5.6	7.2	1.8	65.7
1995	27.8	18.5	15.0	6.0	9.2	2.0	78.5
2000	32.4	21.5	17.9	6.3	11.1	2.2	91.2
Low growth projections							
1985	18.7	13.0	9.6	5.2	5.4	1.6	53.5
1990	22.1	15.1	11.4	5.4	6.8	1.7	62.5
1995	25.5	17.4	13.4	5.6	8.3	1.8	72.0
2000	28.5	19.7	15.3	5.8	9.6	1.9	80.8

a. New South Wales includes the Australian Capital Territory.
b South Australia includes the Northern Territory.
c Vehicles on register adjusted to conform to post-1976 classifications of vehicle type.
d Actual.

TABLE VI.6—PROJECTED RATES OF GROWTH IN THE NUMBER OF ARTICULATED TRUCKS BY STATE OF REGISTRATION, 1982 TO 2000

(per cent per annum)

Year ending 30 June	*New South Wales*[a]	*Victoria*	*Queensland*	*South Australia*[b]	*Western Australia*	*Tasmania*	*Australia*
1972-82[c]	4.0	3.9	5.4	-0.6	5.5	2.8	3.7
High growth projections							
1982-85	4.2	3 1	4.8	1.5	5.5	2.8	3.8
1985-90	5.0	4.1	5.2	1.8	6.5	3 0	4.7
1990-95	4.6	3.8	5.1	1.7	5.8	2.8	4.4
1995-2000	3.9	3.5	4.5	1.5	4.6	2.4	3.8
Median growth projections							
1982-85	2.9	2.6	3.9	1.0	4.6	2.1	3.0
1985-90	4.0	3.6	4.4	1.4	5.6	2.3	3.9
1990-95	3.8	3.3	4 3	1.2	4.9	2.1	3.6
1995-2000	3.1	3.0	3 6	1.0	3.8	1.7	3.1
Low growth projections							
1982-85	2.5	2.1	3.0	0.5	3.8	1.4	2.4
1985-90	3.3	3.1	3.5	0.9	4 8	1.7	3.2
1990-95	2.9	2.8	3.4	0.7	4.1	1.4	2.9
1995-2000	2.2	2.5	2.7	0.5	2.9	1.0	2.3

a New South Wales includes the Australian Capital Territory.
b. South Australia includes the Northern Territory
c Actual

TABLE VI.7—PROJECTED NUMBER AND RATES OF GROWTH IN THE NUMBER OF OTHER TRUCK-TYPE VEHICLES BY STATE OF REGISTRATION, 1982 TO 2000

As at 30 June	*New South Wales*[a]	*Victoria*	*Queensland*	*South Australia*[b]	*Western Australia*	*Tasmania*	*Australia*
			('000)				
1972[c]	7.4	2.5	2.4	2.7	3.7	0.5	19.2
1982[d]	13.3	11.7	4.4	5.9	6.2	2.2	43.7
Median growth projections							
1985	15.0	14.5	5.5	7.1	7.3	2.7	52.1
1990	18.0	19.5	7.7	9.2	9.3	3.7	67.4
1995	21.3	25.0	10.2	11.5	11.5	4.7	84.1
2000	24.7	30.8	13.0	13.9	14.0	5.7	102.0
			(per cent)				
Average annual growth rate							
1972-82[d]	6.0	16.7	6.2	8.1	5.3	16.0	8.6
1982-85	4.1	7.3	7.9	6.4	5.5	7.6	6.0
1985-90	3.7	6.1	6.8	5.4	5.0	6.1	5.3
1990-95	3.4	5.1	5.8	4.5	4.4	4.8	4.5
1995-2000	3.0	4.3	5.0	3.8	4.0	4.0	3.9

a New South Wales includes the Australian Capital Territory.
b South Australia includes the Northern Territory.
c Vehicles on register adjusted to conform to post-1976 classifications of vehicle type.
d. Actual.

TABLE VI.8—PROJECTED NUMBER AND RATES OF GROWTH IN THE NUMBER OF BUSES BY STATE OF REGISTRATION, 1982 TO 2000

As at 30 June	New South Wales[a]	Victoria	Queensland	South Australia[b]	Western Australia	Tasmania	Australia
			('000)				
1972[c]	9.1	5.4	3.4	3.0	2.7	1.4	25.0
1982[c]	17.0	11.5	6.7	3.9	5.1	2.1	46.3
Median growth projections							
1985	19.6	13.3	8.0	4.3	6.2	2.3	53.7
1990	24.4	16.7	10.5	5 0	8.2	2.7	67.5
1995	29.5	20.3	13.3	5.6	10.6	3.2	82 5
2000	35.0	24.1	16.5	6.3	13.2	3.7	98.7
			(per cent)				
Average annual growth rate							
1972-82[c]	6.4	7.9	7.0	2.7	6.6	3.6	6 4
1982-85	4.9	5.1	6.2	3.2	6.7	4.3	5.1
1985-90	4.4	4.6	5.5	2.9	5.9	3.8	4.6
1990-95	3.9	4.0	4.9	2.6	5.1	3.3	4.1
1995-2000	3.5	3.5	4.4	2.4	4.5	2.8	3.7

a. New South Wales includes the Australian Capital Territory
b South Australia includes the Northern Territory.
c Actual.

PART B—AVERAGE VKT

TABLE VI.9—PROJECTED AVERAGE ANNUAL VEHICLE KILOMETRES TRAVELLED BY LIGHT COMMERCIAL VEHICLES BY STATE OF REGISTRATION, 1985 TO 2000

('000)

Year ending 30 June	New South Wales[a]	Victoria	Queensland	South Australia[b]	Western Australia	Tasmania	Australia
1971[c]	17.3	15.3	13.6	15.5	19.8	13.7	16.3
1976[c]	16.4	18.7	17.4	15.2	16.7	14.1	17.0
1979[c]	17.1	16.8	16.4	17.2	18.7	14.6	17.0
1982[c]p	18.2	16.6	14.6	17.0	17.4	17.0	16.7
High growth projections							
1985	18.4	16.7	14.7	17.1	17.6	17.1	16.9
1990	18.7	17.0	15.0	17.3	18.0	17.3	17.2
1995	19.0	17.2	15.3	17.5	18.4	17.5	17.4
2000	19.2	17.5	15.6	17.6	18.7	17.6	17.7
Median growth projections							
1985	18.3	16.7	14.6	17.1	17.5	17.1	16.8
1990	18.5	16.8	14.8	17.2	17.7	17.2	17.0
1995	18.6	16.9	14.9	17.3	17.9	17.3	17.1
2000	18.7	17.0	15.1	17.3	18.0	17.3	17.2
Low growth projections							
1985-2000	18.2	16.6	14.6	17.0	17.4	17.0	16.7

a. New South Wales includes the Australian Capital Territory.
b South Australia includes the Northern Territory.
c. Survey of Motor Vehicle Usage estimates

p preliminary

TABLE VI.10—PROJECTED AVERAGE ANNUAL VEHICLE KILOMETRES TRAVELLED BY RIGID TRUCKS BY STATE OF REGISTRATION, 1985 TO 2000

('000)

Year ending 30 June	New South Wales[a]	Victoria	Queensland	South Australia[b]	Western Australia	Tasmania	Australia
1971[c]	17.2	16.0	13.8	15.3	17.6	13.8	16.0
1976[c]	16.1	16.0	15.0	14.5	17.1	15.4	15.7
1979[c]	18.0	17.2	14.4	14.3	16.5	15.3	16.7
1982[c]p	20.7	17.8	19.6	14.6	18 5	16.0	18.8
High growth projections							
1985	21.2	18.1	20.0	14.3	19.0	16.2	19.2
1990	22.3	18.8	20.7	14.5	20 2	16.5	20.1
1995	23.3	19.4	21.4	14.7	21.3	16.8	21.0
2000	24.2	20.0	22.1	14.9	22.2	17.1	21.9
Median growth projections							
1985	21.0	18.0	19.8	14.3	18.8	16.1	18.9
1990	21.5	18.3	20.2	14.4	19.3	16.3	19.4
1995	22 0	18.6	20.5	14.5	19.9	16.4	19.9
2000	22.5	18.9	20.8	14.5	20.3	16.5	20.3
Low growth projections							
1985-2000	20.7	17.8	19.6	14.2	18.5	16.0	18.8

a New South Wales includes the Australian Capital Territory.
b South Australia includes the Northern Territory.
c Survey of Motor Vehicle Usage estimates.

p preliminary

TABLE VI.11—PROJECTED AVERAGE ANNUAL VEHICLE KILOMETRES TRAVELLED BY ARTICULATED TRUCKS BY STATE OF REGISTRATION, 1985 TO 2000

('000)

Year ending 30 June	New South Wales[a]	Victoria	Queensland	South Australia[b]	Western Australia	Tasmania	Australia
1971[c]	47.7	49.2	37.3	62.7	60.7	49.4	48.3
1976[c]	52.4	45.8	35.7	71.0	49.4	48.4	50.5
1979[c]	59.4	61.4	47.7	77.5	51.8	57.5	59.3
1982[c]p	63.9	65.7	52.0	76.7	63.3	61.0	63.4
High growth projections							
1985	67.0	68.2	54.9	78.1	67.4	63.0	66.2
1990	73.6	73.8	60.8	80.8	76.2	66.8	72.0
1995	80.4	79.2	67.0	83.5	85.0	70.4	78.1
2000	86.6	84.7	72.9	85.9	92.9	73.7	83.9
Median growth projections							
1985	65.9	67.4	53.9	77.6	66.0	62.3	65.2
1990	70.3	71.1	57.9	79.5	71.9	64.9	68.9
1995	74.9	74.7	62.0	81.2	77.8	67.3	72.9
2000	79.0	78.4	65.9	82.8	83.0	69.5	76.9
Low growth projections							
1985	64.9	66.5	53.0	77.2	64.7	61.7	64.1
1990	67.1	68.4	54.9	78.1	67.6	62.9	66.1
1995	69.3	70.2	57.0	79.0	70.5	64.2	68.0
2000	71.4	72.0	59.0	79.8	73.2	65.3	69.8

a New South Wales includes the Australian Capital Territory.
b South Australia includes the Northern Territory.
c. Survey of Motor Vehicle Usage estimates

p preliminary

TABLE VI.12—PROJECTED AVERAGE ANNUAL VEHICLE KILOMETRES TRAVELLED BY OTHER TRUCK-TYPE VEHICLES BY STATE OF REGISTRATION, 1982 TO 2000

('000)

Year ending 30 June	New South Wales[a]	Victoria	Queensland	South Australia[b]	Western Australia	Tasmania	Australia
1971[c]	13.4	7.6	8.7	5.8	12.1	4.5	9.5
1976[c]	16.6	11.8	18.7	11.4	10.9	10.7	14.4
1979[c]	15.9	10.6	12.4	14.4	12.3	8 7	12.9
Median growth projections							
1982-2000[d]	15.9	10.6	12.4	14.4	12.3	8 7	13.0

a New South Wales includes the Australian Capital Territory
b South Australia includes the Northern Territory
c Survey of Motor Vehicle Usage estimates.
d. Average annual kilometres travelled by each of the State's fleets of other truck-type vehicles are assumed to remain constant (at 1979 levels) throughout the forecast period. However, due to differences between the States in the projected rate of growth of these fleets (see Table VI.7) projected average annual kilometres travelled by all other truck-type vehicles in Australia gradually declines from 13 050 kilometres in 1981-82 to 12 750 kilometres in 1999-2000

TABLE VI.13—PROJECTED AVERAGE ANNUAL VEHICLE KILOMETRES TRAVELLED BY BUSES BY STATE OF REGISTRATION, 1982 TO 2000

('000)

Year ending 30 June	New South Wales[a]	Victoria	Queensland	South Australia[b]	Western Australia	Tasmania	Australia
1971[c]	31.1	27.5	28.3	29.2	33.5	20.9	29.3
1979[c]	28.4	24.6	28.8	39.4	28.7	22.3	28.4
Median growth projections							
1982	26.6	22.7	26.0	38.7	27.8	22.0	26.3
1985	25.5	21.9	25.1	37.2	26.7	21.0	25.4
1990	24.4	21.0	24.0	35 2	25.2	20.1	24.2
1995	23.6	20.4	23.1	33.6	24.2	19.5	23.3
2000	23.0	19.9	22.4	32.3	23.4	19.0	22.6

a. New South Wales includes the Australian Capital Territory
b. South Australia includes the Northern Territory.
c. Survey of Motor Vehicle Usage estimates.

PART C—TOTAL VKT

TABLE VI.14—PROJECTED TOTAL VEHICLE KILOMETRES TRAVELLED BY LIGHT COMMERCIAL VEHICLES BY STATE OF REGISTRATION, 1985 TO 2000

(millions)

Year ending 30 June	New South Wales[a]	Victoria	Queensland	South Australia[b]	Western Australia	Tasmania	Australia
1972[c]	3 938	2 026	2 127	1 098	1 481	338	11 008
1977[c]	4 295	2 925	3 154	1 140	1 578	366	13 456
1980[c]	4 982	2 786	3 663	1 418	2 041	443	15 333
1982[c]p	6 182	3 012	3 887	1 557	2 041	557	17 237
High growth projections							
1985	6 946	3 357	4 511	1 673	2 401	600	19 488
1990	8 761	4 167	5 927	1 935	3 302	685	24 777
1995	10 841	5 081	7 748	2 216	4 391	773	31 050
2000	12 997	6 090	9 779	2 497	5 525	858	37 746
Median growth projections							
1985	6 770	3 298	4 374	1 635	2 333	588	18 998
1990	8 174	3 964	5 459	1 817	3 049	651	23 114
1995	9 689	4 687	6 779	1 999	3 858	714	27 726
2000	11 133	5 456	8 133	2 165	4 645	767	32 299
Low growth projections							
1985	6 588	3 237	4 250	1 591	2 267	576	18 509
1990	7 613	3 770	5 030	1 700	2 824	617	21 554
1995	8 640	4 321	5 926	1 797	3 409	655	24 748
2000	9 517	4 874	6 754	1 872	3 906	682	27 605

a New South Wales includes the Australian Capital Territory.

b South Australia includes the Northern Territory.

c. Estimates derived from the number of vehicles on register at 30 June 1972 (adjusted to conform to post-1976 vehicle classifications), 1977, 1980 and 1982, and Survey of Motor Vehicle Usage estimates of average kilometres travelled per vehicle during the years ending 30 September 1971, 1976, 1979 and 1982 (ABS 1973b, 1978, 1981f and unpublished preliminary figures for Survey of Motor Vehicle Usage, Twelve Months ended 30 September 1982)

p preliminary

TABLE VI.15—PROJECTED RATES OF GROWTH IN TOTAL VEHICLE KILOMETRES TRAVELLED BY LIGHT COMMERCIAL VEHICLES BY STATE OF REGISTRATION, 1982 TO 2000

(per cent per annum)

Year ending 30 June	*New South Wales*[a]	*Victoria*	*Queensland*	*South Australia*[b]	*Western Australia*	*Tasmania*	*Australia*
1972-82[c]	4.6	4.0	6.1	3.6	3.3	5.1	4.6
High growth projections							
1982-85	4.0	3.7	5.1	2.4	5.6	2.5	4.2
1985-90	4.8	4.4	5.6	2.9	6.6	2.7	4.9
1990-95	4.4	4.0	5.5	2.8	5.9	2.4	4.6
1995-2000	3.7	3.7	4.8	2.4	4.7	2.1	4.0
Median growth projections							
1982-85	3.1	3.1	4.0	1.6	4.6	1.8	3.3
1985-90	3.8	3.7	4.5	2.1	5.5	2.1	4.0
1990-95	3.5	3.4	4.4	1.9	4.8	1 9	3.7
1995-2000	2.8	3.1	3.7	1.6	3.8	1.4	3.1
Low growth projections							
1982-85	2.1	2.4	3.0	0.7	3.6	1.1	2.4
1985-90	2.9	3.1	3.4	1.3	4.5	1.4	3.1
1990-95	2.6	2.8	3.3	1.1	3.8	1.2	2.8
1995-2000	2.0	2.4	2.6	0.8	2.8	0.8	2.2

a New South Wales includes the Australian Capital Territory.
b South Australia includes the Northern Territory.
c Estimates.

TABLE VI.16—PROJECTED TOTAL VEHICLE KILOMETRES TRAVELLED BY RIGID TRUCKS BY STATE OF REGISTRATION, 1985 TO 2000

(millions)

Year ending 30 June	*New South Wales*[a]	*Victoria*	*Queensland*	*South Australia*[b]	*Western Australia*	*Tasmania*	*Australia*
1972[c]	1 784	1 664	536	589	642	137	5 351
1977[c]	1 968	1 925	682	584	800	161	6 120
1980[c]	2 637	2 238	721	596	924	181	7 298
1982[c]p	3 432	2 666	1 112	637	1 185	199	9 231
High growth projections							
1985	4 052	2 964	1 259	665	1 443	214	10 597
1990	5 594	3 773	1 582	727	2 125	243	14 044
1995	7 522	4 708	1 979	790	3 004	274	18 277
2000	9 694	5 767	2 404	850	3 970	304	22 989
Median growth projections							
1985	3 836	2 897	1 221	654	1 387	209	10 204
1990	4 915	3 533	1 463	697	1 899	231	12 738
1995	6 193	4 236	1 743	737	2 509	251	15 669
2000	7 518	4 989	2 022	773	3 123	270	18 695
Low growth projections							
1985	3 743	2 828	1 186	645	1 332	205	9 939
1990	4 508	3 310	1 350	670	1 702	218	11 758
1995	5 310	3 802	1 531	691	2 098	230	13 662
2000	6 028	4 300	1 691	707	2 442	238	15 406

a New South Wales includes the Australian Capital Territory

b. South Australia includes the Northern Territory.

c. Estimates derived from the number of vehicles on register at 30 June 1972 (adjusted to conform to post-1976 vehicle classifications), 1977, 1980 and 1982; and Survey of Motor Vehicle Usage estimates of average kilometres travelled per vehicle during the years ending 30 September 1971, 1976, 1979 and 1982 (ABS 1973b, 1978, 1981f and unpublished preliminary figures for Survey of Motor Vehicle Usage, Twelve Months ended 30 September 1982)

p preliminary

TABLE VI.17—PROJECTED RATES OF GROWTH IN TOTAL VEHICLE KILOMETRES TRAVELLED BY RIGID TRUCKS BY STATE OF REGISTRATION, 1982 TO 2000

(per cent per annum)

Year ending 30 June	*New South Wales*[a]	*Victoria*	*Queensland*	*South Australia*[b]	*Western Australia*	*Tasmania*	*Australia*
1972-82[c]	6.8	4.8	7.6	0.8	6.3	3.8	5.6
High growth projections							
1982-85	5.7	3.6	4.2	1.5	6.8	2.5	4.7
1985-90	6.7	4.9	4.7	1.8	8.0	2.6	5.8
1990-95	6.1	4.5	4.6	1.7	7.2	2.5	5.4
1995-2000	5.2	4.1	4.0	1.5	5.7	2.1	4.7
Median growth projections							
1982-85	3.8	2.8	3.2	0.9	5.4	1.7	3.4
1985-90	5.1	4.0	3.7	1.3	6.5	2.0	4.5
1990-95	4.7	3.7	3.6	1.1	5.7	1.7	4.2
1995-2000	4.0	3.3	3.0	1.0	4.5	1.4	3.6
Low growth projections							
1982-85	2.9	2.0	2.2	0.4	4.0	1.0	2.5
1985-90	3.8	3.2	2.6	0.7	5.0	1.2	3.4
1990-95	3.3	2.8	2.5	0.6	4.3	1.1	3.0
1995-2000	2.6	2.5	2.0	0.5	3.1	0.7	2.4

a. New South Wales includes the Australian Capital Territory.
b South Australia includes the Northern Territory.
c. Estimates

TABLE VI.18—PROJECTED TOTAL VEHICLE KILOMETRES TRAVELLED BY ARTICULATED TRUCKS BY STATE OF REGISTRATION, 1985 TO 2000

(millions)

Year ending 30 June	*New South Wales*[a]	*Victoria*	*Queensland*	*South Australia*[b]	*Western Australia*	*Tasmania*	*Australia*
1972[c]	558	408	192	339	172	56	1 725
1977[c]	698	447	220	433	183	58	2 039
1980[c]	962	644	358	372	223	81	2 639
1982[c]p	1 110	802	458	391	304	92	3 157
High growth projections							
1985	1 319	914	555	416	380	103	3 687
1990	1 847	1 210	796	471	588	126	5 038
1995	2 533	1 561	1 125	528	869	153	6 769
2000	3 300	1 983	1 524	585	1 191	180	8 763
Median growth projections							
1985	1 246	889	534	408	363	100	3 540
1990	1 625	1 116	706	446	519	117	4 529
1995	2 082	1 382	930	484	713	134	5 725
2000	2 560	1 685	1 180	519	919	151	7 014
Low growth projections							
1985	1 213	865	509	400	347	97	3 431
1990	1 482	1 033	626	423	458	107	4 129
1995	1 768	1 222	764	443	584	117	4 898
2000	2 035	1 419	903	460	700	125	5 642

a New South Wales includes the Australian Capital Territory

b. South Australia includes the Northern Territory.

c Estimates derived from the number of vehicles on register at 30 June 1972 (adjusted to conform to post-1976 vehicle classifications), 1977, 1980 and 1982; and Survey of Motor Vehicle Usage estimates of average kilometres travelled per vehicle during the years ending 30 September 1971, 1976, 1979 and 1982 (ABS 1973b, 1978, 1981f and unpublished preliminary figures for Survey of Motor Vehicle Usage, Twelve Months ended 30 September 1982).

p preliminary

TABLE VI.19—PROJECTED RATES OF GROWTH IN TOTAL VEHICLE KILOMETRES TRAVELLED BY ARTICULATED TRUCKS BY STATE OF REGISTRATION, 1982 TO 2000

(per cent per annum)

Year ending 30 June	*New South Wales*[a]	*Victoria*	*Queensland*	*South Australia*[b]	*Western Australia*	*Tasmania*	*Australia*
1972-82[c]	7 2	7.0	9.1	1.5	5.9	5.0	6.2
High growth projections							
1982-85	5.9	4.4	6.6	2.0	7.7	3.9	5.3
1985-90	7.0	5.8	7.5	2.5	9.1	4.3	6.4
1990-95	6.5	5 2	7.2	2.3	8.1	3.9	6.1
1995-2000	5.4	4.9	6 3	2.0	6.5	3.3	5.3
Median growth projections							
1982-85	3.9	3.5	5.3	1.4	6.1	2.8	3.9
1985-90	5.5	4.7	5.7	1.8	7.4	3.2	5.1
1990-95	5.1	4.4	5.7	1.6	6.6	2.9	4.8
1995-2000	4.2	4.0	4.9	1.4	5.2	2.4	4.1
Low growth projections							
1982-85	3.0	2.6	3.6	0.7	4.5	1.8	2.8
1985-90	4.1	3.6	4.2	1.1	5.7	2.1	3.8
1990-95	3.6	3.4	4.0	1.0	5.0	1.8	3.5
1995-2000	2.9	3.0	3.4	0.7	3.7	1.4	2.9

a. New South Wales includes the Australian Capital Territory.
b South Australia includes the Northern Territory
c. Estimates

TABLE VI.20—PROJECTED TOTAL VEHICLE KILOMETRES TRAVELLED AND RATES OF GROWTH IN TOTAL VEHICLE KILOMETRES TRAVELLED BY OTHER TRUCK-TYPE VEHICLES BY STATE OF REGISTRATION, 1982 TO 2000

Year ending 30 June	New South Wales[a]	Victoria	Queensland	South Australia[b]	Western Australia	Tasmania	Australia
			(millions)				
1972[c]	99	17	21	16	45	2	202
1977[c]	143	61	58	52	50	12	376
1980[c]	172	111	43	75	71	17	490
Median growth projections							
1982	212	124	55	85	76	19	570
1985	239	153	69	102	90	24	676
1990	286	207	95	133	114	32	867
1995	339	265	126	166	142	41	1 077
2000	393	327	161	199	172	49	1 301
			(per cent)				
Average annual growth rate							
1972-80[c]	7.1	25.1	9.4	21.6	6.0	29.5	11.7
1980-85	6.8	6.6	9.6	6.4	4.7	6.5	6.7
1985-90	3.7	6.1	6.8	5.4	5.0	6.1	5.1
1990-95	3.4	5.1	5.8	4.5	4.4	4.8	4.4
1995-2000	3.0	4.3	5.0	3.8	4.0	4.0	3.9

a. New South Wales includes the Australian Capital Territory.
b. South Australia includes the Northern Territory.
c. Estimates derived from the number of vehicles on register at 30 June 1972 (adjusted to conform to post-1976 vehicle classifications), 1977 and 1980; and Survey of Motor Vehicle Usage estimates of kilometres travelled per vehicle during the years ending 30 September 1971, 1976 and 1979 (ABS 1973b, 1978 and 1981f). Estimates for the year ending 30 June 1982 are not available.

TABLE VI.21—PROJECTED TOTAL VEHICLE KILOMETRES TRAVELLED AND RATES OF GROWTH IN TOTAL VEHICLE KILOMETRES TRAVELLED BY BUSES[a] BY STATE OF REGISTRATION, 1982 TO 2000

Year ending 30 June	*New South Wales*[b]	*Victoria*	*Queensland*	*South Australia*[c]	*Western Australia*	*Tasmania*	*Australia*
			(millions)				
1972[d]	283	148	96	88	90	29	735
1980[d]	403	224	150	154	129	45	1 104
Median growth projections							
1982	448	261	175	151	142	44	1 219
1985	501	293	202	159	165	48	1 367
1990	596	351	252	175	208	55	1 636
1995	696	413	307	190	256	63	1 925
2000	803	478	369	205	309	70	2 234
			(per cent)				
Average annual growth rate							
1972-80	4.5	5.3	5.7	7.3	4.6	5.4	5.2
1980-85	4.4	5.5	6.1	0.7	5.0	1.3	4.4
1985-90	3.5	3.7	4.5	1.9	4.7	2.9	3.6
1990-95	3.2	3.3	4.1	1.7	4.2	2.6	3.3
1995-2000	2.9	3.0	3.7	1.5	3.8	2.3	3.0

a. The sum of estimates for each type of bus fleet given in Appendix II.
b. New South Wales includes the Australian Capital Territory
c. South Australia includes the Northern Territory
d Estimates derived from the number of vehicles on register at 30 June 1972 and 1980; and Survey of Motor Vehicle Usage estimates of kilometres travelled per vehicle during the years ending 30 September 1971 and 1979 (ABS 1981e)

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ABBREVIATIONS

ABS	Australian Bureau of Statistics
ARPC	Average Rate of Petrol Consumption
BTE	Bureau of Transport Economics
cc	cubic centimetres
CBD	Central Business District
COMVE	Committee on Motor Vehicle Emissions
GDP	Gross Domestic Product
IAC	Industries Assistance Commission
IAESR	Institute of Applied Economic and Social Research
km	kilometres
NRMA	National Roads and Motorists Association
OECD	Organisation for Economic Co-operation and Development
RMC	Road Maintenance Charges
UK	United Kingdom
USA	United States of America
VKT	Vehicle kilometres travelled