Assessment of the Australian Road System: Operational Characteristics

Information Paper

This Paper deals with the operational characteristics of the Australian Road System and provides time series information to show changes over approximately the last decade in characteristics of the road system. The road system has been defined to include the road network. road users, vehicles and road user legislation while the operational characteristics of the road system have been defined as travel time, comfort and convenience, safety, vehicle operation and community effects.

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Assessment of the Australian Road System: Operational Characteristics

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FOREWORD

In May 1982 the then Minister for Transport directed the Bureau of Transport Economics to undertake an assessment of the Australian Road System. The Bureau had reported previously on the subject in 1979 and similar reports were prepared by the former Commonwealth Bureau of Roads in 1969, 1973 and 1975.

In satisfying the Ministerial reference of 1982 a number of discrete but related investigations were carried out. Each investigation has been reported in separate BTE publications in support of the main BTE Report Number 56 'Assessment of the Australian Road System: 1984'. The Papers in the series are:

- Occasional Paper 60 'Assessment of the Australian Road System: Travel forecasts';
- Occasional Paper 61 'Assessment of the Australian Road System: Financing';
- Occasional Paper 62 'Assessment of the Australian Road System: Provision of Roads in Local Government Areas'; and
- Occasional Paper 63 'Assessment of the Australian Road System: Economic Assessment Model for Rural Arterial Roads'.

This paper deals with the operational characteristics of the Australian Road System and provides time series information to show changes over approximately the last decade in characteristics of the road system. The road system has been defined to include the road network, road users, vehicles and road user legislation while the operational characteristics of the road system have been defined as travel time, comfort and convenience, safety, vehicle operation and community effects.

Results are presented separately for each State and for Australia as a whole, and data are also presented by road category.

The staff of the Planning and Technology Branch of the Bureau carried out this study, the main team comprising Messrs W. Leslie, G. Piko, J. Miller, K. Loong, G. Morris, F. Poldy, R. Hogan and N. Graham.

Among the agencies which provided data used in this study the following are mentioned for their assistance: the State Road Authorities, the various authorities responsible for recording and analysing accidents in each State and members of the NAASRA Roads Study team.

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Canberra
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CHAPTER 1—INTRODUCTION

BACKGROUND

Strategic decisions regarding the level and distribution of expenditure on the Australian road network have usually been based on estimates of the state of the road system at the outset of an investment period and have generally been taken without analysing the effects of earlier funding strategies on the operation of the road system. The aim of this study has been to quantify the operational effects of change to the road system and to provide technical material as an input to the Bureau's 1984 Report on the Australian Road System.

The study provides an analysis of road system operation using data which are routinely available and includes estimates of changes in selected aspects of road system operation over the approximate period 1972–1981. For the purposes of the study the components of the road system are defined as the road network, road users, vehicles, and regulations governing vehicle operation. The changes in the road system are not necessarily attributable to expenditure on the road network or on any other single component of the road system. As a consequence the analysis often masks the effects of changes within and among road system components and more particularly often does not allow ready identification of the extent to which those changes are complementary or counteractive. Notwithstanding the aggregate level of analysis, the work reveals information which should provide useful background to decisions concerning future investment in roads.

OPERATIONAL CHARACTERISTICS OF THE ROAD SYSTEM

For the purposes of this study the operational characteristics of the road system comprised the following elements which, as feasible and appropriate, were separately assessed:

- travel time
- comfort and convenience
- safety
- vehicle operation
- community effects.

With the exception of the last item, the characteristics relate to the road user in a more or less direct fashion, while community effects represent those aspects of the road system operation which have a more widespread impact.

Travel Time

Many writers, including Heggie (1972, p88) and Thomson (1974, p56), note that travel time savings are an important consequence of improvements to a transport system. The travel time between two points on a road network is the time that elapses while travelling between those points, including delays due to factors such as traffic congestion and traffic management devices.

Comfort and Convenience

The American Association of State Highway Officials (AASHO) (1960, p76) describes driver comfort and convenience as:

> '. . . being able to drive without frequent brake applications, stops and starts, or unexpected interference to travel. There is value in the conservation of health through driving in a relaxed manner without the tension necessary where roadside interference is imminent.'

Convenience is taken to include interruption to travel (such as delays due to floods or roadworks) other than any delay due to traffic congestion. The latter is reflected in travel time.

Winfrey (1969, p278) approaches the concept of comfort and convenience by pointing out that road users have subjective evaluations of whether a trip was pleasant, enjoyable and according to desires, or whether the trip was annoying, fatiguing and producing physical strain and mental anguish. Winfrey distinguishes between convenience, physical comfort and mental comfort.

Safety

The benefits of a reduced traffic accident rate include a reduction in the incidence of such factors as motor vehicle and property damage costs, medical costs, time lost and the pain, suffering and anguish involved (Winfrey, 1969, p360).

Vehicle Operation

The components of vehicle operation include fuel and oil consumption, tyre wear, vehicle maintenance and vehicle depreciation for wear and tear. Pignataro (1973, p69) points out that vehicles depreciate both with the wear and tear of use and with age. In assessing the effects of a change to the road network, only depreciation with use (or wear and tear) should be considered.

Community Effects

The National Association of State Road Authorities (NAASRA) (1976, p12) identified a number of ways in which the community can be affected by changes to the operation of the road system. These effects include the degree of co-ordination of transport modes, the extent of achievement of regional and community development goals, nuisance from air pollution and noise, and influences on desirable social characteristics in the community including neighbourhood unity.

STUDY OBJECTIVES

The specific objectives of this study may be summarised as:

- describe the status of the operational characteristics of the Australian road system;
- identify trends in the operational characteristics over recent years; and
- make comparisons of the characteristics among road categories and among States.

OUTLINE OF THE STUDY

The significance of particular operational characteristics can vary depending on the function of the road. Hence, the status and trends in the operational characteristics of the road system were considered separately for each of the following road categories[1]:

- national highways
- rural arterial roads

1. Definitions of national highways, arterial roads, local roads and rural and urban areas are presented in Appendix I.

- rural local roads
- urban arterial roads
- urban local roads.

Within each road category, the information on operational characteristics is presented separately for each State. The information for national highways is presented in Chapter 2. The information for both rural arterial roads and rural local roads is presented in Chapter 3. These road categories are not always considered separately because some data items were available only for the total rural road network. Similarly, the information for both urban arterial roads and urban local roads is presented in Chapter 4. The analyses contained in Chapters 2, 3 and 4 are self-contained and may be read without reference to each other. In Chapter 5 data for each State as a whole are presented to provide some overall assessments. The final chapter (Chapter 6) contains a discussion of some cross-analyses which have been derived from a comparison and combination of individual tables contained in Chapters 2, 3, 4 and 5. In the final chapter conclusions are also drawn having regard to the overall information set. The appendixes are numbered to match the corresponding chapter numbers where possible. Thus, Appendixes II to V correspond with Chapters 2 to 5 respectively. Appendix I includes explanatory information concerning the areas and categories adopted for the study and also sets out data sources and accuracy levels.

The measures used in this study to assess the operational characteristics of the road system are listed in Table 1.1. In general, the assessment spans the period 1972 to 1981. However, the data available for particular measures may span a greater or lesser period. Also, for some data items information was not available for all States.

Travel time is one operational characteristic for which it is possible to obtain a direct quantitative measure. Travel time estimates are presented in three ways in this Paper. Firstly, they are shown simply as travel times; secondly, travel times and road lengths are used to estimate average travel speeds; and, thirdly, travel times in urban areas are used to determine travel time contours with respect to the Central Business District (CBD).

Comfort and convenience are not directly measurable, and require the subjective assessment of a number of characteristics of the road system. However, there are some surrogates available which indicate physical (or riding) comfort (which is considered to be related to surface type) and mental comfort (which is associated with the sealed width/traffic volume relationship).

Road accidents provide a direct measure of road safety. Data are presented for fatal accidents and road fatalities, as these provide a more consistent basis for making comparisons among States than do casualty or property damage data.

Vehicle operation information is confined to a presentation of fuel consumption by vehicle type.

Air pollution is a community effect for which quantitative information is provided. Changes in the levels of ozone, carbon monoxide, nitrogen dioxide and airborne lead are presented, together with an estimate of the contribution made by motor vehicles to emissions from all sources. The loss of amenity, or quality of life, on urban local streets is another community effect discussed in the study.

Each measure of the operational characteristics is reported separately and no attempt is made to rank the measures in order of importance or to aggregate them into a single index.

FACTORS AFFECTING THE OPERATION OF THE ROAD SYSTEM

The components of the road system were earlier defined as the road network, the road user, the vehicles and road user legislation. Changes in any of these components

TABLE 1.1—MEASURES USED TO ASSESS THE OPERATIONAL CHARACTERISTICS OF THE ROAD SYSTEM

Operational characteristic	*Measures reported*	*Applicable road categories/ regions*[a]
Travel time	Travel time	NH, RA
	Average travel speed	RA
	Travel time contours	UA
Comfort and convenience	Length by surface type by AADT[c]	NH, RA
	Length by seal width by AADT	NH, RA
	Length by surface type	RL
Safety	Number of fatalities	Australia
	Number of fatalities/VKT	Australia
	Number of fatal accidents	NH, R, U
	Number of fatal accidents/VKT	NH, R, U
Vehicle operation	Fuel consumed by road vehicles	Australia
	Fuel consumed by road vehicles/VKT	Australia
Community effects[b]	Maximum hourly concentrations of ozone and carbon monoxide Numbers of days on which maximum hourly ozone concentrations exceeded WHO long-term goal Annual mean concentrations of nitrogen dioxide and airborne lead	State capitals and some other cities

a. Road Category Legend
NH — National highways
RA — Rural arterials
UA — Urban arterials
R — All roads outside the capital cities and provincial urban areas as defined by the Australian Bureau of Census and Statistics (ABS)
U — All roads inside the capital cities and provincial urban areas as defined by the Australian Bureau of Statistics (ABS)
RL — Rural locals
b. A discussion of the factors affecting loss of amenity on urban local roads is also provided.
c. Annual average daily traffic (AADT).

of the road system can affect the operation of the system.

To assess, for example, the effects of road funding it is desirable to identify those operational effects resulting from changes to the road network. However, this is not always possible and the measures reported in this Paper often represent the combined effect of changes in a number of components of the road system.

The following discussion illustrates some of the ways in which individual components can affect road system operation.

Changes to the Road Network

The average annual expenditure on roads by all three levels of government between 1971-72 and 1979-80 was approximately $2700 million (expressed in constant 1981-82 dollars). The physical effects of this expenditure include an increase in the total length of sealed road, an increase in the length of divided road, and widening of pavements. The total length of sealed road increased from approximately 189 000km in 1970 to approximately 256 000km in 1981, representing an overall increase of 35 per cent in eleven years.

These physical changes in the road network contributed to the observed changes in the operational characteristics of the road system. For example, the sealing of a road which was previously unsealed usually results in an increased level of physical comfort and a reduction in travel time for users of that road. Similarly, the upgrading of an undivided road to a divided road usually achieves a reduction in the accident rate on that road.

Changes in Road Usage

In the period 1971 to 1982, vehicle-kilometres of travel (VKT) and tonne-kilometres performed increased by 58 and 119 per cent respectively. In most regions traffic growth could have affected the operational characteristics of the road system in a number of ways, eg by promoting congestion (thereby leading to travel time increases), increasing accident potential and increasing vehicle emissions.

Other Factors

Vehicle and driver regulation, vehicle characteristics and human factors also affect the operation of the road system. For example, road safety can be affected by seat belt regulations and vehicle size. Appendix VI provides a discussion of such factors and includes a list of some of the major legislative changes influencing the level of road safety in each State of Australia. This legislation includes the introduction of compulsory seat-belt wearing, random breath tests, maximum speed limits, compulsory child restraints, and compulsory wearing of motorcycle crash helmets. Appendix VI also includes a discussion of the effect on road safety of the trend toward smaller cars and measures aimed at minimising the effect of human factors.

CHAPTER 2—NATIONAL HIGHWAYS

BACKGROUND

In 1974 the Commonwealth Government defined a set of national roads which it considered to be of importance to Australia as a whole. These roads consisted largely of national highways but also included some export and major commercial roads. The Commonwealth Government accepted full responsibility for funding the construction and maintenance of national highways. The *National Roads Act* 1974 was the first of a number of Acts to provide financial assistance to the States for national highways and permit the Commonwealth to notify design standards to the States to ensure that national highways are constructed to an appropriate standard.

National highways include the major links between capital cities, the highway from Brisbane to Cairns and the highway from Hobart to Burnie (see Figure 2.1). National highways terminate at defined locations on the outskirts of major cities, and a small proportion of their length is in inner and outer urban areas. Some short sections of national highways extending into inner urban areas are excluded from the 1981 data since inventory details of these sections are not available. The total length of national highways has been fairly constant since they were first declared in 1974.

An indication of the status of the national highway network is given in Table 2.1 for 1981 when the total length was 16 193km (excluding short sections in inner urban areas). The only States having unsealed lengths of national highway in 1981 were Queensland, South Australia and Western Australia. The unsealed lengths in these States amounted to 1961km, or 12 per cent of the length of national highways in Australia; 587km (or approximately 4 per cent) of national highways were divided.

The growth in VKT on national highways between 1972[1] and 1981 is shown in Figure 2.2. New South Wales[2], Queensland and South Australia exhibited a generally higher

TABLE 2.1—LENGTH OF NATIONAL HIGHWAYS, 1981

(km)

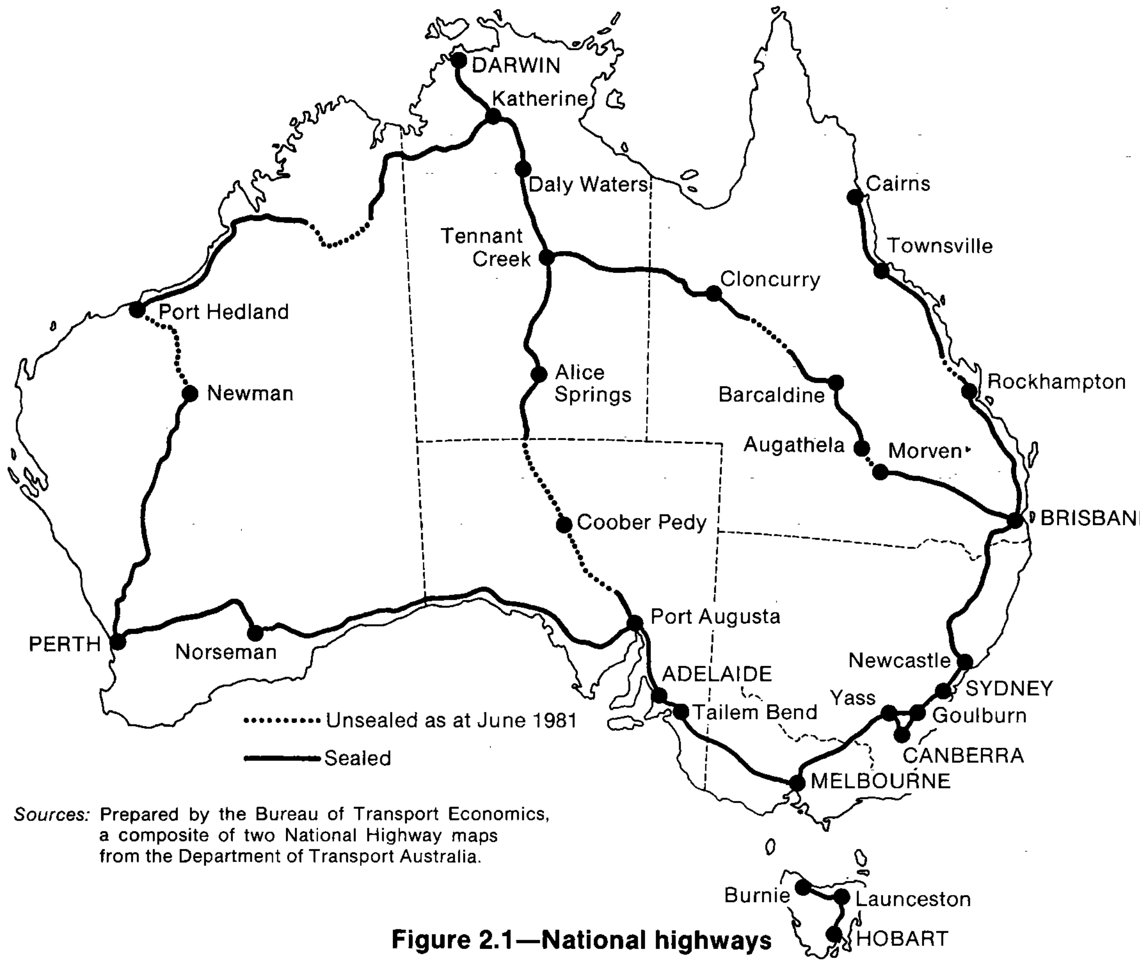
State	*Total length*	*Sealed length*	*Unsealed length*	*Divided length*[a]
New South Wales	1 301	1 301	0	212
Victoria	686	686	0	167
Queensland	3 880	3 536	344	102
South Australia	2 602	1 704	898	85
Western Australia	4 733	4 014	719	8
Tasmania	310	310	0	7
Northern Territory	2 681	2 681	0	6
Australia[b]	16 193	14 232	1 961	587

a. Expressed as route length, not carriageway length.

b. No roads within the Australian Capital Territory have been declared as national highways.

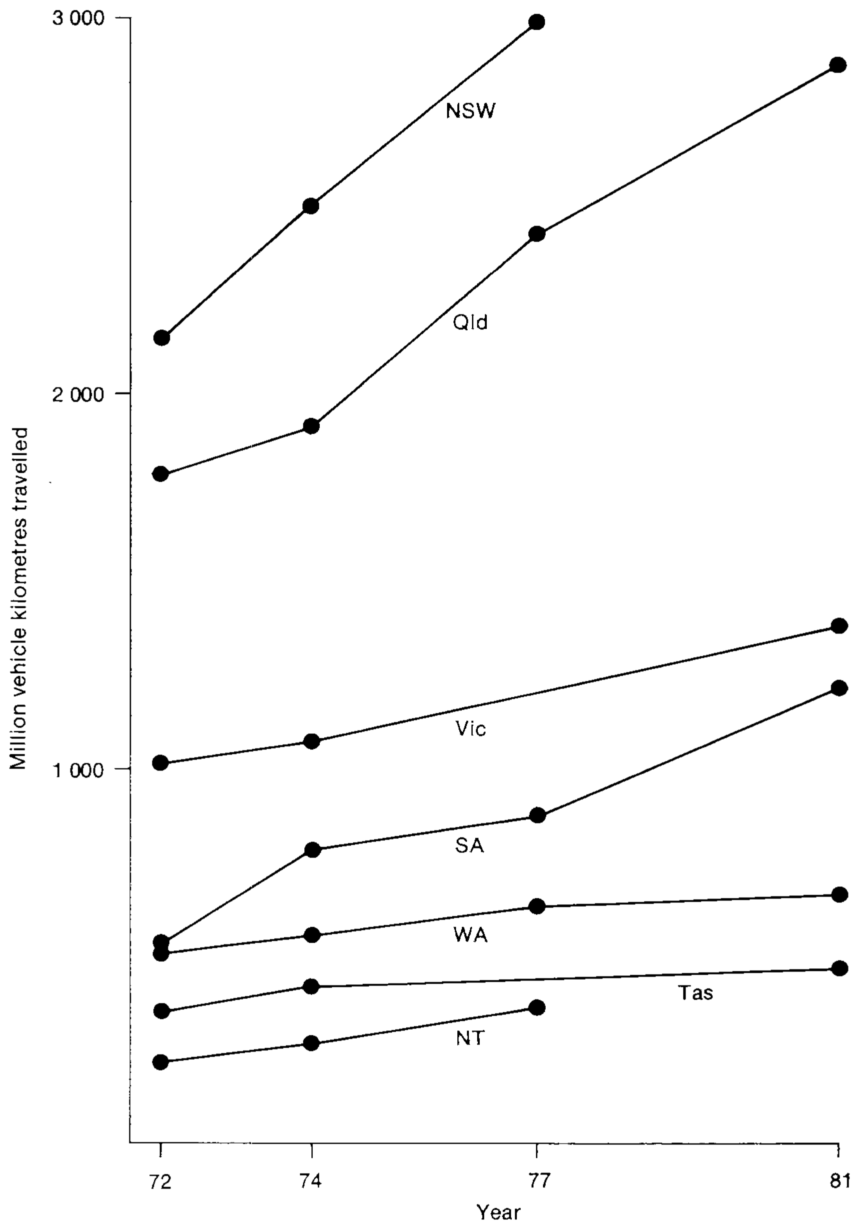
Source: State Road Authorities, personal communication.

1. The 1972 Australian Roads Survey (ARS) data are used to obtain inventory data for those roads which later became national highways.
2. Data for New South Wales and Northern Territory are only available from 1972 to 1977.



Sources: Prepared by the Bureau of Transport Economics, a composite of two National Highway maps from the Department of Transport Australia.

Figure 2.1—National highways



Source: Table II.1

Figure 2.2—Vehicle kilometres travelled on national highways, 1972–81

rate of growth of VKT than did the other States. The national highways in New South Wales and Victoria represented only 12 per cent of the total length of national highways in 1974, but they accounted for 48 per cent of the VKT in that year.

The distribution of length by annual average daily traffic (AADT) is shown for 1981 for each State in Figure 2.3. The AADT distributions for New South Wales, Victoria and Tasmania differed markedly from those for the remaining States. All sections of national highway in New South Wales, Victoria and Tasmania had an AADT greater than 1000, while 20-30 per cent of the length of national highways in each of these States had an AADT in excess of 6000. In each of the remaining States a large proportion of the length had an AADT of less than 1000. This predominance of lightly trafficked roads also characterised the national highway network as a whole. About 67 per cent of the length of all national highways had an AADT less than 1000, while only 7 per cent of the length had an AADT greater than 6000.

The measures used to assess the operational characteristics of national highways are listed in Table 2.2. The data source, method of collection and available error estimates for each of these measures are outlined in Appendix I. Appendix II contains tabulations of the source data for national highways.

OPERATIONAL CHARACTERISTICS

Travel time

Travel Time Estimates

Estimates of the change in travel time on national highways are available for New South Wales, Queensland and Tasmania. These travel time changes are presented in Tables 2.3 to 2.5 respectively and show an overall downward trend over the respective periods despite the growth in VKT illustrated in Figure 2.2.

The travel time between Sydney and the Queensland border decreased by 1 hour 5 minutes (or 9 per cent) between 1966 and 1983. The reduction in travel time between Sydney and the Victorian border was 30 minutes (or 6 per cent) during the same period. Travel times on the national highways between Canberra and Goulburn and Canberra and Yass remained approximately constant between 1966 and 1983. Major road infrastructure improvements appear to have had a significant impact on travel times. For example, the provision of 64km of freeway conditions between Liverpool and Mittagong was associated with a reduction in travel time for that section of 30 minutes (or 33 per cent) between 1978 and 1981.

Table 2.4 indicates that the travel time between Brisbane and Cairns decreased by approximately 2 hours (or 8 per cent) between 1970 and 1983. The national highway between Brisbane and the Northern Territory border experienced a reduction in travel time of 1 hour 38 minutes (or 6 per cent), while travel time between Brisbane and the New South Wales border decreased by 14 minutes (or 6 per cent). Again, major infrastructure improvements were associated with significant reductions in travel time. For example, the sealing of over 200km of previously unsealed road between Longreach and Cloncurry was associated with a reduction in travel time on that section from 8 hours 20 minutes in 1970 to 7 hours 5 minutes in 1983. The VKT

TABLE 2.2—MEASURES USED TO ASSESS THE OPERATIONAL CHARACTERISTICS OF NATIONAL HIGHWAYS

Operational characteristics	*Measures reported*
Travel time	Travel time
Comfort and convenience	Length by surface type
	Length by seal width by AADT
Safety	Number of fatal accidents
	Number of fatal accidents/VKT

TABLE 2.3—TRAVEL TIME ON NATIONAL HIGHWAYS; NEW SOUTH WALES, 1966, 1972 AND 1983

Route	*1966* Length[a] (km)	*1966* Travel time (hr:min)	*1972* Length[a] (km)	*1972* Travel time (hr:min)	*1983* Length[a] (km)	*1983* Travel time (hr:min)
Sydney-Queensland border	777	11:50	753	10:45	760	10:45
Sydney[b]-Victorian border	550	7:45	550	7:40	541	7:15
Canberra-Goulburn	90	1:15	90	1:15	94	1:15
Canberra-Yass	63	0:50	63	0:50	61	0:50
Total	1 480	21:40	1 456	20:30	1 456	20:05

a. Lengths obtained from travel time maps. They do not correspond exactly to the declared length of national highway.
b. Measured from Liverpool.

Source: New South Wales, Department of Main Roads (DMR), 1966, 1972 and 1983.

TABLE 2.4—TRAVEL TIME ON NATIONAL HIGHWAYS; QUEENSLAND, 1970 AND 1983

Route	*1970* Length[a] (km)	*1970* Travel time (hr:min)	*1983* Length[a] (km)	*1983* Travel time (hr:min)
Brisbane-Cairns	1 852	24:16	1 770	22:15
Brisbane-Northern Territory border	2 037	27:08	2 015	25:30
Brisbane-New South Wales border	254	.3:39	262	3:25
Total	4 143	55:03	4 047	51:10

a. Lengths obtained from travel time maps. They do not correspond exactly to the declared length of national highways.

Source: Queensland, Main Roads Department (MRD), 1970 and 1983.

TABLE 2.5—TRAVEL TIME ON NATIONAL HIGHWAYS; TASMANIA, 1969 AND 1980

Route	*1969* Length[a] (km)	*1969* Travel time (hr:min)	*1980* Length[a] (km)	*1980* Travel time (hr:min)
Hobart-Burnie	351	5:40	342	4:42

a. Length obtained from travel time maps. It does not correspond exactly to the declared length of national highways.

Sources: Tasmania, Department of Public Works. (1969). Tasmania, Department of Main Roads (DMR), (1980).

on Queensland national highways increased by 61 per cent between 1972 and 1981 whilst the travel times on these roads generally decreased.

The travel time from Hobart to Burnie decreased by 58 minutes (or 17 per cent) between 1969 and 1980. The construction of the Ulverstone bypass and other road works contributed to a reduction in travel time between Burnie and Devonport from 1 hour 5 minutes in 1969 to 37 minutes in 1980. The reductions in travel times on Tasmanian national highways occurred despite an overall increase in vehicle kilometres of travel of 33 per cent between 1972 and 1981.

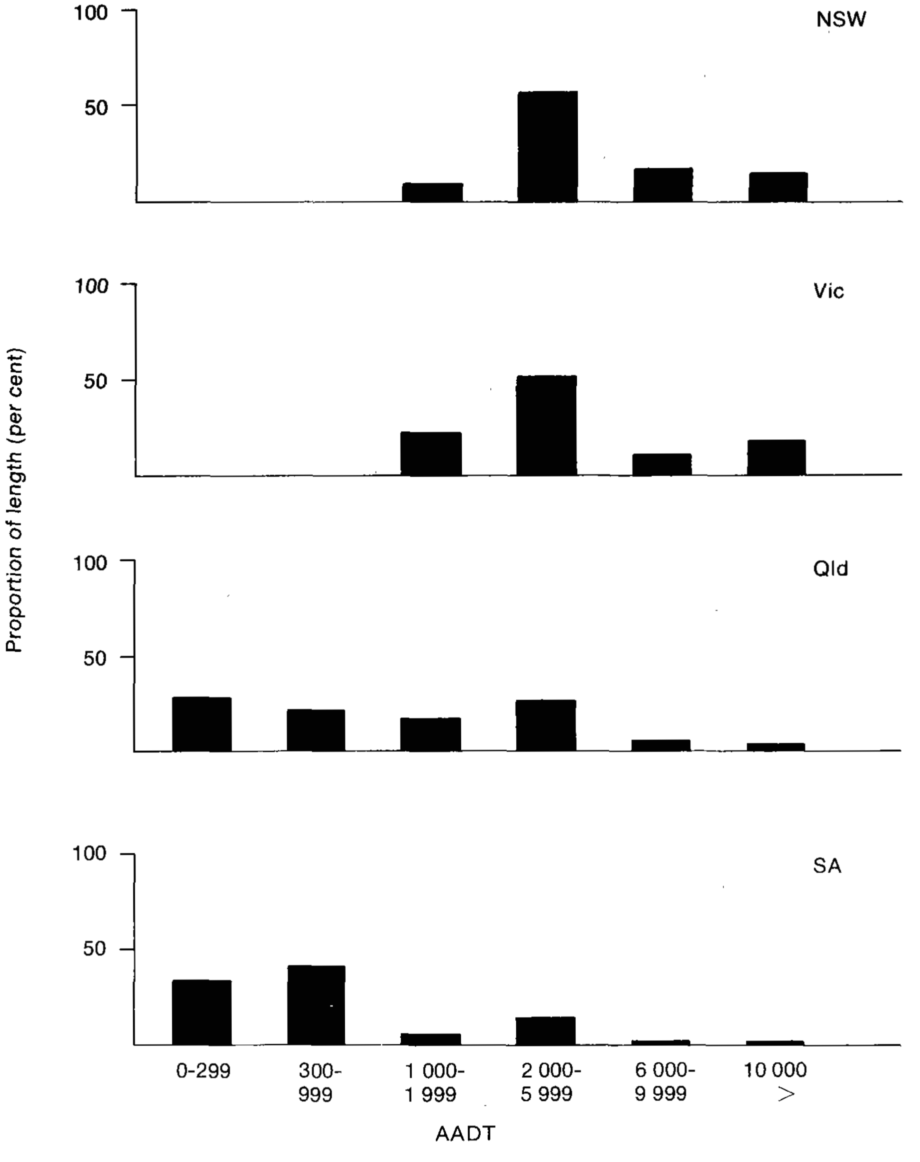
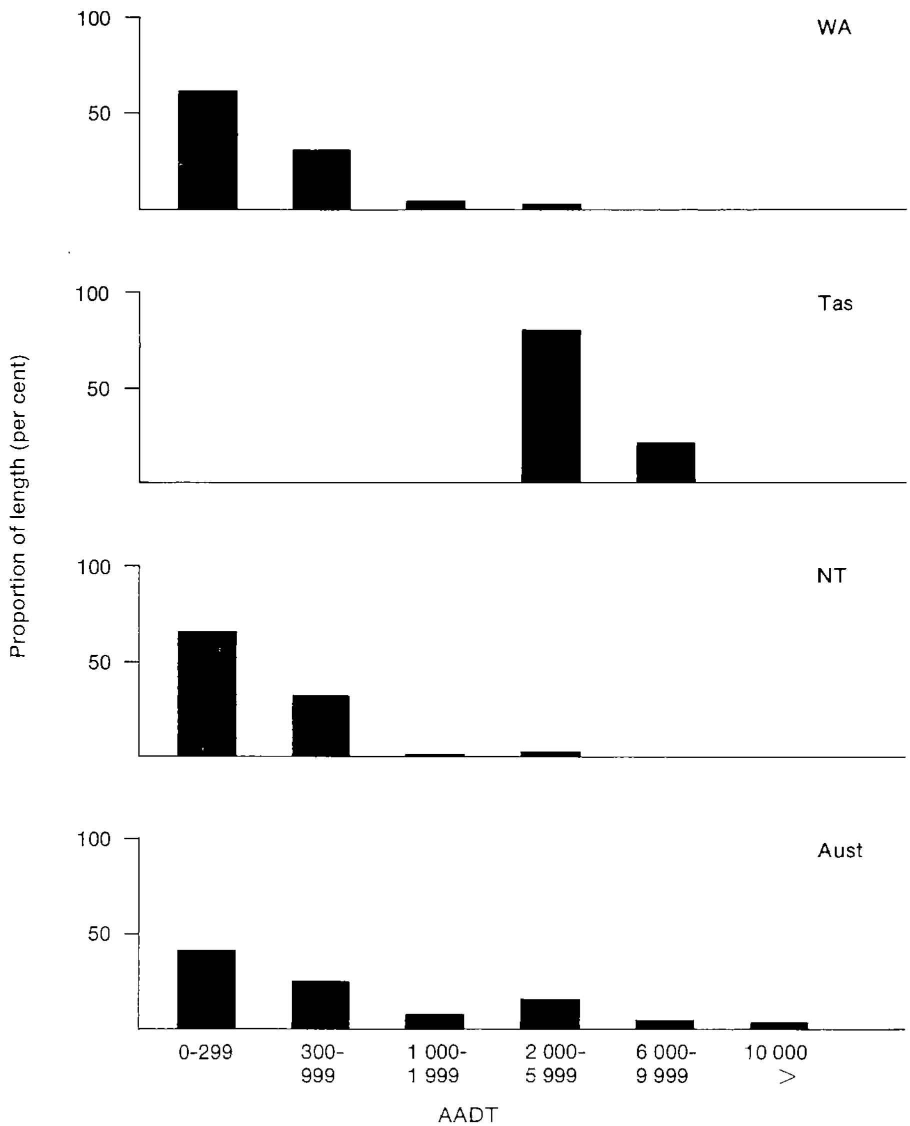


Figure 2.3—Length by AADT for national highways, 1981

Comfort and convenience

Surface type

All national highways in New South Wales, Victoria and Tasmania were sealed prior to 1972. About 425km of national highways in the Northern Territory was unsealed in 1972 but has since been sealed. In 1981 significant lengths of unsealed national highways remained in Queensland, South Australia and Western Australia. The change in the surface type distribution between 1972 and 1981 is illustrated in Figure 2.4.



Source: Tables II.2 to II.25

Figure 2.3 (Cont)—Length by AADT for national highways, 1981

The length of unsealed national highways in Queensland decreased from 613km (or 16 per cent) in 1972 to 344km (or 9 per cent) in 1981. The data given in Table II.10 indicate that the unsealed sections of national highways tend to be lightly trafficked. In 1981, only 66km of the unsealed national highways in Queensland carried an AADT greater than 300 vehicles per day.

In South Australia the length of unsealed national highways decreased from 1520km (or 58 per cent) in 1972 to 898km (or 35 per cent) in 1981. All unsealed national

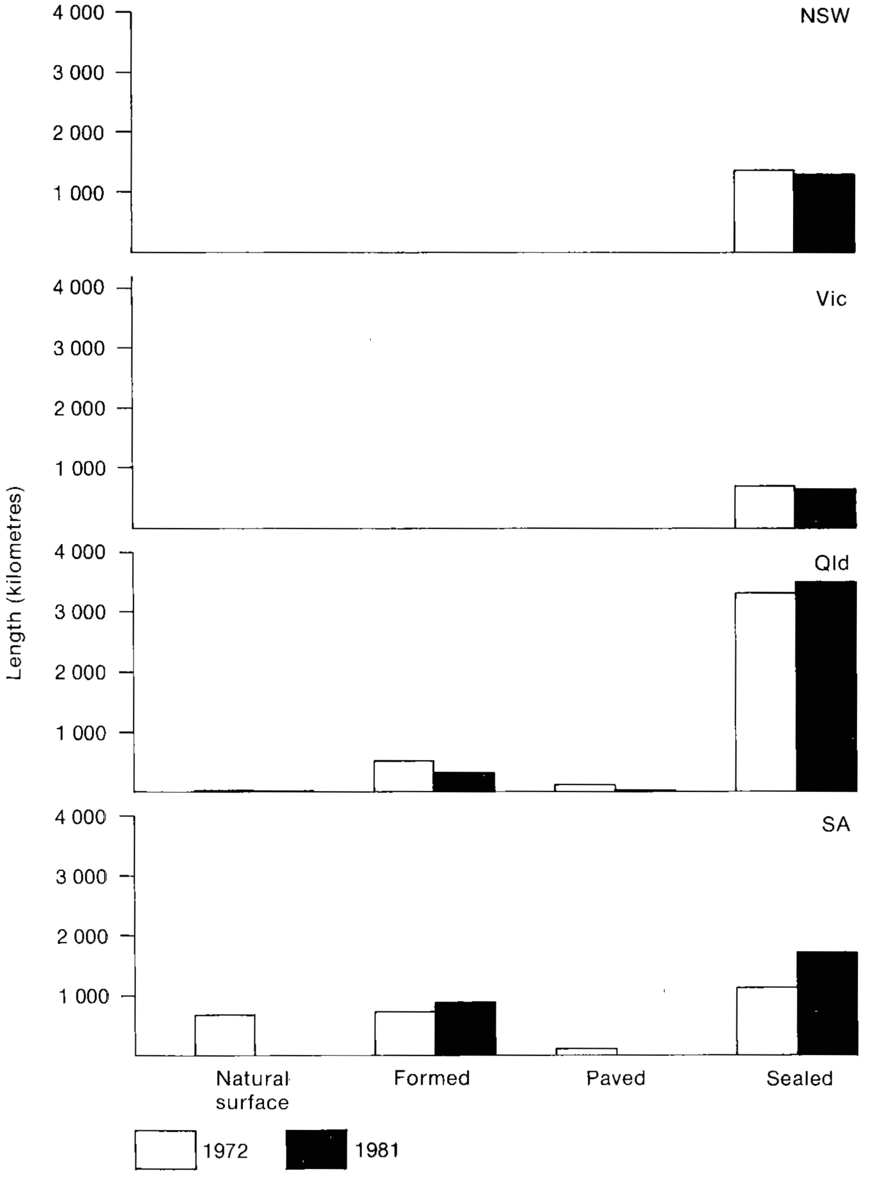
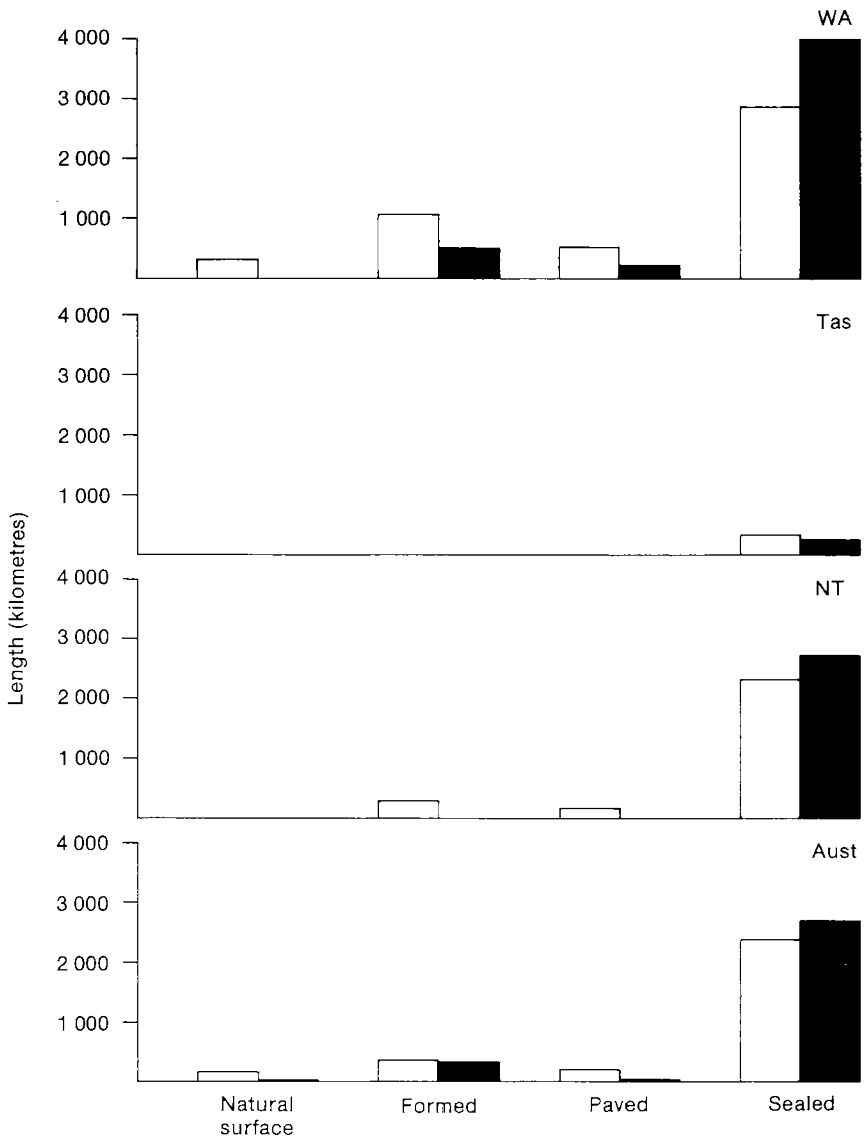


Figure 2.4—Length by surface type for national highways, 1972 and 1981

highways in this State carried an AADT of less than 300 vehicles per day in 1981 (see Table II.14).

In Western Australia the length of unsealed national highways decreased from 1908 km (or 40 per cent) in 1972 to 719km (or 15 per cent) in 1981. Again, the unsealed lengths of national highway were lightly trafficked (see Table II.18).

For the national highway network as a whole, the length of unsealed road decreased from 4466 km (or 27 per cent) in 1972 to 1961km (or 12 per cent) in 1981. Much



Source: Tables II.2 to II.28

Figure 2.4 (Cont)—Length by surface type for national highways, 1972 and 1981

of the road network that has been sealed carried low traffic volumes. About 4780km of sealed national highways in Queensland, Western Australia and the Northern Territory carried an AADT of less than 300 vehicles per day in 1981[1]. This length represented about 30 per cent of the total length of national highways.

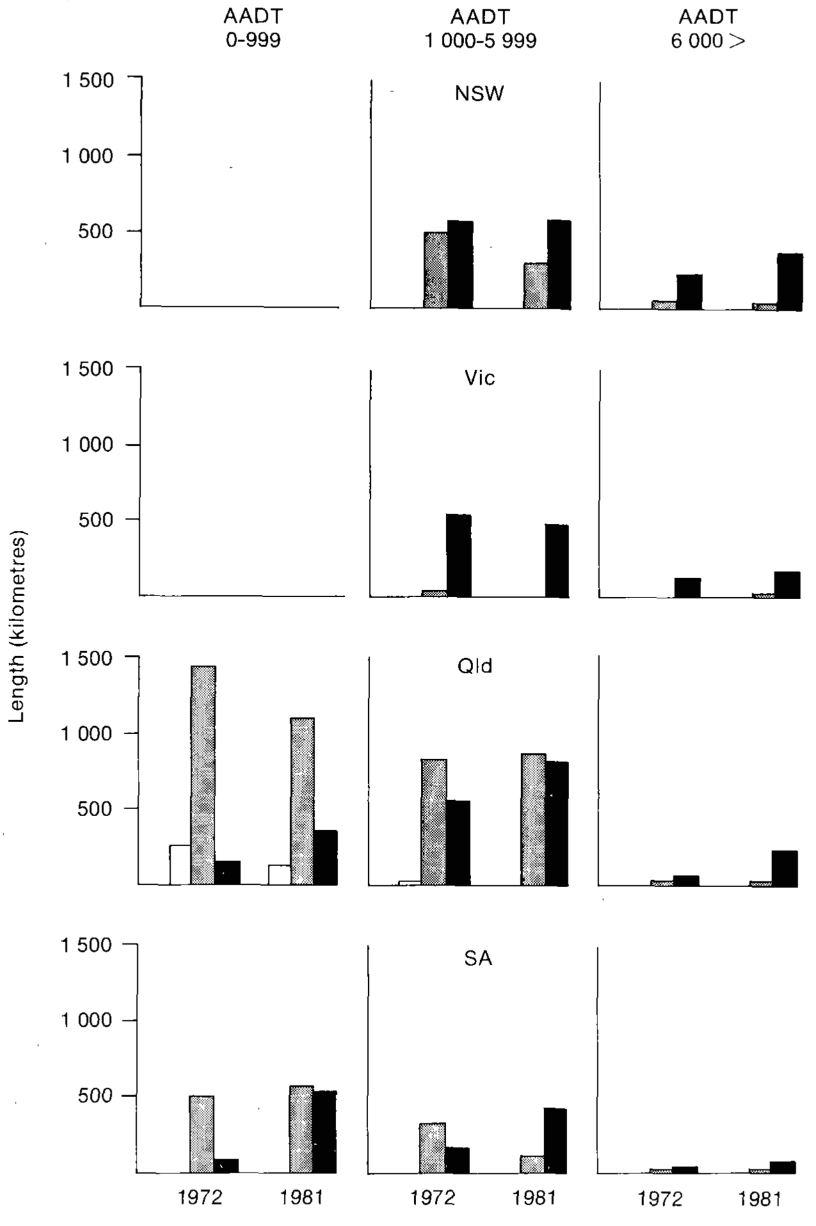
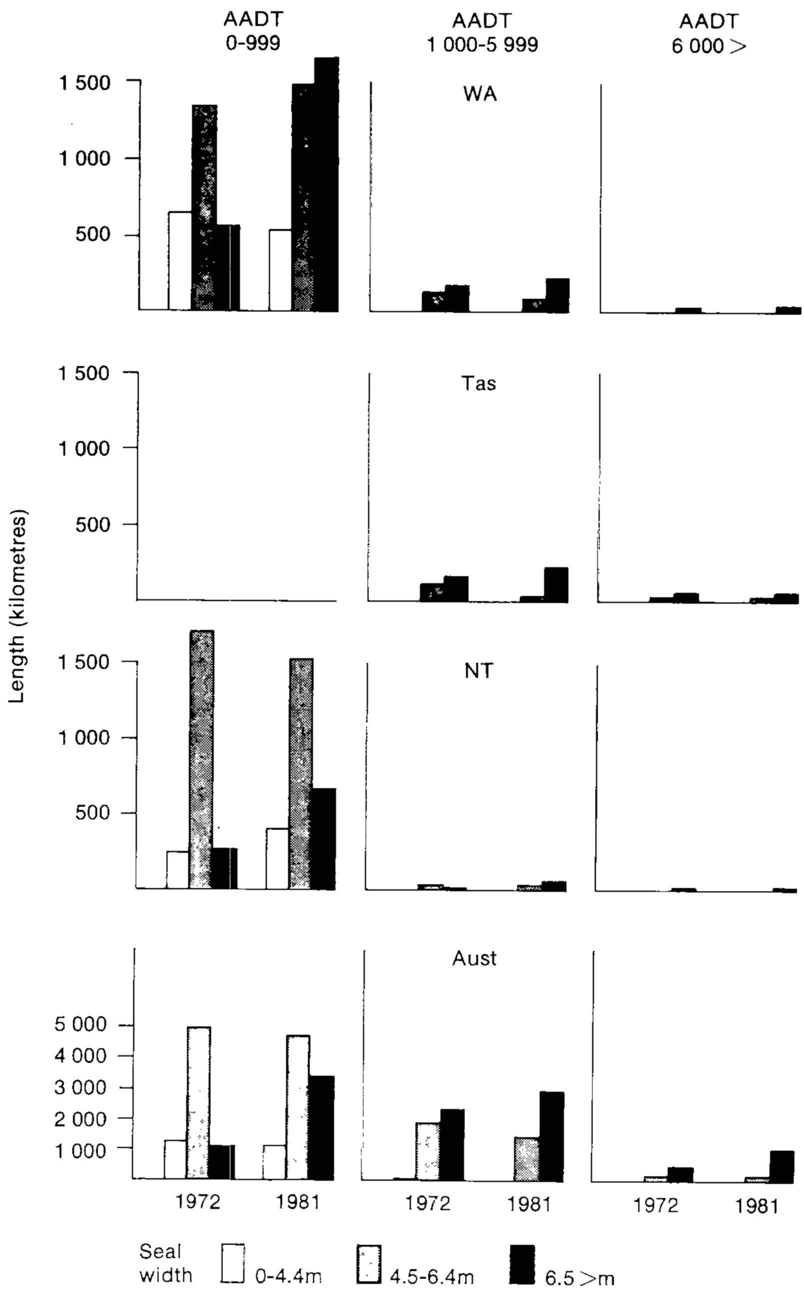


Figure 2.5—Sealed width by AADT for national highways, 1972 and 1981

1. Based on 1981 data for Queensland and Western Australia and 1977 data for the Northern Territory. See Tables II.10, II.18 and II.26.

Seal width by AADT

Trends in the distribution of seal width by AADT are illustrated in Figure 2.5 for each State and for the national highway network as a whole. The seal width ranges



Source: Tables II.2 to II.28

Figure 2.5 (Cont)—Sealed width by AADT for national highways, 1972 and 1981

were chosen to separately identify one lane seals (less than 4.5m wide) and wide seals (greater than 6.5m wide).

The length of national highways in New South Wales with an AADT greater than 6000 increased from approximately 298km (or 22 per cent) in 1972 to about 428km (or 32 per cent) in 1977. However, the length of this relatively highly trafficked road having a seal width of less than 6.5m decreased from 76km in 1972 to 45km in 1977. Overall, the length of national highways in New South Wales with a seal width greater than 6.5m increased from 782km (or 57 per cent) in 1972 to 1074km (or 83 per cent) in 1981 (see Table II.2) but in arriving at those proportions it should be noted that over the period 1972 to 1981 the length of national highways in New South Wales decreased from 1372km to 1301km.

In Victoria the length of national highways with an AADT greater than 6000 increased from 128km (or 19 per cent) in 1972 to 193km (or 28 per cent) in 1981. Almost all national highways in Victoria had a seal width greater than 6.5m in 1972; and the length of divided road increased from 71km to 168km between 1972 and 1981.

In contrast to New South Wales and Victoria, the national highways system in Queensland consists of significant lengths of lightly trafficked road. For example, 1570km (or 40 per cent) of national highways in Queensland carried an AADT less than 1000 in 1981. The length with an AADT greater than 6000 increased from only 83km (or 2 per cent) in 1972 to 270km (or 7 per cent) in 1981. Only about 13km of this relatively heavily trafficked road had a seal width less than 6.5m in 1981. The length of national highway with a seal width greater than 6.5m increased from 744km (or 19 per cent) in 1972 to 1431km (or 37 per cent) in 1981.

About 102km (or 4 per cent) of national highways in South Australia had an AADT greater than 6000 in 1981. About 12km of this road had a seal width less than 6.5m. The length of national highways with a seal width greater than 6.5m increased from 277km (or 11 per cent) in 1972 to 1033km (or 40 per cent) in 1981.

In Western Australia about 3691km (or 78 per cent) of sealed national highways had an AADT less than 1000. Nevertheless, the length of national highways with a seal width greater than 6.5m increased from 700km (or 15 per cent) in 1972 to 1875km (or 40 per cent) in 1981.

The length of national highways in Tasmania with an AADT greater than 6000 increased from 30km (or 10 per cent) in 1972 to 63km (or 20 per cent) in 1981. Almost all of this road had a seal width greater than 6.5m in 1981. The length of national highways with a seal width greater than 6.5m increased from 206km (or 65 per cent) in 1972 to 284km (or 92 per cent) in 1981.

About 2651km (or 97 per cent) of national highway in the Northern Territory had an AADT less than 1000 in 1977. The length of national highway with a seal width greater than 6.5m increased from 296km (or 11 per cent) in 1972 to 1086km (or 41 per cent) in 1981 (see Table II.26).

For the national highway network as a whole, the length of road with an AADT greater than 6000 increased from 578km (or 4 per cent) in 1972 to 1084km (or 7 per cent) in 1981[1]. However, only 74km of this road had a seal width less than 6.5m in 1981. The total length of national highways with a seal width greater than 6.5m increased from 3677km (or 22 per cent) in 1972 to 7467km (or 46 per cent) in 1981.

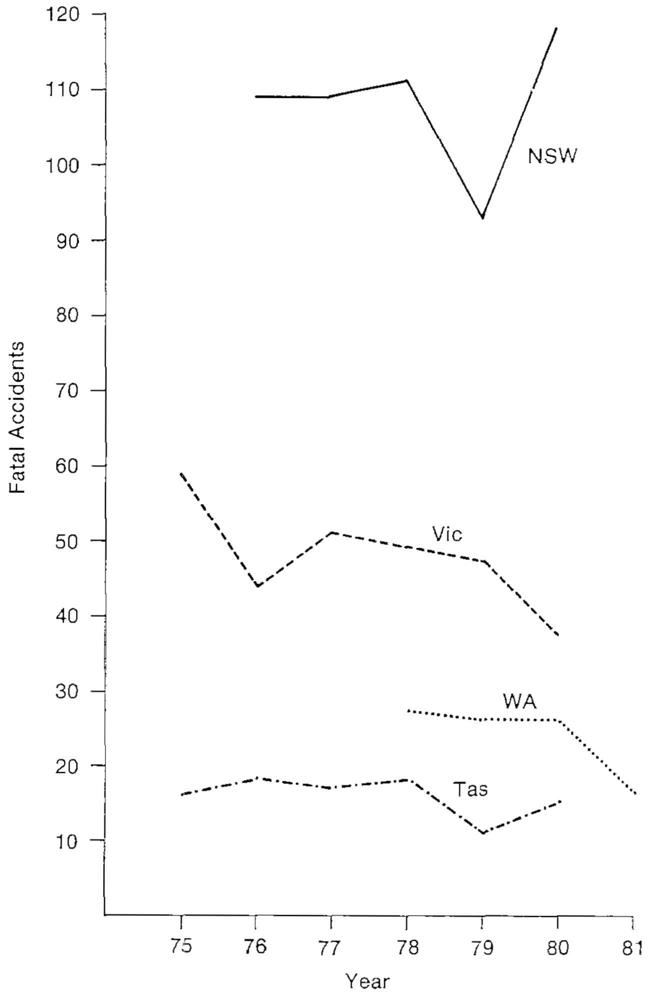
The data in Tables II.2 to II.26 indicate that 496km of national highway had an AADT greater than 10 000 in 1981[1]. About 246km of this road was divided, a further 220km had a seal width greater than 6.5m and 30km had a seal width less than 6.5m.

1. Based on 1977 data for New South Wales and the Northern Territory.

Safety

Fatal accidents
The trends in the numbers of fatal accidents occurring on national highways are illustrated in Figure 2.6. The data suggest that there is a downward trend in the number of fatal accidents occurring in Victoria and perhaps in Western Australia (although the time series available for this State is relatively short). No clear downward trend is evident in New South Wales or Tasmania. Information concerning fatal accidents in other States is not readily available.

Fatal accident rates
Figure 2.7 shows the numbers of fatal accidents per 100 million VKT in the States for which data are available. The fatal accident rates in Victoria, Western Australia and Tasmania all appear to be decreasing; however the information for New South



Source: Tables II.29 to II.33

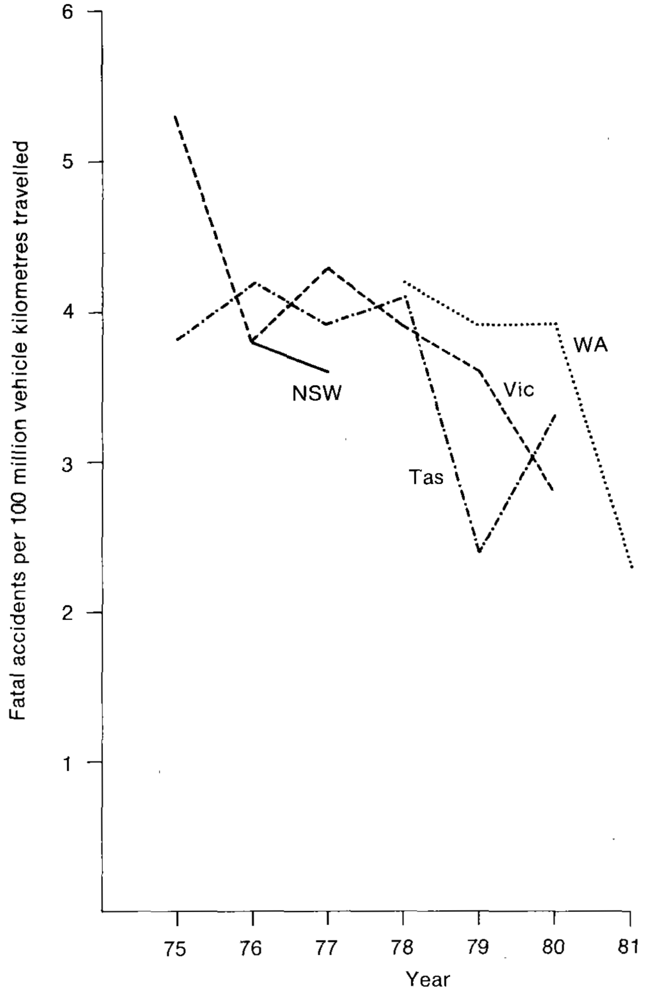
Figure 2.6—Fatal accidents on national highways, 1975-81

Wales is too limited to be able to determine whether the rate is falling in that State. Fatal accident rates are not available for national highways in South Australia; however fatality rates are available. The information in Appendix Table II.31 suggests that between 1975 and 1980 the numbers of fatalities per 100 million VKT in South Australia were comparable with those in other States and were declining.

SUMMARY OF FINDINGS

The national highway network consists of about 16 200km of road. Although the amount of traffic on the network was growing between 1972 and 1981 much of its length was lightly trafficked with more than 65 per cent of the length of all national highways having an AADT of less than 1000 in 1981.

The available travel time information suggests that major road infrastructure



Sources: Derived from Figure 2.2 and 2.6

Figure 2.7—Fatal accident rates on national highways, 1975-81

improvements made a significant contribution to the reduction in travel times on national highways in New South Wales. Queensland and Tasmania. Those national highways which did not undergo major upgrading in recent years generally did not exhibit travel time increases despite the growth in traffic, but factors such as vehicle performance may have contributed to the situation.

All national highways in New South Wales, Victoria, Tasmania and the Northern Territory are sealed. Significant progress was made between 1972 and 1981 with the sealing of national highways in Queensland, South Australia and Western Australia. About 1961km remained to be sealed in these States in 1981, of which only 66km had an AADT exceeding 300.

The length of national highways with a seal width greater than 6.5m increased substantially between 1972 and 1981. In 1981 only 74km of national highways that had an AADT greater than 6000 was associated with a seal width of less than 6.5m.

The available accident data suggest that the fatal accident rates for national highways in New South Wales, Victoria, Western Australia and Tasmania have generally shown a tendency to decline between 1975 and 1981.

CHAPTER 3-RURAL ROADS

BACKGROUND

Rural roads comprise some 90 per cent of the total length of Australian roads. Federal aid to the States for road construction and maintenance commenced with the *Loans Act* 1922 and has been continued in various Acts thereafter. A common feature of Acts in recent years (1950–1969) was the specific provision of funds for roads in rural areas. In 1969 the allocation of funds to defined road categories was placed on a more precise footing and that year also signified a departure from the past practice of allocating the major part of total funds to rural roads. Under the *Commonwealth Aid Roads Act* 1969. funds allocated to rural roads amounted to on average, about 50 per cent of total funds, a significant decrease from that in previous Roads Acts where 80 per cent had been the norm.

In terms of construction of completely new roads this redirection of funds from rural to urban roads was not of great significance since by 1950 most of the current route length of the Australian road network was already in existence. However much of the network consists even today of natural surface roads whose trafficability is often dependent on weather conditions. The *Commonwealth Aid Roads Act* 1969 was also notable for its incorporation of two specific rural road categories; arterial roads and local roads. While some previous Acts had given a loose recognition for funds to be channelled into particular types of roads in rural areas the 1969 Act was the first to put this on a precise and formal footing. This separation of roads into (predominantly) arterial roads and local roads continued up to and including the *Road Grants Act* 1982.

The arterial roads described in this chapter correspond to those of NAASRA functional classes 1, 2 and 3 in rural areas, and classes 6 and 7 in outer urban areas as of June 1981 and are exclusive of national highways which separate data is presented in Chapter 2. These roads differ to some extent from those defined as arterial roads by the Commonwealth for funding purposes as discussed in Appendix I.

The operational characteristics and their associated measures reported in this chapter are shown in Table 3.1. Explanatory information concerning data sources, methods and accuracy levels is presented in Appendix I. The data used for most of the analysis in this chapter are summarised in Appendix III.

Description of the System

Road length

The total length of the rural road network in Australia in 1981 was approximately 738 000km of which approximately 97 000km or (13 per cent) was rural arterial road. The length of arterial roads and of local roads in each State in 1981 are shown in Table 3.2.

Approximately 199 000km (27 per cent) of the length of the network was sealed in 1981 although the proportion of arterial road length sealed was far higher at 77 per cent (Table III.37). In individual States the proportion of length sealed varied from 61 per cent in the Australian Capital Territory to 13 per cent in the Northern Territory (Table 3.3).

Total road usage (including national highways)

The graphs in Figure 3.1 show that in all States except Victoria, there was continuous growth in VKT in rural areas generally between the years 1971, 1976 and 1979. As might be expected, the absolute levels of rural VKT are in accord with State populations of both people and vehicles. These estimates of rural travel were obtained from ABS Surveys of Motor Vehicle Usage which are described in Appendix I. The method of travel estimation differs from that obtained from inventory data for arterial road travel as also explained in Appendix I.

TABLE 3.1—OPERATIONAL CHARACTERISTICS FOR RURAL ROADS

Operational Characteristics	*Measure*	*Coverage*[a]
Travel time	Travel time Average travel speed	Arterial roads in New South Wales, Queensland and Tasmania
Comfort and Convenience	Length by surface type	Local and arterial roads
	Length by surface type by AADT Length by seal width by AADT	Arterial roads
Safety	Number of fatal accidents Number of fatal accidents per 100 million VKT	Rural roads (excluding roads in outer urban areas) except in the Australian Capital Territory

a. Each State is covered individually except where a statement to the contrary is made.

TABLE 3.2—LENGTH OF RURAL ROADS; 1981

(km)

State	*Road Category*		
	Arterial	*Local*	*Total*
New South Wales	29 904	154 535	184 439
Victoria	15 600	129 509	145 109
Queensland	19 059	131 071	150 130
South Australia	10 364	84 317	94 681
Western Australia	16 446	113 063	129 509
Tasmania	2 621	13 024	15 645
Northern Territory	3 125	14 683	17 808
Australian Capital Territory	103	364	467
Australia	97 222	640 566	737 788

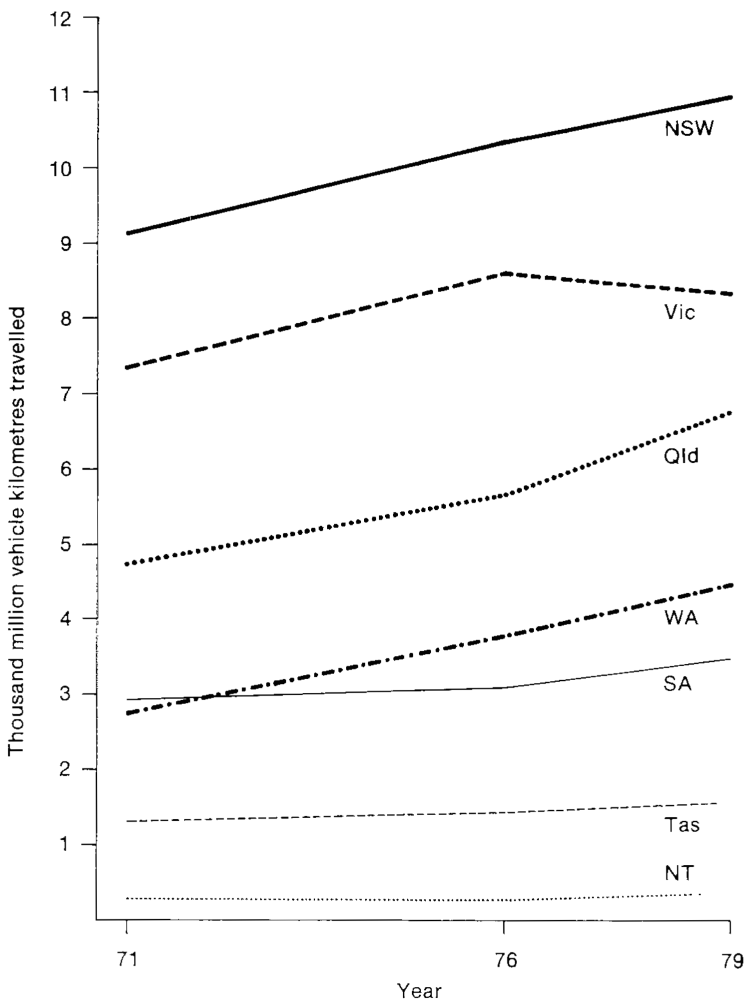
Notes: 1 Australian Capital Territory data is for June 1980.
2. Data excludes national highways.
3. BTE estimates were made of road lengths in the outer urban component of certain LGAs as described in Appendix I.

Sources: Australian Bureau of Statistics (1982 and undated). State Road Authorities, personal communications.

The data in Table III.8 indicate that for Australia the growth in VKT by cars between 1971 and 1979 was 23 per cent. This compares with a VKT growth of 55 per cent for utilities and panel vans and 11 per cent for trucks during the same period. Although VKT by heavy trucks increased by only 11 per cent the tonne kilometres performed by trucks increased by 67 per cent (see Table III.9). These figures suggest that average vehicle loadings increased substantially between 1971 and 1979 (probably due to an increase in the mean capacity of the trucks using rural roads).

Arterial road usage

The data on arterial road VKT which are shown in Figure 3.2 are based on estimates of AADT at various locations on the arterial road network. Since the data in Figure 3.2 include roads in outer urban areas, the growth rates for these arterial roads are not directly comparable with the growth rate for all roads in rural areas given in Figure 3.1.



Source: Tables III.1 to III.7.

Figure 3.1—Travel in rural areas, 1971-79

TABLE 3.3—DISTRIBUTION OF LENGTH BY SURFACE TYPE FOR RURAL ROADS; 1981

(km)

State	Surface Type				
	Natural surface	*Formed*	*Gravel*	*Sealed*	*Total*
New South Wales	21 800	37 901	65 360	59 378 (32%)	184 439
Victoria	22 420	24 144	47 718	50 827 (35%)	145 109
Queensland	22 546	56 059	33 973	37 552 (25%)	150 130
South Australia	24 452	18 354	37 470	14 405 (15%)	94 681
Western Australia	22 012	44 727	34 783	27 987 (22%)	129 509
Tasmania	208	401	8 572	6 464 (41%)	15 645
Northern Territory	6 670	4 624	4 262	2 252 (13%)	17 808
Australian Capital Territory	0	0	183	284 (61%)	467
Australia	120 108	186 210	232 321	199 149 (27%)	737 788

Notes: 1. Australian Capital Territory data is for June 1980.
2. Data excludes national highways.
3. BTE estimates were made of road lengths in the outer urban component of certain LGAs as described in Appendix I.
4. Percentages of road length sealed is shown in brackets.

Sources: Australian Bureau of Statistics (1982b and undated). State Road Authorities, personal communications.

Total travel on rural arterial roads in Australia in 1981 was approximately 30 000 million VKT, an increase of nearly 50 per cent over the 1972 level (Table III.10). Distributions of length by AADT for individual States and Australia are shown in Figure 3.3. The distributions can be separated into two distinct groups:

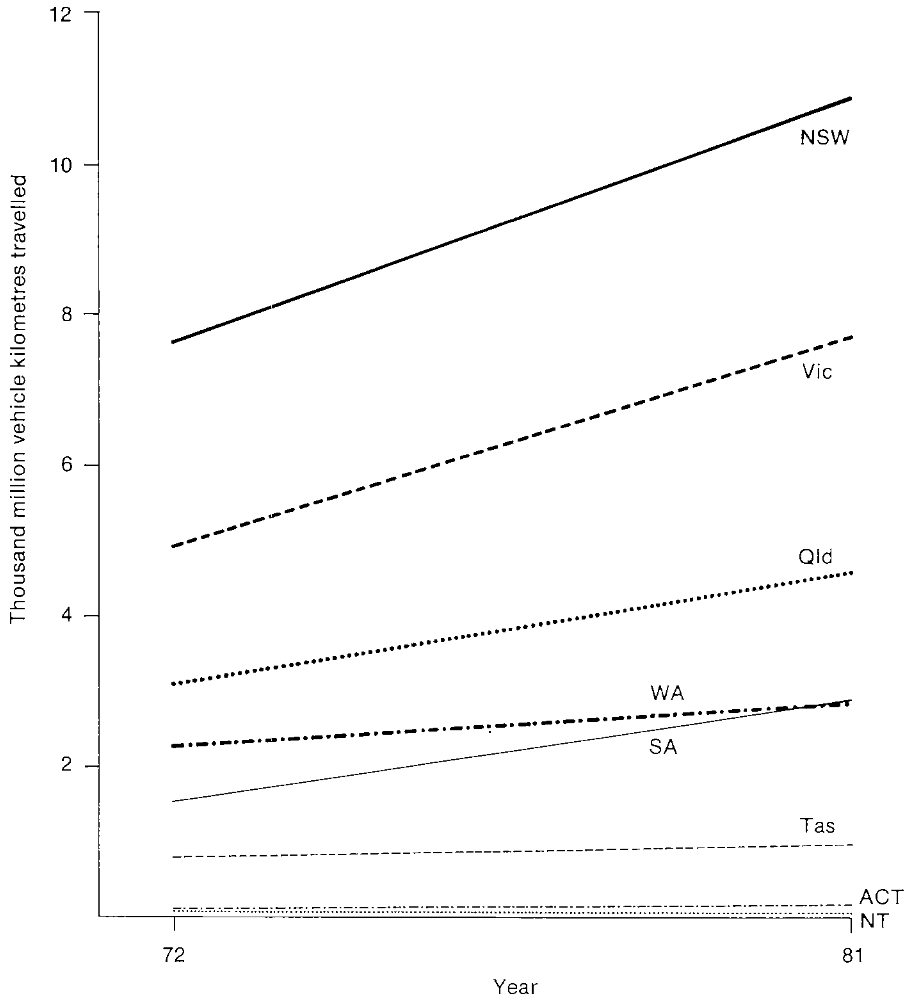
- those distributions skewed to the left with approximately fifty percent or more of arterial road length in the lowest volume category of 0–299 AADT (New South Wales, Queensland, South Australia, Western Australia and the Northern Territory); and
- those distributions which are more symmetrical with modal volumes of 300–1000 vehicles per day (Victoria, Tasmania) or higher (Australian Capital Territory).

Overall approximately one-fifth of the length of the Australian rural road network had an AADT greater than 1000.

Local road usage

Unlike the situation for arterial roads, AADT measurements on local roads have not been either as frequent or as extensive. The 1972 ARS estimates of AADT are the only available comprehensive data source from which local road VKT can be calculated. On this basis travel on local roads in 1972 in Australia was approximately 12 500 million VKT or approximately 34 per cent of the travel on rural roads in 1972. Travel on local roads in all States, except the Australian Capital Territory and the Northern Territory, showed a similar ratio to travel on arterial roads as Australia generally in 1972.

In 1972, traffic levels on the States' local roads were generally less than 100 vehicles per day and on unpaved roads (natural surface roads and formed roads) maximum traffic levels of 30 vehicles per day predominated (Tables III.11–18).



Source: Table III.10

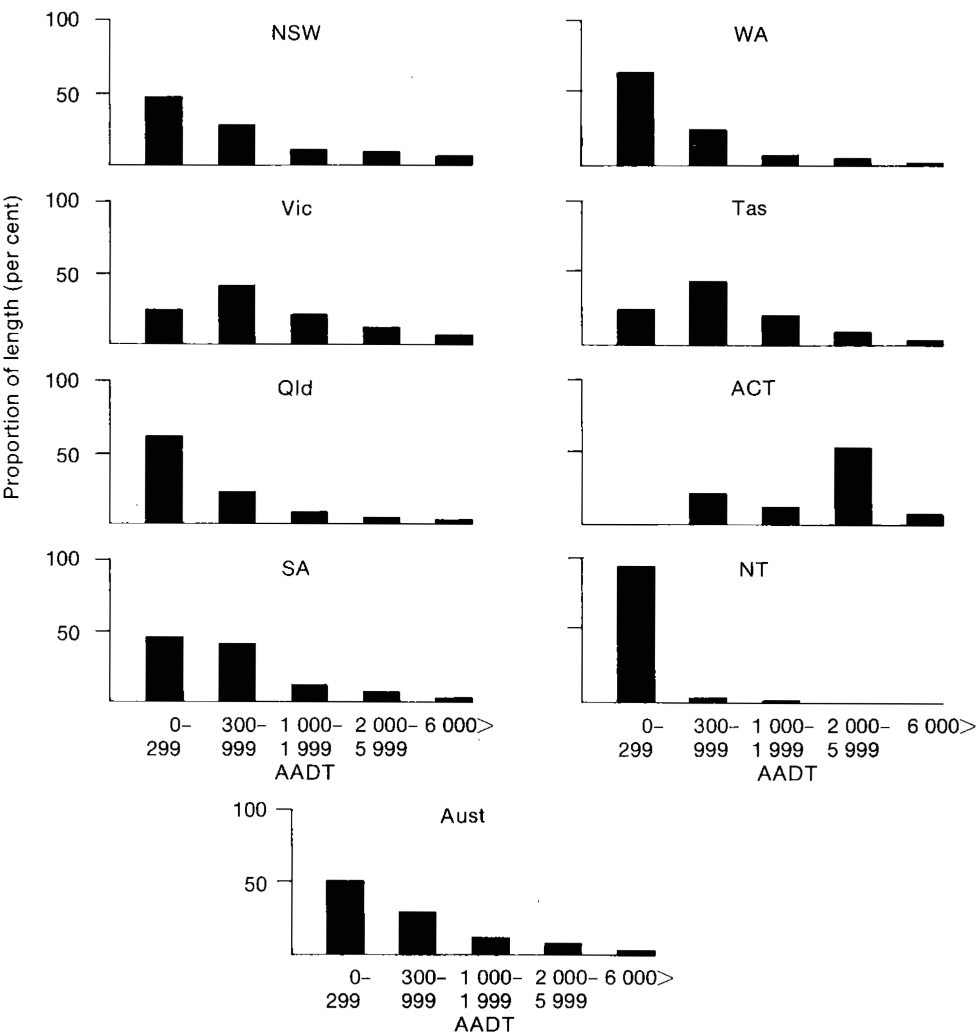
Figure 3.2—Travel on rural arterial roads, 1972-81

OPERATIONAL CHARACTERISTICS

Travel times and mean speeds

Time series data for travel times on rural arterial roads are restricted because of data limitations to three States; New South Wales, Queensland and Tasmania. In each State a number of routes were selected so as to cover a wide area and thereby encompass a reasonable range of both topography and traffic levels. The routes concerned are illustrated in Figures 3.4, 3.5 and 3.6 for New South Wales, Queensland, and Tasmania respectively. In most cases the arterial road is the only direct link between the centres shown. Tables 3.4, 3.5, and 3.6 show the travel times on these routes over the analysis period for New South Wales, Queensland and Tasmania respectively. The route lengths shown in the tables comprise 13 per cent, 20 per cent and 49 per cent of the arterial route length in New South Wales, Queensland and Tasmania respectively.

Table 3.4 shows that travel times in New South Wales were the same or slightly less in 1980 than they were eight years previously, despite the significant increases in traffic volumes as shown in Table 3.7 (although it is arguable whether AADT levels were high enough to significantly affect travel times, except possibly on the Newcastle to Grafton and Wollongong to Bega routes). All the routes shown in Table 3.4 were sealed in both 1972 and 1980 and there was virtually no change in any of the link distances over this period. The roadworks on these routes between 1972



Source: Tables III.29 to III.36

Figure 3.3—Proportion of length by AADT for rural arterials, 1981

and 1980 were characterised by maintenance and pavement widening rather than carriageway realignment or other major construction works.

Table 3.5 shows that travel time reductions on selected arterial roads in Queensland were generally greater than in New South Wales. The largest reductions (up to 15

TABLE 3.4—TRAVEL TIMES ON SELECTED RURAL ARTERIAL ROADS IN NEW SOUTH WALES; 1972 AND 1980

Route	Distance 1980 (km)	Travel time 1972 (hrs:min)	Travel time 1980 (hrs:min)	Per cent decrease 1972 to 1980	Average annual speed 1980 (km/h)
Dubbo-Bourke	369	4:45	4:25	7	84
Dubbo-Broken Hill	756	9:35	9:35	–	79
Dubbo-Hay	505	6:15	6:10	1	82
Wollongong-Bega	348	5:20	5:05	5	68
Newcastle-Grafton	481	7:10	6:40	7	72
Bathurst-Wagga Wagga	317	4:20	4:05	6	78
Dubbo-Moree	378	4:45	4:40	2	81
Grafton-Moree	377	4:45	4:45	–	79
Narrandera-Bega	492	7:05	6:40	6	74

– nil or rounded to zero.

Source: New South Wales, Department of Main Roads (1972 and 1980).

TABLE 3.5—TRAVEL TIMES ON SELECTED RURAL ARTERIAL ROADS IN QUEENSLAND; 1973 AND 1980

Route	Surface type 1973	Surface type 1980	Distance 1973 (km)	Distance 1980 (km)	Travel time 1973 (hrs:mins)	Travel time 1980 (hrs:mins)	Travel time 1973–1980 (per cent decrease)	Average annual speed 1980 (km/h)
Townsville-Mt Isa	225km formed only	sealed	917	910	12:15	11:05	10	82
Rockhampton-Longreach	116km formed only	50km formed only	721	686	9:45	8:28	13	81
Dalby-Cunnamulla	145km formed only	50km unsealed	594	596	7:05	7:06	–	84
Emerald-Charters Towers	260km formed only	240km unsealed	467	478	7:00	6:48	3	70
Rockhampton-Miles	20km gravel	sealed	468	424	6:40	5:39	15	75
Innisfail-Normanton	200km formed only	155km formed only	674	655	9:25	8:33	9	77

– nil or rounded to zero

Source: Queensland, Main Roads Department (1973 and 1980).

TABLE 3.6—TRAVEL TIMES ON SELECTED RURAL ARTERIAL ROADS IN TASMANIA; 1969 AND 1980

Route	Surface type		Distance	Travel time			Average
	1969	1980	1980	1969	1980	1969-1980 (per cent decrease)	annual speed 1980
			(km)	(hrs:mins)			(km/h)
Hobart Devonport[a]	87km unsealed	67km unsealed	257	4:40	3:38	22	71
Hobart-Strahan	35km unsealed	sealed	299	6:25	4:27	31	67
Hobart-St Helens	sealed	sealed	264	4:50	3:40	24	72
Devonport-St Helens	sealed	sealed	257	5:25	3:59	26	65
Burnie-Strahan	sealed	sealed	220	5:20	3:08	41	70

a. Part of this route is national highway.

Sources: Tasmania, Department Public Works (1969). Tasmania, Department of Main Roads (1980).

per cent), which occurred on the routes between Townsville and Mount Isa, Rockhampton and Longreach, and Rockhampton and Miles, can be attributed mainly to the poor initial state of these roads. Between 1973 and 1980, significant roadworks involving initial sealing, resealing, widening and realignment were carried out on these routes (MRD Queensland 1974-80). As shown in the table these roadworks were generally accompanied by small decreases in link distances.

The relative travel time reductions for Tasmania shown in Table 3.6 were by far the greatest of any of the three States for which time series data were available. Except for the two central routes, Hobart to Devonport and Hobart to Strahan, there were no changes in surface type or link distance and so any real reductions in travel time can be reasonably ascribed to other types of roadwork such as widening and minor realignment. All routes shown, particularly the two central routes, underwent considerable reconstruction work in the 1970's (Tasmania, Department of Public Works 1977, Tasmania, Department of Main Roads 1977-80).

Tables 3.4, 3.5, and 3.6 also show the corresponding average travel speed on each route. The generally lower average speeds for the routes in Tasmania compared to those in New South Wales and Queensland is probably more a reflection of the hilly topography of Tasmania than any other single factor.

The reliability of the quantitative data on travel time for all three States should be considered against the intention behind its collection. The published information is released mainly as a guide to tourists and the procedures for measurement are not rigorously consistent over time or between regions within a State (see Appendix I). Consequently only large variations in travel times such as occurred in Tasmania and some of the routes in Queensland are likely to be significant in terms of reflecting the impact of physical changes to the road system.

Length by Surface Type

Arterial roads

Length by surface type distributions for arterial roads in each State and for Australia in 1972 and 1981 are shown in Figure 3.7. In all States there has been a shift in the distributions from unpaved surfaces (natural surface and formed) to paved surfaces (gravel surface or bitumen seal).

The proportion of sealed arterial road is shown in Figure 3.8 for each State and for Australia for 1972 and 1981. A steady growth in the proportion sealed occurred in most States over the period, the growth being more marked in the States with the lower proportions sealed. In absolute terms the largest increase occurred in Queensland where 2370km of arterial road was sealed over the period (Tables III.22, III.31).

Local roads

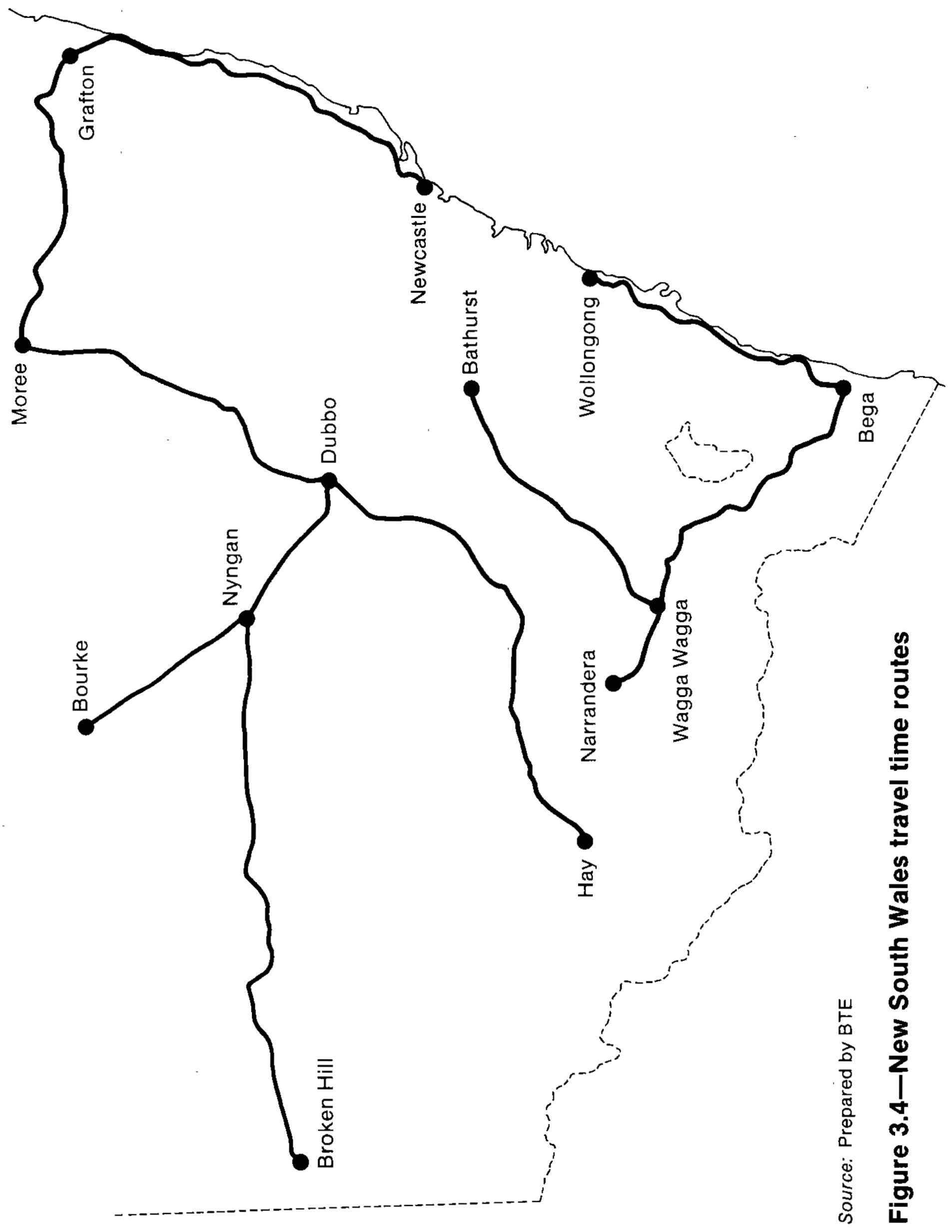
A direct comparison of the 1972 and 1981 distributions is complicated by significant differences in the length of the local road system in some States between 1972 and 1981. This is particularly so for unpaved roads. Such changes in length are the combined result of new road construction, changes in the definition of a road, improvements in length measurements and errors due to improper inventory recording. This matter is discussed further in Appendix I. Consequently it is advisable

TABLE 3.7—ANNUAL AVERAGE DAILY TRAFFIC ON SELECTED RURAL ARTERIAL ROADS IN NEW SOUTH WALES; 1971 AND 1977

		AADT		
Route	*Location of station*	*1971*	*1977*	*1971-77 (per cent increase)*
Dubbo-Bourke	Talbragar (Dubbo)	1 780	2 810	58
Dubbo-Bourke	Bourke	190	280	47
Dubbo-Broken Hill	Cobar	440	490	11
Dubbo-Broken Hill	Broken Hill	na	430	na
Dubbo-Hay	Dubbo	2 480	3 760	52
Dubbo-Hay	Parkes	1 380	2 260	64
Dubbo-Hay	Narrandera	1 210	1 800	49
Dubbo-Hay	Marsden	340	520	53
Dubbo-Hay	West Wyalong	1 340	2 190	63
Dubbo-Hay	Hay	500	720	44
Wollongong-Bega	Wollongong	20 080	21 930	9
Wollongong-Bega	Kiama	6 260	8 430	35
Wollongong-Bega	Eurobodalla	3 660	5 490	50
Wollongong-Bega	Mumbulla	1 120	1 520	36
Newcastle-Grafton	Newcastle	12 760	14 600	14
Newcastle-Grafton	Karuah	4 520	5 850	29
Newcastle-Grafton	Nabiac	3 390	4 590	35
Newcastle-Grafton	Hastings	3 100	4 620	49
Newcastle-Grafton	Macksville	3 370	4 780	42
Newcastle-Grafton	South Grafton	2 580	3 760	46
Bathurst-Wagga	Cowra	1 680	2 190	30
Bathurst-Wagga	Wagga-Wagga	1 750	2 440	39
Dubbo-Moree	Moree	900	1 380	53
Grafton-Moree	Gibraltar Range	370	470	27
Narrandera-Bega	Adaminaby	730	840	15
Narrandera-Bega	Cooma	2 050	2 680	31
Narrandera-Bega	Mumbulla	600	880	47

na not available

Source: New South Wales, Department of Main Roads (1971-72, 1977-78).

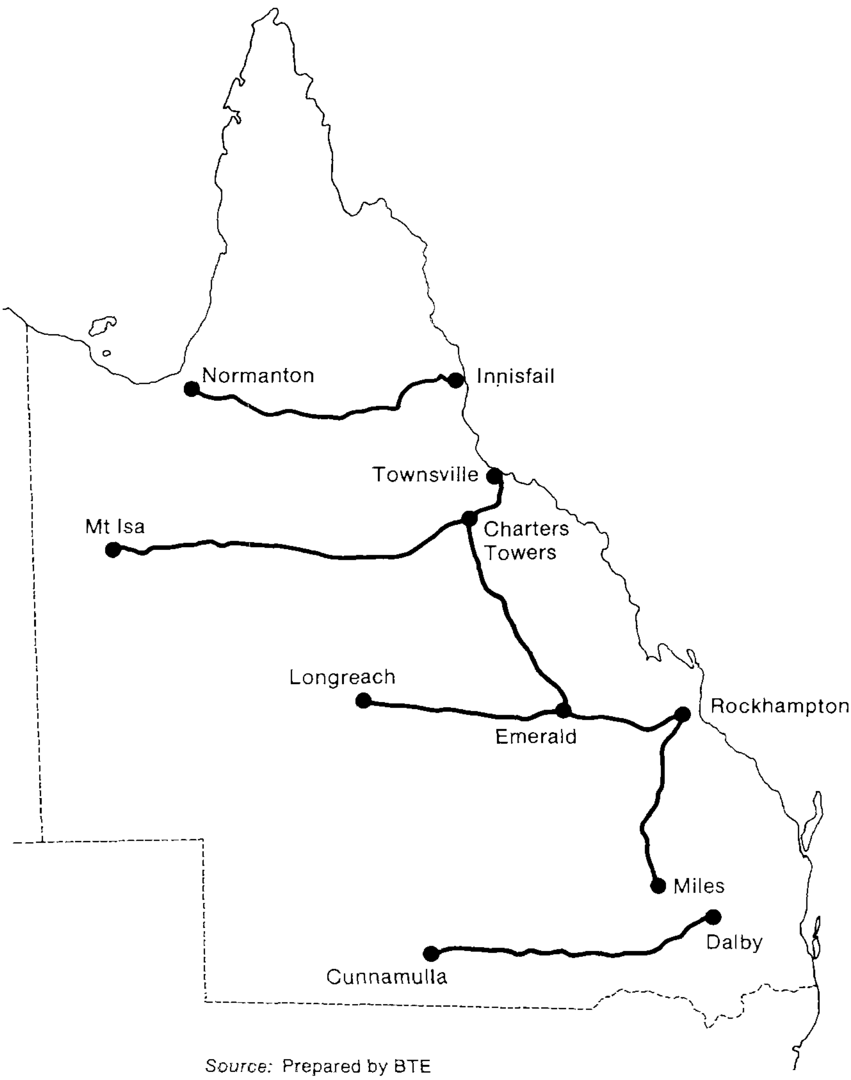


Source: Prepared by BTE

Figure 3.4—New South Wales travel time routes

to compare changes in the distributions of lengths of paved roads. These distributions are shown in Figure 3.9. The figure shows that, with the exception of Tasmania, the length of sealed road and the length of gravelled surface road in each State increased over the analysis period. In Tasmania the length of sealed road increased and the length of gravelled surface road decreased. However the net increase in sealed road length in this State is twice as great as the decrease in gravelled surface length, indicating that some 700km of sealed local road was constructed over the period (Table III.38). Overall the length of paved local roads in Australia increased from 265 000km in 1972 to 345 000km in 1981. As indicated in Table III.38 a large part of the increase resulted from the upgrading of unpaved roads.

The growth in the proportion of local roads paved in each State is shown in Figure



Source: Prepared by BTE

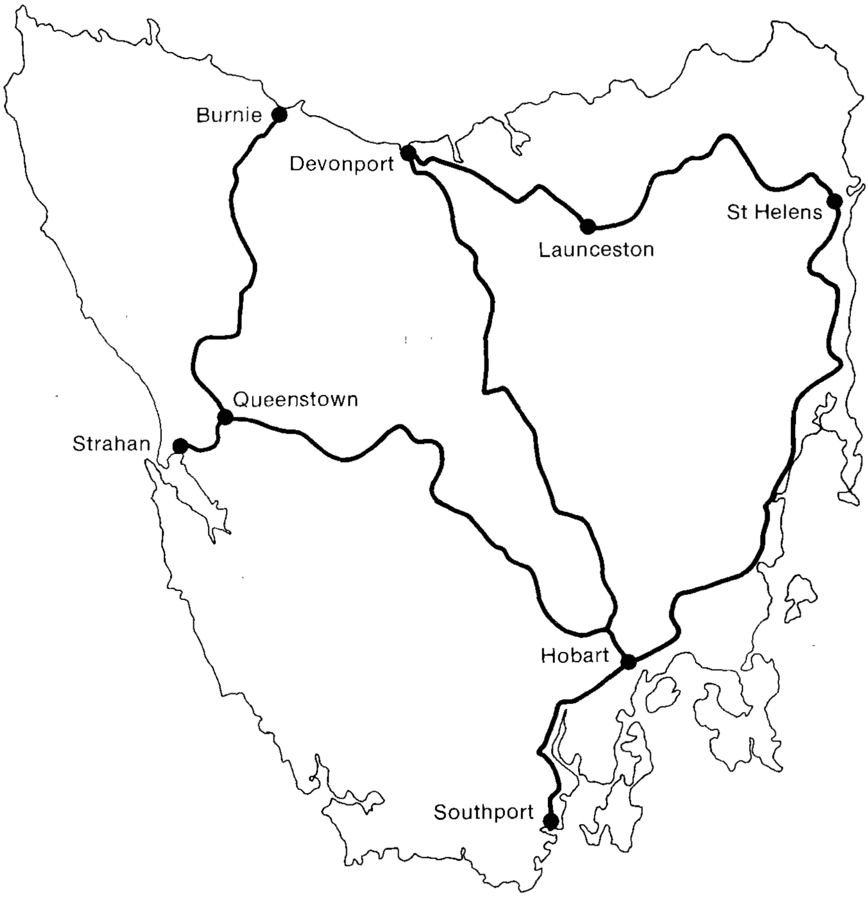
Figure 3.5—Queensland travel time routes

3.10. Due to inconsistencies in the basis for the inclusion of unpaved roads in inventories in past years the proportions shown in the figure are based on 1981 total local road lengths. The figure shows that in Tasmania most of the local road system was paved whereas in the Northern Territory only about one quarter of the local road system was paved. A comparison of Figures 3.8. and 3.10. shows that, in all States except Tasmania the proportion of rural arterial road that was sealed in 1972 and 1981 was greater than the proportion of local road that was paved.

Length by Surface Type by AADT

As shown in Table 3.8, traffic volumes greater than 300 vehicles per day were relatively uncommon on unsealed arterial roads in both 1972 and 1981. Further, for all States except New South Wales and Victoria, the reduction in unsealed length between 1972 and 1981 occurred in both high (AADT > 300) and low (AADT < 300) volume ranges. Throughout Australia the unsealed length of rural road declined by almost 23 per cent in the period 1972 to 1981.

The data in Table 3.8 show also that VKT on unsealed arterial roads in Australia



Source: Prepared by BTE

Figure 3.6—Tasmania travel time routes

in 1981 was only 2.5 per cent of total rural arterial VKT; two States, New South Wales and Queensland, had greater proportions. This small proportion of travel on unsealed roads implies that a detailed examination of traffic volumes on sealed roads is likely to be more informative than an examination of length by surface type by AADT distributions for arterial roads.

Length by Seal Width by AADT Distributions

In Figure 3.11 distributions of road length by seal width in each of the AADT ranges 0 to 299, 300 to 999 and 1000 plus are shown for rural arterial roads in each State. If an improvement over the period 1972 to 1981 occurred in the distribution of length by seal width for a particular AADT this is observed in Figure 3.11 as an increase in the length of the widest seal accompanied generally by a decrease in length of narrower seal widths. For example the distributions in Figure 3.11 for the 1000 plus AADT range in New South Wales show such an improvement. If this improvement occurred in all AADT ranges for a State then there should have been an overall improvement in the measure for that State. Such overall improvements occurred in Victoria, South Australia and Western Australia and to a lesser degree in Tasmania. In New South Wales and Queensland improvement occurred in the two highest volume ranges with virtually no change in the lowest volume range. Overall, the length by seal width by AADT distribution for the Australian rural arterial network showed an improvement from 1972 to 1981.

In Appendix III further details are given for various road width and AADT ranges. For example, Table III.37 shows that the length of rural arterial road carrying an AADT of 6000 or more in 1981 amounted to 2006km, of which 348km was divided

TABLE 3.8—UNSEALED RURAL ARTERIAL ROADS; LENGTHS, TRAFFIC VOLUMES AND VKT, 1972 AND 1981

	All unsealed rural arterials			*Unsealed rural arterials with AADTs > 300*		
State	*Length (km)*		*VKT*[a] *(per cent)*	*Length (km)*		*VKT*[b] *(per cent)*
	1972	*1981*	*1981*	*1972*	*1981*	*1981*
New South Wales	10 074	8 787	3.0	288	388	0.8
Victoria	504	380	0.9	41	63	0.4
Queensland	7 076	4 652	5.1	119	71	na
South Australia	2 688	1 937	2.0	45	35	0.2
Western Australia	5 725	4 270	1.5	164	11	0.2
Tasmania	347	218	1.6	80	18	0.7
Northern Territory	2 041	1 697	13.3	0	0	0
Australian Capital Territory	1	0	0	1	0	0
Australia	28 456	21 941	2.5	738	586	na

a. VKT on all unsealed rural arterial roads as a percentage of total rural arterial VKT.
b. VKT on unsealed rural arterial roads with AADT > 300 as a percentage of total rural arterial VKT.

na not available

Sources: Commonwealth Bureau of Roads (1973b). State Road Authorities, private communications.

road. The data in Tables III.29 to III.37 show that the length of divided rural arterial road in Australia was 487km in 1981, or approximately one half of one per cent of the total rural arterial length, and that 389km of this divided road was situated in the three eastern seaboard States.

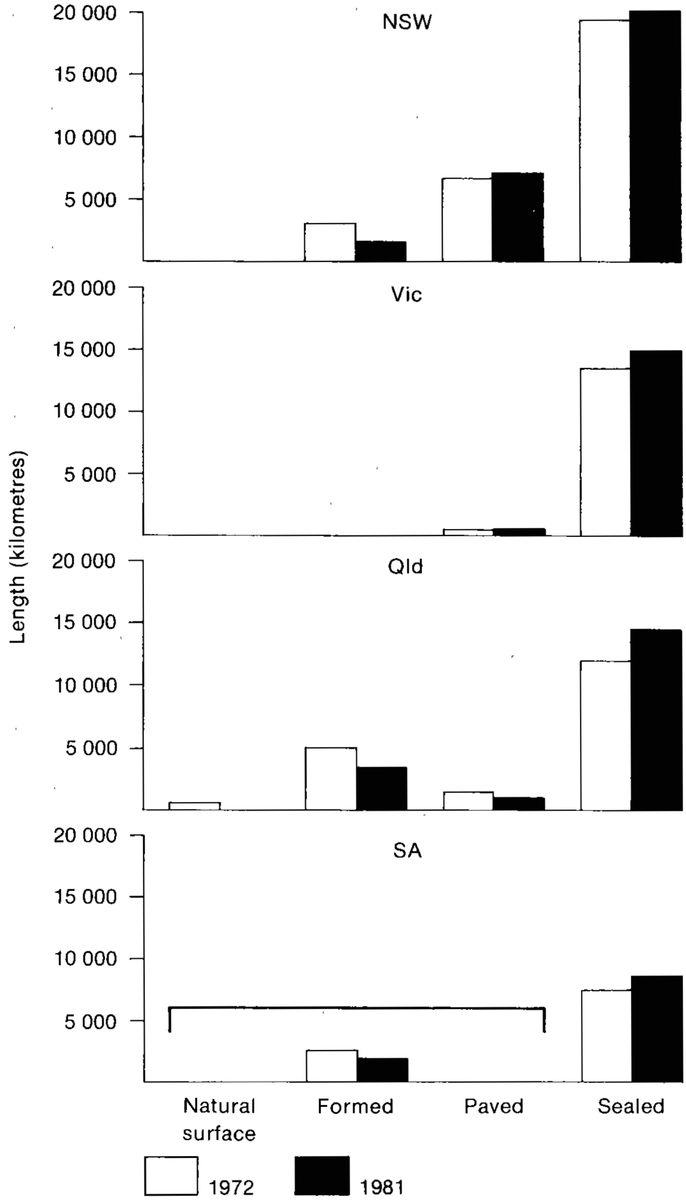
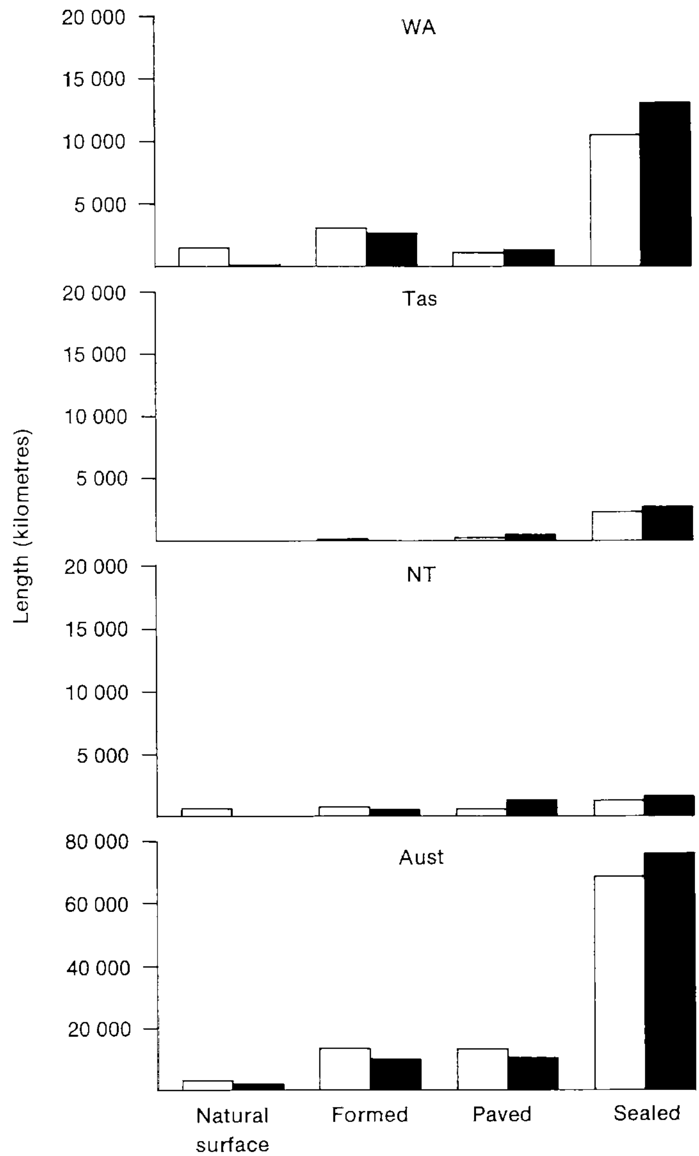


Figure 3.7—Length by surface type for rural arterial roads, 1972 and 1981



Note: Because of differences in the basis of recording of unsealed surface categories in South Australia between 1972 and 1981, changes in the proportion sealed are more reliable than changes in the complete surface type distribution for that State.

Source: Tables III.20 to III.37

Figure 3.7(Cont)—Length by surface type for rural arterial roads, 1972 and 1981

Safety

Fatal accidents

The number of fatal accidents in rural[1] areas in each State over the period 1975-82 is shown in Figure 3.12. (Data prior to 1975 were not available specifically for rural areas). The numbers of accidents per year appear to be declining in some State trends, although are difficult to identify. In general, the relativities among States in the numbers of fatal accidents per year correspond to relativities in VKT (Figure 3.1) except for the disproportionately high Northern Territory accident level.

Fatal accident rates

The number of fatal accidents per 100 million VKT of travel on rural roads in each State over the period 1975-82 is shown in Figure 3.13. New South Wales, Queensland and the Northern Territory experienced rates greater than the Australian average of 4.5 to 5 fatal accidents per 100 million VKT per year. The rates for the Northern Territory are by far the greatest for any State, being 50 per cent or more higher than those for New South Wales.

SUMMARY OF FINDINGS

The rural road system in Australia (excluding national highways) comprised about 738 000km of road in 1981 of which about 97 000km were arterial roads and the remainder local roads. About 2000km of arterial roads carried traffic volumes of over 6000 vehicles per day and levels of several hundred vehicles per day were common in all States except the Northern Territory. Local roads generally carried far lower volumes, of the order of 100 vehicles per day. Although travel on rural arterial roads increased by nearly 50 per cent between 1972 and 1981 various measures of the operational characteristics showed an overall improvement.

Travel times on arterial roads in New South Wales, Queensland and Tasmania were generally the same as or less than at the beginning of the analysis period, and were maintained despite significant traffic growth. In many cases this is considered to be due to significant improvements to road infrastructure. Such improvements in road infrastructure were reflected in increases in the proportion of sealed arterial roads in all States and a generally improved length by sealed width to traffic volume distribution in 1981 as compared to 1972. High traffic volumes tended to be carried by wider roads in 1981 than in 1972.

Although lack of data on local roads precludes any definitive statements on changes in their operational characteristics, it can be said that there has been a continuous growth in the length of paved local roads in all States. Thus by 1981 about 54 per cent of the length of the local road system in Australia was paved.

The number of fatal accidents in rural areas over the period 1975 to 1982 appeared to be declining in some States. Fatal accidents rates per 100 million VKT generally declined over the period.

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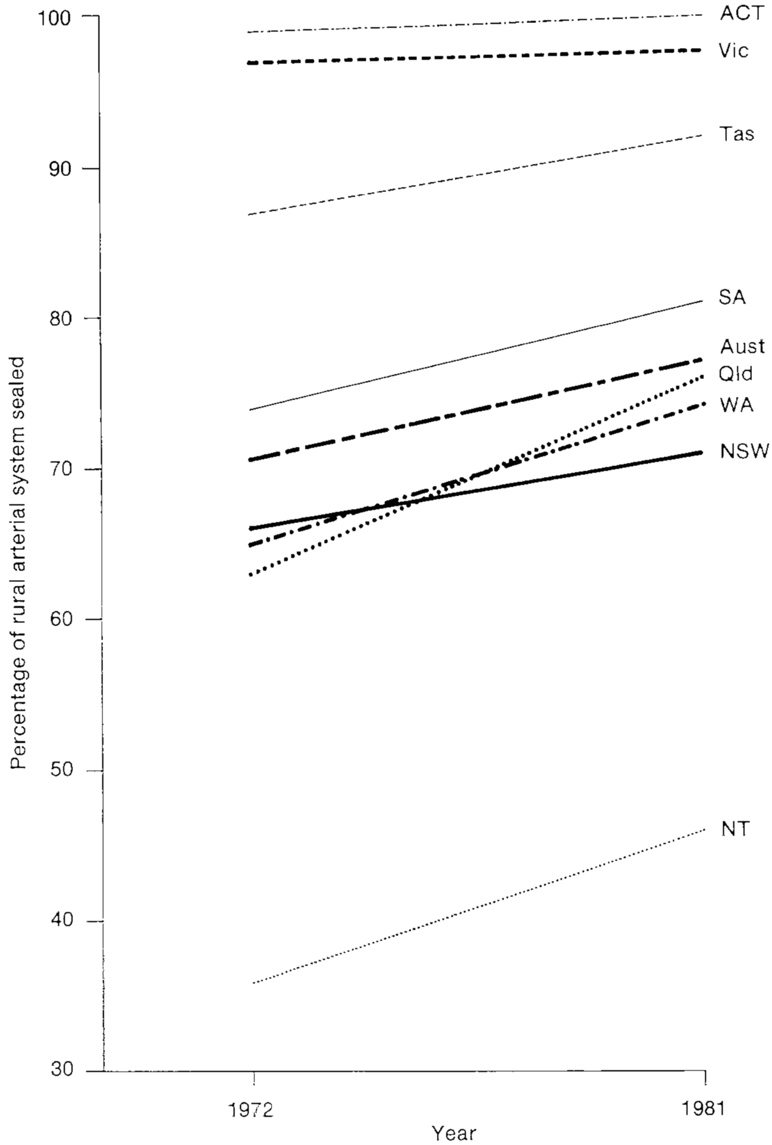
1. Accident data are for all roads outside the capital cities and provincial urban areas as defined by ABS. Thus the data exclude roads in outer urban areas.



Source: Tables III.20 to III.37

Figure 3.8—Proportion of rural arterial system sealed, States and Australia, 1972-81

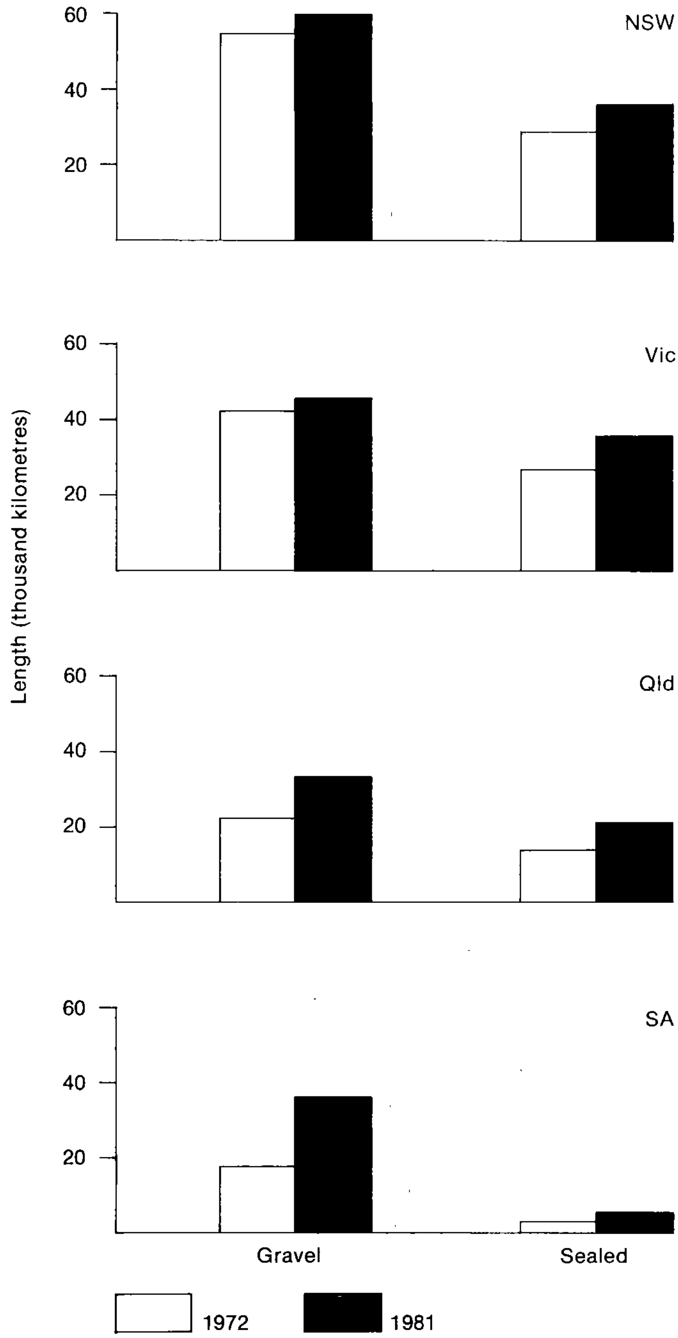
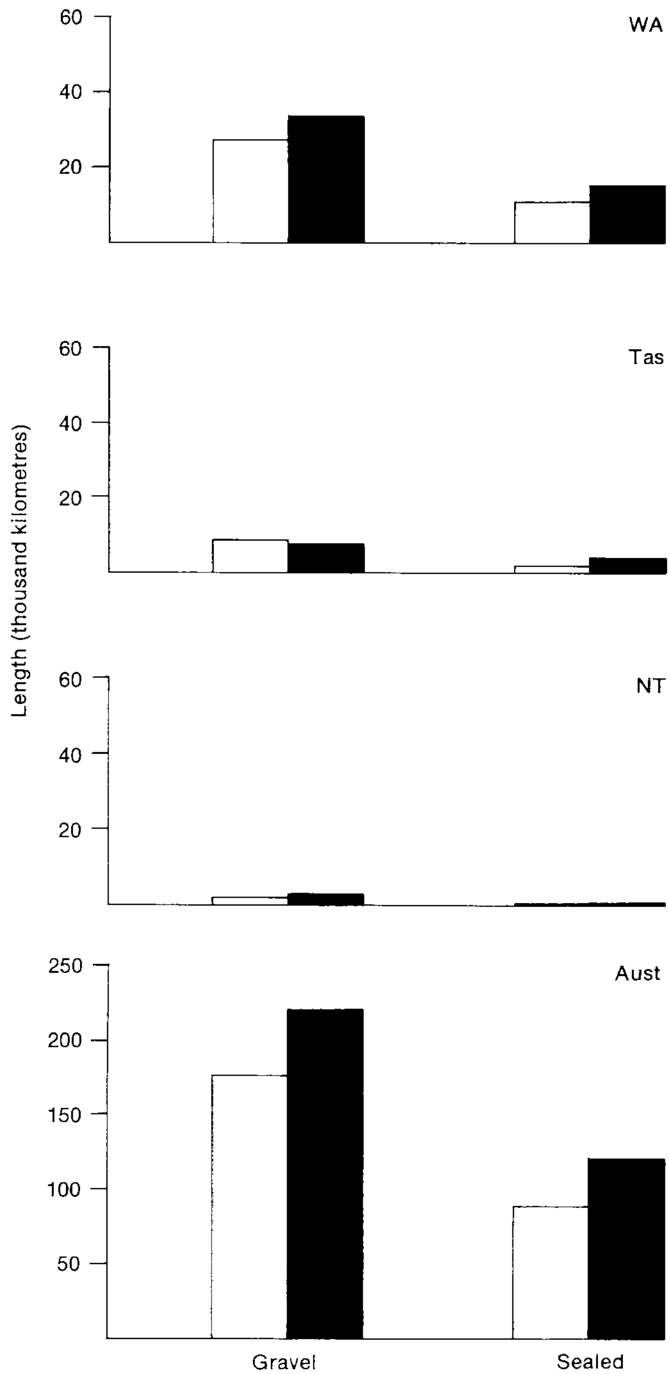
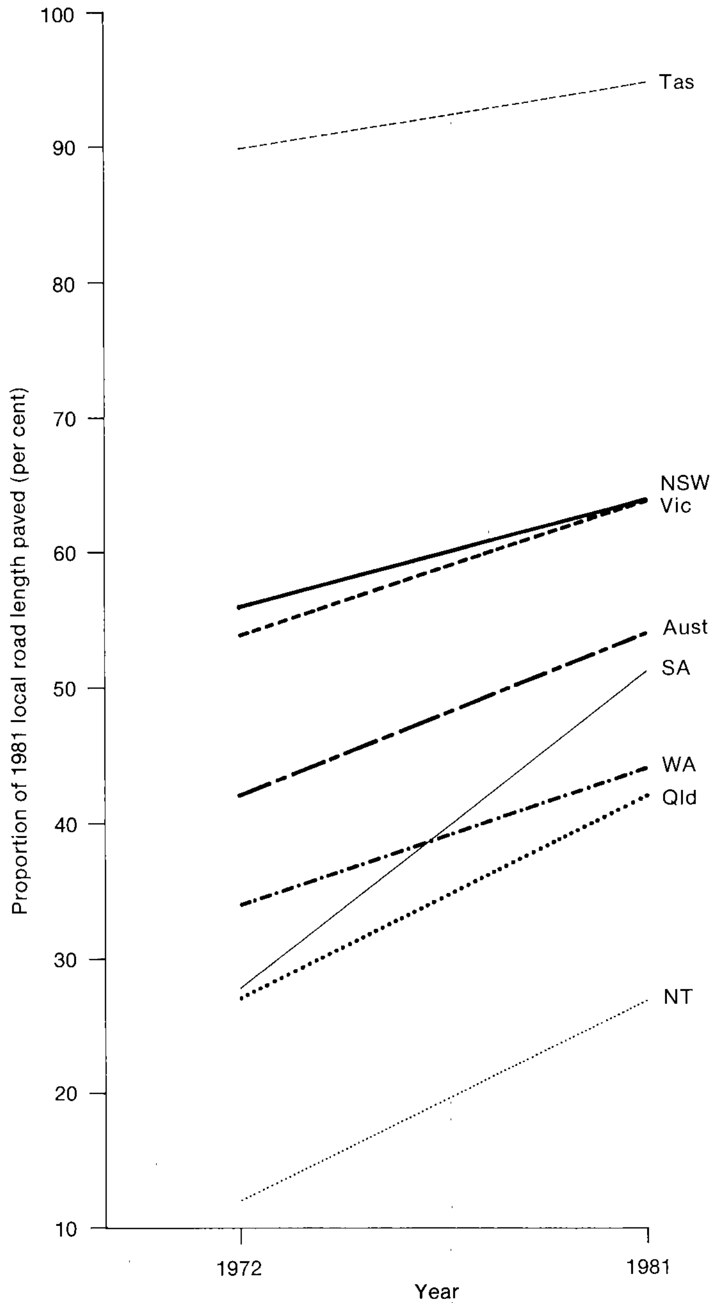


Figure 3.9—Length of paved local roads, 1972 and 1981



Source: Table III.38.

Figure 3.9(Cont)—Length of paved local roads, 1972 and 1981



Source: Table III.38

Figure 3.10—Proportion of local road systems paved, 1972-81

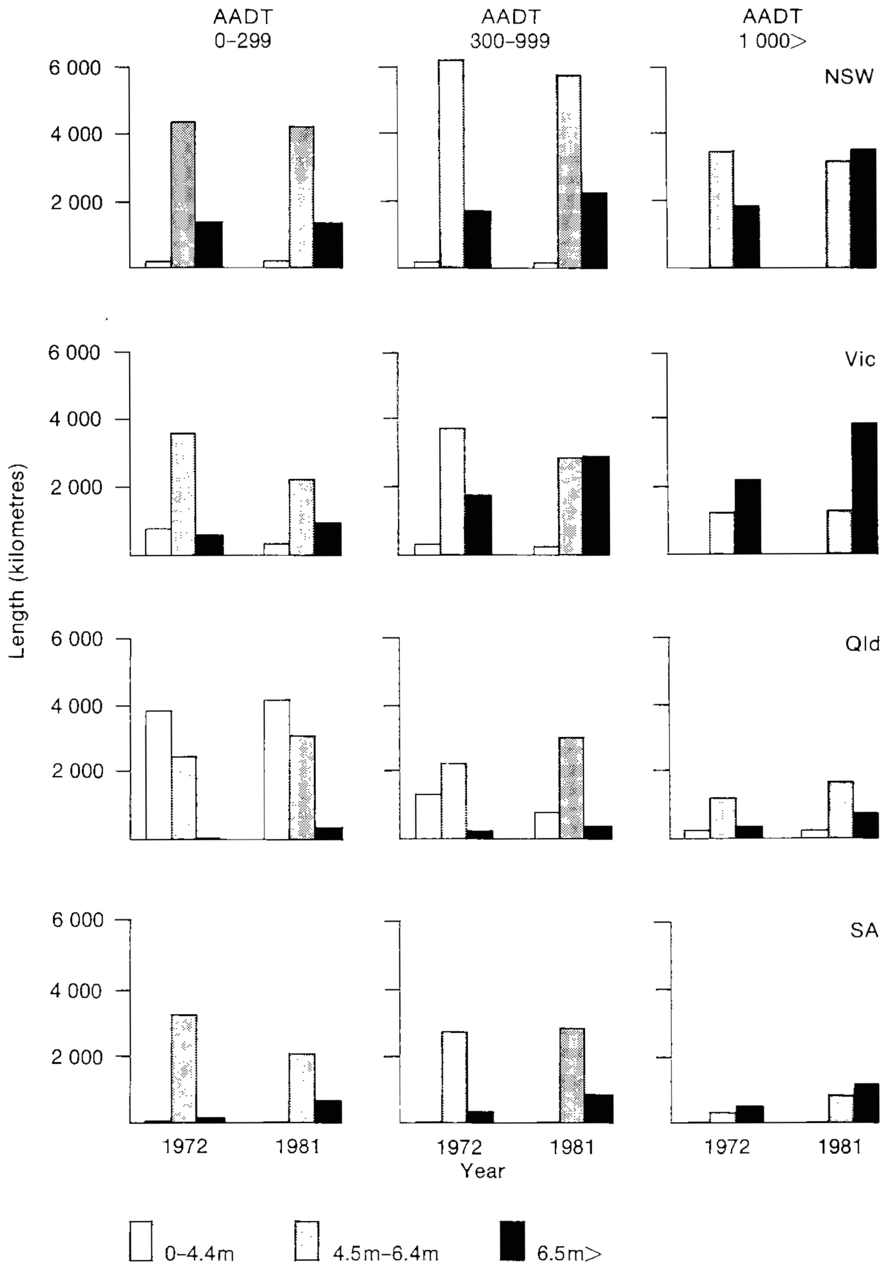
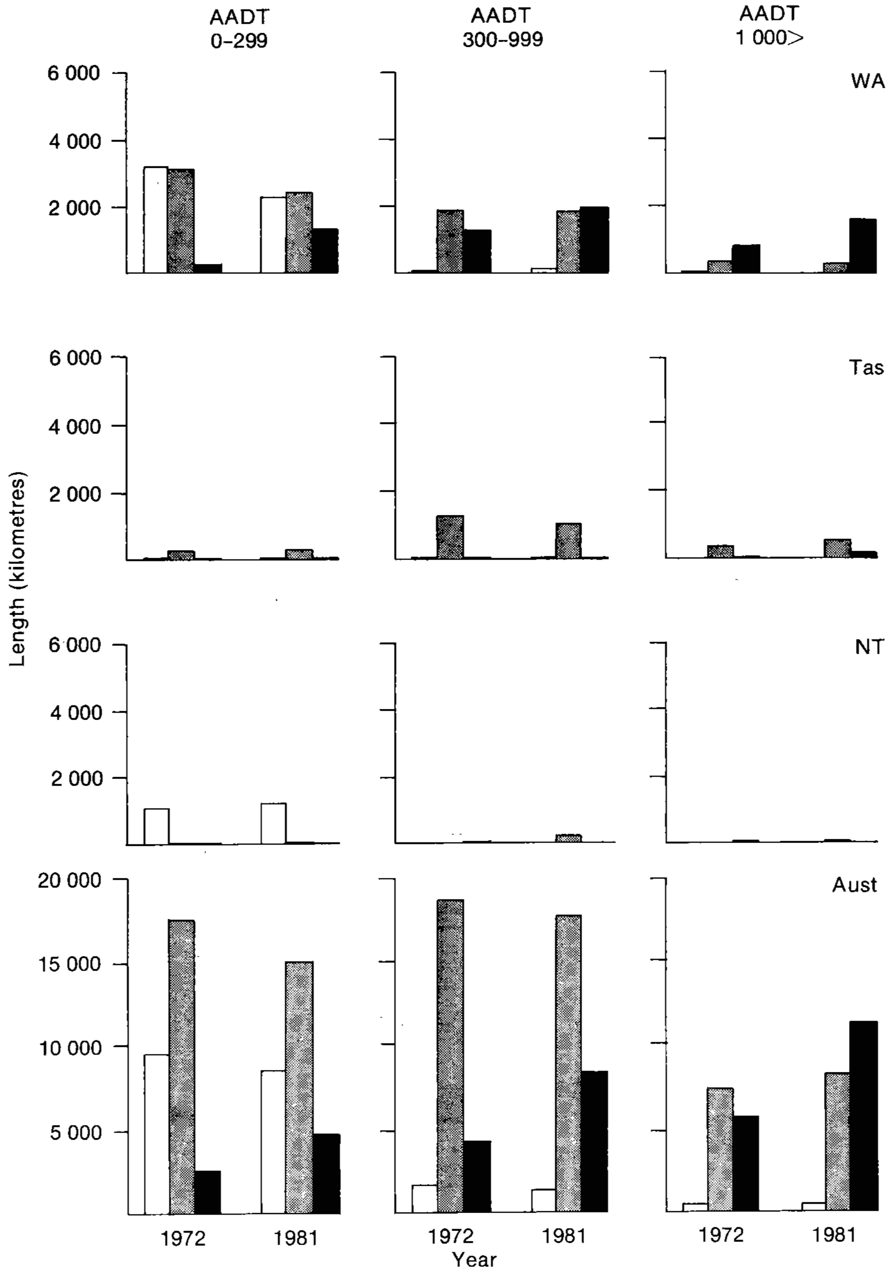
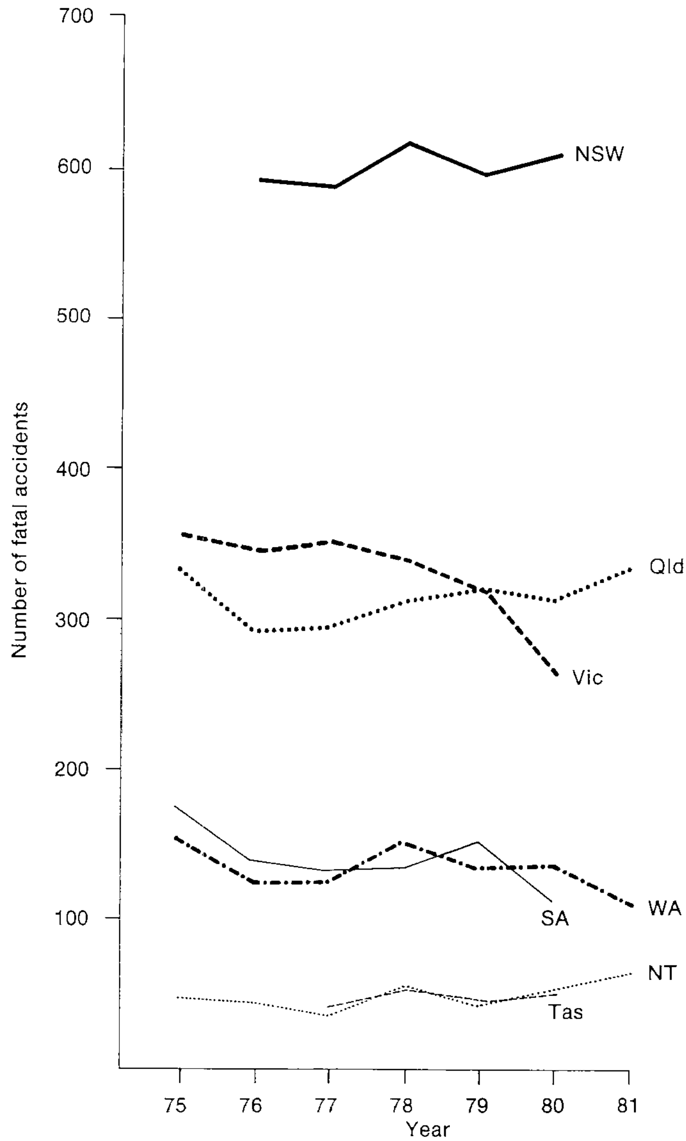


Figure 3.11—Length by seal width by AADT distribution for rural arterial roads, 1972 and 1981



Source: Tables III.20 to III.37

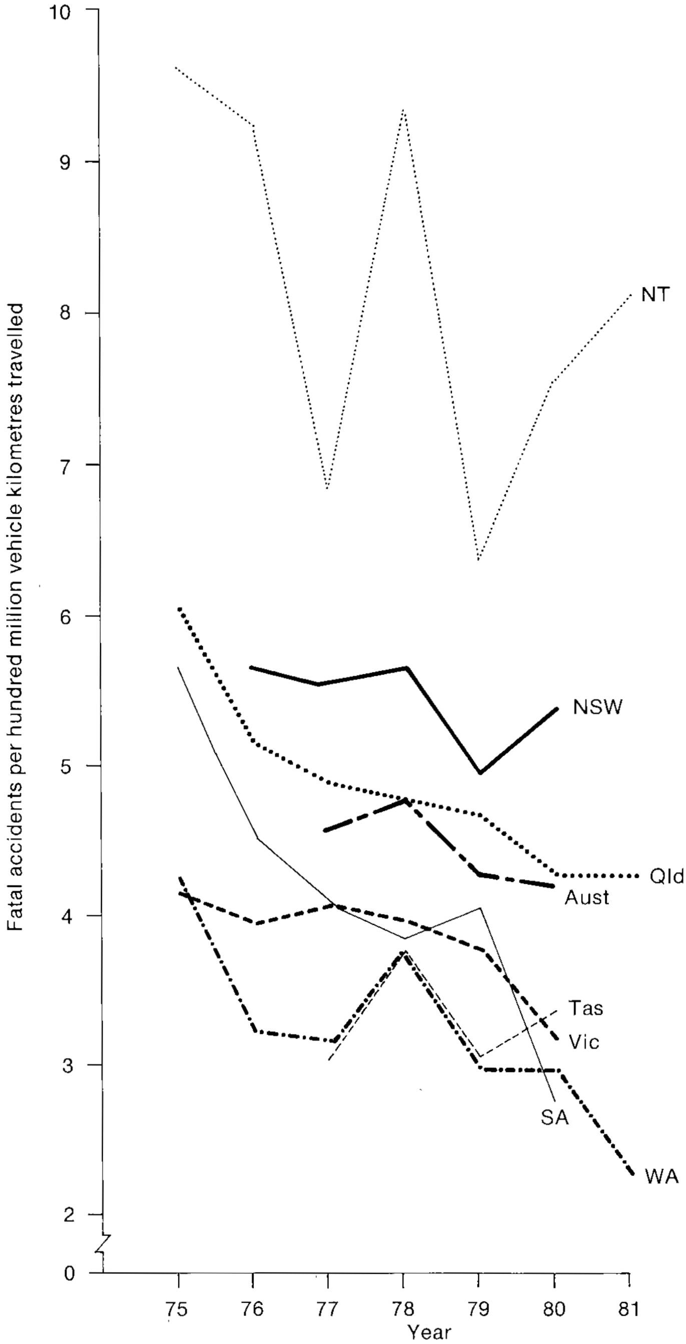
Figure 3.11(Cont)—Length by seal width by AADT distribution for rural arterial roads, 1972 and 1981



Note: Accidents for all roads outside the capital cities and provincial urban areas as defined by ABS. Northern Territory includes Darwin.

Source: Tables III.39 to III.45

Figure 3.12—Fatal accidents in rural areas, 1975-81



Note: Travel estimates for 1979 in NSW, Qld and Tas were based on a slightly smaller rural area than that of 1976, resulting in slightly higher rates.

Source: Tables III.39 to III.45.

Figure 3.13—Fatal accident rates on rural roads, 1975-81

CHAPTER 4—URBAN ROADS

BACKGROUND

Scope of Chapter

The operational characteristics discussed in this chapter are listed in Table 4.1 together with the associated measures applicable to each characteristic. Supplementary explanatory information concerning data sources and accuracy is given in Appendix I. The analysis in this chapter was based largely on the data summarised in Appendix IV.

Roads in outer urban areas are generally included in the analysis of rural roads. Part of the analysis in this chapter embraces both inner and outer urban roads largely due to the nature of the source data. Similarly, part of the analysis deals jointly with both arterial and local roads. The background information presented in the following paragraphs includes details of road lengths and road usage in urban areas and also of the journey to work in the six capital cities.

Length of roads

In Table 4.2 the sealed road length in 1972 and 1981 is given for the capital cities and provincial urban areas as defined by ABS, for each State.

The total length of the sealed roads in the cities was approximately one quarter of the total length of sealed road in Australia in 1981. The increases in sealed length between 1972 and 1981 comprise new sealed roads and existing roads which were upgraded to a sealed surface over the period.

The lengths of divided roads and freeways are shown in Table 4.3 for 1972 and 1977. Improvements to the arterial road networks are evident for most of the States, the most noteworthy being the introduction of 73km of freeways in New South Wales over the five year period.

Trends in travel

Road usage

Vehicle kilometres of travel in 1971 and 1979 are given for the cities in each State in Table 4.4. The largest increase over this eight year period occurred in Queensland, where the growth was nearly eighty per cent. Appreciable increases were recorded

TABLE 4.1—MEASURES USED TO ASSESS THE OPERATIONAL CHARACTERISTICS OF URBAN ROADS

Operational characteristic	*Measures reported*
Travel time	Travel time contours for travel to and from the Central Business District (CBD)
Safety	Number of fatal accidents Number of fatal accidents/VKT
Community effects[a]	Air pollution

a. A discussion is also given on the loss of amenity due to traffic on local roads.

in all States. The amounts of travel are given for various vehicle categories in Table IV.1 in Appendix IV for the years 1971, 1976 and 1979 for the capital cities.

Journey to work

The amount of travel within urban areas is related to the extent of spatial separation of different kinds of activities within the cities, and the locations where people choose

TABLE 4.2—SEALED ROAD LENGTHS IN THE CITIES[a], 1972 AND 1981

State	*1972 (km)*	*1981 (km)*	*Increase 1972-81 (per cent)*
New South Wales	18 314	20 822	14
Victoria	13 696	18 137	32
Queensland	6 716[b]	8 457	26
South Australia	5 385	6 418	19
Western Australia	6 357	8 040	26
Tasmania	1 233[b]	1 434	16
Northern Territory	na	665[c]	na
Australian Capital Territory[d]	1 075	1 865	73

a. The 1981 data are based on boundaries for the capital cities and provincial urban areas as defined by ABS for the 1976 census. The 1972 data are based on the 1971 census boundaries, except for New South Wales where the sealed road lengths for areas which became part of the Sydney statistical division in 1976, are included in the 1972 data. The only other significant boundary changes between the 1971 and 1976 censuses have occurred in the provincial urban areas of Tasmania and Queensland as noted in (b) below.
b. These lengths apply to 1971 census boundaries, and the boundaries of the provincial urban areas were extended appreciably for the 1976 census. Thus the increases in length between 1972 and 1981 are partly due to the boundary changes.
c. Based on the 1976 Darwin City area plus the balance of the 1945 area.
d. All roads within the Australian Capital Territory.
e. Estimate for 1980.
na not available

Sources: Australian Bureau of Statistics (1982b) and BTE Estimates. Commonwealth Bureau of Roads (1974a). Department of Housing and Construction, personal communication. Northern Territory, Department of Transport and Works, personal communication.

TABLE 4.3—LENGTHS OF DIVIDED ROADS AND FREEWAYS IN THE CITIES[a], 1972 AND 1977

(km)

	Divided road[b]		*Freeway*	
State	*1972*	*1977*	*1972*	*1977*
New South Wales	348	418	43	116
Victoria	391	481	55	84
Queensland	137	194	0	18
South Australia	158	285	8	10
Western Australia	77	167	6	8
Tasmania	21	24	0	0
Northern Territory	12[c]	13	0	0
Australian Capital Territory	92	109	0	0
Australia	1 236	1 691	112	236

a. Capital cities and provincial urban areas as defined by ABS.
b. Excluding freeways.
c. This length is the total for the Northern Territory and may include some length outside the city area.

Source: Commonwealth Bureau of Roads (1974a and 1978)

TABLE 4.4—TRAVEL IN THE CITIES[a], 1971 AND 1979

State of registration	1971 (100 million VKT)	1979 (100 million VKT)	Increase 1971-79 (per cent)
New South Wales	183.1	246.5	35
Victoria	141.4	200.9	42
Queensland	55.2	98.9	79
South Australia	45.1[c]	62.1	38
Western Australia	45.2[c]	68.2	51
Tasmania	9.4	14.3	52
Northern Territory	2.3	3.0	32
Australian Capital Territory[b]	9.7	13.3	37
Australia	491.4	707.2	44

a. Capital cities and provincial urban areas as defined by ABS. Changes to the boundaries between 1971 and 1979 may account for an appreciable part of the increase in travel recorded in this Table for New South Wales, Queensland and Tasmania. Interstate travel is not included, as explained in Appendix I.

b. Based on the whole of the Australian Capital Territory area rather than the Statistical Division.

c. The figures disagree slightly from those given in Table IV.1 for Adelaide and Perth due to inconsistencies in the data sources.

Source: Australian Bureau of Statistics (1981a). Commonwealth Bureau of Census and Statistics (1973b).

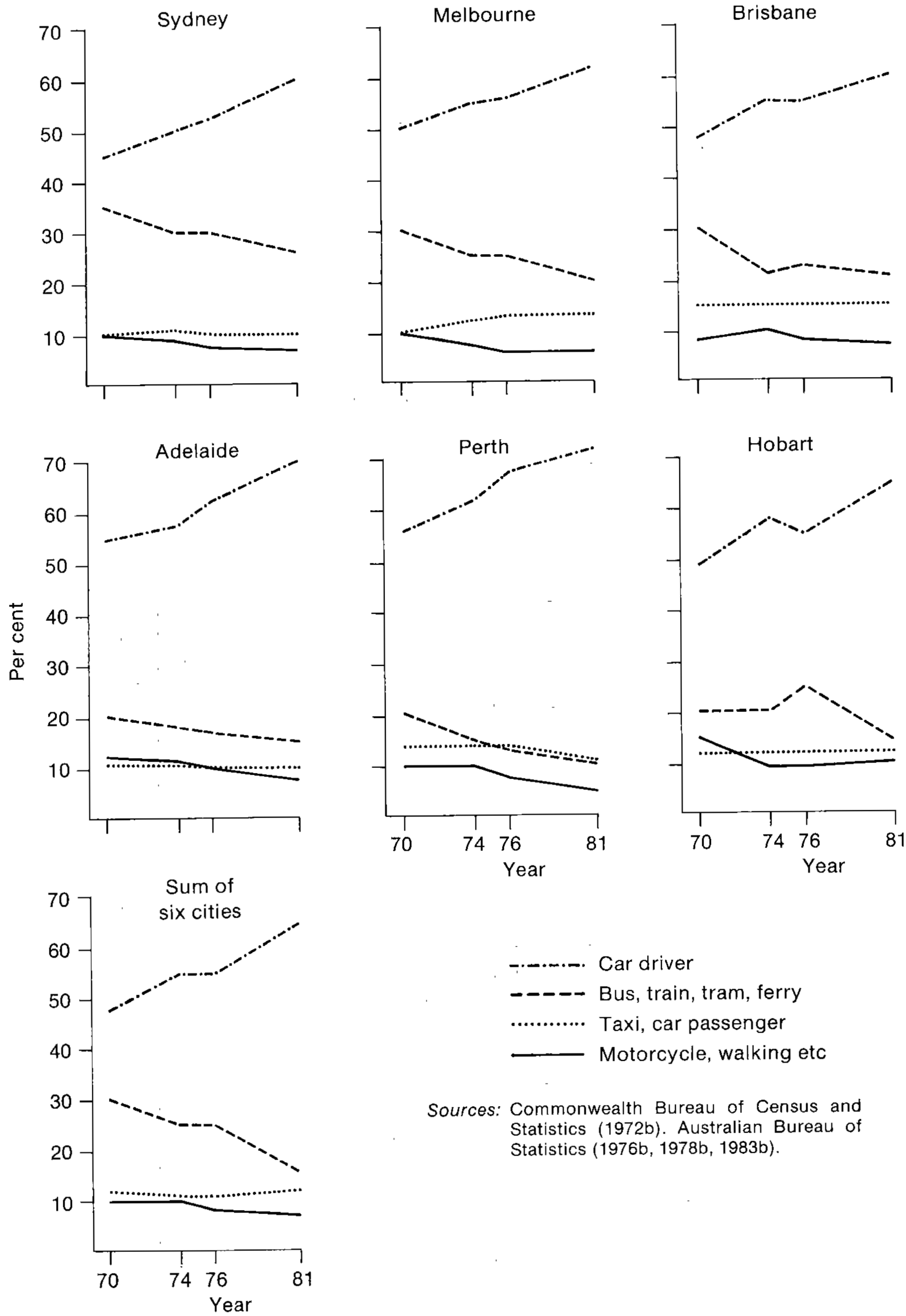
to live. The journey to work is largely responsible for the peak period traffic flows which influence the provision of capacity in the urban roads system. Not only is the work trip more concentrated in peak periods than trips for other purposes, but a higher proportion terminate in the CBD. For example, in Sydney in 1971 about 18 per cent of the journeys to work were to the CBD compared with about 6 per cent of trips for other purposes (Neutze 1981). Figure 4.1 shows the evolution of the modal distribution of all work trips between 1970 and 1981 within the statistical divisions of the six State capital cities[1]. The principal feature is the shift to car driving at the expense, primarily, of public transport. The reduced patronage sustained by public transport diminished somewhat in Melbourne, Sydney and Brisbane after 1974. The strong increase in the proportion of trips using public transport in Hobart between 1974 and 1976 was due to the shift to ferries following the collapse of the Tasman Bridge early in 1975. The bridge was subsequently re-opened and an increase in the proportion of work trips using private cars was recorded in the 1981 Census.

The pattern of journeys to work changed appreciably in the 1960s and 1970s reflecting the trend towards decentralisation of work locations within urban areas (Neutze 1981). The development of other business centres in most capital cities attracted a proportion of work trips, as well as shopping and business trips, away from the CBD.

Movement of freight and personal travel

The data presented in Appendix IV includes an outline of freight movement and personal travel in the capital cities of the six States. Freight movement increased steadily over the period 1971 to 1979, and an increasing proportion was carried by articulated trucks, utilities and panel vans, while the proportion carried by rigid trucks decreased. Personal travel increased in these cities by 12.6 per cent over the period 1976 to 1979, and the proportion carried by utilities and panel vans increased from 8.2 per cent to 10.4 per cent. Also, as mentioned in Appendix IV, mean vehicle occupancy was relatively stable between 1971 and 1979, being approximately two persons per vehicle for cars (Tables IV.1 and IV.2).

1. In 1970 and 1974, only the predominant mode of travel to work was recorded. In 1976 and 1981 each mode was counted where more than one mode was used. The greatest effect of this variation in procedure occurred in Sydney where over 7 per cent of work trips employed more than one mode. However, even for Sydney the effect is not detectable at the scale of Figure 4.1



Sources: Commonwealth Bureau of Census and Statistics (1972b). Australian Bureau of Statistics (1976b, 1978b, 1983b).

Figure 4.1—Percentage of trips to work by mode, 1970-81

OPERATIONAL CHARACTERISTICS

Travel time

Travel time surveys have generally concentrated on radial weekday travel to the CBD in the morning, and from the CBD in the evening. The high peak flows and associated congestion occurring at such times place the greatest demand on the road network, and the associated mean speed (or travel time) is thus a good single indicator of travel conditions. The focus of arterial roads in the direction of the CBD in Australian cities means that many trips are made on these routes simply because they provide a most convenient path for part of many trips between origins and destinations other than the CBD itself. Since travel on these routes constitutes a significant proportion of total travel, travel conditions on urban arterial roads tend to be representative of the entire city road network.

The travel time surveys for which city-wide time series data are available, relate primarily to peak period travel to and from the CBD in Sydney and Melbourne. The methods used for these travel time surveys are discussed in Appendix I.

Once the travel time on each link of the network of roads is obtained the travel time between each node of the network and the CBD can be determined. By interpolating between the nodes it is then possible to construct a travel time contour map in which each contour links points with equal travel time to the CBD. Such travel time contour maps constitute the principal data format on which this analysis was based.

Trends in travel time are influenced by changes in a range of factors including the level and pattern of travel, the road system and its traffic management facilities, the composition of the vehicle fleet, the driving population and the regulations governing drivers and vehicles. In the analysis of the Sydney and Melbourne data no attempt was made to relate travel time trends to overall changes in any of these factors. However, to assist in the assessment of changes in travel time patterns, changes in travel and traffic levels over the relevant time period are presented where data are readily available. Also, some data are presented concerning changes in the road network, such as the addition of freeway links.

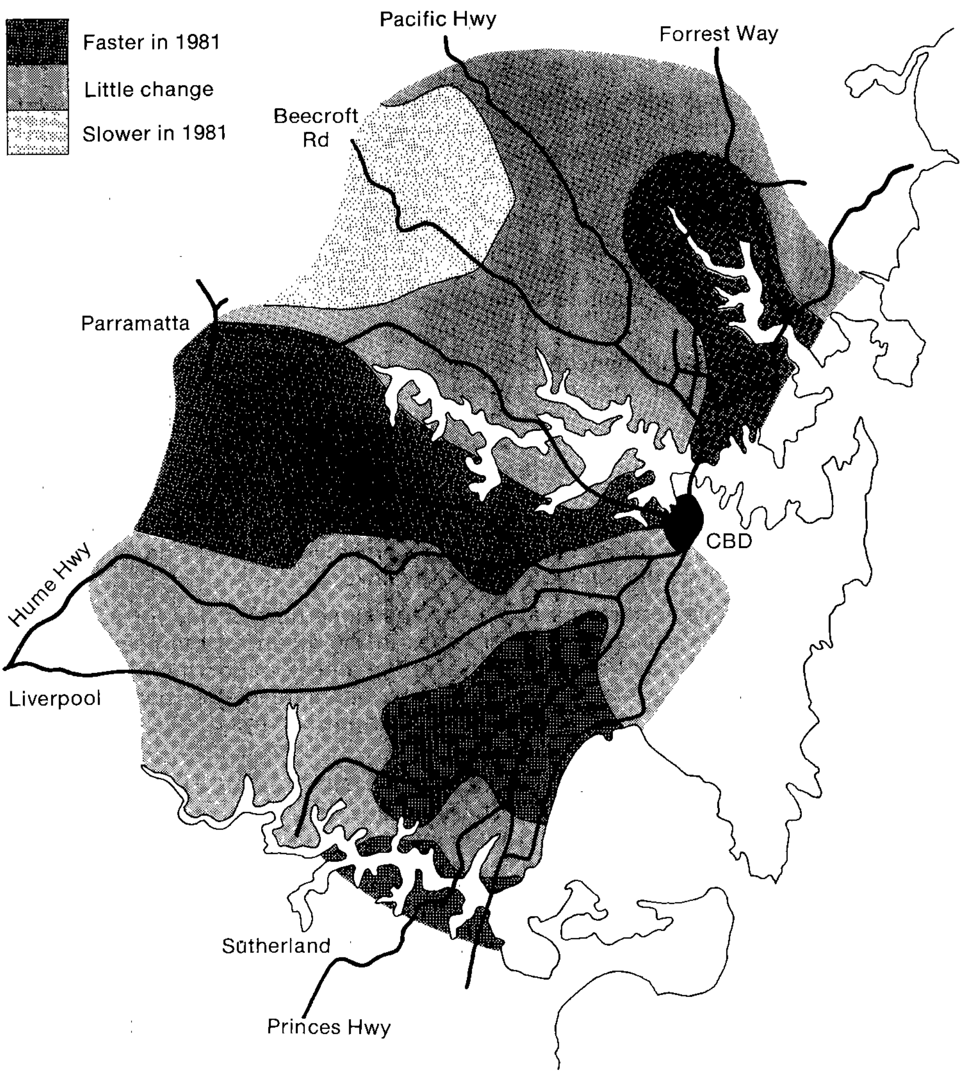
Since the available time series data applies to the same time of day for each peak period, no indication is available as to changes in the extent of the peak periods. Thus while little change may have been observed in a peak period there could have been an appreciable change in travel times in periods immediately before or after the time periods selected as 'peak' periods in the various surveys.

Sydney

The New South Wales Department of Main Roads (DMR) conducted major travel time studies during 1962, 1968 and 1981. These studies were conducted mainly during the peak periods on principal arterial routes leading to the Sydney CBD. However, in the 1981 study, a limited number of other routes were surveyed during the off-peak period, including a survey of travel to the Parramatta business district. In addition, the 1968 and 1981 studies covered a limited number of circumferential routes. For the purpose of these studies, the morning peak period was regarded as extending from 7am to 9am and the afternoon peak from 4pm to 6pm. The peak period information collected in these surveys was plotted to show contours at five minute intervals with time of travel along the arterial routes measured from the CBD.

An indication of the changes between the 1962 and 1981 DMR surveys of weekday travel time is given in Figures 4.2 and 4.3 for travel to the CBD in the morning peak period, and from the CBD in the peak afternoon period, respectively. In Figures 4.2 and 4.3, areas where travel time change exceeded five minutes are identified either as having increased or decreased. Areas where the recorded increases or decreases did not exceed five minutes are identified as having experienced little change in travel time.

In the morning peak period travel time increased in an area to the north west of the CBD and decreased in areas to the west, north, and south west of the CBD. Part of the area to the north west also experienced increased travel time in the afternoon peak whilst most of the city experienced either little change or improved travel times. Improved travel times were experienced in a much larger area of Sydney in the afternoon peak than in the morning peak. Appendix IV includes some details of changes to the road network relevant to the period for which the city wide travel

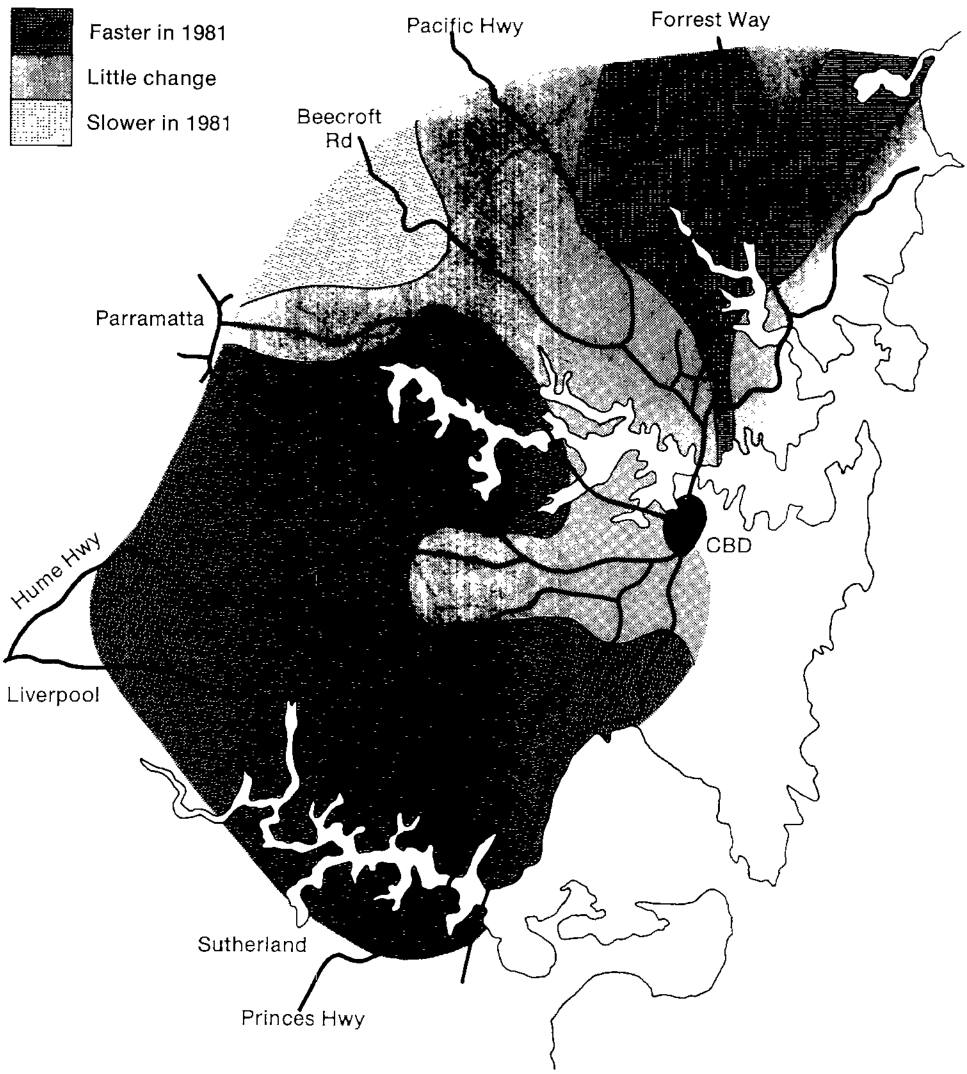


Source: Prepared by BTE from contour maps provided by DMR New South Wales indicating travel time to the CBD for the period 7 am to 9 am.

Figure 4.2—Sydney morning peak travel time change, 1962–81

time trends are given and contains further discussion of the travel times recorded by DMR.

Figure 4.4 shows traffic volume increase between 1971 and 1979 across screenlines[1] to the west and south of the city. These traffic volumes are 24 hour two-way flows averaged over the year based on counts by the DMR, that is AADT. The increases

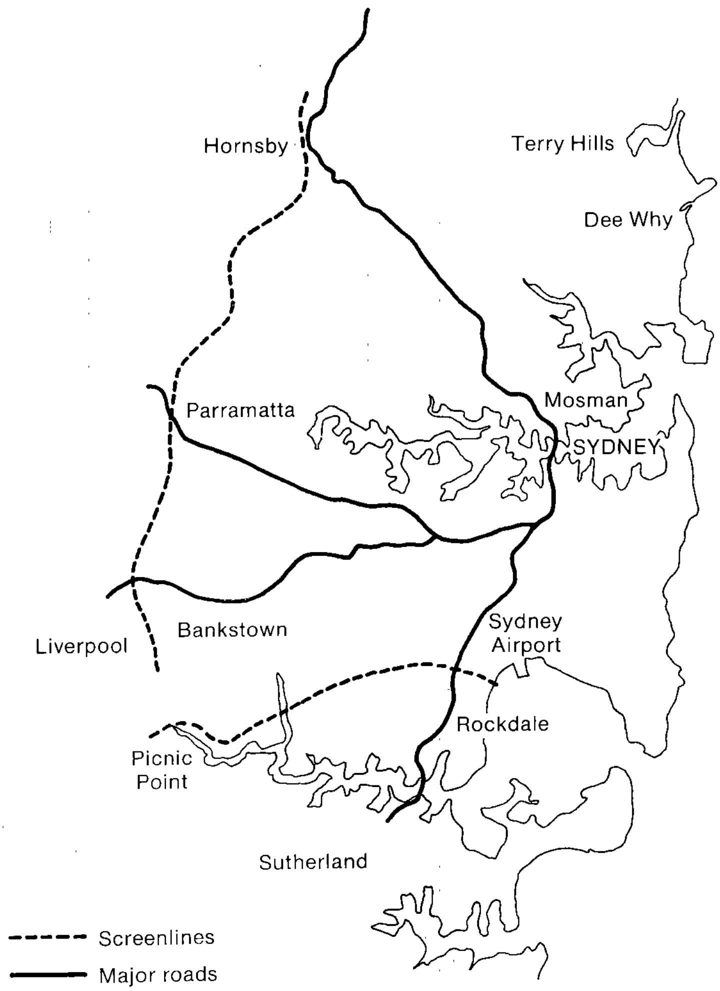


Source: Prepared by BTE from contour maps provided by DMR New South Wales indicating travel time to the CBD for the period 4 pm to 6 pm.

Figure 4.3—Sydney evening peak travel time change, 1962-81

1. A screenline is a hypothetical line (often established along natural or artificial barriers such as rivers or railways) dividing a city into areas, between which the movement of vehicles can be readily measured.

across the screenlines of about 15 per cent are somewhat less than the city wide increase in vehicular travel of about 26 per cent recorded by the ABS surveys of motor vehicle usage between the same two years. However, part of the increase recorded in the ABS Surveys resulted from an increase in the Sydney statistical



Location	Measure	Increase 1971 to 1979 (per cent)
North-South screenline	AADT	15.2
East-West screenline	AADT	14.9
Sydney statistical division	VKT	25.9

Sources: Map prepared by BTE. Commonwealth Bureau of Census and Statistics (1973). Australian Bureau of Statistics (1981b).

Figure 4.4—Sydney traffic volume screen lines

division in 1976. Appendix IV includes further details of the screenline traffic flows.

The National Roads and Motorist's Association (1982) also carried out travel time surveys on selected arterial routes over the last decade. Although the results could not be used for city-wide analysis, in Appendix IV the data collected by NRMA in March 1982 are used to compare peak and off-peak travel times on selected arterial roads. The data in Table IV.4 demonstrate generally higher mean speeds from the CBD in the afternoon peak period, and consistently higher mean speeds between the two peak periods.

Melbourne

The analysis of Melbourne travel time trends was based on the Melbourne Metropolitan Area Traffic Surveys carried out by the Royal Automobile Club of Victoria (RACV) in 1969–70, 1971 and 1976, and also on the Metropolitan Street Service Study 1961 carried out by the Traffic Commission of Victoria. The relevant peak period data deal with travel to the CBD from 8am to 9am and away from the CBD from 5pm to 6pm.

Figure 4.5 shows the changes between 1961 and 1976 for travel to the CBD in the morning peak period. Areas where travel time change exceeded five minutes are identified either as having increased or decreased. Areas where the recorded increases or decreases did not exceed five minutes are identified as having experienced little change in travel time. For much of the area covered by the two surveys little net change in travel time occurred between 1961 and 1976, although some areas experienced increased travel time particularly in the western sector of the city.

Changes in the afternoon peak period between 1961 and 1976 followed a similar pattern. Appendix IV includes further details of changes for both morning and afternoon peak periods. In particular the data in Appendix IV indicate that some marked changes occurred in some corridors between intermediate years within the period 1961 to 1976, and Appendix IV includes a discussion of the apparent effects on these travel time changes arising from the construction of sections of freeway.

Accidents

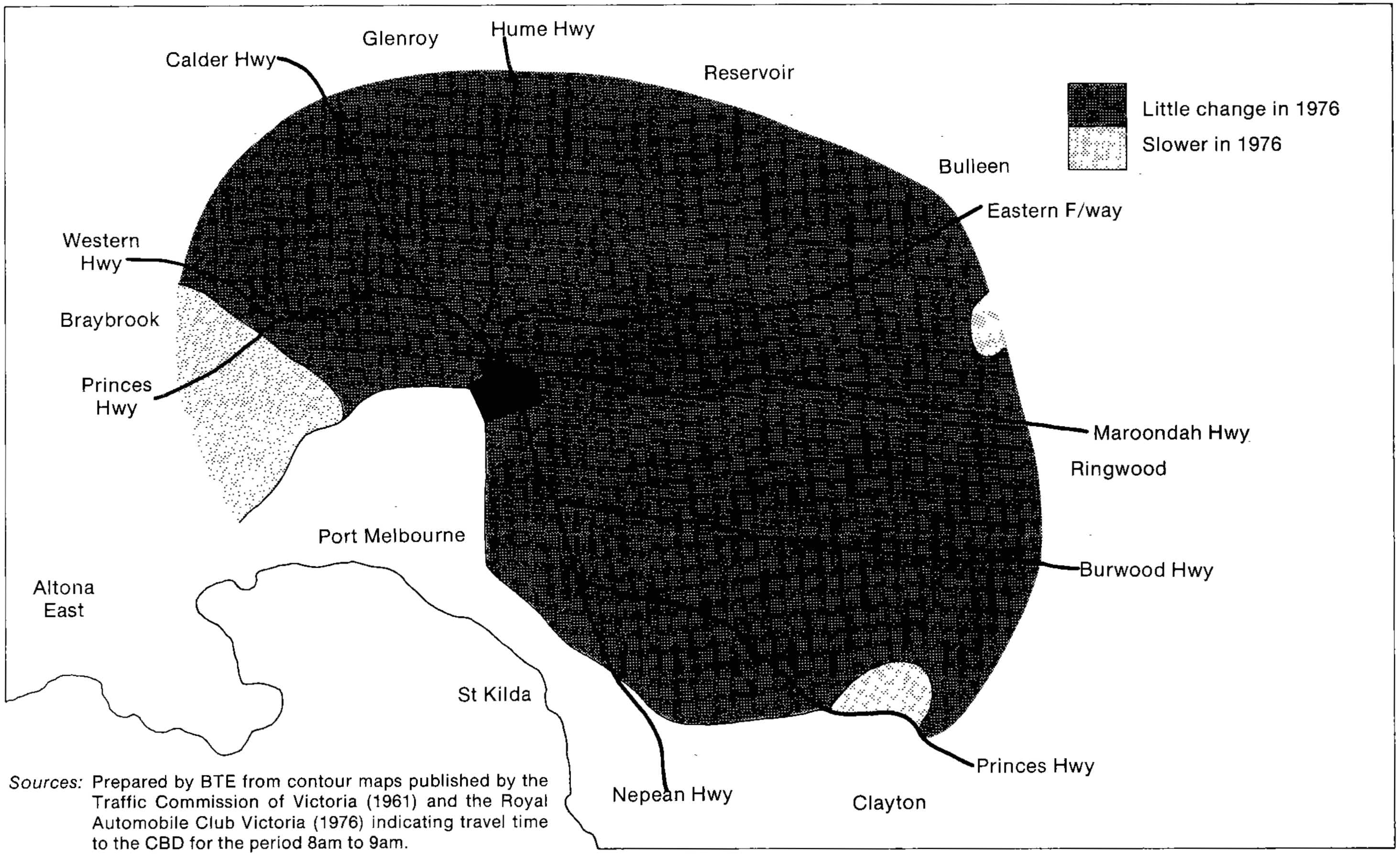
In this section an examination of the status and trends in fatal accident numbers and rates in urban areas of Australia has been made. Accident rates are reported in terms of fatal accidents per 100 million VKT. The source of the travel data is the Survey of Motor Vehicle Usage (Commonwealth Bureau of Census and Statistics 1973b and Australian Bureau of Statistics 1978c, 1981a). It should be noted that all of the urban accident data, and the corresponding travel data, relate to the capital cities and provincial urban areas as defined by ABS. Appendix IV includes the basic data which were used for the accident analysis which follows, together with data concerning the number of fatalities and casualties and the number of casualty accidents.

The graphs in Figure 4.6 show the number of fatal accidents which occurred between 1975 and 1981 in urban areas for each State except the Northern Territory. In 1980 nearly 40 per cent of urban fatal accidents occurred in New South Wales and over three quarters occurred in the three eastern seaboard States. The fatal accident rate per 100 million VKT is shown for each State (but not for the Northern Territory for which no separate urban data are available) in Figure 4.7. These rates generally declined over the period. The fatal accident rate for Tasmania was noticeably higher than that for the other States over the period 1977 to 1980.

Community Effects

Air pollution

In Australia the emissions from motor vehicles which have the potential to cause direct detriment to the environment are lead, carbon monoxide and nitrogen oxides.



Sources: Prepared by BTE from contour maps published by the Traffic Commission of Victoria (1961) and the Royal Automobile Club Victoria (1976) indicating travel time to the CBD for the period 8am to 9am.

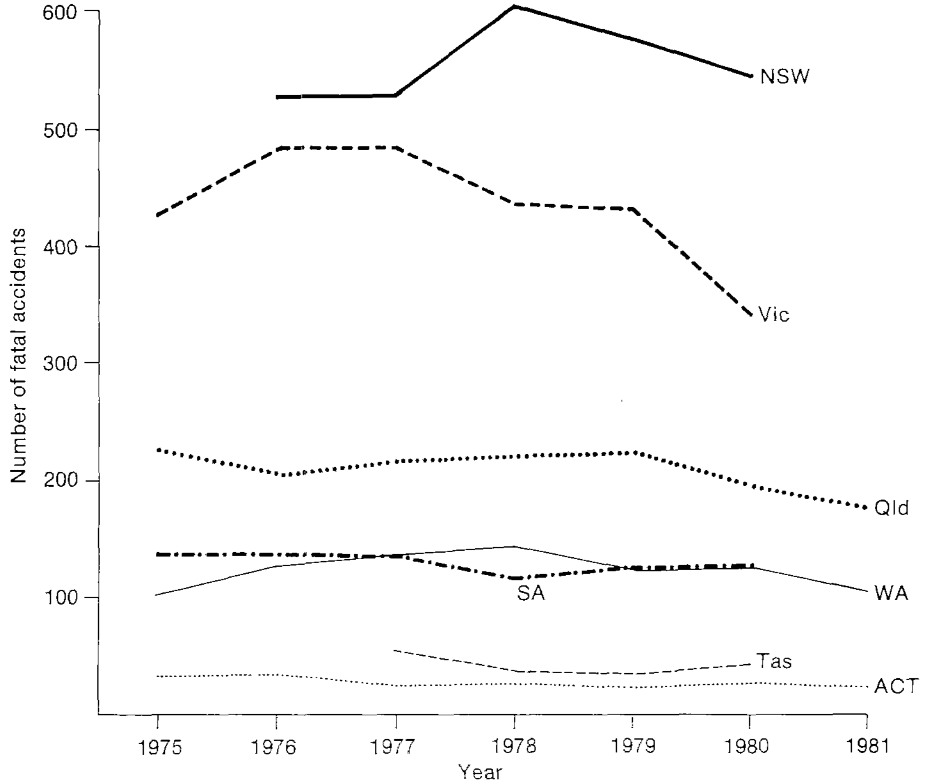
Figure 4.5—Melbourne morning peak travel time change, 1961-76

Hydrocarbons, which are emitted from vehicles and other sources, are not considered environmentally damaging in their own right. However these can react with nitrogen oxides to form photochemical oxidant (which is largely composed of ozone). Ozone is an air pollutant which is also potentially harmful to the environment.

The occurrence of high air pollution levels is assessed for a number of Australian cities for the period 1975 to 1980 based largely on data from the Department of Home Affairs and Environment (1981). Details of this assessment are given in Appendix IV, and the principal features are outlined below.

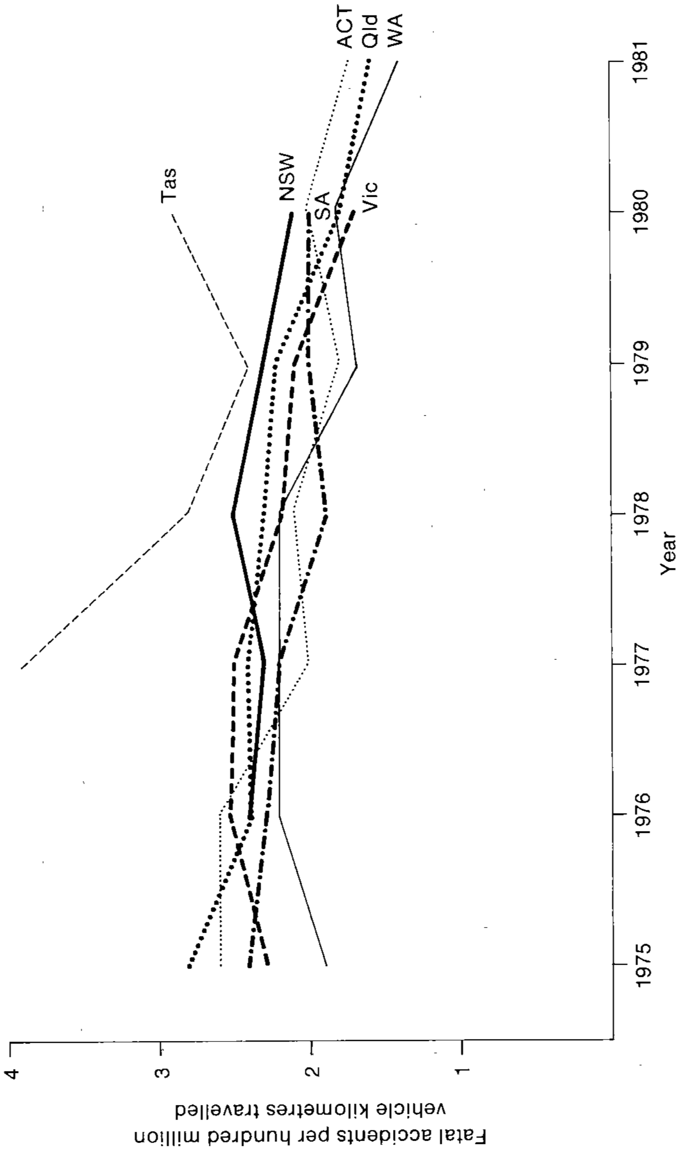
Increases in air pollutant levels appear to be confined largely to the levels of nitrogen oxides in Sydney and of airborne lead in Newcastle and Wollongong. The highest one-hour ozone levels recorded each year between 1975 and 1980 in both Melbourne and Sydney exceeded the level of concern recommended by the National Health and Medical Research Council of Australia (NHMRC). However the number of days in Sydney on which one-hour ozone levels exceeded the World Health Organisation (WHO) long-term goal fell considerably between 1975 and 1980. The 24 hour lead level exceeded the NHMRC level of concern during at least three months of each year over this period in Sydney, Newcastle, Wollongong and Brisbane.

Data obtained from the Committee on Motor Vehicle Emissions (1981) and



Source: Tables IV.5 to IV.11.

Figure 4.6—Fatal accidents in urban areas, 1975-81



Source: Tables IV.5 to IV.11.

Figure 4.7—Fatal accident rates in urban areas, 1975–81

summarised in Table 4.5 indicates the contribution of the motor vehicle towards the total emission of lead, hydrocarbons, carbon monoxide and nitrogen oxides in Australian capital cities. In the case of lead and carbon monoxide, motor vehicles are estimated to be responsible for a very high proportion of emissions from all sources in all capitals.

TABLE 4.5—CONTRIBUTION OF MOTOR VEHICLES TO EMISSIONS FROM ALL SOURCES, CAPITAL CITIES; 1976

(per cent)

City	*Proportion of Total Emissions*			
	Lead	*Hydrocarbons*	*Carbon Monoxide*	*Oxides of Nitrogen*
Sydney	95	51	80	78
Melbourne	95	42	81	70
Brisbane	96	58	89	37
Adelaide	96	47	84	53
Perth	97	59	90	64
Hobart	95	54	72	79
Canberra	96	63	86	89
National weighted average	96	49	86	64

Source: Committee on Motor Vehicle Emissions (1981).

Loss of amenity on local roads

Local roads provide access to properties used for a wide range of purposes. Urban local roads comprise some 4 per cent of the length of Australian roads, and cater for approximately 14 per cent of travel, as discussed later in Chapter 6. Whilst the prime function of all local roads is to provide access, there is a considerable range of types and volumes of vehicular and pedestrian traffic on local roads; this being due to variations in land use and, in some cases, from the undesirable use of local roads to supplement the arterial road system. Unlike arterial roads, local roads are normally designed to accommodate relatively low traffic volumes operating at relatively low speeds.

Action to improve conditions on local roads are generally taken by local government authorities. However some State authorities have also introduced measures affecting local roads. For example in Victoria the METCON and STATCON programs were aimed at improving control of traffic on both the arterial and local road systems. A large proportion of local road intersections were signed and marked for the allocation of right of way. This influenced accident patterns, and also discouraged traffic from using local roads more than necessary by increasing intersection delays (McKelvey, 1976). Action has also been taken by the planning authority, Melbourne and Metropolitan Board of Works (1981) to designate primary street functions through its road hierarchy plan for Melbourne. Such plans aid the control of land development and usage according to the function of the road which serves the property.

The amount of capital expenditure on the local road system needed to prevent or alleviate adverse traffic effects is small compared with the cost of maintenance and reconstruction of these roads. Whilst the incidence of these effects is often concentrated in particular areas or streets, the combined effect of widespread treatment can lead to an appreciable increase in usage of arterial roads.

The access function of local roads is rarely an issue, and the principal concern relates to loss of amenity. The users of local roads and of the abutting property can suffer loss of amenity due to excessive traffic flows, excessive speeds, high incidence of parked vehicles, and other ill-effects of traffic such as noise and fumes. The impact of traffic varies with the type of development abutting the road. For one type of local road, namely residential streets, a discussion of the issues, and of the measures required to reduce the adverse effects of traffic, is presented in Appendix VII. These measures include both the use of sound planning principles in the initial design of residential street layouts, and the use of traffic management techniques to treat adverse traffic effects. The information in that Appendix demonstrates that the use of these two approaches is widespread.

Many of the adverse effects of excessive traffic volumes, speeds and parking levels on residential streets discussed in Appendix VII apply also to local roads which serve commercial, industrial and other properties and most of the methods of prevention and treatment of these adverse effects are identical in principle for all local roads. As illustrated in that Appendix there can be a great variation between locations in the impact of any particular adverse effect of traffic, and also in the appropriate measures for dealing with the effect. For example, the appropriate degree of restrictions on parked vehicles can vary widely between locations. Therefore, it is considered inappropriate to attempt to monitor operational characteristics on local roads on a city-wide basis.

SUMMARY OF FINDINGS

Travel on urban roads in the six State capital cities increased by 38 per cent over the period 1971 to 1979. The proportion of trips to work by car increased in all six State capitals over the period 1970 to 1981 whilst the proportion using trains, buses and trams decreased over this period.

Travel times on arterial routes increased over a small proportion of the Sydney area in the morning peak period over the period 1962 to 1981, and there were a number of areas where decreases were recorded. In the afternoon peak a smaller area showed an increase in travel time but for a significant part of Sydney decreases in travel time were observed. In Melbourne, both morning and afternoon peak period travel times on arterial routes increased appreciably between 1962 and 1976 in certain areas, but changes were small over most of the city.

Fatal accident rates generally showed downward trends over the period 1975 to 1980 in the urban areas of all States for which data were available. Fatal accident rates for Tasmania fluctuated somewhat over the period 1977 to 1980 and were higher than those of the other States.

The motor vehicle contributes a high proportion of the emissions from all sources of both lead and carbon monoxide in Australian capital cities, and also contributes a significant proportion of nitrogen oxides and hydrocarbons. The latter two emissions can react together in the presence of sunlight to form the air pollutant ozone. Studies of air pollutants indicate an increase of nitrogen oxides in Sydney and of lead in Newcastle and Wollongong. The highest one hour levels of both ozone and carbon monoxide exceeded the standards or goals set down by recognised authorities in each year between 1975 and 1980 in Sydney and Brisbane. The contribution of the motor vehicle to emissions in urban areas other than the capital cities, and the contribution to trends in pollutant levels are both unknown.

The prime function of local roads is to provide vehicular and pedestrian access to abutting property. The amenity of the precincts of local roads can be eroded by unacceptable levels of traffic flows, speeds and parked vehicles. The impact of these effects can vary greatly by area and by individual road, and can only be evaluated in terms of the local requirements. Thus, city-wide aggregate assessments of average conditions for all local roads are generally inappropriate.

CHAPTER 5—THE AUSTRALIAN ROAD SYSTEM

BACKGROUND

All categories of roads in each State are discussed in this Chapter. However, the nature of some characteristics such as travel time differ between urban and rural areas, and thus it is not appropriate to apply such characteristics to the complete road network. Operational characteristics are described in terms of selected measures of comfort and convenience, safety and vehicle operation. The measures used to assess these conditions are summarised in Table 5.1. The analysis in this Chapter is generally based on the data given in Appendix V.

TABLE 5.1—MEASURES USED TO ASSESS THE OPERATIONAL CHARACTERISTICS OF THE AUSTRALIAN ROAD SYSTEM

Operational characteristics	*Measures reported*
Comfort and convenience	Length by surface
Safety	Number of fatal accidents Number of fatal accidents/VKT Number of fatalities Number of fatalities/VKT
Vehicle operation	Total annual fuel consumption Average rate of fuel consumption

The length of roads in 1981 in each State is listed in Table 5.2 and categorised into sealed and unsealed lengths. New South Wales had the greatest length of any State and had over a quarter of all sealed roads and nearly a quarter of all unsealed roads. The VKT in each State, and trends in travel over the period 1971 to 1979 are given in Figure 5.1. About one third and one quarter of all travel occurred on New South Wales and Victorian roads respectively, and three quarters of all travel occurred in the three eastern seaboard States. The highest proportionate growth in travel over the period 1971 to 1979 occurred in Queensland where travel increased by more than 60 per cent. The percentage increases in travel in this period are given for each State in Table V.1 in Appendix V. The growths in tonne-kilometres and occupant kilometres of travel are given in Tables V.2 and V.3 of Appendix V.

OPERATIONAL CHARACTERISTICS

Comfort and convenience

The trend in the proportion of the length of sealed roads in each State is shown in Figure 5.2 for the period 1950 to 1981. Every State has achieved a significant increase in the proportion sealed, being most marked in the Australian Capital Territory. The change in the length of roads of various surface types between 1970 and 1981 is given in Figure 5.3 from which the general improvement in the status of each State's road network is evident. However it should be noted that much of the reduction of the length of the low standard road is due to amendments to the set of roads included in such statistics with consequent reductions in the total length of roads. In Tables V.4 to V.8 in Appendix V the total road lengths recorded for each State are given for the period 1950 to 1981, for various surface types.

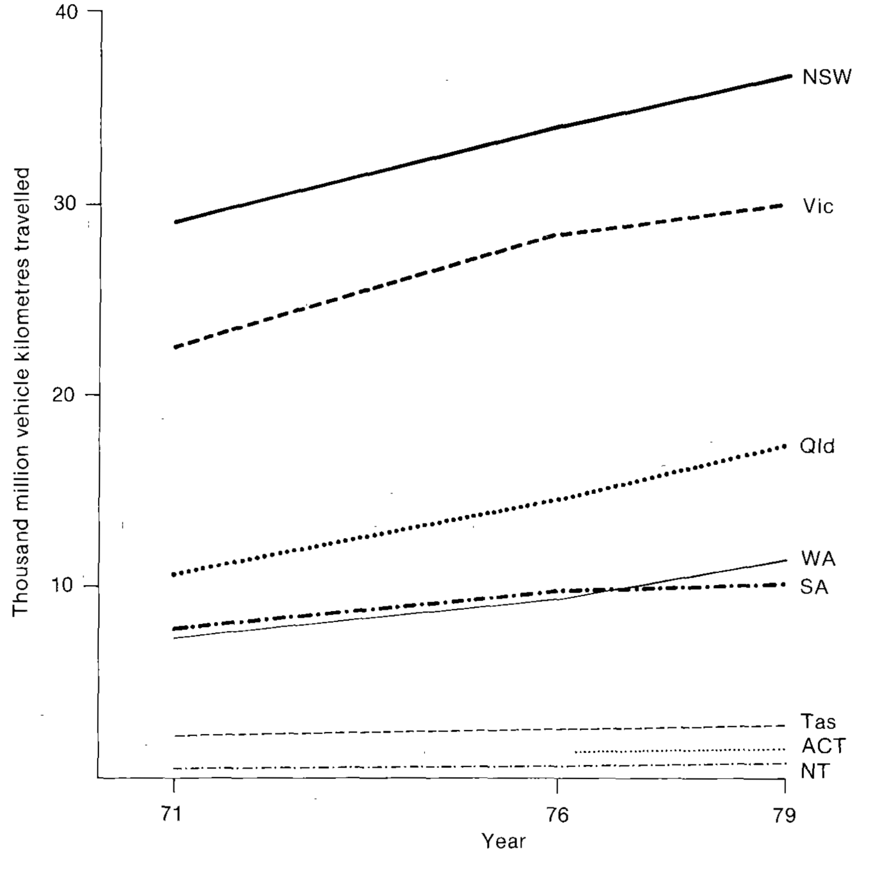
TABLE 5.2—LENGTH OF THE AUSTRALIAN ROAD SYSTEM; 1981

(km)

State	*Sealed*	*Unsealed*	*Total*
New South Wales	72 177	125 737	197 914
Victoria	63 196	94 879	158 075
Queensland	47 562	113 419	160 981
South Australia	21 175	82 470	103 645
Western Australia	36 258	102 254	138 512
Tasmania	7 676	9 181	16 857
Northern Territory	5 598	15 749	21 347
Australian Capital Territory[a]	1 865	369	2 234
Australia	255 507	544 058	799 565

a. Estimate for 1980.

Sources: Australian Bureau of Statistics (undated). State Road Authorities, personal communications.

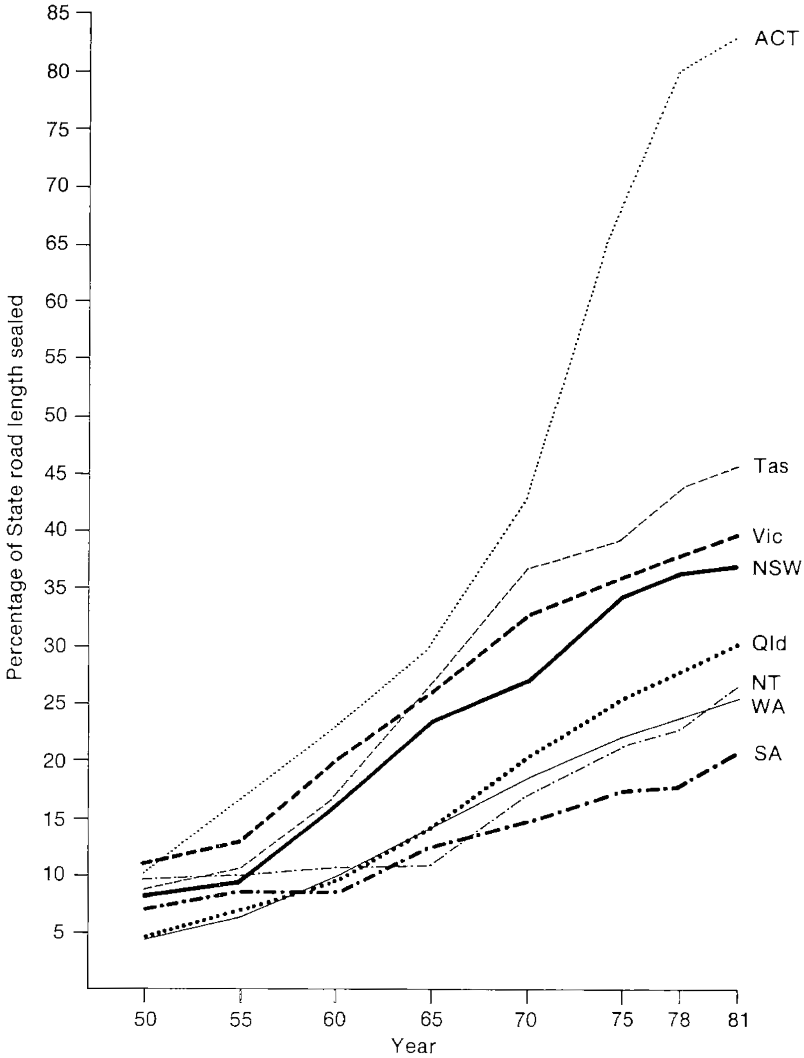


Source: Table V.1

Figure 5.1—Vehicle kilometres of travel on the Australian road system, 1971-79

Safety

The graphs in Figures 5.4 and 5.5 show the number of fatal accidents, and the number of fatalities respectively, which occurred on the roads in each State between 1971 or 1972 and 1982. The two figures indicate downward trends in some States, and show similar patterns. The ratio of the number of fatalities to the number of fatal accidents, has essentially remained constant. The ratio is dependent upon average vehicle occupancy and can also be affected by other factors such as the use of seatbelts. In 1982 approximately 79 per cent of all Australian road fatalities occurred in the three eastern seaboard States.



Note: Percentages based on 1981 lengths.

Source: Table V.5.

Figure 5.2—Percentage of sealed roads by State, 1950-81

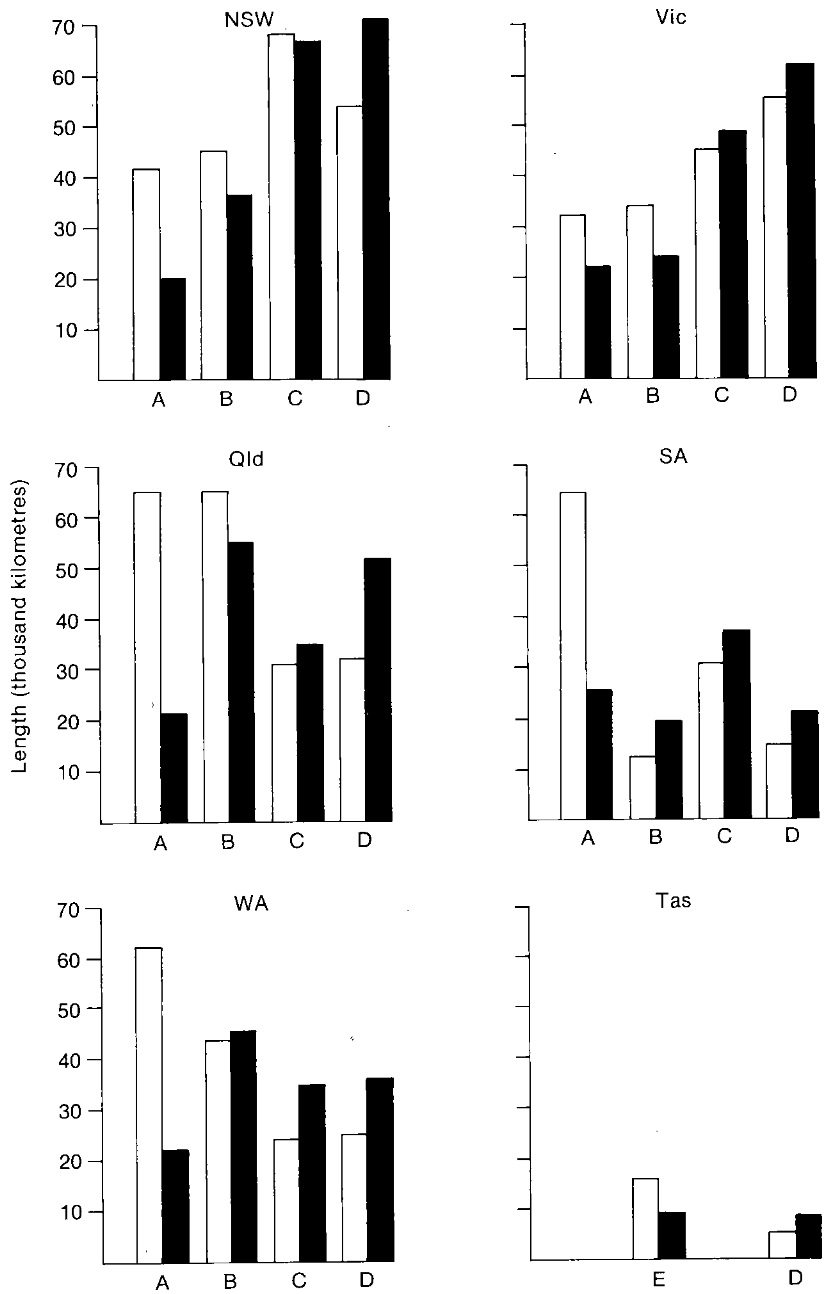
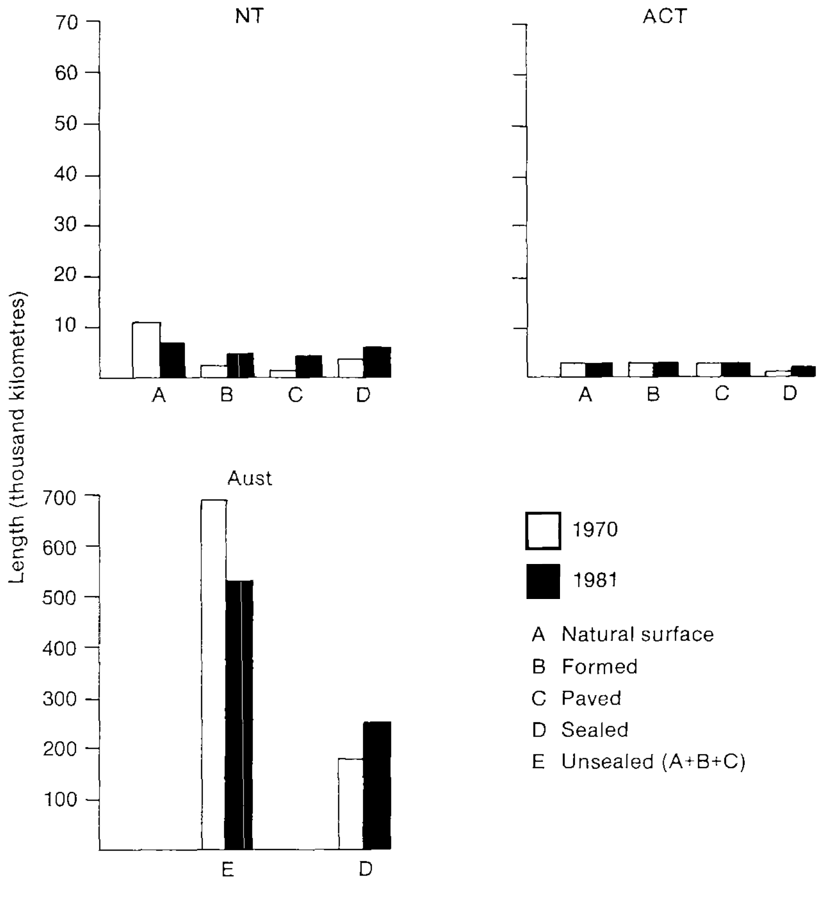


Figure 5.3—Road length by surface type for the Australian road system

Figure 5.6 shows the number of fatalities and number of fatal accidents per 100 million VKT between 1971 and 1982. A decline in these rates is quite evident in most States, and very few differences can be seen between the trends in the fatality rates and those of the fatal accident rates. The rates for each State and for Australia are given in Tables V.9 to V.17. Trends in the number of casualties and number of casualty accidents are included in Appendix V. Comparisons of casualties cannot be made among States because of differences in the practice of recording road injuries. Factors affecting road accidents are discussed in Appendix VI.

Estimates of the number of fatalities per 100 million VKT are available for a number of countries, and in Figure 5.7 the rates are presented for twelve other countries for comparison with the most recent Australian rate. Figure 5.7 indicates that a number of developed countries exhibit a fatality rate lower than that in Australia, the lowest



Note: In some States significant lengths of road have been added or deleted from the records at various points in time, as discussed in Appendix I.

Source: Tables V.5 to V.8.

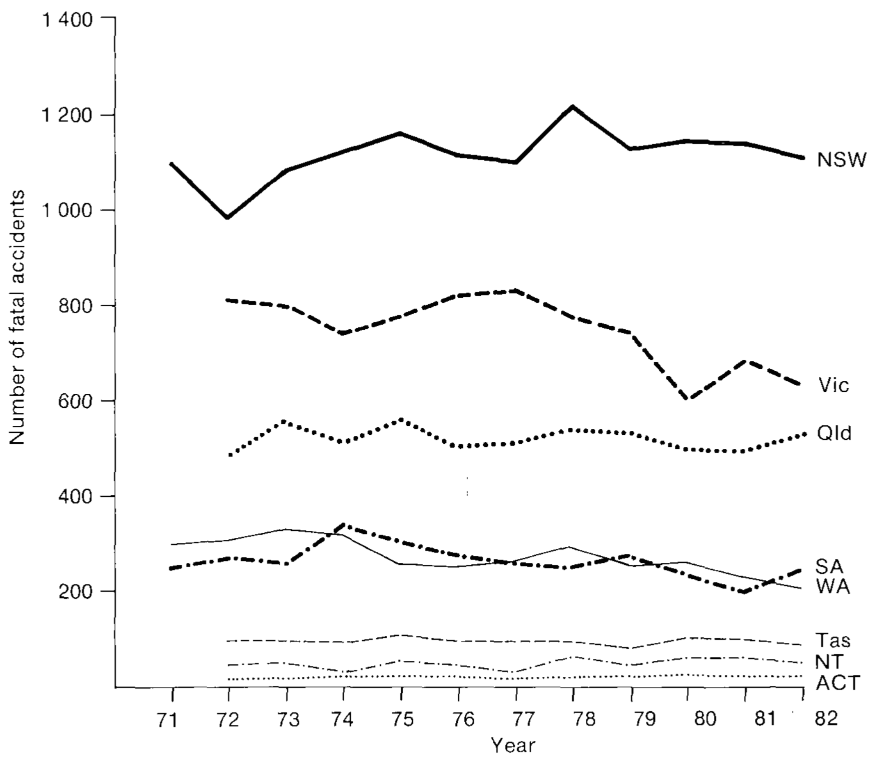
Figure 5.3(Cont)—Road length by surface type for the Australian road system

rate being 2.0 fatalities per 100 million VKT in the United States of America. In Appendix VIII it is noted that the definition of a road fatality in some countries differs from the Australian definition. If the effects of these differences could be quantified they would result in France, Austria, Spain, Greece and Portugal exhibiting even higher fatality rates than those shown in Figure 5.7.

Table VIII.1 indicates that the fatality rate in Australia has decreased from 4.8 fatalities per 100 million VKT in 1970 to 2.9 fatalities per 100 million VKT in 1980 and that this reduction in the fatality rate is comparable to that achieved in the other countries listed.

Vehicle operation

Estimates of the consumption of petrol and other motor vehicle fuels is given for each State for 1979 in Table 5.3. The corresponding rates of fuel consumption in terms of the average number of litres consumed per 100km of travel are given in Table 5.4. Australian trends in the consumption of fuel and in the average consumption rate are given in Figures 5.8 and 5.9 respectively for the period 1971 to 1982. Whilst the consumption of each fuel type increased appreciably between 1971 and 1982, given the increase in travel over the period, the consumption rate has remained relatively steady. Consumption rates would have been affected by a range of factors such as trends in the composition of the vehicle fleet and in engine size and efficiency.



Source: Tables V.9 to V.16.

Figure 5.4—Fatal accidents on Australian roads, 1971-82

SUMMARY OF FINDINGS

New South Wales had by far the greatest length of roads, length of sealed roads, and VKT among the States in 1981. However Queensland had the highest percentage growth in VKT over the period 1971 to 1979, and the highest percentage growth in tonne-kilometres of freight carried over the period.

TABLE 5.3—TOTAL ANNUAL FUEL CONSUMPTION FOR THE YEAR ENDING 30 SEPTEMBER 1979

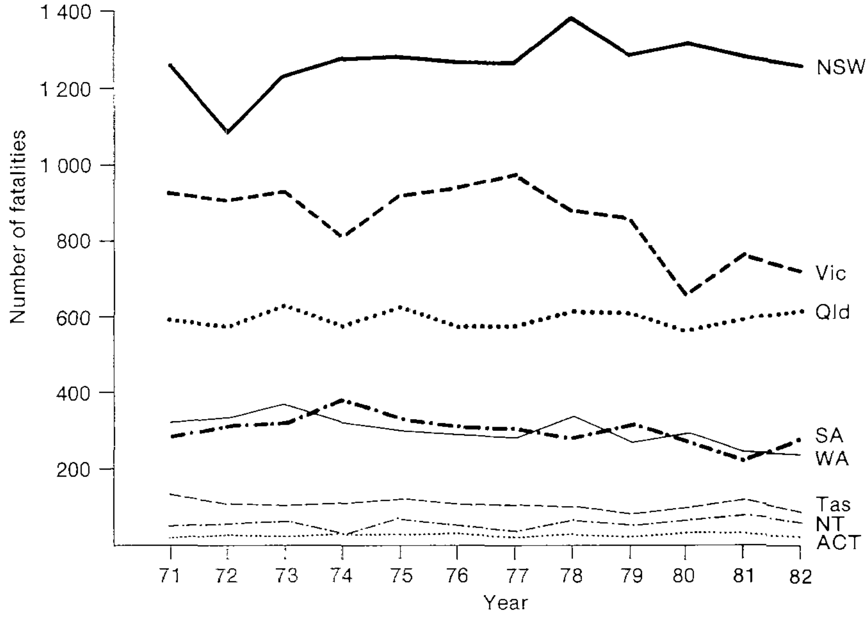
(ML)

State of registration	*Petrol*	*Diesel or distillate*	*LPG*	*Unknown*	*Total*
New South Wales	4 666	764	2	13	5 444
Victoria	3 912	464	32	8	4 416
Queensland	2 175	306	2	-	2 482
South Australia	1 273	243	7	1	1 524
Western Australia	1 431	192	3	-	1 626
Tasmania	375	62	-	-	437
Northern Territory	88	41	-	-	129
Australian Capital Territory	212	15	-	-	227
Australia	14 131	2 086	46	22	16 285

\- nil or rounded to zero.

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

Source: Australian Bureau of Statistics (1981a).



Source: Tables V.9 to V.16.

Figure 5.5—Fatal accidents on Australian roads, 1971-82

There was an increase in the proportion of road length which is sealed in each State over the period 1950 to 1981, the most significant proportionate increase being in the Australian Capital Territory. Over this period there was a general progressive upgrading of road surface types in all States.

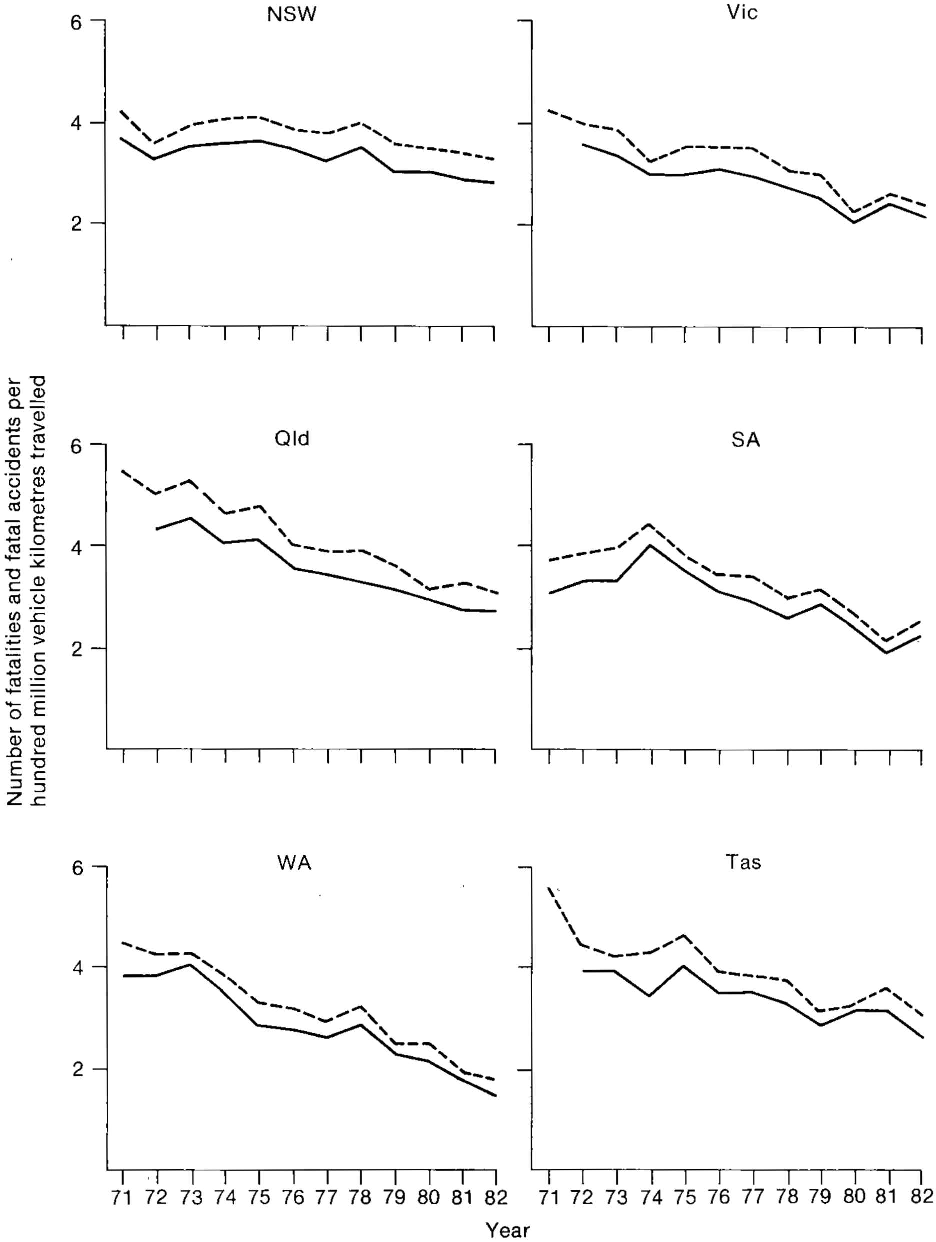


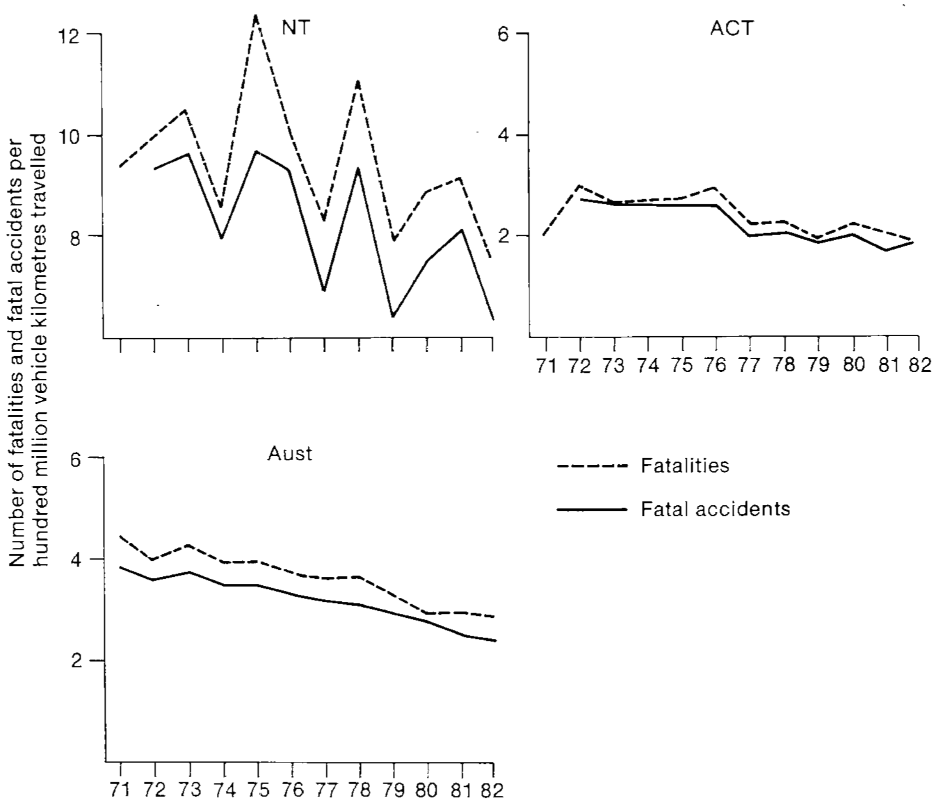
Figure 5.6—Fatal accident rates and fatality rates on Australian roads, 1971-82

TABLE 5.4—AVERAGE RATE OF FUEL CONSUMPTION FOR THE YEAR ENDING 30 SEPTEMBER 1979

(L/100 km)

State of registration	*Petrol*	*Diesel or distillate*	*LPG*	*Unknown*	*Total*
New South Wales	13.4	41.8	34.8	33.0	14.8
Victoria	13.7	40.6	30.8	15.4	14.8
Queensland	13.2	36.2	39.7	11.2	14.3
South Australia	13.1	44.2	9.6	15.2	14.7
Western Australia	13.2	35.1	56.2	23.9	14.2
Tasmania	13.2	43.6	20.0	37.7	14.6
Northern Territory	14.2	45.1	na	5.7	18.1
Australian Capital Territory	12.2	39.7	48.0	6.0	12.8
Australia	13.4	40.3	23.6	22.3	14.6

na not available
Source: Australian Bureau of Statistics (1981a).



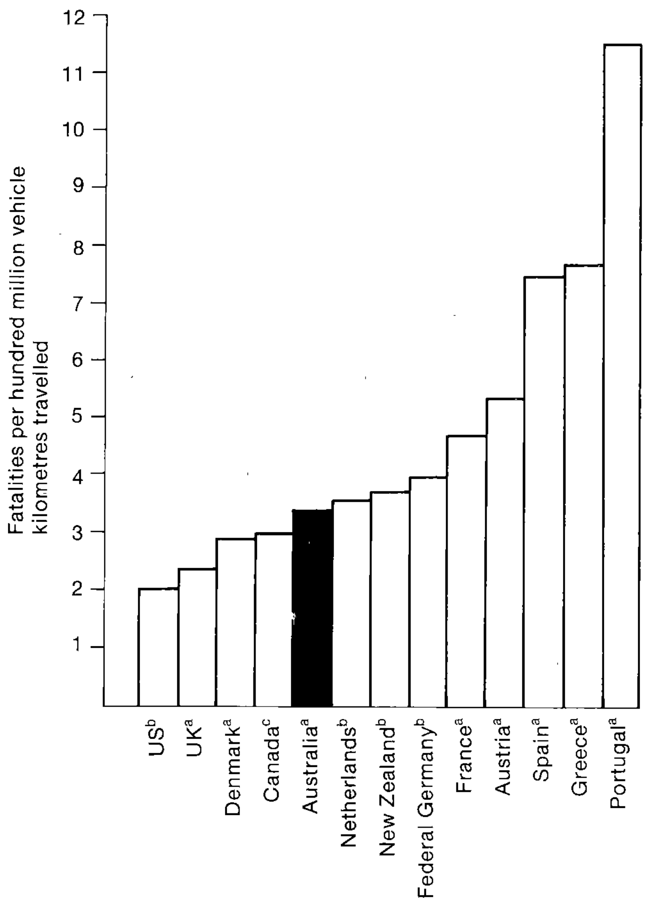
Source: Tables V.9 to V.16.

Figure 5.6(Cont)—Fatal accident rates and fatality rates on Australian roads, 1971-82

The number of fatalities and fatal accidents in each State has either declined or fluctuated over the period 1971 to 1982, but the corresponding numbers per 100 million VKT have shown a general downward trend.

Among those countries for which the information is readily available, the Australian rate of fatalities per 100 million VKT in the late 1970s was higher than that of the United States of America, United Kingdom, Denmark and Canada.

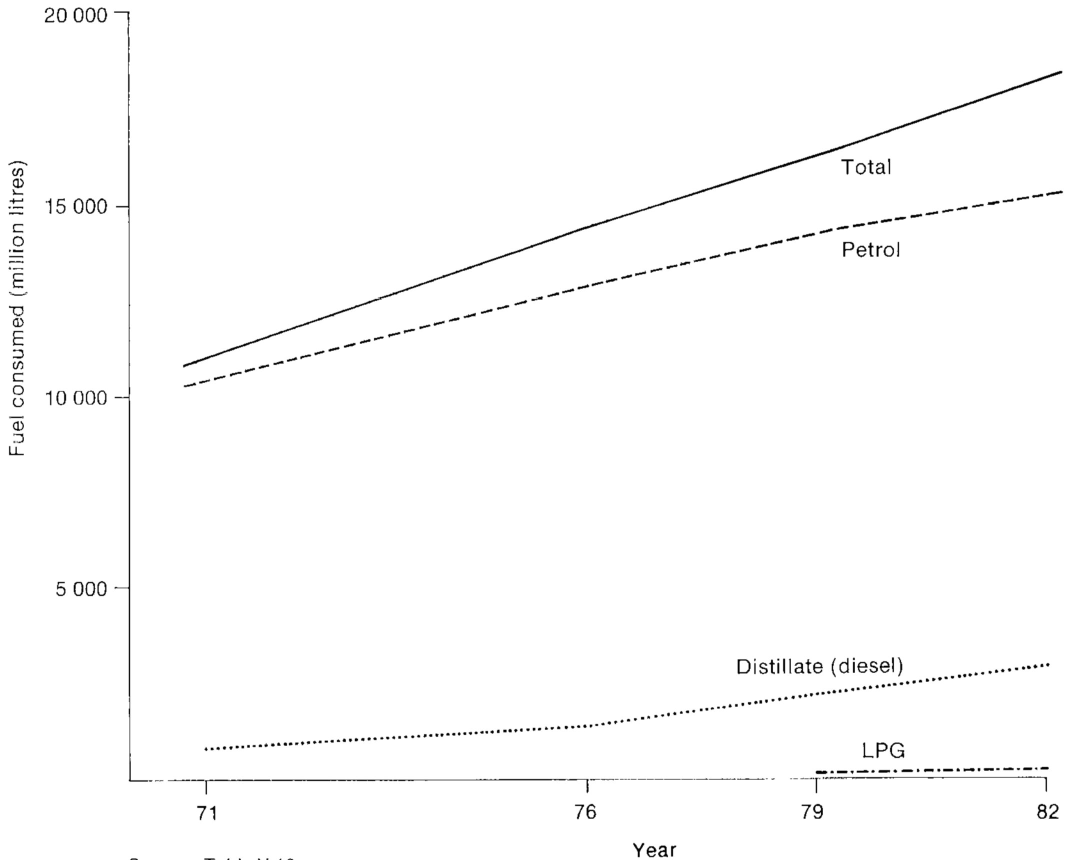
The quantity of motor vehicle fuel consumed in 1982 was highest in New South Wales and lowest in the Northern Territory. The rate of fuel consumption was highest in the Northern Territory and lowest in the Australian Capital Territory. Total fuel consumption increased in Australia over the period 1971 to 1982 but the fuel consumption rate remained relatively steady over this period.



a 1979 data
b 1978 data
c 1976 data

Source: Table IX.1

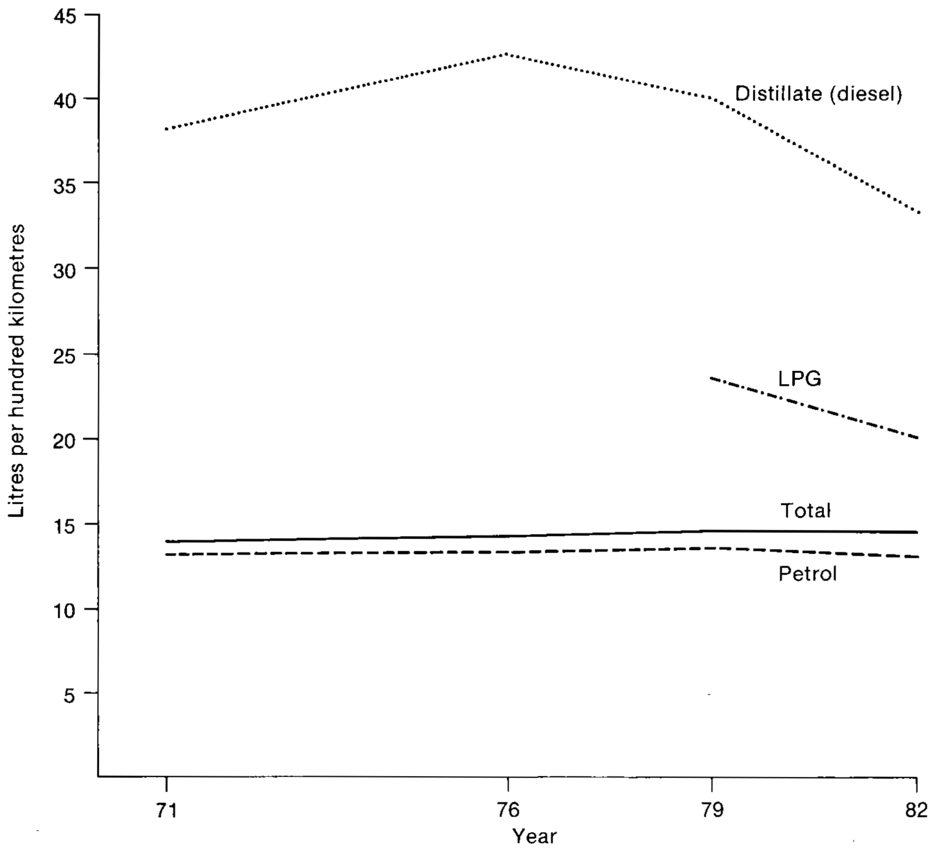
Figure 5.7—Fatality rates in selected countries



Source: Table V.18

Note: Total includes petrol, diesel or distillate and small amount of fuel of unknown type.

Figure 5.8—Annual fuel consumption Australia, 1971-82



Note: Total includes petrol, diesel or distillate and a small amount of fuel of unknown type.

Source: Table V.19.

Figure 5.9—Average rate of fuel consumption Australia, 1971-82

CHAPTER 6—OVERVIEW

BACKGROUND

The principal findings of the report are reviewed in this Chapter, and where data are comparable, the results for particular road categories are compared. Findings which are exclusive to a particular chapter (eg air pollution in Chapter 4) are not discussed here any further; these have been reviewed in the relevant summary comments at the ends of the earlier chapters. The road categories adopted for this study are explained in Appendix I. However, the legal significance of the adopted road categories varied over the analysis period, eg national highways did not legally exist prior to 1974.

Distribution of road length

The proportion of total road length by category is shown in Figure 6.1 based on the inventory of roads obtained in 1972 and 1981.

There is considerable similarity in the two diagrams, particularly the high proportion for rural local road length, a situation which prevails in each of the States except the Australian Capital Territory where rural local roads account for about 30 per cent of total road length.

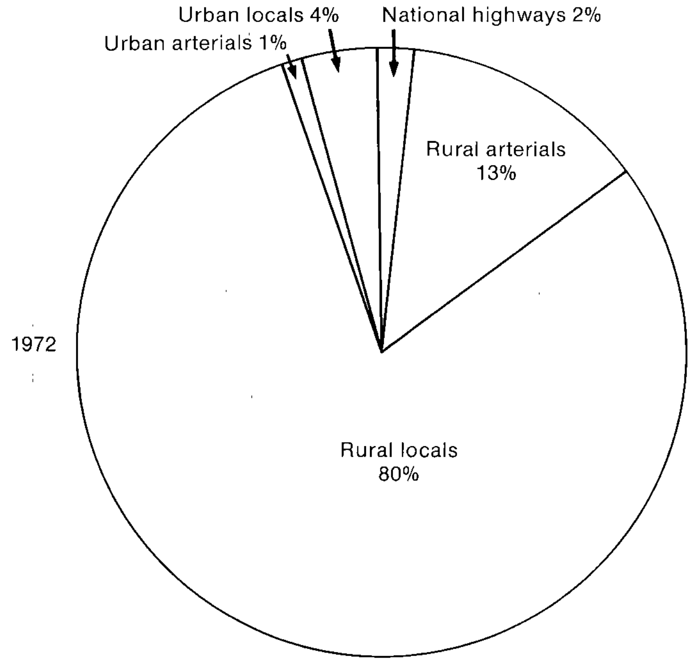
Although the proportion of total road length of national highways has remained constant at 2 per cent other road category proportions have exhibited some changes in the period 1972 to 1981. These changes have arisen principally from definitional and boundary alternations rather than network modifications. Thus, some outer urban arterials which were formerly included in the rural arterial category have now been assigned to the urban arterial category, probably as a result of urban growth and modified statistical boundaries. The 1981 data did not enable the urban arterial and urban local road categories to be separated and only a combined proportion is shown.

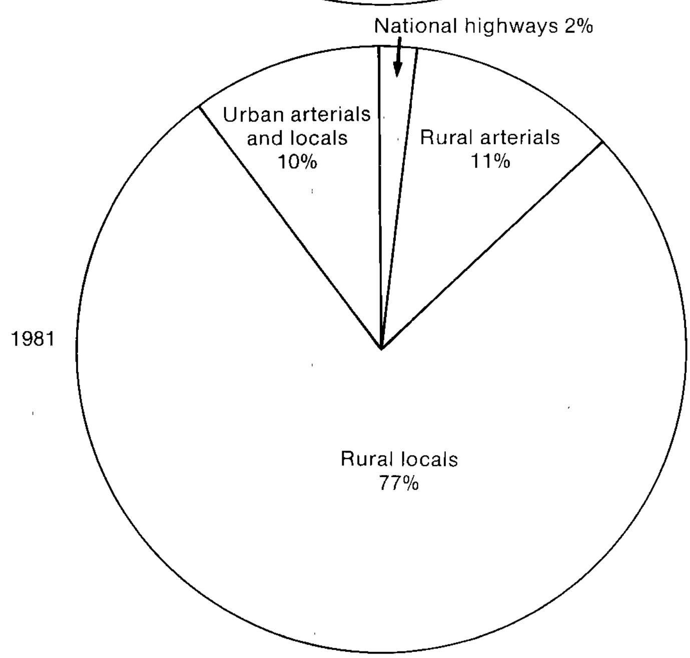
Distribution of road travel

The proportion of travel expressed as VKT by road category is shown for Australia in Figure 6.2 for 1972 and 1981. For each category, the proportion of travel contrasts greatly with the corresponding proportion of road length. The proportional amount of road travel by category remained approximately the same for national highways and for rural arterials. Because 1981 urban travel data could not be separated only a combined urban arterial and urban local roads total can be provided. This figure of 66 per cent compares with 62 per cent (4616) obtained in 1972. The most apparent change has occurred on rural local roads with a decline between 1972 to 1981 of from 12 to 6 per cent. It seems unlikely that this has actually occurred; rather the analysis demonstrates that the source data should be interpreted with caution.

Nonetheless when Figure 6.1 and 6.2 are combined, Figure 6.3 emerges and shows the mean AADT on each road category. As urban travel data could only be analysed collectively, the comparison between 1972 and 1981 is not complete. However with the exception of rural local category all other categories have exhibited significant traffic increases over the period. The rises being 67 per cent for national highway, 45 per cent for rural arterials and 20 per cent for the combined urban arterial and urban local road categories.

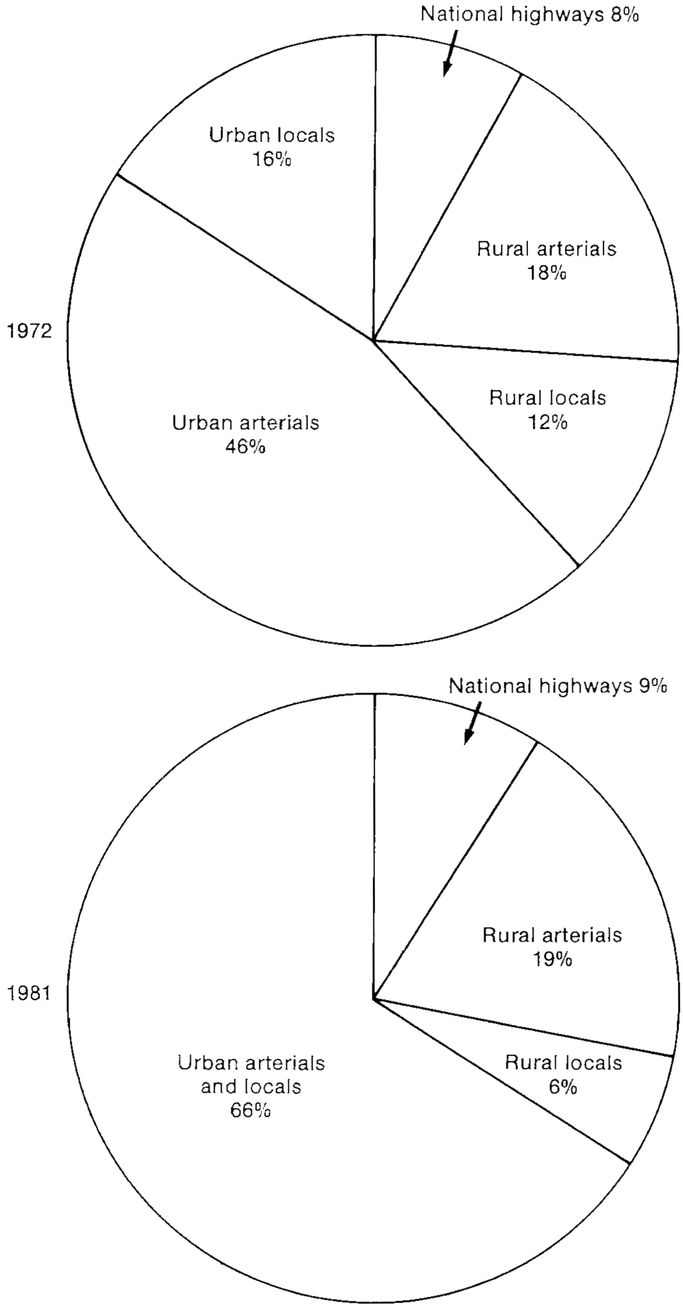
In absolute terms in 1972 the mean traffic volume of 9080 vehicles per day on urban





Sources: Commonwealth Bureau of Roads (1974a). Australian Bureau of Statistics (1982b). BTE estimates.

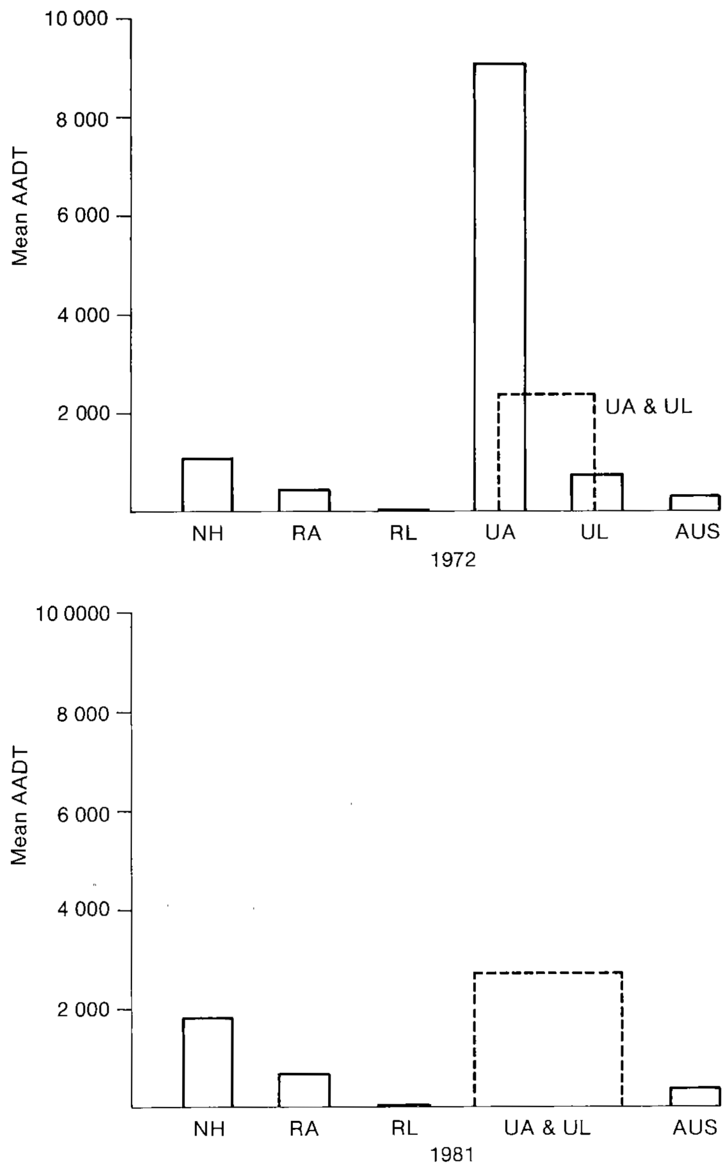
Figure 6.1—Distribution of Australian road length by road category, 1972 and 1981



Sources: Commonwealth of Bureau of Roads (1974a). Australian Bureau of Statistics (1982b). BTE estimates.

Figure 6.2—Distribution of Australian road travel by road category, 1972 and 1981

arterial roads was 180 times higher than the mean AADT of 50 on rural local roads. If the relationship between urban arterials and urban local roads which was evident in 1972 was maintained the AADT on these road categories would have rises to 10 850 and 880 by 1981.



Sources: Commonwealth Bureau of Roads (1974a). Australian Bureau of Statistics (1982b).

Figure 6.3—Mean AADT on Australian roads by road category, 1972 and 1981

Trends in road usage

The average annual increase in VKT between 1971 and 1979 is given in Table 6.1 for each State subdivided into the cities (the capital cities and provincial urban areas as defined by ABS) and the rest of the State. The growth rate in Queensland city travel was markedly higher than that of other States. In all States except Western Australia the traffic growth rate in the cities was higher than the growth rate for the rest of the State.

TABLE 6.1—TRENDS IN TRAVEL; AVERAGE ANNUAL INCREASE IN VKT[a], 1971-82

(per cent)

State	*Cities*[b]	*Rest of State*	*State Total*
New South Wales	3.5[c d]	4.4[d]	3.8[c]
Victoria	4.0	1.9	3.4
Queensland	7.9[d]	5.1[d]	6.7
South Australia	3.4	2.5	3.1
Western Australia	4.7	4.9	4.8
Tasmania	6.3[d]	2.6[d]	4.3
Northern Territory	6.2	4.8[e]	5.7
Australia	4.4	3.7	4.2

a. Compound growth rate over the period September 1971 to September 1979. The data excludes travel by vehicles whilst outside the State of registration (for which area of travel is not available).
b. Capital cities and provincial urban areas as defined by the Australian Bureau of Statistics except for the Northern Territory.
c. Includes data for the Australian Capital Territory.
d. Part of the growth rates given for New South Wales, Queensland and Tasmania for the cities is due to an increase in the areas adopted for the 1979 Survey of Motor Vehicle Usage for Sydney and for the provincial urban areas of Queensland and Tasmania. The growth rates given for the rest of these States are the minima increases.
e. Includes data for Stuart and Barkly Highway travel in the Northern Territory shown under provincial urban heading by the Australian Bureau of Statistics.

Source: Commonwealth Bureau of Census and Statistics (1973b). Australian Bureau of Statistics (1983c).

OVERVIEW OF OPERATIONAL CHARACTERISTICS

Travel Time

Despite progressive increases in VKT, travel times for rural arterial roads and national highways improved over past years in the three States for which data are available. The travel time data for Sydney peak periods show that although some areas of these cities have experienced increased travel time in the evening and/or morning peak periods, decreases in travel times have been experienced in past years for extensive areas, particularly during the evening peak period. Travel time in Melbourne in both peak periods over the years 1961 to 1976 increased slightly over most of the city, increased appreciably over limited areas, and decreased slightly in some areas.

Comfort and Convenience

The proportion of road length sealed for each rural road category in 1972 and in 1981 is illustrated in Figure 6.4 for each State and for Australia overall. National highways had a higher proportion sealed than rural arterial roads in each State except South Australia. The rate of increase of sealed length over this period was highest for national highways in South Australia and Western Australia. In 1981 the lengths of national highways remaining unsealed were in Queensland, South Australia and Western Australia and amounted to 344km, 898km and 719km respectively.

For rural arterial roads in 1981, the highest proportions of the length sealed were

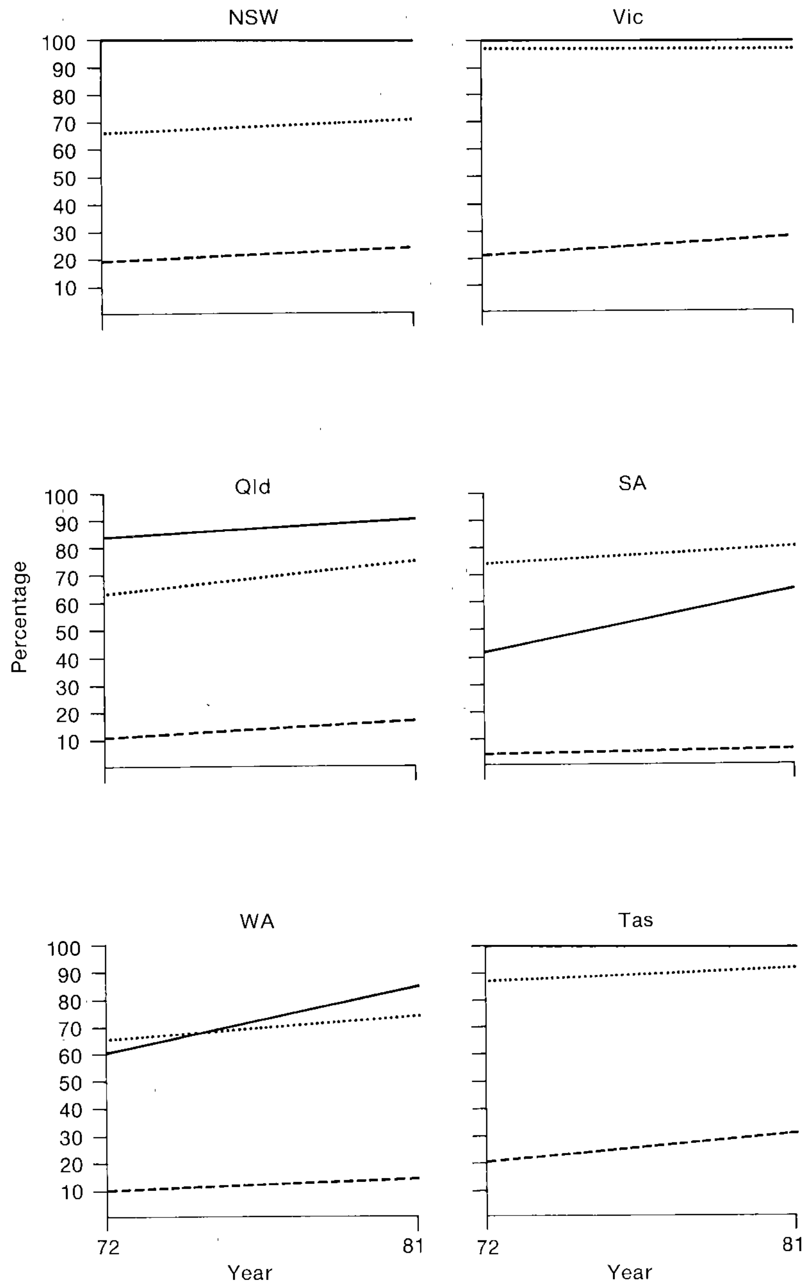
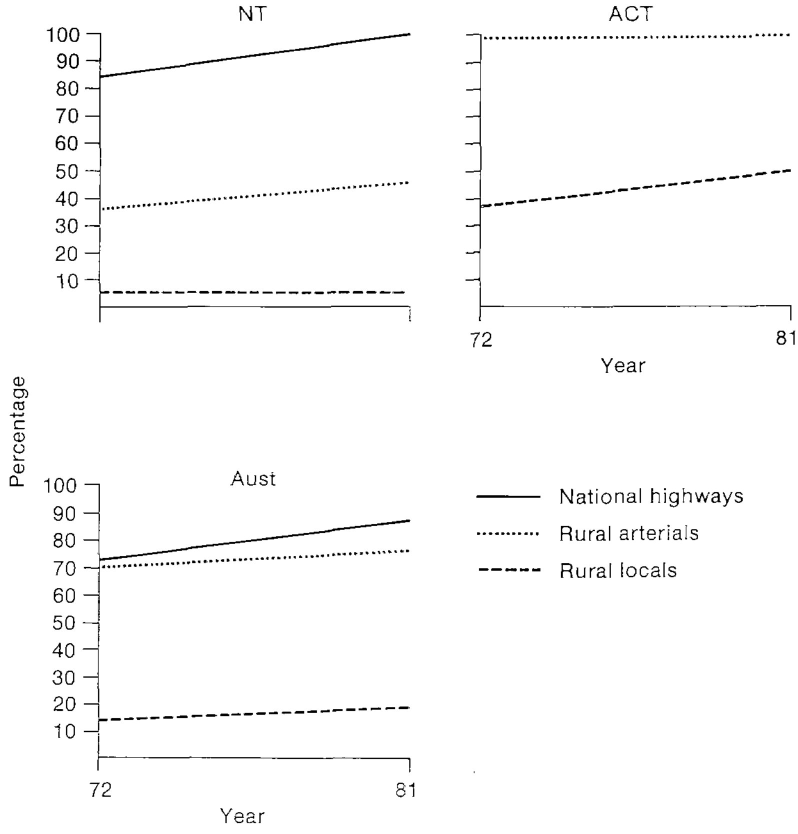


Figure 6.4—Percentage of road length sealed, 1972-81

in Tasmania, Australian Capital Territory and Victoria. However, appreciable increases in the proportion sealed were recorded for the period 1972 to 1981 in the other States.

For rural local roads in South Australia and the Northern Territory, a significantly lower proportion of road length was sealed than in the other States between 1972 and 1981. The Australian Capital Territory had the highest proportion sealed. The increases in the proportion sealed between 1972 and 1981 ranged from one per cent in the Northern Territory (ie from 5 to 6 per cent) to 13 per cent in the Australian Capital Territory (ie from 37 to 50 per cent).

In earlier Chapters surface type and seal width of rural roads were compared with traffic volume for national highways and rural arterial roads to give an indication



Note: 1. National highways and Rural arterial lengths are shown as a percentage of the total length in the relevant year.
2. Rural locals lengths are shown as a percentage of the 1981 lengths for both 1972 and 1981.

Sources: Commonwealth Bureau of Roads (1974a). Australian Bureau of Statistics (1982b. 1983d). Statutory Road Authorities (personal communication).

Figure 6.4(Cont)—Percentage of road length sealed, 1972-81

of the level of service. Where these roads pass through towns the local effects of vehicle parking, intersections and pedestrians can greatly vary travel conditions, although separate data are not available specifically for roads outside towns. However, the overall rural data, which includes towns and cities other than the 18 capital and major provincial cities are considered to be sufficiently indicative of travel conditions outside towns. The following observations draw on the 1981 data presented in Chapters 2 and 3 and Appendices II and III.

Aspects of rural road travel conditions indicating a low level of service include the presence of high traffic volumes on unsealed roads, or on roads with narrow[1] or intermediate seal widths (other conditions being equal).

For national highways, only one State had unsealed surfaces carrying an AADT of 300 or more in 1981. This consisted of 66km of road in Queensland which comprised 1.7 per cent of the length of national highways in that State. In the case of rural arterial roads, six States had unsealed lengths with an AADT of 300 or more in 1981, although the proportions of the total length of rural arterials were very small. The highest proportion (1.3 per cent) was in New South Wales and consisted of 388km.

In 1981 the only length of national highways with a narrow seal width and an AADT of 300 or more amounted to 39km in Queensland. Rural arterials of narrow seal and carrying an AADT of 300 or more comprised less than 2 per cent of the total

TABLE 6.2—LENGTHS OF NATIONAL HIGHWAYS AND RURAL ARTERIALS WITH SEAL WIDTH LESS THAN 6.5M AND AADT OF 1000 OR MORE; 1981

	National highways		*Rural arterials*	
State	*Length (km)*	*Per cent of total length*	*Length (km)*	*Per cent of total length*
New South Wales	226[a]	17.4[a]	3 368	11.3
Victoria	1	0.1	1 387	8.9
Queensland	885	22.8	1 866	9.8
South Australia	124	4.8	870	8.4
Western Australia	97	2.0	282	1.7
Tasmania	25	8.1	623	23.8
Northern Territory	23[b]	0.8[b]	32	1.0
Australian Capital Territory	..	..	21	20.4
Australia	1 381[c]	8.5[c]	8 449	8.7

a. Assuming all sections of New South Wales national highways had a 1981 AADT of 1000 or more (which was the case in 1977).
b. 1977 data.
c. Based on the 1977 data for New South Wales and the Northern Territory.
.. not applicable

Sources: State Road Authorities, private communications. Commonwealth Bureau of Roads (1978).

1. For present purposes a seal width of less than 4.5m is taken as narrow, a width of 4.5m to 6.4m is considered to be intermediate, and a width of 6.5m or more is considered to be wide.

length of rural arterials in each State except for Queensland which had a noticeably higher proportion (5.2 per cent).

National highways and rural arterial roads with a seal width of less than 6.5m and carrying an AADT of 1000 or more, are listed for each State for 1981 in Table 6.2. Percentages of the total length of road in the respective categories are also given.

Table 6.2 shows that Queensland had the greatest length and proportion of national highways carrying an AADT of 1000 or more on a seal width less than 6.5m. In the case of rural arterials, Tasmania had the highest proportion of any State and New South Wales the greatest length, carrying a high AADT on a seal width less than 6.5m.

Some indication of a relatively high level of service is given where a wider sealed road carries low or intermediate traffic volume ranges (other conditions being equal). Some examples are illustrated in Table 6.3 which gives the length of national highways and rural arterials having a seal width of 6.5m or more with an ADDT of less than 1000 in 1981 and 1972.

For the Australian totals in Table 6.3 there was a significant increase between 1972 and 1981 in the proportion of roads providing a high level of service. For national highways the total length at this service level trebled from 6.3 to 19.2 per cent, while for rural arterials the increase was from 7.9 to 13.4 per cent. The greatest increases in length occurred in Western Australia and amounted to approximately 1000km of national highway and 1700km of rural arterial roads.

TABLE 6.3—LENGTHS OF NATIONAL HIGHWAYS AND RURAL ARTERIALS, WITH SEAL WIDTH OF 6.5M OR MORE AND AN AADT BELOW 1000, 1972 AND 1981 *(km)*

	National highways		*Rural arterials*	
	1972	*1981*	*1972*	*1981*
New South Wales	0 (0.0)	0 (0.0)[a]	3 043 (10.3)	3 610 (12.1)
Victoria	0 (0.0)	0 (0.0)	2 362 (15.5)	4 040 (25.9)
Queensland	126 (3.2)	346 (8.9)	201 (1.1)	670 (3.5)
South Australia	80 (3.1)	525 (20.2)	454 (4.4)	1 467 (14.2)
Western Australia	543 (11.4)	1 549 (32.7)	1 489 (9.0)	3 186 (19.4)
Tasmania	0 (0.0)	0 (0.0)	23 (0.9)	43 (1.6)
Northern Territory	279 (10.3)	682 (24.9)[b]	25 (0.8)	5 (0.2)
Australian Capital Territory	..	..	2 (2.2)	11 (10.7)
Australia	1 028 (6.3)	3 102 (19.2)[c]	7 599 (7.9)	13032 (13.4)

.. not applicable

Note: Percentage of total length shown in brackets.

a. Assuming all sections of New South Wales national highways had an AADT of 1000 or more in 1981 (which was the case in 1977).
b. 1977 data.
c. Based on the 1977 data for New South Wales and the Northern Territory.

Sources: Commonwealth Bureau of Roads (1973b and 1978). State Road Authorities, personal communications.

CONCLUDING REMARKS

The aim of this study has been to quantify the operational effects of change to the road system and to provide technical material as an input to the Bureau's 1984 Report on the Australian Road System. The road system has been defined to include the road network, road users, vehicles and road user legislation.

The length, proportion sealed, growth in usage and other characteristics have been described in order that the changes in the operational characteristics may be seen in perspective. It has been demonstrated that between approximately 1972 and 1981 rural travel times tended to decrease in those States for which data are available and the sealing of all categories of rural road, and the widening of national highways and rural arterial roads, progressed in all States. The observed changes in these measures can be attributed substantially but not entirely to changes in the road network.

Over a time frame of several years Peak period travel times in Sydney and Melbourne increased in some areas, remained essentially the same in others while in the remainder there were decreases.

Fatal accident rates decreased in all States. Generally, the decline in accident rates was most evident on rural roads including national highways, with a much slower rate of decline in urban areas. However, fatal accident rates in urban areas continue to be significantly lower than in rural areas.

No conclusive statement can be made concerning the status of operational characteristics on urban local roads; however it has been shown that many LGAs consider it necessary to try to improve amenity in the vicinity of urban residential streets. Changes to the road network can have a significant effect on urban travel times, accident rates and amenity on urban residential streets; however the effects of the road network on these items can often be overwhelmed by the effects of other factors such as legislative changes.

The average rate of fuel consumption by all vehicles did not change greatly between 1971 and 1982. The level of a number of important air pollutants generally remained either fairly steady or fluctuated from year to year. Changes to the road networks, over the period examined, probably had relatively little impact on the average rate of fuel consumption or the level of air pollution given the modifications to vehicle and engine design and the trend to smaller motor cars which occurred over this period.

Although the reported measures do provide an appreciation of the changes that have occurred to the road system, generally they do not permit definitive statements to be made about changes in an individual operational characteristic. There are several reasons for this situation. Firstly, for some operational characteristics there are additional measures which are not reported due to lack of data. For example, road roughness and road closure are measures of comfort and convenience that have not been addressed, and the accident analysis excluded consideration of casualty and property damage accidents. Secondly, for some measures that have been addressed the data are not comprehensive and/or are of unknown reliability. Thirdly, different measures of the same operational characteristic can imply contradictory conclusions about that characteristic.

In spite of these qualifications the study has quantified as a time series a number of statistics which describe road system changes. The analysis indicated that, in rural areas, improvements in operational characteristics have taken place against a sustained growth in VKT. In urban areas road network changes have tended to keep pace with traffic growth, more or less maintaining the level of operational performance. There are indications that some improvements could have been deferred and the effort spent in other areas of the road system. This was highlighted by enumerating improvements to rural roads carrying low traffic volumes as compared to an increasing length of roads on which traffic volumes were relatively high. This effect was evident within and among States. Overall however, there was little evidence of significant differential changes among road categories or among States. In other words, rates of change by road categories were fairly closely maintained.

Further data collection could be undertaken to remedy many of these inadequacies and, hence, enable the effects of investment in the road network to be more clearly identified. However, before such data collection was carried out it would be desirable to examine the trade-off between the cost of collection of the data and the extent to which it would improve the identification of the effects of road investment.

APPENDIX I—DATA SOURCES AND COLLECTION PROCEDURES

SCOPE

This Appendix covers the following items:

- definitions of road categories
- definitions of area categories
- data sources and collection procedures.

DEFINITIONS OF ROAD CATEGORIES

In this Paper roads are analysed, where practicable, in the categories of national highways, rural arterial roads, rural local roads, urban arterial roads and urban local roads.

The nine-level National Association of State Road Authorities (NAASRA) functional classification of roads adopted for the 1972 Australian Roads Survey[1] provided the basis for the determination of roads as arterial or local in subsequent Commonwealth roads grants legislation. In this classification rural roads were grouped into five classes according to the size and nature of the population centres they connected, whereas urban roads were classified according to the level of traffic they carried. Rural arterial roads were classified as functional classes 1, 2 and 3 and urban arterial roads were classified as functional classes 6 and 7. All other roads were classified as either access roads or special purpose roads and the roads in these functional classes were designated as local roads in Commonwealth road grants legislation.

In 1974 the Commonwealth Government declared a set of national highways which included the major links between capital cities, the highway from Brisbane to Cairns and the highway from Hobart to Burnie. The set of roads formerly declared by the Commonwealth as rural arterials was reduced to exclude roads which became national highways in 1974. All roads declared as national highways are either functional classes 1 or 6. Information concerning national highways is presented in Chapter 2. Although national highways were not declared until 1974, Australian Roads Survey (ARS) data were used to obtain inventory data as of 1972 for those roads which later became national highways.

Information is presented in Chapter 3 for rural arterial roads and for rural local roads. To conform more closely with the Commonwealth system, in this Paper rural arterial roads are deemed to consist of those roads of functional class 1, 2 or 3 plus those outer urban roads of functional class 6 or 7, less all national highways. Rural local roads consist of all rural and outer urban roads excluding rural arterial roads and national highways.

Information regarding urban arterial roads and urban local roads is presented in Chapter 4. Urban arterial roads are all inner urban roads of functional class 6 or 7. Urban local roads are all other inner urban roads.

Since the present NAASRA functional classification was adopted in 1972 there have

1. This survey was titled the Australian Roads Survey 1969–74 and the inventory data were for June 1972. The survey was repeated to update the inventory to June 1974 and again to June 1977. For convenience these surveys and updates are referred to in this paper as the 1972 Australian Roads Survey, the 1974 Australian Roads Survey and the 1977 Australian Roads Survey.

been progressive changes in the application of the classification to individual roads. The classification as it existed at June 1981 was generally adopted as the basis for this Paper. Accordingly, functional class changes between 1972 and 1981 are taken into account when comparing road inventory over time for rural roads. In the case of urban roads no separate data are presented for arterial or local roads for 1981, and thus changes in functional classifications in inner urban areas over the period 1972 to 1981 do not need to be taken into account.

The road categories adopted for this Paper have been used in various Commonwealth legislation providing road funds to the States. However, there are some differences between the sets of roads generally used for this Paper and those used in such Commonwealth legislation. In particular, the basis for distinction between urban roads and rural roads adopted for this Paper varies from that of the Commonwealth because of the inclusion of outer urban arterial roads with rural arterial roads. Outer urban arterial road length amounted to 4735km in 1977, or approximately 4 per cent of the combined rural and outer urban arterial road length of 116 528km in 1977. Travel on outer urban arterial roads in that year amounted to approximately 19 per cent of the total rural and outer urban arterial road travel. It should also be noted that differences have occurred between the set of roads declared as rural arterial roads by the Commonwealth and the set based on the NAASRA functional classifications (apart from the exclusion of national highways). In 1981 prior to the commencement of the *Road Grants Act* 1981, there were approximately 2000km of road which were rural arterials on the basis of the NAASRA functional classification but which were not declared as rural arterials by the Commonwealth. On the other hand at that time there were approximately 1200km of arterial roads declared as arterial by the Commonwealth which were not designated as arterials under the NAASRA functional classification.

DEFINITIONS OF AREAS

The definitions of rural and urban used for the 1972 ARS were based on 1971 Census boundaries for capital cities and other major cities with populations greater than 40 000 persons at the time of the census. No urban area was defined for Darwin. The same set of cities were designated as urban in later road surveys except that 1981 data were based on 1976 Census boundaries for the cities, and an urban area of Darwin was also defined. The definitions of areas used in this Paper are as follows:

- Urban
  - —all areas within capital city statistical divisions;
  - —the proposed Greater Darwin as defined at the 1971 census[1];
  - —the statistical districts of Newcastle, Wollongong and Geelong; and
  - —urban areas, as defined by ABS[2], of Ballarat, Bendigo, Townsville Toowoomba, Gold Coast, Rockhampton and Launceston.
- Rural
  - —all other areas.

In addition, areas within the capital city statistical divisions and the Newcastle, Wollongong and Geelong statistical districts but outside the urban centres (identified by ABS using the criteria in note 2 above) were termed 'outer urban' to distinguish them from the more closely settled inner urban areas. This was done because the characteristics of outer urban roads tended to be more rural in nature than urban.

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1. Comparable to the 1976 City of Darwin plus the balance of the 1945 Area (Australian Bureau of Statistics 1977, 1978b).
2. Contiguous areas with population densities of at least 200 persons/sq km at the time of the appropriate census.

For the purposes of the collection of inventory data for 1981, the State Road Authorities (SRAs) adopted urban centres within the capital cities, and also the cities of Newcastle, Wollongong and Geelong which had been identified as having at least 200 persons per sq km by the Australian Bureau of Statistics (ABS) for the 1976 Census, modified to avoid much of the division of Local Government Authority (LGA) areas by the urban centre boundary. The differences between the 1971 and 1976 urban centres (as modified by the SRAs) were examined to ensure that the 1972 and 1981 rural arterial inventories would be comparable. In each State except the Australian Capital Territory the length of road affected by the urban centre change was found to be negligible compared with the total length of rural and outer urban arterial roads. For the Australian Capital Territory the effects of the changed boundaries could not be determined adequately, and data are either not presented in this Paper, or in some cases attention is drawn as to the possible effects of the changes.

As previously noted because of the comparatively rural nature of the standard and operation of roads in outer urban areas, road data collection for the ARS were based on inventory items and procedures used for rural roads. In Bureaux reports[1] utilising the results of such Surveys, urban data were generally presented for the complete statistical areas of the cities. However this is impracticable for many operational characteristics and therefore, except where otherwise stated, data presented in this Paper for rural roads include data for outer urban roads.

The boundaries of the capital cities and provincial urban areas defined by ABS underwent a number of changes over the periods analysed in this Paper. The effects on the data presented are minor except for the changes to the statistical division of Sydney and to the provincial urban areas in Queensland and Tasmania. Data affected by these boundary changes are firstly the lengths of roads given in Table 4.2, and secondly all of the VKT data given for the urban areas of the three affected States. An adjustment is made in Table 4.2 for the change in the Sydney area, but the remaining effects of the changes is noted in the relevant parts of the report in qualitative terms since they are either not readily quantifiable or are unquantifiable.

Travel by vehicles outside the State of registration is recorded only in total by ABS in its Surveys of motor vehicle usage. As a result, estimates of travel for areas of operation (capital city, provincial urban, and rest of State) are low by an average of four and a half per cent for Australian totals. Percentages in individual States vary from approximately 1.4 per cent in Tasmania to approximately 7.8 per cent in the Northern Territory, except for vehicles registered in the Australian Capital Territory where approximately 25 per cent of travel occurred outside the Australian Capital Territory border in 1979. In this Paper no attempt is made to apportion the distribution of interstate travel by area of operation and where necessary footnotes are made to indicate the exclusion of interstate travel from tables and figures.

DATA SOURCES AND COLLECTION PROCEDURES

Vehicle kilometres of travel

By area

Surveys carried out by the ABS at regular intervals (now three-yearly) are the only comprehensive sources of data on the travel task by area of operation. The urban boundaries used for these surveys correspond to the ABS statistical divisions, statistical districts and urban areas defined above. Each Survey is based on questionnaires filled out by a sample of owners of registered vehicles of various body types. In the 1979 survey for example a total Australian sample of 57 000 was obtained out of a registered vehicle fleet of 7.3 million vehicles. In this sample 18 per cent of the vehicles were cars, station wagons and motorcycles, 75 per cent

1. Commonwealth Bureau of Roads (1973a, 1975b) and Bureau of Transport Economics (1979).

were trucks, utilities and panel vans and the remaining 7 per cent were buses and microbuses. The structure of the sampling procedure enables sampling errors to be calculated in each survey. Some typical sampling errors are shown in Table I.1 for the 1979 Survey. The significance of these standard errors is that they allow some statement to be made about the accuracy of reported VKT in so far as sampling error is concerned. For example, from Table I.1 it can be stated that there is approximately a 95 per cent probability that the true rural VKT in NSW in 1979 was sample value plus or minus 8 per cent of the sample value. From Table III.1 (Appendix III) the sample value for rural NSW in 1979 was 10 951 million VKT so that a 95 per cent confidence interval for the true rural VKT in that year is 10 951 plus or minus 876, ie 10 075 to 11 827 million.

Apart from sampling error in such surveys there is the separate problem of errors due to inaccurate response. Some response error is unavoidable due to the nature of the questions asked in the surveys, and is likely to affect the estimates of VKT in specific areas of each State in particular. Unfortunately virtually no work has been done by ABS to determine the size of this type of error[1].

By road category

Changes in VKT on particular categories of road over the period 1972–81 are available for national highways and rural arterial roads only. These VKT estimates are obtained by the SRAs from calculation of the sum

$$VKT = \Sigma \text{ (section length x AADT on section)}$$

over all sections of road in a particular road category. Consequently the accuracy of the estimates depends on the accuracy of both the measurement of section length and of the AADT on the section. Since section length is directly measurable and AADT most often is not, the accuracy of VKT estimates is much more dependent on the estimation of AADT.

The AADT on a particular section of road can be approximately determined by direct measurement (by dividing the annual traffic flow by 365) only if a permanent count

TABLE I.1—STANDARD ERRORS IN VKT ESTIMATES; 1979 SURVEY OF MOTOR VEHICLE USAGE

(per cent)

	Area of operation			
State	*Rural*	*Capital city*	*Provincial city*	*All*
New South Wales	4.0	3.1	6.6	1.8
Victoria	3.9	2.8	7.4	1.9
Queensland	4.7	4.1	6.7	2.3
South Australia	4.3	3.1	..	2.2
Western Australia	4.6	3.0	..	2.2
Tasmania	3.3	4.3	6.7	2.0
Northern Territory	8.3	6.4	8.2	3.7
Australian Capital Territory	..	2.8	..	2.8
Australia	1.9	1.5	3.9	0.9

.. not applicable
Source: Australian Bureau of Statistics (1981a).

1. ABS, personal communication. See Commonwealth Bureau of Census and Statistics (1973b) for brief mention of non-response error in the ACT.

station is located on that section. Even in this case the AADT is only approximate because the axle counts measured by the detector at the count station have to be converted into AADT. The conversion is done using results from traffic composition studies which are usually carried out manually.

Cost considerations preclude the establishment of a large number of fixed, permanent counting stations, and other counting techniques are used to cover the whole road network in each State. Seasonal stations are used to determine AADT's for a given year by a complete enumeration of vehicles for that year, in a similar fashion to permanent stations. Trends in AADT may be adequately assessed from data at these stations provided that the time period between measurement is not too great. At temporary stations traffic flows are measured for a short period (usually less than one week), enabling complete road networks to be covered within budgetary constraints, but at the cost of reliability and accuracy in the estimated AADT. At these stations the AADT in the given year is estimated by a seasonal adjustment factor. The seasonal adjustment factor is obtained from annual data at a selected permanent count station. The accuracy of the estimated AADT depends on both the correct identification of the traffic pattern at the temporary station with that of a permanent station and the duration of the short term count at the temporary station. AADTs on sections of road some distance from a counting station are calculated from AADTs at the nearest counting stations, taking into account estimated flows entering and leaving the main route between the stations.

For further details of traffic counting procedures in Australia the reader is referred to National Association of State Road Authorities (1982).

Travel time

National highways and rural arterial roads

Trends in national highway and rural arterial travel times are available for New South Wales, Queensland and Tasmania. The SRAs in Victoria, South Australia and Western Australia each published a travel time map in the early 1970s but further such work was discontinued because of its perceived lack of value.

The rural travel time data published for New South Wales, Queensland and Tasmania relate to the majority of the declared roads in each of these States. The times are in all cases stipulated to be for daylight travel on weekdays in good weather and with drivers experienced with the routes. The collection of rural travel time data is given a fairly low priority by the SRAs and, apart from the general directive just mentioned, no definitive or rigorous data collection procedure exists in any State. The extent to which field data are used to update travel times each year varies among SRA Divisions (areas) within each State, and depends mainly on the availability of local resources. Collection procedures may involve some or all of the following techniques:[1]

- local knowledge of SRA staff members to provide estimates of the extent to which a particular piece of reconstruction or upgrading has affected travel times;
- spot checks on times by staff members driving on roads in the course of normal duties; and
- where extensive and major roadworks have been completed a deliberate re-determination of the travel time over that section of road is made by driving over that section.

Nodal points for measurement of travel times are usually major junctions or intersections on the outskirts of towns. and so changes in travel times over the analysis period due to variations in town traffic levels should be minimal.

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1. Provided in personal communications with a number of State Road Authorities.

Because there are no statistical procedures used for the collection of rural travel time data it is not possible to assign error limits to the published values. The only alternative is to compare times obtained for given routes from two (or more) sources as an indication of the reliability of the data used. This can be done only for travel times in Queensland, where the Royal Automobile Club of Queensland (RACQ) has surveyed all main highways and about fifty per cent of other declared roads in the State. The RACQ surveys were conducted using a vehicle fitted with distance and time recording equipment, and involved a single run in daylight over each route. Times were generally measured from post office to post office. A comparison of the RACQ values with those obtained by the Queensland Main Roads Department (MRD) is shown in Table I.2. This table shows that significant differences between the MRD and RACQ values occurred on two routes: Rockhampton to Longreach and Innisfail to Normanton.

Urban arterial roads

The Sydney travel time data for 1962, 1968 and 1981 were recorded by the New South Wales Department of Main Roads (DMR). Data used for peak and off-peak comparisons for 1982 were recorded by the NRMA. The Melbourne travel times were recorded in 1961 by the Traffic Commission of Victoria, and in various later years by the Royal Automobile Club of Victoria (RACV).

In most surveys travel times were determined by the 'floating car' technique in which the survey car passes the same number of vehicles as pass the survey car. It therefore determines the median speed or travel time over the section of interest. This travel time is of course influenced by a large number of random events and therefore varies considerably even for journeys made under apparently similar conditions. In order to obtain an estimate of this variation and to determine the mean travel time to within acceptable confidence limits, it is necessary for the survey car to make a number of runs over each road section during the periods of interest.

The three Sydney travel time surveys were carried out by the DMR on major routes using a type of floating car technique. Table I.3 contains a summary of the main characteristics of the surveys. The following additional information was also made available by DMR to describe various aspects of the travel time data collected in 1968:

- Starting time at the beginning of the route was established to fit peak demand of the route (on longer routes this usually resulted in earlier starts).
- Whenever two or more cars were available on the same day, their starting times were separated by 5-15 minutes (depending on runs).

TABLE I.2—COMPARISON OF MRD AND RACQ TRAVEL TIMES; QUEENSLAND, 1979-80

Route	*Travel time (hours: minutes)*		*Difference (per cent of MRD time)*
	MRD	*RACQ*	
Townsville-Mt Isa	11:05 (1980)	10:40 (1980)	3.8
Rockhampton-Longreach	8:28 (1980)	9:11 (1979)	8.5
Dalby-Cunnamulla	7:06 (1980)	7:05 (1978)	-
Emerald-Charters Towers	6:48 (1980)	6:50 (1980)	-
Rockhampton-Miles	5:39 (1980)	5:37 (1979-80)	-
Innisfail-Normanton	8:33 (1980)	9:05 (1980)	6.2

\- nil or rounded to zero

Note: Year of data shown in brackets.

Sources: Queensland, Main Roads Department, (1980). Royal Automobile Club of Queensland 1978-80).

TABLE I.3—COMPARISON OF SYDNEY JOURNEY TIME SURVEY CHARACTERISTICS; 1961, 1967 AND 1981

	Survey	
Characteristics	*1961 and 1967*[a]	*1981*
Period of survey	Am and pm peaks	Am and pm peaks
Survey duration	All year	November, 1981
Survey start times	Various	Fixed
Surveys per period	Up to three	One only
Surveys per week	Not relevant	Five each week
Method of survey	Floating car technique	Floating car technique
Measurement	Average journey time	Median journey time
Data stored	Field sheets	Computer

a. The field work for the 1961 Survey was carried out over the period October 1961 to March 1962 and is referred to in Chapter 4 as 1962 data. The field work for the 1967 Survey was carried out in 1968.

Source: New South Wales, Department of Main Roads, personal communications.

- The intention was to cover as many weekdays as possible. Thus, journeys were spread over a full week (in some cases more than one week) although it was not always possible to have all days equally represented.
- Drivers were over 21 years of age and experienced. They were instructed to maintain the speed of the survey vehicle to that of surrounding vehicles.
- Travel time was recorded from the time the survey vehicle cleared the stop lines of the intersections.
- The recording was either by tachograph or a stop watch.
- Each recording was checked at the office prior to being translated into punch cards.
- It is not possible to quantify the accuracy of the recorded travel times.

Sydney travel time data were recorded by the DMR on five minute time interval contour maps for the periods 7am to 9am for the morning peak period and 4pm to 6pm for the evening peak period. These data are used for the analysis of travel time trends in Chapter 4.

The NRMA survey data used in Chapter 4 were obtained in March 1982, and the data collection methods are described by National Roads and Motorists' Association (1982). Routes were surveyed on five consecutive weekdays. Starting times for surveys varied according to the route. Travel times were averaged over the week for each route and each starting time.

Both sources for the Melbourne travel time data indicated that it was recorded for the periods 8am to 9am and 5pm to 6pm over a number of days of the week, but little further information has been available concerning the methods used to collect the data.

Insufficient data are available to determine the accuracy with which either the Sydney or Melbourne travel time data were obtained. The information given above for the Sydney travel time procedures includes some comments relevant to accuracy. The following extracts and comments summarise the available information relevant to the accuracy of the reported travel times for Melbourne:

Metropolitan Street Service Study 1961—Traffic Commission of Victoria:

> 'Runs were started at different times throughout the peak hour and repeated on different days until sufficient information had been obtained to enable a statistically

satisfactory average travel time to be obtained. The number of runs varied from a minimum of six to a maximum of thirty' (Traffic Commission Victoria, undated).

Melbourne Metropolitan Area Traffic Survey 1969-70—RACV

'Runs were started at different times during the peak hours and on different days until sufficient information had been gathered which gave consistent recordings' (Royal Automobile Club of Victoria, 1970).

Melbourne Metropolitan Area Traffic Survey 1971—RACV

'Surveys started at different times during each peak hour and on different days until sufficient information had been gathered to give consistent recordings' (Royal Automobile Club of Victoria, 1971).

Melbourne Metropolitan Area Traffic Survey 1976—RACV

'The number of runs made per section during the single off-peak survey was three. During the peak period an unspecified larger number of runs was made' (Royal Automobile Club of Victoria, 1976).

Surface type and seal width by AADT

National highways and rural arterials

The data sources for both surface type and seal width by AADT were the SRAs (for 1981 data) and the 1972 Australian Roads Survey (ARS) and updates of this (for 1974 and 1977). It is not possible to comment on the level of errors existing in the original data bases except to say that, in each year, considerable effort was made to minimise errors using appropriate check procedures.

Accuracy and reliability is more of a problem with AADT than with length, surface type or seal width because it is generally estimated rather than measured (as described earlier in this Appendix).

Rural local roads

Length by surface type

The 1972 data for rural local roads were obtained from the 1972 ARS. Data for 1981 were derived from information supplied by LGAs to ABS, and from the SRAs. Whereas 1972 rural local road data were specifically available for rural and outer urban areas it was necessary to estimate the outer urban component for 1981 for most States. This was done as follows:

- Those LGAs which were wholly within the 1976 Census centre urban boundary were identified, and their road inventories were assigned as urban.
- In each of those LGAs split by the 1976 Census urban centre boundary a proportion of the paved road length was allocated to the rural and outer urban area on the basis of both the LGA area outside the urban boundary and the distribution of roads within the LGA. All unpaved roads within these LGAs were allocated to the rural and outer urban areas.
- All other LGAs were classified as rural and outer urban and their road inventories assigned as such.

1981 data for the Northern Territory and the Australian Capital Territory were available for urban and rural (including outer urban) areas separately, and no estimation was required.

The 1981 data include an unknown component due to new road construction carried out after 1972. This should show up simply as the length of rural local road added to the network since 1972. However the different nature of the data sources for 1972 and 1981 introduce complexities which obscure such a determination and also render difficult a direct comparison of the length by surface type distributions for the two years. A large part of the problem results from differences in the scope of the road networks included in the inventories for the two years. Changes in LGA inventories since 1972 due to revised measurements, realignments, changes in the definition of roads and changes in the classification of surface types have also occurred[1]. Some idea of the differences in the two types of inventory for 1972 can be obtained from Table I.4. The table shows that length of sealed roads is nearly identical in both inventories but large differences exist for unsealed roads. As the majority of unsealed roads are in rural and outer urban areas the differences in the two inventories relate primarily to roads in these areas.

ARS data (Commonwealth Bureau of Roads, 1974a) are used in this Paper to describe rural local roads in 1972. Due to the significant problems with estimation of the unformed road length, and hence the unsealed road length, 1972 rural local roads are generally reported in this Paper in terms of length of sealed road and/or length of paved road.

Safety

The primary source of data for road accidents is the police accident reporting form. Accident statistics are collected by the various SRAs and/or traffic accident authorities using these forms as input. The accident analysis in this Paper concerns fatalities and fatal accidents, and fatality and fatal accident rates per million VKT.

A person is counted as a road fatality if he or she died within 30 days of being injured in a reported motor vehicle crash and his or her death was directly attributable to injuries sustained during the crash. A fatal accident is an accident in which one or more fatalities occurred.

Problems associated with under reporting or incorrect reporting of accident details by police officers do not usually affect the recording of fatalities. A possible exception arises when fatalities do not occur at the scene of the accident but only after admission to hospital. In such a situation the accident reporting authority may not correctly assign the fatality to the accident. This source of potential error could be virtually eliminated if hospital and medical data were matched to police records[2].

TABLE I.4—COMPARISON OF ARS AND CBCS ROAD LENGTHS; 1972

(km)

State	*Sealed*		*Unsealed*	
	ARS	*CBCS*	*ARS*	*CBCS*
New South Wales	62 039	60 323	123 784	146 440
Victoria	53 136	53 179	117 909	105 344
Queensland	34 886	35 710	130 833	156 710
South Australia	16 826	17 834	83 242	82 766
Western Australia	28 464	28 234	132 026	131 165
Tasmania	6 045	6 256	12 233	14 322
Northern Territory	4 244	4 310	14 603	14 722
Australian Capital Territory	1 075	1 142	277	427
Australia	206 714	206 988	614 906	651 896

Notes: 1. Table refers to roads in both rural and urban areas of each State
2. Figures may not add to totals due to rounding.

Sources: Commonwealth Bureau of Census and Statistics (1973a). Australian Bureau of Statistics (1974). Commonwealth Bureau of Roads (1974a).

1. Affects mainly natural surface roads: see, for example. ABS (1978a, 1979a).
2. Such a project is currently under consideration by the Traffic Accident Research Unit at the NSW Traffic Authority (Searles and Jamieson. 1983).

A person is counted as a road casualty if he or she received medical treatment, was admitted to hospital or died as a result of a motor vehicle crash. A casualty accident is an accident in which one or more casualties occurred.

Although some road casualty information is presented in Appendices II to V, no evaluation of casualties or casualty accidents is made in this Paper because of the lack of uniformity in the reporting of casualty data that existed until the late 1970s. Recently, however, the inclusion of the category 'admitted to hospital' on accident forms established a sufficiently consistent basis for future casualty accident evaluation (Boughton, 1983, Australian Bureau of Statistics 1981b).

The urban boundaries used for reporting accident data differ from the boundaries used for some other data items. Where available, road accident data are presented separately for each of the following categories:

- national highways;
- all roads outside the capital and major provincial cities as defined by ABS;
- all roads inside the capital and major provincial cities as defined by ABS; and
- States as a whole.

Statistics on derived rates are subject to error in both the numerator (number of fatalities or number of fatal accidents) and the denominator (VKT).

The underestimation of the number of fatalities due to inaccurate reporting and the use of the 'death within 30 days' definition is considered minor. A more significant concern relates to the estimation of VKT for rural areas, urban areas and States as a whole (ie except in the case of national highways). These VKT estimates are based on the results of the ABS surveys of motor vehicle usage. Accident rates calculated using these data are generally slightly over-estimated because of the exclusion of VKT occurring in each State due to vehicles registered in other States, (even though such vehicles contribute to the accident statistics for that State). In 1979 approximately four and half per cent of VKT in Australia was due to such interstate travel (ABS 1981a). This over-estimation of the accident rate is noteworthy for the Northern Territory, where vehicles from the more populated States may carry out approximately ten per cent more travel than its registered vehicles carry out in other States. Other anomalies in the estimation of VKT result mainly from the accuracy of the estimated values in different areas of operation (refer to the discussion of VKT earlier in this Appendix). No attempt is made in this Paper to adjust the VKT estimates based on the ABS Surveys but annotations are made of the limitations of the VKT estimates, and of the implications where appropriate.

APPENDIX II—DATA TABULATIONS: NATIONAL HIGHWAYS

This Appendix presents the source data that were used to produce the Tables and Figures in Chapter 2.

The data in Tables II.2 to II.28 represent route lengths, not carriageway lengths, and the columns headed 'seal width' exclude divided road. Australian Roads Survey data were used to obtain inventory data as of 1972 for those roads which later became national highways. Inventory data for Tasmanian national highways are not available for 1977 in the detail required, and the relevant table is omitted.

The road accident measures shown in Tables II.29 to II.33 are defined in Appendix I. The casualty data were not discussed in Chapter 2 because of the inconsistency of recording among States and over time as explained in Appendix I, but have been included here to supplement the fatality data particularly for States where the fatality numbers are small and are thus more prone to annual fluctuations. National highway accident data are not available for Queensland or the Northern Territory.

TABLE II.1—VEHICLE KILOMETRES TRAVELLED ON NATIONAL HIGHWAYS; 1972, 1974, 1977 AND 1981

(million VKT)

State	*Year*	*Cars*	*Light trucks*	*Heavy trucks*	*Total*
New South Wales	1972	na	na	na	2 154
	1974	1 723	228	546	2 497
	1977	2 061	272	662	2 996
	1981	na	na	na	na
Victoria	1972	634	92	279	1 004
	1974	672	98	295	1 065
	1977	na	na	na	na
	1981	896	152	331	1 379
Queensland	1972	1 394	192	200	1 786
	1974	1 500	204	209	1 913
	1977	1 839	248	341	2 429
	1981	2 177	298	395	2 870
South Australia	1972	299	61	170	530
	1974	522	109	152	783
	1977	648	93	133	874
	1981	829	218	164	1 211
Western Australia	1972	321	111	79	511
	1974	344	119	88	552
	1977	438	127	65	630
	1981	433	139	102	674
Tasmania	1972	254	52	44	350
	1974	296	61	52	410
	1977	na	na	na	na
	1981	400	34	32	466
Northern Territory	1972	116	51	56	223
	1974	140	62	67	269
	1977	189	83	91	363
	1981	na	na	na	na

na not available

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

Sources: Commonwealth Bureau of Roads, (1974a, 1975a and 1978). State Road Authorities, personal communication.

TABLE II.2—LENGTH BY SURFACE TYPE AND WIDTH; NEW SOUTH WALES' NATIONAL HIGHWAYS, 1981

(km)

	Natural surface	Formed	Gravel	Seal Width(m)					Divided	Total
				0–4.4	4.5–6.4	6.5–9.1	9.2–11.6	11.7+		
Total	0	0	0	0	226	675	84	103	212	1 301

Notes: 1. Length by AADT range is not available for New South Wales for 1981.
2. Figures may not add to totals due to rounding.

Source: New South Wales, Department of Main Roads, personal communication.

TABLE II.3—LENGTH BY SURFACE TYPE AND WIDTH BY AADT; NEW SOUTH WALES' NATIONAL HIGHWAYS, 1977

(km)

AADT	Natural surface	Formed	Gravel	Seal Width(m)					Divided	Total
				0–4.4	4.5–6.4	6.5–9.1	9.2–11.6	11.7+		
0–299	0	0	0	0	0	0	0	0	0	0
300–999	0	0	0	0	0	0	0	0	0	0
1000–1999	0	0	0	0	74	33	14	2	0	123
2000–5999	0	0	0	0	241	411	80	27	22	781
6000–9999	0	0	0	0	27	119	25	19	39	229
10 000+	0	0	0	0	18	76	13	27	65	199
Total	0	0	0	0	360	639	132	75	126	1 332

Source: Commonwealth Bureau of Roads (1978).

TABLE II.4—LENGTH BY SURFACE TYPE AND WIDTH BY AADT; NEW SOUTH WALES' NATIONAL HIGHWAYS, 1974

(km)

AADT	Natural surface	Formed	Gravel	Seal Width(m)					Divided	Total
				0-4.4	4.5-6.4	6.5-9.1	9.2-11.6	11.7+		
0-299	0	0	0	0	0	0	0	0	0	0
300-999	0	0	0	0	0	0	0	0	0	0
1000-1999	0	0	0	0	131	69	17	2	0	219
2000-5999	0	0	0	0	312	360	54	10	30	766
6000-9999	0	0	0	0	53	68	18	13	32	184
10 000+	0	0	0	0	24	72	7	26	47	176
Total	0	0	0	0	520	569	96	51	109	1 345

Source: Commonwealth Bureau of Roads (1975a).

TABLE II.5—LENGTH BY SURFACE TYPE AND WIDTH BY AADT; NEW SOUTH WALES' NATIONAL HIGHWAYS, 1972

(km)

AADT	Natural surface	Formed	Gravel	Seal Width(m)					Divided	Total
				0-4.4	4.5-6.4	6.5-9.1	9.2-11.6	11.7+		
0-299	0	0	0	0	0	0	0	0	0	0
300-999	0	0	0	0	0	0	0	0	0	0
1000-1999	0	0	0	0	181	88	20	3	0	292
2000-5999	0	0	0	0	332	371	44	25	10	782
6000-9999	0	0	1	0	62	82	8	13	20	186
10 000+	0	0	0	0	14	45	4	26	23	112
Total	0	0	1	0	589	586	76	67	53	1 372

Source: Commonwealth Bureau of Roads (1973b).

TABLE II.6—LENGTH BY SURFACE TYPE AND WIDTH BY AADT; VICTORIA NATIONAL HIGHWAYS, 1981

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-299	0	0	0	0	0	0	0	0	0	0
300-999	0	0	0	0	0	0	0	0	0	0
1000-1999	0	0	0	0	0	133	2	3	2	140
2000-5999	0	0	0	0	0	325	2	4	21	351
6000-9999	0	0	0	0	1	13	0	2	63	79
10 000+	0	0	0	0	0	21	2	9	82	115
Total	0	0	0	0	1	492	6	19	167	686

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

Source: Victoria, Country Roads Board, personal communication.

TABLE II.7—LENGTH BY SURFACE TYPE AND WIDTH; VICTORIA NATIONAL HIGHWAYS, 1977

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
Total	0	0	0	0	7	513	7	18	141	686

Note: Length by AADT range is not available for Victoria for 1977.

Source: Commonwealth Bureau of Roads (1978).

TABLE II.8—LENGTH BY SURFACE TYPE AND WIDTH; VICTORIA HIGHWAYS, 1974

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-299	0	0	0	0	0	0	0	0	0	0
300-999	0	0	0	0	0	0	0	0	0	0
1000-1999	0	0	0	0	4	128	1	0	0	133
2000-5999	0	0	0	0	3	377	4	4	12	400
6000-9999	0	0	0	0	0	46	3	16	66	131
10 000+	0	0	0	0	0	0	0	6	17	23
Total	0	0	0	0	7	551	8	26	95	686

Source: Commonwealth Bureau of Roads (1975a).

TABLE 11.9—LENGTH BY SURFACE TYPE AND WIDTH BY AADT; VICTORIA NATIONAL HIGHWAYS, 1972

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-299	0	0	0	0	0	0	0	0	0	0
300-999	0	0	0	0	0	0	0	0	0	0
1000-1999	0	0	0	0	12	169	1	0	1	183
2000-5999	0	0	0	0	6	355	3	5	10	379
6000-9999	0	0	0	0	0	45	2	17	54	118
10 000+	0	0	0	0	0	0	1	3	6	10
Total	0	0	0	0	18	569	7	25	71	690

Source: Commonwealth Bureau of Roads (1973b).

TABLE II.10—LENGTH BY SURFACE TYPE AND WIDTH BY AADT; QUEENSLAND NATIONAL HIGHWAYS, 1981

(km)

AADT	Natural surface	Formed	Gravel	Seal Width(m)					Divided	Total
				0-4.4	4.5-6.4	6.5-9.1	9.2-11.6	11.7+		
0-299	0	250	28	81	499	215	0	0	1	1 074
300-999	0	52	8	39	600	131	0	0	4	832
1000-1999	6	0	0	0	494	148	2	1	1	652
2000-5999	0	0	0	0	378	616	20	9	23	1 046
6000-9999	0	0	0	0	12	109	7	4	20	153
10 000+	0	0	0	0	1	61	1	2	53	120
Total	6	303	36	120	1 985	1 280	31	18	102	3 880

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

Source: Queensland, Main Roads Department, personal communication.

TABLE II.11—LENGTH BY SURFACE TYPE AND WIDTH BY AADT; QUEENSLAND NATIONAL HIGHWAYS, 1977

(km)

AADT	Natural surface	Formed	Gravel	Seal Width(m)					Divided	Total
				0-4.4	4.5-6.4	6.5-9.1	9.2-11.6	11.7+		
0-299	35	339	61	91	615	113	0	0	11	1 265
300-999	0	0	0	152	505	31	0	1	4	693
1000-1999	0	0	0	0	569	210	1	1	2	783
2000-5999	0	0	0	0	428	518	36	8	27	1 017
6000-9999	0	0	0	0	2	85	2	4	11	104
10 000+	0	0	0	0	0	36	0	0	36	72
Total	35	339	61	243	2 119	993	39	14	91	3 934

Source: Commonwealth Bureau of Roads (1978).

TABLE II.12—LENGTH BY SURFACE TYPE AND WIDTH BY AADT; QUEENSLAND NATIONAL HIGHWAYS, 1974

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-299	23	325	0	181	297	8	0	0	26	860
300-999	0	113	103	95	1 012	125	1	0	7	1 456
1000-1999	0	0	0	0	552	129	10	1	2	694
2000-5999	0	0	0	2	325	405	22	8	21	783
6000-9999	0	0	0	0	13	67	4	4	6	94
10 000+	0	0	0	0	0	0	0	1	7	8
Total	23	438	103	278	2 199	734	37	14	69	3 895

Source: Commonwealth Bureau of Roads (1975a).

TABLE II.13—LENGTH BY SURFACE TYPE AND WIDTH BY AADT; QUEENSLAND NATIONAL HIGHWAYS, 1972

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-299	31	442	0	202	369	13	1	1	1	1 060
300-999	0	36	103	84	1 054	105	4	1	0	1 387
1000-1999	1	0	0	0	558	168	12	2	2	743
2000-5999	0	0	0	2	279	321	21	12	15	650
6000-9999	0	0	0	0	18	38	4	4	4	68
10 000+	0	0	0	0	0	2	2	6	5	15
Total	32	478	103	288	2 278	647	44	26	27	3 923

Source: Commonwealth Bureau of Roads (1973b).

TABLE II.14—LENGTH BY SURFACE TYPE AND WIDTH BY AADT; SOUTH AUSTRALIA NATIONAL HIGHWAYS, 1981

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-299	0	898	0	0	1	0	0	0	0	899
300-999	0	0	0	0	546	524	0	1	0	1 071
1000-1999	0	0	0	0	63	101	0	5	0	169
2000-5999	0	0	0	0	49	304	6	1	1	361
6000-9999	0	0	0	0	3	2	0	1	45	51
10 000+	0	0	0	0	9	0	0	3	39	51
Total	0	898	0	0	671	931	6	11	85	2 602

Note: Definitions of the unsealed surface type categories have varied over time in South Australia. 1981 definitions are consistent with other States.

Source: South Australia, Highways Department, personal communication.

TABLE II.15—LENGTH BY SURFACE TYPE AND WIDTH BY AADT; SOUTH AUSTRALIA NATIONAL HIGHWAYS, 1977

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-299	530	353	6	0	0	330	0	0	0	1 219
300-999	41	20	0	0	614	108	0	1	0	784
1000-1999	0	0	0	0	176	139	0	1	0	316
2000-5999	0	0	0	0	60	139	34	4	2	239
6000-9999	0	0	0	0	5	18	0	2	16	41
10 000+	0	0	0	0	0	0	1	2	22	25
Total	571	373	6	0	855	734	35	10	40	2 624

Note: Definitions of the unsealed surface type categories have varied over time in South Australia.

Source: Commonwealth Bureau of Roads (1978).

TABLE II.16—LENGTH BY SURFACE TYPE AND WIDTH BY AADT; SOUTH AUSTRALIA NATIONAL HIGHWAYS, 1974

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-299	530	724	42	0	109	0	0	0	0	1 405
300-999	42	20	1	0	525	30	0	0	1	619
1000-1999	0	0	0	0	239	150	1	2	0	392
2000-5999	0	0	0	0	39	76	33	1	2	151
6000-9999	0	0	0	0	8	28	2	3	22	63
10 000+	0	0	0	0	0	0	0	3	9	12
Total	572	744	43	0	920	284	36	9	34	2 642

Note: Definitions of the unsealed surface type categories have varied over time in South Australia.

Source: Commonwealth Bureau of Roads (1975a).

TABLE II.17—LENGTH BY SURFACE TYPE AND WIDTH BY AADT; SOUTH AUSTRALIA NATIONAL HIGHWAYS, 1972

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-299	666	727	112	0	46	33	0	0	0	1 584
300-999	1	11	3	0	453	42	1	3	1	515
1000-1999	0	0	0	0	277	119	1	3	0	400
2000-5999	0	0	0	0	40	15	32	1	4	92
6000-9999	0	0	0	0	2	5	0	2	4	13
10 000+	0	0	0	0	2	0	0	3	8	13
Total	667	738	115	0	820	214	34	12	17	2 617

Note: Definitions of the unsealed surface type categories have varied over time in South Australia.

Source: Commonwealth Bureau of Roads (1974c).

TABLE II.18—LENGTH BY SURFACE TYPE AND WIDTH BY AADT; WESTERN AUSTRALIA NATIONAL HIGHWAYS, 1981

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-299	0	542	177	542	628	958	48	33	0	2 928
300-999	0	0	0	0	872	608	0	2	0	1 482
1000-1999	0	0	0	0	89	117	4	1	0	211
2000-5999	0	0	0	0	8	77	8	0	0	93
6000-9999	0	0	0	0	0	6	0	2	6	14
10 000+	0	0	0	0	0	3	0	0	2	5
Total	0	542	177	542	1 597	1 769	60	38	8	4 733

Source: Western Australia, Main Roads Department, personal communication.

TABLE II.19—LENGTH BY SURFACE TYPE AND WIDTH BY AADT; WESTERN AUSTRALIA NATIONAL HIGHWAYS, 1977

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-299	0	1 020	482	611	557	263	1	12	0	2 946
300-999	0	87	20	16	918	438	0	1	0	1 480
1000-1999	0	0	0	0	61	148	2	1	0	212
2000-5999	0	0	0	0	0	85	6	1	3	95
6000-9999	0	0	0	0	0	9	0	1	3	13
10 000+	0	0	0	0	0	3	0	0	2	5
Total	0	1 107	502	627	1 536	946	9	16	8	4 751

Source: Commonwealth Bureau of Roads (1978).

TABLE II.20—LENGTH BY SURFACE TYPE AND WIDTH BY AADT; WESTERN AUSTRALIA NATIONAL HIGHWAYS, 1974

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-299	206	1 055	470	644	1 221	62	0	0	0	3 658
300-999	0	128	22	15	82	531	1	1	0	780
1000-1999	0	0	0	0	142	77	4	1	0	224
2000-5999	0	0	0	0	0	67	3	2	2	74
6000-9999	0	0	0	0	0	8	0	1	0	9
10 000+	0	0	0	0	0	0	0	0	0	0
Total	206	1 183	492	659	1 445	745	8	5	2	4 745

Source: Commonwealth Bureau of Roads (1975a).

TABLE II.21—LENGTH BY SURFACE TYPE AND WIDTH BY AADT; WESTERN AUSTRALIA NATIONAL HIGHWAYS, 1972

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-299	288	972	504	653	1 241	94	0	1	0	3 753
300-999	3	123	14	30	127	444	2	2	0	745
1000-1999	4	0	0	0	122	76	3	2	0	207
2000-5999	0	0	0	0	2	62	2	2	2	70
6000-9999	0	0	0	0	0	3	0	3	2	8
10 000+	0	0	0	0	0	0	0	0	0	0
Total	295	1 095	518	683	1 492	679	7	10	4	4 783

Source: Commonwealth Bureau of Roads (1973b).

TABLE II.22—LENGTH BY SURFACE TYPE AND WIDTH BY AADT; TASMANIA NATIONAL HIGHWAYS, 1981

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-299	0	0	0	0	0	0	0	0	0	0
300-999	0	0	0	0	0	0	0	0	0	0
1000-1999	0	0	0	0	0	0	0	0	0	0
2000-5999	0	0	0	0	22	213	1	10	0	246
6000-9999	0	0	0	0	3	47	4	2	6	62
10 000+	0	0	0	0	0	0	0	0	1	1
Total	0	0	0	0	25	260	5	12	7	310

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

Source: Tasmania, Department of Main Roads, personal communication.

TABLE II.23—LENGTH BY SURFACE TYPE AND WIDTH BY AADT; TASMANIA NATIONAL HIGHWAYS, 1974

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-299	0	0	0	0	0	0	0	0	0	0
300-999	0	0	0	0	0	0	0	0	0	0
1000-1999	0	0	0	0	47	45	0	0	0	92
2000-5999	0	0	0	0	47	116	0	0	1	164
6000-9999	0	0	0	0	3	49	0	0	3	55
10 000+	0	0	0	0	1	2	1	1	1	6
Total	0	0	0	0	98	212	1	1	5	317

Source: Commonwealth Bureau of Roads (1975a).

TABLE II.24—LENGTH BY SURFACE TYPE AND WIDTH BY AADT; TASMANIA NATIONAL HIGHWAYS, 1972

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-299	0	0	0	0	0	0	0	0	0	0
300-999	0	0	0	0	0	0	0	0	0	0
1000-1999	0	0	0	0	61	79	0	0	0	140
2000-5999	0	0	0	0	45	97	0	0	3	145
6000-9999	0	0	0	0	1	18	0	0	0	19
10 000+	0	0	0	0	2	6	1	1	1	11
Total	0	0	0	0	109	200	1	1	4	315

Source: Commonwealth Bureau of Roads (1973b).

TABLE II.25—LENGTH BY SURFACE TYPE AND WIDTH; NORTHERN TERRITORY NATIONAL HIGHWAYS, 1981

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
Total	0	0	0	426	1 167	1 064	2	14	6	2 681

Notes: 1. Figures may not add to total due to rounding.
2. Length by AADT range is not available for Northern Territory for 1981.

Source: Northern Territory, Department of Transport and Works, personal communication.

TABLE II.26—LENGTH BY SURFACE TYPE AND WIDTH BY AADT; NORTHERN TERRITORY NATIONAL HIGHWAYS, 1977

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-299	0	17	0	415	1 039	316	5	0	0	1 792
300-999	0	0	0	0	515	359	2	0	0	876
1000-1999	0	0	0	0	12	7	0	0	0	19
2000-5999	0	0	0	0	11	32	1	0	0	44
6000-9999	0	0	0	0	0	0	0	0	0	0
10 000+	0	0	0	0	0	0	2	0	4	6
Total	0	17	0	415	1 577	714	10	0	4	2 737

Source: Commonwealth Bureau of Roads (1978).

TABLE II.27—LENGTH BY SURFACE TYPE AND WIDTH BY AADT; NORTHERN TERRITORY NATIONAL HIGHWAYS, 1974

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-299	0	154	0	415	1 359	371	6	0	0	2 305
300-999	0	0	38	1	247	62	0	0	0	348
1000-1999	0	0	0	0	19	6	0	0	0	25
2000-5999	0	0	0	0	30	6	0	0	1	37
6000-9999	0	0	0	0	0	0	0	0	0	0
10 000+	0	0	0	0	0	0	0	0	5	5
Total	0	154	38	416	1 655	445	6	0	6	2 720

Source: Commonwealth Bureau of Roads (1975a).

TABLE II.28—LENGTH BY SURFACE TYPE AND WIDTH BY AADT; NORTHERN TERRITORY NATIONAL HIGHWAYS, 1972

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-299	0	258	167	268	1 436	269	6	0	0	2 404
300-999	0	0	0	0	264	4	0	0	0	268
1000-1999	0	0	0	0	15	6	0	0	0	21
2000-5999	0	0	0	0	17	6	0	0	0	23
6000-9999	0	0	0	0	0	0	0	0	0	0
10 000+	0	0	0	0	0	1	0	0	4	5
Total	0	258	167	268	1 732	286	6	0	4	2 721

Source: Commonwealth Bureau of Roads (1973b).

TABLE II.29—NATIONAL HIGHWAY ACCIDENT DATA; NEW SOUTH WALES, 1975-81

Year	*Fatalities*	*Fatalities per 100 million VKT*	*Fatal accidents*	*Fatal accidents per 100 million VKT*	*Casualties*	*Casualty accidents*
1975	na	na	na	na	na	na
1976	131	4.6	109	3.8	2 238	1 351
1977	143	4.8	109	3.6	2 121	1 262
1978	137	na	111	na	2 330	1 353
1979	113	na	93	na	1 893	1 228
1980	148	na	118	na	2 108	1 311
1981	na	na	na	na	na	na

na not available

Source: New South Wales, Department of Motor Transport, Traffic Accident Research Unit, personal communication.

TABLE II.30—NATIONAL HIGHWAY ACCIDENT DATA; VICTORIA, 1975-81

Year	*Fatalities*	*Fatalities per 100 million VKT*	*Fatal accidents*	*Fatal accidents per 100 million VKT*	*Casualties* [a]	*Casualty* [a] *accidents*
1975	81	7.3	59	5.3	762	419
1976	48	4.2	44	3.8	636	384
1977	64	5.3	51	4.3	713	429
1978	62	5.0	49	3.9	775	459
1979	55	4.3	47	3.6	694	398
1980	41	3.1	37	2.8	680	422
1981	na	na	na	na	na	na

a. The introduction of a new accident recording form on 1 January 1977 may have increased the reporting of casualties.

na not available

Source: Victoria, Country Roads Board, personal communication.

TABLE II.31—NATIONAL HIGHWAY ACCIDENT DATA; SOUTH AUSTRALIA, 1975-81

Year	*Fatalities*	*Fatalities per 100 million VKT*	*Fatal accidents*	*Fatal accidents per 100 million VKT*	*Casualties*	*Casualty accidents*
1975	47	5.8	na	na	741	437
1976	37	4.4	na	na	518	351
1977	55	6.3	na	na	779	482
1978	38	4.0	na	na	648	394
1979	50	4.8	na	na	623	401
1980	34	3.0	na	na	503	322
1981	na	na	na	na	na	na

na not available

Source: South Australia, Highways Department, personal communication.

TABLE II.32—NATIONAL HIGHWAY ACCIDENT DATA; WESTERN AUSTRALIA, 1975-81

Year	Fatalities	Fatalities per 100 million VKT	Fatal accidents	Fatal accidents per 100 million VKT	Casualties	Casualty accidents
1975	na	na	na	na	na	na
1976	na	na	na	na	na	na
1977	na	na	na	na	na	na
1978	33	5.1	27	4.2	320	210
1979	29	4.4	26	3.9	259	197
1980	29	4.3	26	3.9	312	205
1981	17	2.5	16	2.3	307	187

na not available

Source: Western Australia, Main Roads Department, personal communication.

TABLE II.33—NATIONAL HIGHWAY ACCIDENT DATA; TASMANIA, 1975-81

Year	Fatalities	Fatalities per 100 million VKT	Fatal accidents	Fatal accidents per 100 million VKT	Casualties	Casualty accidents
1975	19	4.6	16	3.8	na	na
1976	23	5.4	18	4.2	na	na
1977	18	4.2	17	3.9	291	174
1978	17	3.8	18	4.1	281	182
1979	14	3.1	11	2.4	227	155
1980	16	3.5	15	3.3	244	170
1981	na	na	na	na	na	na

na not available

Sources: Tasmania, Transport Commission, personal communication. Tasmania Police, Division of Road Safety, personal communication.

APPENDIX III—DATA TABULATIONS; RURAL ROADS

Tables III.1 to III.7 include travel data for all roads in rural areas (but excluding outer urban areas) obtained from ABS surveys in each State for the period 1971–79. Travel on national highways and all other categories of roads in rural areas are included in these tables. No data for travel on rural roads in the Australian Capital Territory are presented since the ABS surveys of motor vehicle usage treated the whole Australian Capital Territory area as a Capital City urban area. Table III.8 is the sum of Tables III.1 to III.7. Table III.9 includes data on the freight task carried out by all types of trucks in rural areas of each State and excludes the outer urban area freight task. In Tables III.1 to III.9 the 'year' shown is that ending 30 September. Table III.10 includes data on travel on the rural arterial roads (including outer urban arterial roads) in each State for 1972 and 1981.

Tables III.11 to III.19 present data for 1972 obtained from the 1972 ARS for rural local roads in each State and for Australia. The Northern Territory data include local roads in Darwin since it was designated as a town in a rural area in 1972 for the purposes of the ARS.

Tables III.20 to III.28 and III.29 to III.37 present data as at 30 June 1972 and 30 June 1981 respectively for rural arterial roads ie roads of functional classes 1, 2 and 3 in rural areas and 6 and 7 in outer urban areas. See Appendix I for further discussions of functional classifications.

Table III.38 includes summary data for lengths of local roads for each surface type for 1972 and 1981 for each State.

The road accident categories shown in Tables III.39 to III.46 are defined in Appendix I. These tables include data for both fatality accidents and casualty accidents in rural areas (excluding outer urban areas) in each State for the period 1975–81 where available. Accidents on all categories of roads in rural areas are included in these tables. The data for the Northern Territory encompass the whole of the Territory ie the urban area as well as the rural area. Data for the Australian Capital Territory are not presented here but are included with urban data in Appendix IV. Care should be exercised when examining casualty accident data because of differences in the practices used in each State for the reporting of casualties (see Appendix I). Because of these differences the accident data for Australia in Table III.46 excludes accident totals.

TABLE III.1—TRAVEL IN RURAL AREAS; NEW SOUTH WALES, 1971, 1976 AND 1979

(million VKT)

Vehicle type	*Year 1971*	*1976*	*1979*	*Growth 1971-79 (per cent)*
Cars[a]	6 611	7 738	8 018	21
Utilities and panel vans	1 297	1 421	1 410	9
Trucks	1 080	1 078	1 329	23
Total	8 988	10 137	10 757	20
Motorcycles	127	194	194	53
All vehicles	9 115	10 331	10 951	20

a. Includes station wagons.

Note: For each year travel in New South Wales by vehicles registered in other States is excluded. Travel in outer urban areas is also excluded. Travel data for 1979 excludes travel for a number of LGAs which were incorporated in the Sydney statistical division and therefore the growth rates should be considered as minima.

Sources: Australian Bureau of Statistics (1978c and 1981a), supplemented by the relevant ABS survey of motor vehicle usage microfiches. Commonwealth Bureau of Census and Statistics (1973b).

TABLE III.2—TRAVEL IN RURAL AREAS; VICTORIA, 1971, 1976 AND 1979

(million VKT)

Vehicle type	*Year 1971*	*1976*	*1979*	*Growth 1971-79 (per cent)*
Cars[a]	5 695	6 653	6 235	10
Utilities and panel vans	860	1 189	1 163	35
Trucks	719	656	848	18
Total	7 274	8 498	8 246	13
Motorcycles	66	102	113	71
All vehicles	7 340	8 600	8 359	14

a. Includes station wagons.

Note: For each year travel in Victoria by vehicles registered in other States is excluded. Travel in outer urban areas is also excluded.

Sources: Australian Bureau of Statistics (1978c and 1981a), supplemented by the relevant ABS survey of motor vehicle usage microfiches. Commonwealth Bureau of Census and Statistics (1973b).

TABLE III.3—TRAVEL IN RURAL AREAS; QUEENSLAND, 1971, 1976 AND 1979

(million VKT)

Vehicle type	Year 1971	1976	1979	Growth 1971-79 (per cent)
Cars[a]	3 529	3 641	4 507	38
Utilities and panel vans	756	1 013	1 529	102
Trucks	568	809	550	-3
Total	4 583	5 463	6 586	44
Motorcycles	51	153	178	249
All vehicles	4 634	5 616	6 764	46

a. Includes station wagons.

Note: For each year travel in Queensland by vehicles registered in other States is excluded. Travel in outer urban areas is also excluded. Travel recorded for 1979 is based on a slightly smaller rural area than that used for previous years.

Sources: Australian Bureau of Statistics (1978c and 1981a), supplemented by the relevant ABS survey of motor vehicle usage microfiches. Commonwealth Bureau of Census and Statistics (1973b).

TABLE III.4—TRAVEL IN RURAL AREAS; SOUTH AUSTRALIA, 1971, 1976 AND 1979

(million VKT)

Vehicle type	Year 1971	1976[a]	1979	Growth 1971-79 (per cent)
Cars[b]	2 161	2 251	2 499	16
Utilities and panel vans	331	386	592	79
Trucks	394	335	410	4
Total	2 886	2 972	3 501	21
Motorcycles	39	69	80	105
All vehicles	2 925	3 041	3 581	126

a. The estimate for 1976 excludes travel in part of the rural area adjacent to the Adelaide statistical division.
b. Includes station wagons.

Note: For each year travel in South Australia by vehicles registered in other States is excluded. Travel in outer urban areas is also excluded.

Sources: Australian Bureau of Statistics (1978c and 1981a), supplemented by the relevant ABS survey of motor vehicle usage microfiches. Commonwealth Bureau of Census and Statistics (1973b).

TABLE III.5—TRAVEL IN RURAL AREAS; WESTERN AUSTRALIA, 1971, 1976 AND 1979

(million VKT)

Vehicle type	*Year* 1971	1976	1979	*Growth 1971-79 (per cent)*
Cars[a]	1 611	2 382	2 644	64
Utilities and panel vans	591	735	1 133	92
Trucks	543	578	576	6
Total	2 745	3 695	4 353	59
Motorcycles	19	49	57	200
All vehicles	2 764	3 744	4 410	60

a. Includes station wagons.

Note: For each year travel in Western Australia by vehicles registered in other States is excluded. Travel in outer urban areas is also excluded.

Sources: Australian Bureau of Statistics (1978c and 1981a), supplemented by the relevant ABS survey of motor vehicle usage microfiches. Commonwealth Bureau of Census and Statistics (1973b).

TABLE III.6—TRAVEL IN RURAL AREAS; TASMANIA, 1971, 1976 AND 1979

(million VKT)

Vehicle type	*Year* 1971	1976	1979	*Growth 1971-79 (per cent)*
Cars[a]	995	1 047	1 076	8
Utilities and panel vans	145	183	250	72
Trucks	141	149	181	28
Total	1 281	1 379	1 507	18
Motorcycles	12	25	17	42
All vehicles	1 293	1 404	1 524	18

a. Includes station wagons.

Note: For each year travel in Tasmania by vehicles registered in other States is excluded. Travel in outer urban areas is also excluded. Travel given for 1979 is based on a slightly smaller area due to the incorporation of some rural territory into the Launceston statistical district. Growth rates should therefore be considered as minima.

Sources: Australian Bureau of Statistics (1978c and 1981a), supplemented by the relevant ABS survey of motor vehicle usage microfiches. Commonwealth Bureau of Census and Statistics (1973b).

TABLE III.7—TRAVEL IN RURAL AREAS; NORTHERN TERRITORY, 1971, 1976 AND 1979

(million VKT)

Vehicle type	Year 1971	Year 1976	Year 1979	Growth 1971-79 (per cent)
Cars[a]	121	116	140	16
Utilities and panel vans	45	85	162	260
Trucks	100	33	49	-51
Total	266	234	351	32
Motorcycles	6	19	7	17
All vehicles	272	253	358	32

a. Includes station wagons.

Note: For each year travel on the Stuart and Barkly Highways is included. For each year travel in the Northern Territory by vehicles registered in other States is excluded.

Sources: Australian Bureau of Statistics (1978c and 1981a), supplemented by the relevant ABS survey of motor vehicle usage microfiches. Commonwealth Bureau of Census and Statistics (1973b).

TABLE III.8—TRAVEL IN RURAL AREAS; AUSTRALIA, 1971, 1976 AND 1979

(million VKT)

Vehicle type	Year 1971	Year 1976	Year 1979	Growth 1971-79 (per cent)
Cars[a]	20 453	23 728	25 120	23
Utilities and panel vans	4 025	5 012	6 239	55
Trucks	3 545	3 638	3 942	11
Total	28 023	32 378	35 301	26
Motorcycles	320	611	646	102
All vehicles	28 343	32 989	35 947	27

a. Includes station wagons.

Note: For each year travel outside State of registration is excluded (see Appendix I).

Sources: Australian Bureau of Statistics (1978c and 1981a), supplemented by the relevant ABS survey of motor vehicle usage microfiches. Commonwealth Bureau of Census and Statistics (1973b).

TABLE III.9—FREIGHT IN RURAL AREAS, 1971, 1976 AND 1979
(million tonne kilometres)

Vehicle type	Year 1971	1976	1979	Growth 1971-79 (per cent)
New South Wales	3 905	5 006	7 210	85
Victoria	2 879	2 858	4 430	54
Queensland	1 505	1 676	3 230	115
South Australia	1 592	1 942	2 659	67
Western Australia	2 265	2 466	2 929	29
Tasmania	488	766	993	103
Northern Territory	593	311	654	10
Total	13 227	15 025	22 105	67

Note: The task performed by utilities and panel vans is excluded. For each year the freight task outside the State of registration is excluded (see Appendix I).

Sources: Australian Bureau of Statistics (1978c and 1981a), supplemented by the relevant ABS survey of motor vehicle usage microfiche. Commonwealth Bureau of Census and Statistics (1973b).

TABLE III.10—TRAVEL ON RURAL ARTERIAL ROADS, 1972 AND 1981
(million VKT)

State	Year	Vehicle category: Cars	Light trucks	Heavy trucks[a]	Total
New South Wales	1972	na	na	na	7610
	1981	8019	1392	1438	10849
Victoria	1972	3543	617	872	4942
	1981	5456	998	1231	7685
Queensland	1972	2294	375	382	3051
	1981	3368	576	655	4599
South Australia	1972	1009	205	293	1507
	1981	2057	561	256	2874
Western Australia	1972	1457	470	308	2235
	1981	1920	534	352	2806
Tasmania	1972	567	120	110	797
	1981	841	74	68	983
Northern Territory	1972	18	8	8	33
	1981	44	2	7	53
Australian Capital Territory	1972	64	9	7	80
	1981	97	1	8	106
Australia	1972	na	na	na	20255
	1981	21802	4138	4015	29955

a. Includes road trains in Queensland, Western Australia and the Northern Territory.
na not available

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

Sources: Commonwealth Bureau of Roads (1973b). State Road Authorities, personal communications.

TABLE III.11—LENGTH BY SURFACE TYPE AND SEAL WIDTH BY AADT; NEW SOUTH WALES RURAL LOCALS, 1972

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-29	177	49 777	27 394	904	1 329	76	47	80	7	79 791
30-99	42	7 633	23 583	4 427	5 075	226	168	290	16	41 460
100-299	3	958	3 899	2 828	6 756	402	264	347	25	15 482
300+	1	24	233	349	4 210	573	257	582	36	6 265
Total	223	58 392	55 109	8 508	17 370	1 277	736	1 299	84	142 998

Source: Commonwealth Bureau of Roads (1973b).

TABLE III.12—LENGTH BY SURFACE TYPE AND SEAL WIDTH BY AADT; VICTORIA RURAL LOCALS, 1972

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-29	14 582	20 474	22 569	1 060	188	146	7	1	9	59 036
30-99	597	2 325	16 840	9 682	2 549	363	26	11	22	32 415
100-299	90	255	3 291	4 730	2 908	622	110	34	15	12 055
300+	23	36	483	1 059	1 873	774	249	196	86	4 779
Total	15 292	23 090	43 183	16 531	7 518	1 905	392	242	132	108 285

Source: Commonwealth Bureau of Roads (1973b).

TABLE III.13—LENGTH BY SURFACE TYPE AND SEAL WIDTH BY AADT; QUEENSLAND RURAL LOCALS, 1972

(km)

AADT	Natural surface	Formed	Gravel	Seal Width(m)					Divided	Total
				0-4.4	4.5-6.4	6.5-9.1	9.2-11.6	11.7+		
0-29	46 235	35 272	10 857	340	80	4	0	0	0	92 788
30-99	3 672	13 718	9 488	5 474	2 182	15	0	0	0	34 549
100-299	203	930	1 461	2 128	718	9	2	1	1	5 453
300+	57	99	161	804	1 942	96	20	13	5	3 197
Total	50 167	50 019	21 967	8 476	4 922	124	22	14	6	135 987

Source: Commonwealth Bureau of Roads (1973b).

TABLE III.14—LENGTH BY SURFACE TYPE AND SEAL WIDTH BY AADT; SOUTH AUSTRALIA RURAL LOCALS, 1972

(km)

AADT	Natural surface	Formed	Gravel	Seal Width(m)					Divided	Total
				0-4.4	4.5-6.4	6.5-9.1	9.2-11.6	11.7+		
0-29	35 451	19 184	11 524	72	188	64	31	0	1	66 515
30-99	899	3 625	7 016	118	785	190	80	0	2	12 715
100-299	81	234	800	88	1 083	256	131	4	2	2 679
300+	4	21	16	12	245	102	147	2	9	588
Total	36 435	23 064	19 356	290	2 301	612	389	6	14	82 467

Source: Commonwealth Bureau of Roads (1973b).

TABLE III.15—LENGTH BY SURFACE TYPE AND SEAL WIDTH BY AADT; WESTERN AUSTRALIA RURAL LOCALS, 1972

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-29	30 466	34 701	21 163	828	358	142	10	3	0	87 671
30-99	922	3 419	5 799	3 792	1 260	263	55	25	1	15 536
100-299	40	232	588	1 347	932	189	59	52	0	3 439
300+	50	55	76	296	755	424	81	129	0	1 866
Total	31 478	38 407	27 626	6 263	3 305	1 018	205	209	1	108 512

Source: Commonwealth Bureau of Roads (1973b).

TABLE III.16—LENGTH BY SURFACE TYPE AND SEAL WIDTH BY AADT; TASMANIA RURAL LOCALS, 1972

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-29	106	400	5 083	32	48	26	1	0	0	5 696
30-99	0	12	2 995	105	424	57	8	1	0	3 602
100-299	0	0	782	123	886	47	15	6	0	1 859
300+	0	1	146	42	666	33	32	26	0	946
Total	106	413	9 006	302	2 024	163	56	33	0	12 103

Source: Commonwealth Bureau of Roads (1973b).

TABLE III.17—LENGTH BY SURFACE TYPE AND SEAL WIDTH BY AADT; NORTHERN TERRITORY RURAL LOCALS[a], 1972

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-29	8113	2533	701	151	17	14	2	0	0	11531
30-99	26	459	275	89	35	81	21	0	1	987
100-299	6	15	14	38	40	75	36	3	2	229
300+	0	0	2	0	59	58	49	14	13	195
Total	8145	3007	992	278	151	228	108	17	16	12942

a. Includes urban local roads in Darwin.

Source: Commonwealth Bureau of Roads (1973b).

TABLE III.18—LENGTH BY SURFACE TYPE AND SEAL WIDTH BY AADT; AUSTRALIAN CAPITAL TERRITORY RURAL LOCALS, 1972

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-29	0	28	24	0	0	0	0	0	0	52
30-99	0	40	39	1	29	0	0	0	0	109
100-299	0	6	127	1	46	8	0	0	0	188
300+	0	0	18	2	36	5	6	0	0	67
Total	0	74	208	4	111	13	6	0	0	416

Source: Commonwealth Bureau of Roads (1973b).

TABLE III.19—LENGTH BY SURFACE TYPE AND SEAL WIDTH BY AADT; AUSTRALIA RURAL LOCALS[a], 1972

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-29	135 130	162 369	99 315	3 387	2 208	472	98	84	17	403 080
30-99	6 158	31 231	66 035	23 688	12 339	1 195	358	327	42	141 373
100-299	423	2 630	10 962	11 283	13 369	1 608	617	438	45	41 384
300+	135	236	1 135	2 564	9 786	2 085	841	962	149	17 873
Total	141 846	196 466	177 447	40 922	37 702	5 340	1 914	1 820	253	603 710

a. Includes urban local roads in Darwin.

Source: Commonwealth Bureau of roads (1973b).

TABLE III.20—LENGTH BY SURFACE TYPE AND SEAL WIDTH BY AADT; NEW SOUTH WALES RURAL ARTERIALS, 1972

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-299	0	3 092	6 694	170	4 451	1 208	1	196	0	15 812
300-999	0	0	280	151	6 266	1 435	18	182	4	8 336
1000-1999	0	0	5	20	2 210	605	22	130	1	2 993
2000-5999	0	0	3	3	1 215	637	51	81	7	1 997
6000-9999	0	0	0	2	111	106	28	60	5	312
10 000+	0	0	0	0	27	39	4	26	12	108
Total	0	3 092	6 982	346	14 280	4 030	124	675	29	29 558

Source: Commonwealth Bureau of Roads (1973b).

TABLE III.21—LENGTH BY SURFACE TYPE AND SEAL WIDTH BY AADT; VICTORIA RURAL ARTERIALS, 1972

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0–4.4	*4.5–6.4*	*6.5–9.1*	*9.2–11.6*	*11.7+*		
0–299	0	0	463	963	3 645	580	2	7	1	5 661
300–999	0	0	22	331	3 912	1 637	96	40	6	6 044
1000–1999	0	0	17	32	972	950	30	39	7	2 047
2000–5999	0	0	2	4	317	801	52	54	24	1 254
6000–9999	0	0	0	0	5	75	10	10	18	118
10 000+	0	0	0	0	3	15	7	8	61	94
Total	0	0	504	1 330	8 854	4 058	197	158	117	15 218

Source: Commonwealth Bureau of Roads (1973b).

TABLE III.22—LENGTH BY SURFACE TYPE AND SEAL WIDTH BY AADT; QUEENSLAND RURAL ARTERIALS, 1972

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0–4.4	*4.5–6.4*	*6.5–9.1*	*9.2–11.6*	*11.7+*		
0–299	567	5 003	1 387	3 871	2 497	78	0	4	1	13 408
300–999	1	73	25	1 367	2 379	106	6	7	1	3 965
1000–9999	1	0	13	70	744	117	7	8	1	991
2000–5999	0	0	3	62	370	166	8	9	4	622
6000–9999	0	0	3	6	17	19	2	2	3	52
10 000+	0	0	0	0	23	8	0	2	42	75
Total	569	5 076	1 431	5 376	6 060	494	23	32	52	19 113

Source: Commonwealth Bureau of Roads (1973b).

TABLE III.23—LENGTH BY SURFACE TYPE AND SEAL WIDTH BY AADT; SOUTH AUSTRALIA RURAL ARTERIALS, 1972

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-299	0	630	2013	80	3443	159	10	12	2	6349
300-999	0	1	43	2	2765	232	14	27	8	3092
1000-1999	0	0	1	1	295	271	4	16	7	595
2000-5999	0	0	0	0	33	117	8	25	21	204
6000-9999	0	0	0	0	2	3	1	4	11	21
10000+	0	0	0	0	0	2	0	3	6	11
Total	0	631	2057	83	6538	784	37	87	55	10272

Source: Commonwealth Bureau of Roads (1973b).

TABLE III.24—LENGTH BY SURFACE TYPE AND SEAL WIDTH BY AADT; WESTERN AUSTRALIA RURAL ARTERIALS, 1972

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-299	1567	2976	1018	3130	3073	255	5	3	0	12027
300-999	0	155	9	85	1898	1200	9	17	0	3373
1000-1999	0	0	0	0	272	369	7	14	0	662
2000-5999	0	0	0	5	89	284	14	26	1	419
6000-9999	0	0	0	0	34	50	3	9	0	96
10000+	0	0	0	0	0	1	0	5	5	11
Total	1567	3131	1027	3220	5366	2159	38	74	6	16588

Source: Commonwealth Bureau of Roads (1974a).

TABLE III.25—LENGTH BY SURFACE TYPE AND SEAL WIDTH BY AADT; TASMANIA RURAL ARTERIALS, 1972
(km)

AADT	Natural surface	Formed	Gravel	Seal Width(m)					Divided	Total
				0–4.4	4.5–6.4	6.5–9.1	9.2–11.6	11.7+		
0–299	0	5	262	23	372	1	0	0	0	663
300–999	0	0	68	4	1 300	22	0	0	0	1 394
1000–1999	0	0	12	0	300	9	1	0	0	322
2000–5999	0	0	0	0	131	52	1	2	1	187
6000–9999	0	0	0	0	11	11	0	0	0	22
10 000+	0	0	0	0	0	0	0	0	0	0
Total	0	5	342	27	2 114	95	2	2	1	2 588

Source: Commonwealth Bureau of Roads (1973b).

TABLE III.26—LENGTH BY SURFACE TYPE AND SEAL WIDTH BY AADT; NORTHERN TERRITORY RURAL ARTERIALS[a], 1972
(km)

AADT	Natural surface	Formed	Gravel	Seal Width(m)					Divided	Total
				0–4.4	4.5–6.4	6.5–9.1	9.2–11.6	11.7+		
0–299	796	723	522	1 088	40	24	0	0	0	3 193
300–999	0	0	0	0	0	1	0	0	0	1
1000–1999	0	0	0	0	0	0	1	0	0	1
2000–5999	0	0	0	0	0	0	1	0	0	1
6000–9999	0	0	0	0	0	0	1	0	0	1
10 000+	0	0	0	0	0	0	0	0	0	0
Total	796	723	522	1 088	40	25	3	0	0	3 197

a. Includes urban arterial roads in Darwin.

Source: Commonwealth Bureau of Roads (1973b).

TABLE III.27—LENGTH BY SURFACE TYPE AND SEAL WIDTH BY AADT; AUSTRALIAN CAPITAL TERRITORY RURAL ARTERIALS, 1972

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-299	0	0	0	0	0	0	0	0	0	0
300-999	0	0	0	0	2	2	0	0	0	4
1000-1999	0	0	0	0	43	3	0	0	0	46
2000-5999	1	0	0	0	7	24	1	1	1	35
6000-9999	0	0	0	0	0	3	0	0	0	3
10 000+	0	0	0	0	0	2	0	0	0	2
Total	1	0	0	0	52	34	1	1	1	90

Source: Commonwealth Bureau of Roads (1973b).

TABLE III.28—LENGTH BY SURFACE TYPE AND SEAL WIDTH BY AADT; AUSTRALIA RURAL ARTERIALS[a], 1972

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-299	2 930	12 429	12 359	9 325	17 521	2 305	18	222	4	57 113
300-999	1	299	447	1 940	18 522	4 635	143	273	19	26 209
1000-1999	1	0	48	123	4 866	2 324	72	207	16	7 657
2000-5999	1	0	8	74	2 162	2 081	136	198	59	4 719
6000-9999	0	0	3	8	180	267	45	85	37	625
10 000+	0	0	0	0	53	67	11	44	126	301
Total	2 933	12 658	12 865	11 470	43 304	11 679	425	1 029	261	96 624

a. Includes urban arterial roads in Darwin.

Source: Commonwealth Bureau of Roads (1973b).

TABLE III.29—LENGTH BY SURFACE TYPE AND SEAL WIDTH BY AADT; NEW SOUTH WALES RURAL ARTERIALS, 1981

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-299	0	1 675	6 724	220	4 293	1 263	18	105	0	14 298
300-999	0	18	314	77	5 858	2 028	60	136	7	8 498
1000-1999	0	0	41	21	1 949	1 242	11	94	0	3 358
2000-5999	0	14	1	0	1 188	1 364	71	268	7	2 913
6000-9999	0	0	0	0	122	265	29	74	16	506
10 000+	0	0	0	5	83	123	5	44	75	335
Total	0	1 707	7 080	323	13 493	6 284	194	721	105	29 904

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

Source: New South Wales, Department of Main Roads, personal communication.

TABLE III.30—LENGTH BY SURFACE TYPE AND SEAL WIDTH BY AADT; VICTORIA RURAL ARTERIALS, 1981

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-299	0	0	317	313	2 196	986	50	13	0	3 873
300-999	0	0	6	72	3 305	2 866	54	71	4	6 110
1000-1999	0	0	57	75	921	1 984	92	44	9	3 184
2000-5999	0	0	0	0	357	1 314	66	106	38	1 882
6000-9999	0	0	0	0	16	213	36	23	32	321
10 000+	0	0	0	0	18	59	18	23	113	229
Total	0	0	380	460	6 543	7 421	315	281	198	15 600

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

Source: Victoria, Country Roads Board, personal communication.

TABLE III.31—LENGTH BY SURFACE TYPE AND SEAL WIDTH BY AADT; QUEENSLAND RURAL ARTERIALS; 1981

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-299	48	3 578	954	4 093	3 090	266	0	1	11	12 041
300-999	0	17	51	858	3 001	393	2	8	5	4 335
1000-1999	0	3	0	120	1 072	316	5	4	8	1 528
2000-5999	0	0	0	17	548	264	12	7	15	863
6000-9999	0	0	0	2	69	52	2	5	7	139
10 000+	0	0	0	0	38	68	1	4	42	153
Total	42	3 599	1 005	5 091	7 819	1 360	22	29	86	19 059

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

Source: Queensland, Main Roads Department, personal communication.

TABLE III.32—LENGTH BY SURFACE TYPE AND SEAL WIDTH BY AADT; SOUTH AUSTRALIA RURAL ARTERIALS, 1981

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-299	103	1 799	0	52	2 058	669	2	2	0	4 685
300-999	0	34	0	8	2 794	776	8	10	4	3 634
1000-1999	0	1	0	0	670	542	5	14	1	1 233
2000-5999	0	0	0	1	145	430	20	33	24	653
6000-9999	0	0	0	0	50	22	4	31	11	118
10 000+	0	0	0	0	4	3	5	7	19	38
Total	103	1 834	0	61	5 721	2 442	44	97	59	10 364

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

Source: South Australia, Highways Department, personal communication.

TABLE III.33—LENGTH BY SURFACE TYPE AND SEAL WIDTH BY AADT; WESTERN AUSTRALIA RURAL ARTERIALS, 1981

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-299	4	2 952	1 303	2 307	2 796	1 247	13	4	0	10 626
300-999	0	0	9	122	1 905	1 892	10	22	0	3 958
1000-1999	0	0	0	0	246	826	17	15	0	1 104
2000-5999	1	1	0	0	33	559	17	29	1	641
6000-9999	0	0	0	0	3	76	2	8	24	113
10 000+	0	0	0	0	0	0	0	0	6	6
Total	5	2 953	1 312	2 429	4 982	4 600	58	76	30	16 446

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

Source: Western Australia, Main Roads Department, personal communication.

TABLE III.34—LENGTH BY SURFACE TYPE AND SEAL WIDTH BY AADT; TASMANIA RURAL ARTERIALS, 1981

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-299	0	0	201	5	431	4	0	0	0	641
300-999	0	0	11	23	1 084	35	2	2	0	1 157
1000-1999	0	0	4	0	476	45	3	9	0	537
2000-5999	0	0	3	0	147	73	21	8	1	253
6000-9999	0	0	0	0	0	15	9	0	0	24
10 000+	0	0	0	0	0	6	6	0	0	12
Total	0	0	218	28	2 138	178	40	19	1	2 621

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

Source: Tasmania, Department of Main Roads, personal communication.

TABLE III.35—LENGTH BY SURFACE TYPE AND SEAL WIDTH OF AADT; NORTHERN TERRITORY RURAL ARTERIALS, 1981

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-299	0	572	1 125	1 211	72	5	0	0	0	2 985
300-999	0	0	0	0	108	0	0	0	0	108
1000-1999	0	0	0	0	32	0	0	0	0	32
2000-5999	0	0	0	0	0	0	0	0	0	0
6000-9999	0	0	0	0	0	0	0	0	0	0
10 000+	0	0	0	0	0	0	0	0	0	0
Total	0	572	1 125	1 211	212	5	0	0	0	3 125

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

Source: Northern Territory, Department of Transport and Works, personal communication.

TABLE III.36—LENGTH BY SURFACE TYPE AND SEAL WIDTH BY AADT; AUSTRALIAN CAPITAL TERRITORY RURAL ARTERIALS, 1981

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-299	0	0	0	0	0	0	0	0	0	0
300-999	0	0	0	0	11	11	0	0	0	22
1000-1999	0	0	0	0	13	0	0	0	0	13
2000-5999	0	0	0	0	21	30	0	0	5	56
6000-9999	0	0	0	0	0	9	0	0	3	12
10 000+	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	32	62	0	0	0	103

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

Source: Australia, Department of Transport, personal communication.

TABLE III.37—LENGTH BY SURFACE TYPE AND SEAL WIDTH BY AADT; AUSTRALIA RURAL ARTERIALS, 1981

(km)

AADT	*Natural surface*	*Formed*	*Gravel*	*Seal Width(m)*					*Divided*	*Total*
				0-4.4	*4.5-6.4*	*6.5-9.1*	*9.2-11.6*	*11.7+*		
0-299	155	10 576	10 624	8 201	14 936	4 440	83	125	11	49 149
300-999	0	69	391	1 160	17 796	8 001	136	247	20	27 822
1000-1999	0	4	102	216	5 366	4 968	133	180	18	10 989
2000-5999	0	15	4	18	2 439	4 034	207	451	91	7 261
6000-9999	0	0	0	5	260	652	82	141	93	1 233
10 000+	0	0	0	2	143	259	35	78	255	773
Total	156	10 655	11 120	9 603	40 940	22 352	673	1 223	487	97 222

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

Source: State Road Authorities, personal communication.

TABLE III.38—LENGTH OF RURAL LOCAL ROADS BY SURFACE TYPE; 1972 AND 1981

(km)

State	*Year*	*Surface type*				
		Natural surface	*Formed*	*Gravel*	*Sealed*	*Total*
New South Wales	1972	223	58 392	55 109	29 274	142 998
	1981	21 800	36 194	58 280	38 261	154 535
Victoria	1972	15 292	23 090	43 183	26 720	108 285
	1981	22 420	24 144	47 338	35 607	129 509
Queensland	1972	50 167	50 019	21 967	13 834	135 987
	1981	22 498	52 460	32 968	23 145	131 071
South Australia	1972	36 435	23 064	19 356	3 612	82 467
	1981	23 349	16 520	37 470	5 978	84 317
Western Australia	1972	31 478	38 407	27 626	11 001	108 512
	1981	22 007	41 774	33 471	15 811	113 063
Tasmania	1972	106	413	9 006	2 578	12 103
	1981	208	401	8 354	4 061	13 024
Northern Territory	1972[a]	8 145	3 007	992	798	12 942
	1981	6 670	4 052	3 137	824	14 683
Australian Capital Territory	1972	0	74	208	134	416
	1981[b]	0	0	183	181	364
Australia	1972	141 846	196 466	177 447	87 951	603 710
	1981	119 952	175 545	221 201	123 868	640 566

a. Includes urban local roads in Darwin.
b. For 30 June 1980.

Note: This table includes lengths of rural local roads in each of four surface type categories in each State for 1972 and 1981. the 1972 data were obtained directly from the 1972 Australian Roads Survey whereas data for 1981 were mostly obtained from local government authorities by ABS. Because of the differences in the basis for defining the road system employed for the two types of data sources care should be exercised in comparing changes in lengths of unpaved (ie natural surface and formed) roads over time.

Sources: Australian Bureau of Statistics (1982b and undated). Australia, Department of Transport, personal communication. Commonwealth Bureau of Roads (1973b). Northern Territory. Department of Transport and Works, personal communication.

TABLE III.39—RURAL ACCIDENT DATA; NEW SOUTH WALES, 1975-81

Year	*Fatalities*	*Fatalities per 100 million VKT*	*Fatal accidents*	*Fatal accidents per 100 million VKT*	*Casualties*	*Casualty accidents*
1975	na	na	na	na	na	na
1976	688	6.6	591	5.7	13039	9004
1977	701	6.6	589	5.6	13483	9271
1978	738	6.8	618	5.7	14178	9570
1979	694	6.3	549	5.0	12262	8113
1980	720	6.4	610	5.4	13416	9403
1981	na	na	na	na	na	na

na not available

Source: New South Wales, Department of Motor Transport Traffic Accident Research Unit, personal communication.

TABLE III.40—RURAL ACCIDENT DATA; VICTORIA, 1975-81

Year	*Fatalities*	*Fatalities per 100 million VKT*	*Fatal accidents*	*Fatal accidents per 100 million VKT*	*Casualties* [a]	*Casualty accidents* [a]
1975	444	5.3	357	4.2	5 651	3 671
1976	403	4.7	346	4.0	5 413	3 530
1977	429	5.0	353	4.1	5 496	3 832
1978	399	4.7	340	4.0	5 647	3 865
1979	384	4.6	320	3.8	5 418	3 756
1980	297	3.6	266	3.2	5 448	3 777
1981	na	na	na	na	na	na

a. The introduction of a new accident form on 1 January 1977 may have increased the reporting of accidents involving casualties and the number of casualties.
na not available

Source: Victoria, Country Roads Board, personal communication.

TABLE III.41—RURAL ACCIDENT DATA; QUEENSLAND, 1975-81

Year	*Fatalities*	*Fatalities per 100 million VKT*	*Fatal accidents*	*Fatal accidents per 100 million VKT*	*Casualties*	*Casualty accidents*
1975	395	7.2	331	6.1	5 060	3 559
1976	342	6.0	292	5.2	4 680	3 377
1977	336	5.5	296	4.9	4 434	3 287
1978	371	5.7	311	4.8	4 697	3 326
1979	372	5.4	321	4.7	4 457	3 224
1980	343	4.7	314	4.3	4 441	3 328
1981	403	5.3	333	4.3	4 341	3 287

Source: Queensland, Australian Bureau of Statistics, personal communication.

TABLE III.42—RURAL ACCIDENT DATA; SOUTH AUSTRALIA, 1975-81

Year	*Fatalities*	*Fatalities per 100 million VKT*	*Fatal accidents*	*Fatal accidents per 100 million VKT*	*Casualties*	*Casualty accidents*
1975	197	6.5	173	5.7	3 642	2 476
1976	162	5.3	140	4.6	3 119	2 157
1977	157	4.8	134	4.1	3 382	2 287
1978	160	4.6	137	3.9	3 355	2 158
1979	177	4.7	153	4.1	3 247	2 198
1980	133	3.4	112	2.8	2 955	2 007
1981	na	na	na	na	na	na

na not available

Source: South Australia, Highways Department, personal communication.

TABLE III.43—RURAL ACCIDENT DATA; WESTERN AUSTRALIA, 1975-81

Year	*Fatalities*	*Fatalities per 100 million VKT*	*Fatal accidents*	*Fatal accidents per 100 million VKT*	*Casualties*	*Casualty accidents*
1975	188	5.2	154	4.3	2 064	1 444
1976	159	4.2	127	3.3	2 218	1 588
1977	154	3.8	127	3.2	2 246	1 601
1978	186	4.4	161	3.8	2 797	1 980
1979	149	3.3	136	3.0	2 615	1 879
1980	155	3.3	139	3.0	2 445	1 736
1981	122	2.5	111	2.3	2 311	1 646

Source: Western Australia, Main Roads Department, personal communication.

TABLE III.44—RURAL ACCIDENT DATA; TASMANIA, 1975-81

Year	*Fatalities*	*Fatalities per 100 million VKT*	*Fatal accidents*	*Fatal accidents per 100 million VKT*	*Casualties*	*Casualty accidents*
1975	na	na	na	na	na	na
1976	na	na	na	na	na	na
1977	55	3.7	45	3.1	1 050	658
1978	67	4.0	57	3.8	990	709
1979	57	3.2	48	3.1	974	697
1980	57	3.2	54	3.4	1 001	730
1981	55	3.4	na	na	na	na

na not available

Source: Tasmania, Transport Commission, personal communication.

TABLE III.45—RURAL ACCIDENT DATA; NORTHERN TERRITORY, 1975-81

Year	*Fatalities*	*Fatalities per 100 million VKT*	*Fatal accidents*	*Fatal accidents per 100 million VKT*	*Casualties*	*Casualty accidents*
1975	64	12.3	50	9.7	789	554
1976	51	10.0	48	9.3	814	582
1977	47	8.3	39	6.9	882	634
1978	68	11.0	58	9.4	980	716
1979	53	7.9	43	6.4	928	650
1980	63	8.8	55	7.6	na	na
1981	70	9.1	63	8.2	na	na

Note: Data is for the whole of the Northern Territory, ie the urban area as well as the rural area.

na not available

Source: Australian Bureau of Statistics (1979b). Road Safety Council of the Northern Territory (1980), personal communication.

TABLE III.46—RURAL ACCIDENT DATA; AUSTRALIA, 1975-81

Year	*Fatalities*	*Fatalities per 120 million VKT*	*Fatal accidents*	*Fatal accidents per 100 million VKT*
1975	na	na	na	na
1976	na	na	na	na
1977	1 879	5.5	1 583	4.6
1978	1 989	5.6	1 682	4.8
1979	1 886	5.2	1 570	4.3
1980	1 768	4.7	1 550	4.2
1981	na	na	na	na

na not available

Sources: Australian Bureau of Statistics (1979b and 1983a). New South Wales Department of Motor Transport Traffic Accident Research Unit, personal communication. Tasmania, Transport Commission, personal communication. Victoria, Country Roads Board, personal communication. South Australia Highways Department, personal communication. Western Australia, Main Roads Department, personal communication. Road Safety Council of the Northern Territory, personal communication.

APPENDIX IV—SUPPLEMENTARY DATA: URBAN ROADS

BACKGROUND DATA

Vehicular Travel

The travel carried out by motor vehicles in the State capital cities in the years 1971, 1976 and 1979, is given for various classifications of vehicle in Table IV.1.

Freight movement

It was estimated by the CBR (Commonwealth Bureau of Roads 1975a pp114–115) that in 1973–74 heavy trucks travelled 3130 million VKT on arterial roads in the six state capital cities[1]. Allowing for various errors of measurement, the CBR estimated that about 55 per cent of all arterial truck travel took place on approximately one fifth of the urban arterial network. In other words, 1388km (out of a total of 6175km in 1973–74) of urban arterials carried over half the urban freight task measured in VKT.

Table IV.2 comprises a summary of tonne-kilometres of freight travel by vehicle type for the statistical divisions of the six State capital cities. In 1979, about 30 per cent of total tonne-kilometres travelled on Australian roads took place in the six State capitals. For Melbourne in 1979, about 52 per cent of tonne-kilometres was performed by rigid two axle trucks and about 42 per cent was performed by large articulated trucks with more than two axles. For Sydney in 1979, the proportion of tonne-kilometres performed by rigid two axle trucks was 42 per cent and the proportion for articulated trucks with more than two axles was about 49 per cent.

From the above proportions it can be seen that the delivery of small consignments using utilities and panel vans was only a small proportion of the total urban freight movement in tonneage terms. However, small loads generated a large proportion of the VKT of travel as shown in Table IV.1.

While there was a strong proportional growth in the amount of freight carried by utilities and panel vans, in absolute terms this was only a small proportion of total freight (although it may, of course, have carried a larger proportion of the total value of goods carried). More notable is the lower growth in tonne-kilometres carried out by rigid trucks compared with articulated trucks. In 1979 each type accounted for approximately the same number of tonne-kilometres in spite of the fact that rigid trucks travelled more than five times the VKT (Table IV.1).

Personal Travel

The distribution of personal travel by vehicle types are given in Table IV.3 for the statistical divisions of the six State capital cities. The percentage increase of annual occupant-kilometres travelled between 1976 and 1979 ranged from approximately 3 per cent for Adelaide to 24 per cent for Brisbane. For Australian capital cities as a whole, the percentage increase was nearly 13 per cent.

Table IV.3 also shows the dominant role of cars and station wagons in urban travel. In 1976, cars and station wagons accounted for 86 per cent of total occupant kilometres

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1. Heavy trucks in this context are trucks with dual tyres, as defined by the Commonwealth Bureau of Roads.

TABLE IV.1—TOTAL TRAVEL IN SIX STATE CAPITAL CITY STATISTICAL DIVISIONS, 1971, 1976 AND 1979

(million VKT)

Type of vehicle	*Year*	*Sydney*[a]	*Melbourne*[b]	*Brisbane*	*Adelaide*[c]	*Perth*	*Hobart*	*Total*[d]	*Per cent*[e]
Cars and Station	1971	12 599	10 579	3 286	3 876	3 672	528	34 540	100
Wagons	1976	14 646	12 774	4 282	5 027	4 511	719	41 959	121
	1979	15 021	14 393	5 372	5 268	5 377	771	46 202	134
Motor Cycles	1971	249	103	62	66	58	8	546	100
	1976	210	181	145	112	103	12	763	139
	1979	255	149	154	105	106	6	775	142
Utilities and	1971	1 199	1 017	415	328	507	71	3 537	100
Panel Vans	1976	1 663	1 487	603	472	708	98	5 031	142
	1979	2 615	1 800	1 207	529	950	140	7 241	204
Rigid Trucks	1971	1 082	775	273	254	306	46	2 736	100
	1976	847	810	456	279	293	43	2 728	100
	1979	1 033	840	259	214	309	45	2 700	99
Articulated	1971	105	94	25	21	27	5	277	100
Trucks	1976	161	127	44	55	33	7	427	154
	1979	206	144	56	46	46	10	508	183
Total Trucks[f]	1971	1 207	884	301	280	340	52	3 064	100
	1976	1 054	966	531	355	350	53	3 309	108
	1979	1 315	1 032	333	304	386	60	3 430	112
Total Vehicles	1971	15 256	12 586	4 063	4 550	4 577	660	41 692	100
	1976	17 573	15 409	5 562	5 976	5 669	883	51 072	122
	1979	19 206	17 375	7 068	6 207	6 820	979	57 655	138

a. The 1979 data are based on a larger statistical division area of Sydney that than used for the 1971 and 1976 data.

b. 1979 data for panel vans and rigid trucks for Brisbane cannot be compared with data for other years or cities. In October 1976 the definition of panel vans was changed to include vehicles less than 4 tonne (gross vehicle mass), which meant that some vehicles, which were previously class as rigid trucks, became panel vans or utilities.

c. The 1976 data for Adelaide are based on an area greater than the statistical division.

d. Travel outside State of registration is excluded.

e. 1971 (base year) = 100, figures rounded.

f. Total trucks includes 'rigid trucks', 'articulated trucks' and 'other truck type vehicles'. 'Other truck type vehicles is not listed separately.

Sources: Australian Bureau of Statistics (1978c and 1981a). Commonwealth Bureau of Census and Statistics (1973b).

TABLE IV.2—FREIGHT TASK; SIX STATE CAPITAL CITY STATISTICAL DIVISIONS, 1971, 1976 AND 1979

(million tonne-kilometres)

Type of vehicle	*Year*	*Sydney*[a]	*Melbourne*	*Brisbane*[b]	*Adelaide*[c]	*Perth*	*Hobart*	*Total*
Utilities & panel vans	1971	185	182	38	53	69	7	534
	1976	298	264	47	74	91	10	784
	1979	397	274	308	71	124	20	1 194
Rigid trucks	1971	1 738	1 257	438	322	551	78	4 384
	1976	1 729	1 478	597	673	680	111	5 268
	1979	1 905	1 722	632	533	815	114	5 721
Articulated trucks	1971	949	697	201	214	230	39	2 330
	1976	1 637	1 045	395	583	305	69	4 034
	1979	2 205	1 421	610	487	454	103	5 280
Total trucks[d]	1971	2 706	1 956	639	547	788	117	6 753
	1976	3 365	2 523	992	1 257	986	181	9 304
	1979	4 110	3 144	1 242	1 040	1 269	217	11 022

a. Due to an increase in the size of the statistical division of Sydney the 1979 data are based on a larger area than are the 1971 and 1976 data.

b. 1979 data for panel vans and rigid trucks for Brisbane cannot be compared with data for other years or cities. In October 1976 the definition of panel vans in Queensland was changed to include vehicles less than 4 tonne (gross vehicle mass), which meant that some vehicles which were previously classed as rigid trucks became panel vans or utilities.

c. The 1976 data for Adelaide are based on an area greater than the statistical division.

d. Some totals exceed the sum of rigid plus articulated trucks due to the inclusion of a small quantity of freight carried by 'other vehicle types' (eg mobile libraries).

Sources: Australian Bureau of Statistics (1978c and 1981a). Commonwealth Bureau of Census and Statistics (1973b).

TABLE IV.3—PERSONAL TRAVEL; SIX STATE CAPITAL CITY STATISTICAL DIVISIONS, 1976 AND 1979

(million occupant kilometres)

Type of vehicle	*Year*	*Sydney*[a]	*Melbourne*	*Brisbane*	*Adelaide*[b]	*Perth*	*Hobart*	*Total*[d]
Cars and station wagons	1976	25 992	23 161	8 419	9 297	8 114	1 427	76 410
	1979	26 892	26 436	10 197	9 517	9 622	1 543	84 207
Motorcycles	1976	216	198	151	117	111	14	807
	1979	274	163	165	115	116	7	840
Utilities and panel vans	1976	2 542	1 993	921	639	1 055	149	7 299
	1979	3 631	2 558	1 866	732	1 418	228	10 433
Trucks	1976	1 360	1 134	705	447	452	68	4 166
	1979	1 693	1 275	423	402	509	83	4 385
Total	1976	30 110	26 486	10 196	10 500	9 733	1 659	88 684
	1979	32 490	30 432	12 651	10 766	11 665	1 862	99 866
Percentage increase		7.90	14.90	24.08	2.53	19.85	12.24	12.61

a. Due to an increase in the statistical division of Sydney, the 1979 data are based on a larger area than that used for the 1976 data.

b. The 1976 data for Adelaide are based on a larger area than that of the statistical division.

Note: Figures may not add due to rounding.

Source: Australian Bureau of Statistics (1978c and 1981a).

performed by registered vehicles (other than buses) in Australian capital cities. However, this proportion declined slightly to 84 per cent in 1979, partly due to the increasing share of total occupant kilometres performed by utilities and panel vans. On the other hand, Thoresen (1981) reported that vehicle occupancy appears to have remained stable over the period 1971 to 1979. Typical occupancies are indicated by Thoresen to be two persons per car or station wagon, 1.5 persons per utility.

OPERATIONAL CHARACTERISTICS

Travel Time in Sydney

Peak periods in 1962, 1968 and 1981

The following observations are based on comparisions of the Department of Main Roads (DMR) contour maps of travel times measured from the Central Business District (CBD) in 1962, 1968 and 1981. These observations were drawn on for the summary description given in Chapter 4 and illustrated in Figures 4.2 and 4.3.

Between 1962 and 1968, in the morning peak period (7am to 9am), travel time to the CBD increased by up to five minutes in an area to the north-west of the CBD embracing Carlingford, Pennant Hills and Epping. Increases of up to five minutes also occurred in an area to the south-east embracing Paddington, Randwick and Mascot. However, travel time decreased over the remainder of the survey area. The decrease amounted to as much as ten minutes in extensive areas to the north and south-west of the CBD.

Between 1968 and 1981, morning peak travel time increased in most of the area north of the Parramatta River, except for an area to the north of the Harbour Bridge extending to Seaforth. This increase was generally of the order of five to ten minutes but amounted to 15 to 20 minutes in the vicinity of Epping. Travel time also increased in a wide corridor extending from the CBD to the St George's river from Lugarno to north of Liverpool, and amounting to over ten minutes in the vicinity of Liverpool. In the remainder of the survey area travel time decreased by less than five minutes generally and by over five minutes in small isolated areas. Thus there was a general deterioration in travel time over most of the extensive area which had experienced improved travel time over the six years prior to 1968.

The overall change between 1962 and 1981 comprised increases in travel time over most of the north-west sector north of the Parramatta River and in an area embracing Liverpool, Padstow and East Hills, and decreases in the remainder of the survey area. The increases were as great as twenty minutes to the north-west of the CBD in the vicinity of Beecroft but generally less than five minutes. The decreases amounted to between five and ten minutes in a large sector extending from the CBD to the west of the survey area between Cabramatta and Parramatta. Decreases of between five and ten minutes also occurred in an area between Botany Bay and Bankstown extending towards to CBD as far as Sydenham, and also in an area north of the CBD surrounding Middle Harbour and embracing Frenchs Forest. In small parts of the areas to the west (Prospect) and north (southern shores of Middle Harbour) of the CBD the decreases amounted to between ten and fifteen minutes.

In the evening peak period (4pm to 6pm) between 1962 and 1968 most of the survey area experienced the same general thrust of the travel time decreases which occurred in the morning peak over the same period. (The evening peak travel time differed in that some increases of up to five minutes occurred to the north-east of the CBD between Bantry Bay, Harbord and Dee Why, and also to the south-east of the CBD in the vicinity of Belmore, Ashfield and Canterbury.) However, between 1968 and 1981 the evening peak travel time increases were confined almost exclusively to the north and north-west of the CBD; and further decreases occurred over the remainder of the survey area. As a result, the overall evening period changes between 1962 and 1981 are characterised by decreased travel time over the whole of the survey area except an area in the north-west sector along the Epping Road corridor from Lane Cove to Pennant Hills in the north, and Carlingford in the west. Decreases of 15 to 20 minutes occurred in areas in the vicinity of the Georges River and along the Parramatta River between Granville and Concord. Decreases of up to ten minutes were recorded in an area north of the Harbour Bridge to the northern limit of the survey area between Terrey Hills and Narrabeen.

Peak and off-peak periods in 1982

The NRMA travel time studies were carried out in March 1982, on Main Road Nos 328 and 599, Secondary Road 2093 (Warringah Road route), Main Road No 164 (Military Road route), Secondary Road No 2043 (Eastern Arterial Road Route) and State Highway No 10 (Pacific Highway). The survey routes are shown in Figure IV.1. Weekday travel times were recorded in both directions of travel during the midday off-peak period as well as in the direction of major traffic flow during the morning and evening peak periods. The data given in Table IV.4 are the mean speeds on each of the five routes for roughly equal distances from the city. The mean speed of the morning peak period ranged from 15 km/h to 34 km/h, while during the evening peak period the range was 21 km/h to 47 km/h in the direction of the peak flow. The overall mean speed (both directions) during the off-peak period ranged from 31 km/h to 52 km/h.

Screen line analysis

In addition to the screen line data given in Chapter 4 for the period 1971 to 1979 and illustrated in Figure 4.4, changes were also estimated for traffic flows across

TABLE IV.4—MEAN TRAVEL SPEEDS IN SYDNEY

(km/h)

Route	*Morning*[a] *Southbound*	*Off-Peak*[b] *both directions*	*Evening*[c] *Northbound*
Military Road Route			
Condamine St to Park Ave (7.4km)			
Out of transit lane	15	32	21
In transit lane	34	na	29
Warringah Road Route			
Addison Avenue to Warringah Fwy (5.8km)	30	47	25
Allambie Road to Addison Avenue (6.6km)	25	52	47
Eastern Arterial Road Route			
Koola Avenue to Warringah Fway (7.6km)	16	39	27
Pacific Highway Route			
Grosvenor Road to Mount Street (8.8km)	18	31	24
Epping Road Route			
Lane Cove Road to Pacific Hwy (5.7km)	16	44	35
Old Beecroft Rd to Lane Cove Rd (6.5km)	26	50	35

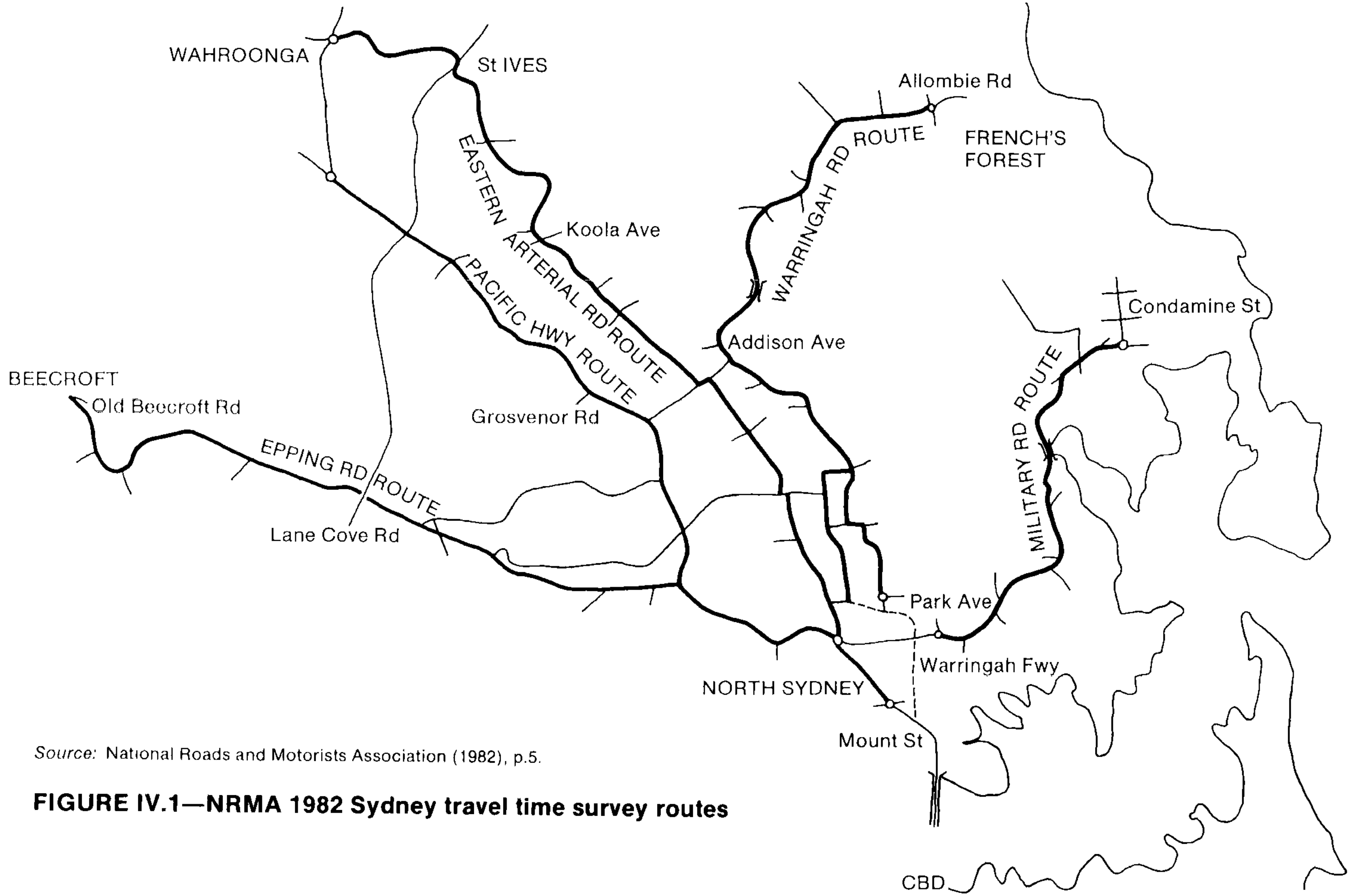
a. Runs commenced between 7.30 am and 7.50 am.

b. Overall mean speed of runs conducted between the morning and evening peak periods.

c. Runs commenced at 5.30 pm.

na not available

Source: National Roads and Motorists' Association (1982).



Source: National Roads and Motorists Association (1982), p.5.

FIGURE IV.1—NRMA 1982 Sydney travel time survey routes

the two screen lines before and after 1976. Across the north-south screen line the AADT increased by 17.4 per cent between 1971 and 1976 which was higher than the Sydney average of 13.4 percent estimated from the ABS surveys. However between 1976 and 1979 there was a decrease in AADT of about 0.6 per cent compared with an increase of 9.3 per cent for the Sydney average.

For the east-west screen line the percentage increase was about 9.0 between 1971 and 1976 compared with about 13.4 for Sydney, and about 5.4 per cent increase between 1976 and 1979 compared with the Sydney increase of 9.3 per cent.

Traffic and road network changes

As indicated previously, it is often difficult to attribute trends in travel time to changes in traffic levels or to other changes in the road system, due to the combined effects of the various factors. However the relevant increases in traffic, and road network changes, are worthy of note. Increases in levels of travel and traffic over the period 1971 to 1979 are illustrated in Table 4.4 and in Figure 4.4 respectively in Chapter 4 and also in Table IV.1. A list of some of the road works completed in Sydney during the analysis period is given below:

Princess Highway 1971-1979
- the Sutherland bypass between Acacia Avenue and Princes Highway, Loftus;
- reconstruction between Old Bush Rd, Engadine and Fennings Rd, Heathcote;
- construction of a deviation between Loftus and Engadine; and
- reconstruction between Miowera Ave and Bunyale St at King Georges Rd, Blakehurst.

Lane Cove road, Ryde road and Mona Vale road 1971-1980
- extensive construction and reconstruction work between Goulding Rd, Lane Cove Rd intersection and Cowan Rd, Mona Vale Road intersection, to provide six lanes.

Great Western Highway 1971-1976
- Parramatta Bypass
- construction of dual carriageway from the Prospect Deviation to Glossop Street, St Marys;
- the four lane carriageway extension at Quarry Hill easterly across Bound Creek, Werrington;
- the reconstruction of the intersection of Potts Street with Parramatta Road;
- reconstruction of six lanes between Bennett Road and Glossop Street, St Marys; and
- construction of an additional lane of Parramatta Road near its junction with Marlborough Road, Flemington.

Warringah Freeway 1973-1979
- construction of the second stage between Miller Street and Willoughby Road.

Hume Highway 1971-1977
- the construction of kerbside lanes between Cooks River and Stacy Street, Greenacre;
- construction work to provide a six lane divided carriageway between Burwood Road and Coronation Parade;
- construction of kerbside lanes between Brennan Street, and Wycombe Street; and
- the reconstruction of intersections at Cowpasture Road and Bringelly Road.

Military Road, Spit Road, Pittwater Road and Barrenjoey Road 1971-1979
- reconstruction of Military Road to provide six lanes between Paling Street and Spit Junction; and

- reconstruction of Barrenjoey Road to provide six lanes through Mona Vale shopping centre and four lanes between Central Road and Elaine Avenue, Avalon.

Western Freeway 1971-1979
- the 22 km section from Prospect to the Nepean River.

South Western Expressway 1973-1974
- the 12.6 km first section between the Hume Highway at Prestons and Main Road 177 at Minto.

Western Distributor 1972-1973
- Stage 1 which extends from the southern Toll Plaza on the Harbour Bridge to Day St between Erskine and King Streets. The work consisted of a four lane concrete viaduct on an upper level and a two lane ramp on a lower level.

North Western Expressway
- 1962-66 Gladesville Bridge, Tarban Creek Bridge and Huntley's Point interchange;
- 1976-77 the extension of Pyrmont St to Quarry St and the construction of the service road between Sussex St and Day St;
- 1979-80 the westbound viaduct linking Day St, City, with Harris St, Pyrmont; and
- 1980-81 the East bound viaduct from Pyrmont St to Day Street.

Travel Time in Melbourne

The following observations are based on comparisons of contours of travel times measured from the CBD in 1961,1969-70, 1971 and 1976. The 1961 travel times were recorded by the Traffic Commision of Victoria and those for the later years by the RACV. These observations were drawn on for the summary description of Melbourne travel time trends given in Chapter 4 and illustated in Figure 4.5.

The city-bound morning peak (8-9am)
Between 1961 and 1969-70 the region north-north-west of the CBD (centred on the Tullamarine Freeway) experienced an improvement in travel time over a wide area rising to over 5 minutes on the Freeway at a distance of 7km from the CBD. To the east and south-east, on the other hand, there was a marked deterioration rising to over 15 minutes on Toorak Road east of Warrigal Road. In other regions the changes, both improvements and deteriorations, were more limited, nowhere exceeding 5 minutes.

Between 1969-70 and 1976 travel times in the region at the north-north-west around the Tullamarine Freeway deteriorated, and travel times to the CBD increased by over 5 minutes. The east and south-east approaches, on the other hand, showed a marked improvement in a broad wedge from the Nepean highway to the Maroondah Highway with a maximum of over 10 minutes along Toorak Road and the Burwood Highway.

Over the whole period 1961-1976 for most of the city there was a small deterioration of less than 5 minutes except in the west and south-west approaches and in two isolated spots to the east. In two regions, one to the north-east and one to the south-south-east, there were small travel time improvements, though these too were less than 5 minutes. Thus the trends in travel time between 1961 and 1969-70 were largely reversed between 1969-70 and 1976.

Effects of freeways on travel time
The Tullamarine Freeway was opened in February 1970 and its impact on travel time was recorded in the 1969-70 travel times. A survey just before the opening may have shown a travel time deterioration due to growth in travel demand after the earlier measurements of 1961. The new freeway apparently absorbed any accumulated deterioration and travel time in the morning peak improved by up to five minutes between 1961 and 1969-70 in the vicinity of the freeway. The growth

in traffic demand, however, continued during the period from 1969-70 to 1976, and travel times in the freeway corridor were slightly higher in 1976 than in 1961.

The South-eastern freeway was opened in two sections; the first section from Anderson St to Grange Road in May 1961, and the second from Grange Road to Toorak Road in May 1970. The first section therefore was opened shortly after the 1961 survey and by the time of the following survey in 1969-70 any improvement due to the freeway had been more than absorbed by the growth in travel. The travel time contours in the east and south-east sector showed a pronounced deterioration between 1961 and 1969-70. The deterioration was reversed between 1969-70 and 1976 largely due to the opening of the second section. The effect of this opening can be examined more closely by comparing travel time contours from the 1969-70 and 1971 surveys which show that the improvement in the corridor occurred between 1969-70 and 1971, and that subsequently there was no deterioration prior to 1976.

The opening of the second section of the South-eastern freeway therefore had a pronounced and persistent benefit in a way that the first section did not. There is some indication, from limited data, that the rate of growth of urban travel during the period 1961 to 1969-70 was greater than during 1969-70 to 1976, which may partly explain why the benefit of the second section of the freeway was apparently more sustained than that of the first section. However it is also likely that the limited effect of the first section may account for the difference. The opening of the second section moved the eastern end of the freeway a further 3km from the CBD and the inner suburban congestion, thus allowing city bound traffic to join the freeway without becoming entangled with (and contributing to) this congestion.

The evening peak (5-6pm)

The broad features of changes in travel times during the evening peak hour are similar to those of the morning peak. For example, for the period 1961 to 1969-70, in the evening peak the same general improvement in the north-north west around the Tullamarine Freeway is evident as is the general deterioration in the east and south-east sector. In the latter sector however the details are different. The main deterioration in the evening peak is in the narrow band between the Maroondah Highway and Canterbury Road, and the marked deterioration (of over 10 minutes) which occurred in the morning peak on Toorak Road is not present in the evening peak.

Accidents

Tables IV.5 to IV.11 include the data which formed the basis for the accident analysis in Chapter 4. The casualty data in these tables were not used in the accident analysis because of the inconsistency of definition amongst States and over time, as explained in Appendix I, but has been included here to supplement the fatal accident data (particularly for States where the fatality numbers are small and are thus more prone to annual fluctuations). The analysis in Chapter 4 also excludes fatalities and fatality rates for urban areas, since these data show a similar pattern to that of fatal accidents and fatal accident rates. No separate accident data were available for Darwin.

Community Effects

Air pollution

With over 60 per cent of Australia's vehicle travel carried out in urban areas, most of the air pollution caused by motor vehicles is concentrated in these areas. The effects of urban air pollution on the environment can be strongly influenced by the physical shape and layout of cities and local wind and weather characteristics.

The operation of motor vehicles is responsible for the production of several pollutants which contribute to the burden of air pollution in Australia. At the present time in this country the emissions which have the potential to directly cause detriment to the environment are lead, carbon monoxide and nitrogen oxides. Emissions of hydrocarbons from fuels, vehicle components and lubricants may not of themselves lead to adverse environmental effects. However they can react together with nitrogen oxides in the presence of sunlight to form photochemical oxidant, the principal

TABLE IV.5-URBAN ACCIDENT DATA: NEW SOUTH WALES, 1975-81

Year	*Fatalities*	*Fatalities per 100 million VKT*	*Fatal accidents*	*Fatal accidents per 100 million VKT*	*Casualties*	*Casualty accidents*
1975	na	na	na	na	na	na
1976	576	2.6	528	2.4	21 380	16 261
1977	567	2.5	529	2.3	21 969	16 517
1978	646	2.7	604	2.5	23 698	17 715
1979	596	2.4	576	2.3	21 715	16 231
1980	583	2.2	542	2.1	22 277	16 863
1981	na	na	na	na	na	na

na not available

Source: New South Wales, Department of Motor Transport, Traffic Accident Research Unit. personal communication.

TABLE IV.6—URBAN ACCIDENT DATA; VICTORIA, 1975-81

Year	*Fatalities*	*Fatalities per 100 million VKT*	*Fatal accidents*	*Fatal accidents per 100 million VKT*	*Casualties*[a]	*Casualty*[a] *accidents*
1975	466	2.5	427	2.3	11 959	8 974
1976	537	2.8	482	2.5	12 265	9 165
1977	530	2.7	482	2.5	14 393	10 983
1978	479	2.4	435	2.2	15 775	11 228
1979	472	2.3	430	2.1	14 334	10 948
1980	360	1.8	342	1.7	14 495	11 188
1981	na	na	na	na	na	na

a. The introduction of a new accident reporting form on 1 January 1977 may have increased the reporting of casualties.

na not available

Source: Victoria, Country Roads Board, personal communication.

TABLE IV.7—URBAN ACCIDENT DATA; QUEENSLAND, 1975-81

Year	*Fatalities*	*Fatalities per 100 million VKT*	*Fatal accidents*	*Fatal accidents per 100 million VKT*	*Casualties*	*Casualty accidents*
1975	240	3.0	222	2.8	5 959	4 682
1976	227	2.7	205	2.4	5 725	4 437
1977	236	2.6	219	2.4	5 568	4 409
1978	241	2.5	221	2.3	6 153	4 768
1979	241	2.4	223	2.2	5 846	4 522
1980	214	2.0	194	1.8	5 442	4 310
1981	191	1.7	177	1.6	5 627	4 481

Source: Queensland, Australian Bureau of Statistics, personal communication.

component of which is ozone. Ozone also has the potential to adversely affect the environment. The term pollutant is used to cover both the emissions and their reaction products.

A number of difficulties are encountered when assessing the change over time of the impact on air quality of emissions produced by motor vehicles in Australian urban areas. Because many emissions are produced by vehicular and other sources,

TABLE IV.8—URBAN ACCIDENT DATA; SOUTH AUSTRALIA, 1975-81

Year	*Fatalities*	*Fatalities per 100 million VKT*	*Fatal accidents*	*Fatal accidents per 100 million VKT*	*Casualties*	*Casualty accidents*
1975	142	2.5	137	2.4	8 175	6 317
1976	145	2.4	137	2.3	7 842	5 933
1977	149	2.4	136	2.2	7 276	5 635
1978	131	2.1	117	1.9	7 807	6 002
1979	132	2.1	124	2.0	7 927	6 161
1980	136	2.2	128	2.0	6 749	5 329
1981	na	na	na	na	na	na

na not available

Source: South Australia, Highways Department, personal communication.

TABLE IV.9—URBAN ACCIDENT DATA; WESTERN AUSTRALIA, 1975-81

Year	*Fatalities*	*Fatalities per 100 million VKT*	*Fatal accidents*	*Fatal accidents per 100 million VKT*	*Casualties*	*Casualty accidents*
1975	116	2.1	105	1.9	4 768	3 660
1976	149	2.8	128	2.2	4 841	3 699
1977	136	2.2	132	2.2	6 107	4 623
1978	158	2.4	143	2.2	7 292	5 533
1979	130	1.9	121	1.7	6 729	5 147
1980	137	1.9	129	1.8	5 945	4 725
1981	116	1.5	106	1.4	5 919	4 701

Source: Western Australia, Main Roads Department, personal communication.

TABLE IV.10—URBAN ACCIDENT DATA; TASMANIA, 1975-81

Year	*Fatalities*	*Fatalities per 100 million VKT*	*Fatal accidents*	*Fatal accidents per 100 million VKT*	*Casualties*	*Casualty accidents*
1975	na	na	na	na	na	na
1976	na	na	na	na	na	na
1977	59	4.3	54	3.9	1 320	945
1978	39	2.8	39	2.8	1 265	932
1979	36	2.5	35	2.4	1 133	810
1980	43	2.9	42	2.9	1 098	841
1981	56	3.7	na	na	na	na

na not available

Sources: Tasmania, Transport Commission, personal communication. Tasmanian Police, Division of Road Safety, personal communication.

TABLE IV.11—URBAN ACCIDENT DATA; AUSTRALIAN CAPITAL TERRITORY, 1975-82

Year	Fatalities	Fatalities per 100 million VKT	Fatal accidents	Fatal accidents per 100 million VKT	Casualties	Casualty accidents
1975	32	2.6	32	2.6	1 124	869
1976	38	3.0	33	2.6	1 145	833
1977	29	2.2	26	2.0	1 176	868
1978	30	2.3	27	2.1	1 051	802
1979	24	1.8	24	1.8	1 094	816
1980	30	2.2	27	2.0	987	717
1981	29	2.1	24	1.7	1 000	776
1982	26	1.9	26	1.9	na	na

na not available

Note: This data is for the whole area within the boundary of the Australian Capital Territory.

Source: Australian Bureau of Statistics (1979b and 1983a).

regular baseline studies are required to determine the contribution of all sources to total emissions. Only one such study has been carried out in Australia. This was conducted in Sydney in 1980 by the Commonwealth Department of Transport, the BTE and the State Pollution Control Commission of NSW (SPCC).

Because the peak levels of air pollutants can occur at different times of the day in different parts of an urban area, each having the potential for different environmental effects, it has not been possible to develop a single overall measure of the air pollution burden. It has also not been possible to devise a single overall measure of acceptable air quality.

It is usual to use the concentrations of a single pollution product (ozone) to represent the magnitude of pollution levels. The SPCC combines ozone levels with the coefficient of haze to provide a pollution index used for example in weather forecasts to describe pollution levels.

Standards

Standards have been developed for acceptable levels of some pollutants of concern (known as air quality standards). The air pollution burden is then measured against the extent to which air quality standards have been exceeded.

Emission standards have also been developed as a means of controlling the production of air pollution by various sources. The levels chosen for bothair quality and emission standards vary from country to country, indicating a lack of consensus among researchers and legislators.

By 1982, the only State having legally proclaimed air quality standards was Victoria. However, the National Health and Medical Research Council (NHMRC) has indicated certain levels of concern with respect to airborne lead, nitrogen oxide and ozone. Many overseas air quality standards are commonlyquoted in Australia when discussing the incidence of pollution particularly US standards and World Health Organisation (WHO) goals.

Available data

The available data on air pollution levels and the frequency of occurrence of high pollution levels in Australian cities is for the period 1975-80. These data were extracted from Australian Department of Home Affairs and Environment (DHAE) (1981), which covered the period up to 1978, with updated data for 1979 and 1980 extracted from the sources used to compile the data for 1975 to 1978. Data on levels of hydrocarbons are not presented since, as previously to 1978, with updated data for 1979 and 1980 extracted from the sources used to compile the data for 1975 to 1978. Data on levels of hydrocarbons are not presented since, as previously mentioned, hydrocarbons are not regarded as pollutants in their own right.

The data are presented in the form of annual means for nitrogen dioxide and lead. This method of presentation permits ready comparison of trends between cities.

The data on lead are expressed in the same form as recognised health standards, which permits comparison of pollution levels with these standards. A considerable effort would be required to extract data on nitrogen dioxide in a form compatible with the recognised health goal. It is doubtful whether data exist in this form in many of the States.

Data on ozone and carbon monoxide are expressed in terms of maximum hourly concentrations recorded anywhere in each city. Available data on the frequency of exceeding certain levels in the case of ozone relate to the WHO long term one-hour average goal of 120 ug/m^3 (0.06 ppm), whereas the level of concern in Australia recommended by the NHMRC is 240 ug/m^3 (0.12 ppm). No frequency data are available with respect to carbon monoxide.

Accuracy of the data

There are differences between States with respect to the measurement methods and the time period of measurement for some pollutants. The coverage of city areas by monitoring equipment also varies between pollutants in most States. It has not been possible to determine whether data on particular pollutants can be compared between airsheds, nor whether any data are truly representative of the airshed concerned.

Results of the analysis

The data in Tables IV.12 to IV.16 show that the levels of the pollutants of concern were generally either fairly steady or else fluctuated year by year.

The following pollutants exhibit an upward trend; nitrogen dioxide (Sydney) and airborne lead (Newcastle region and Wollongong). The highest one-hour ozone levels recorded in Sydney and Melbourne exceeded the NHMRC recommended level of concern each year between 1975 and 1980. Maximum levels recorded in Newcastle and Brisbane exceeded this level less frequently during these years. The number of days on which one-hour ozone levels exceeded the WHO long term goal in Sydney fell considerably between 1975 and 1980, while they fluctuated in Melbourne and Newcastle for the same period.

TABLE IV.12—MAXIMUM HOURLY CONCENTRATIONS OF OZONE FOR SELECTED AUSTRALIAN CITIES; 1975-80[a]

(micrograms per cubic metre)

City	Year					
	1975	*1976*	*1977*	*1978*	*1979*	*1980*
Sydney	537	651	583	425	355	409
Newcastle	na	na	168	252	197	203
Melbourne	482	539	286	362	300	400
Brisbane	na	245	294	265	188	203

a. Maximum concentration recorded at any monitoring site in each city.

na not available

Notes: 1. The long term 1 hour average goal recommended by NHMRC is 240 ug/m^3 (0.12 ppm) not to be exceeded more than once a year (National Health and Medical Research Council 1980).

2. The WHO long-term goal is 120 ug/m^3 (0.06 ppm) not to be exceeded more than once a year (World Health Organisation (1972).

Source: Department of Home Affairs and Environment (1981) and associated references.

The highest one-hour carbon monoxide levels exceeded the recognised WHO standard during each year from 1975 to 1980 in Sydney and Brisbane, while 24-hour lead levels exceeded the NHMRC level of concern during three months of each year in Sydney, the Newcastle region, Wollongong and Brisbane.

TABLE IV.13—NUMBER OF DAYS ON WHICH MAXIMUM ONE-HOUR OZONE CONCENTRATIONS EXCEEDED WHO LONG TERM GOAL IN SELECTED AUSTRALIAN CITIES; 1975-80[a]

City	*Year*					
	1975	*1976*	*1977*	*1978*	*1979*	*1980*
Sydney	120	129	97	78	59	56
Newcastle	na	na	23	49	4	4
Melbourne	22	19	9	38	26	21

a. WHO long-term goal for ozone for a one-hour concentration of 120 ug/m^3 (0.06 ppm) not to be exceeded more than once a year (World Health Organisation 1972).

na not available

Source: Department of Home Affairs and Environment (1981) and associated references.

TABLE IV.14—MAXIMUM HOURLY CONCENTRATIONS OF CARBON MONOXIDE FOR SELECTED AUSTRALIAN CITIES; 1975-80[a]

(milligrams per cubic metre)

City	*Year*					
	1975	*1976*	*1977*	*1978*	*1979*	*1980*
Sydney	80	54	58	67	77	na
Melbourne	28	25	21	28	18	14
Brisbane	41	40	54	47	51	64[b]
Perth	18	23	29	29	32	14

a. Maximum concentration recorded at any monitoring site in each city.
b. 1980-81

na not available

Note: The WHO one-hour average standard is 40 mg/m^3 not to be exceeded more than once a year (World Health Organisation 1979).

Source: Department of Home Affairs and Environment (1981) and associated references.

TABLE IV.15—ANNUAL MEAN CONCENTRATIONS OF NITROGEN DIOXIDE FOR SELECTED AUSTRALIAN CITIES; 1975-80[a]

(micrograms per cubic metre)

City	*Year*					
	1975	*1976*	*1977*	*1978*	*1979*	*1980*
Sydney	16	28	27	23	40	44
Melbourne	24	46	30	36	34	40

a. Data are the arithmetic mean of the annual arithmetic mean of all monitoring stations in each city/region. Basic data at each station are averages of successive 3 second periods.

Note: The WHO goal for nitrogen dioxide is expressed in terms of 24 hour average concentrations not to be exceeded more than once a month (World Health Organisation 1977). This goal does not related to the above data.

Source: Department of Home Affairs and Environment (1981) and associated references.

TABLE IV.16—ANNUAL MEAN CONCENTRATIONS OF AIRBORNE LEAD IN SELECTED AUSTRALIAN CITIES; 1975-80[a]

(micrograms per cubic metre)

City	Year					
	1975	*1976*	*1977*	*1978*	*1979*	*1980*
Sydney	1.4	1.4	1.4	1.6	1.7	1.4
Newcastle region	1.6	1.1	1.9	1.1	4.0	4.0
Wollongong	1.0	1.0	1.3	1.2	3.0	2.6
Melbourne	1.2	0.8	0.8	0.6	0.6	0.6
Brisbane	na	na	1.7	2.0	2.1	1.6[b]
Perth	0.8	0.7	0.8	0.8	0.9	0.9

a. Data are the arithmetic mean of the annual arithmetic mean of all monitoring stations in each city/region. Basic data at each station are averages of successive 24 hour periods.

b. 1980-81.

na not available

Note: The level of concern recommended by NHMRC is 1.5 ug/m^3 over 3 calendar months (National Health and Medical Research Council 1980).

Source: Department of Home Affairs and Environment (1981) and associated references.

Contribution of the motor vehicle

Emissions of hydrocarbons and nitrogen oxides are produced by stationary sources as well as by cars. For a given airshed, the intensity and frequency of pollution episodes caused by mobile and stationary sources are a function of the composition, concentration and frequency of occurrence of emissions produced by each type of source, the duration of emission output, and the geographical location of the sources. An indication of the contribution of the motor vehicle to the burden of air pollution in urban areas requires estimates to be made of the magnitude of emissions from various sources.

The most detailed assessment of the sources of particular pollutants was made in the case of hydrocarbons in Sydney by the State Pollution Control Commission (SPCC) (1980), which indicates that motor vehicles were responsible for 51 per cent of total hydrocarbon emissions in 1976.

The Committee on Motor Vehicle Emissions (1981) reported on the development of a long term national motor vehicle emission strategy. In the course of this work, estimates were made of the contribution of the motor vehicle to total emissions of lead, hydrocarbons, carbon monoxide and nitrogen oxides in Australian capital cities. These estimates also relate to the year 1976, and are set out in Table 4.5 in Chapter 4. The data indicate that the motor vehicle is responsible for almost all lead and most carbon monoxide emissions. It produces two-thirds of emissions of nitrogen oxides, and one-half of emissions of hydrocarbons. However these proportions of emissions of nitrogen oxides and hydrocarbons cannot be used to determine the contribution of the motor vehicle to the production of ozone, for the reasons discussed in Daly (1981).

APPENDIX V—DATA TABULATIONS: THE AUSTRALIAN ROAD SYSTEM

This Appendix presents the source data that were used to produce the Tables and Figures in Chapter 5. However road lengths for Tasmania in Tables V.4 to V.8 include 5634km of Hydro-Electric Commission roads which are not in the data given in Chapter 5 nor in data given elsewhere in this Paper.

The road accident measures shown in Tables V.9 to V.17 are defined in Appendix I which also includes a discussion of the effect of some inadequacies of the travel data on the accident rates. The casualty data were not discussed in Chapter 5 because of the inconsistency of definition among States and over time as explained in Appendix I, but have been included here in the table for each State to supplement the fatality data (particularly for States where the fatality numbers are small and are thus more prone to annual fluctuations).

TABLE V.1—TRAVEL ON THE AUSTRALIAN ROAD SYSTEM: 1971, 1976, 1979 AND 1982

(million VKT)

State	*Year*				*Increase 1971 to 1982 (per cent)*
	1971	*1976*	*1979*	*1982*	
New South Wales	29 104[a]	33 708	36 832	42 920	54[b]
Victoria	22 619	28 363	29 957	32 432	43
Queensland	10 691	14 587	17 364	21 636	102
South Australia	7 879	9 645	10 378	11 031	40
Western Australia	7 417	9 581	11 451	12 336	66
Tasmania	2 269	2 803	2 995	3 615	59
Northern Territory	522	553	712	974	87
Australian Capital Territory	na	1 680	1 780	1 922	na
Australia	80 501	100 920	111 469	126 866	57.59

a. Includes Australian Capital Territory.
b. Increase for New South Wales plus Australian Capital Territory.

na not available

Note: VKT by State of registration.

Sources: Commonwealth Bureau of Census and Statistics (1973b), Australian Bureau of Statistics (1978c and 1981a).

TABLE V.2—FREIGHT TASK ON THE AUSTRALIAN ROAD SYSTEM; 1971, 1976, 1979 AND 1982

(million tonne km)

State	Year 1971	Year 1976	Year 1979	Year 1982	Increase 1971 to 1979 (per cent)	Increase 1971 to 1982 (per cent)
New South Wales	9 699[a]	12 297	16 456	20 384	73.2[b]	114.4[b]
Victoria	6 875	8 149	11 482	13 782	67.0	100.5
Queensland	2 962	3 863	6 590	8 853	122.5	198.9
South Australia	3 294	6 968	6 253	6 305	89.8	91.4
Western Australia	3 220	3 711	4 652	6 366	44.5	97.7
Tasmania	687	1 095	1 407	1 513	104.8	120.2
Northern Territory	690	433	946	1 757	37.1	154.6
Australian Capital Territory	na	187	340	407	na	na
Australia	27 427	36 703	48 126	59 962	75.5	118.6

a. Includes Australian Capital Territory.
b. Increase for New South Wales plus Australian Capital Territory.

na not available

Note: Tonne kilometres shown by State of registration.

Sources: Commonwealth Bureau of Census and Statistics (1973b). Australian Bureau of Statistics (1978c, 1981a and 1983c).

TABLE V.3—PERSONAL TRAVEL ON THE AUSTRALIAN ROAD SYSTEM; 1971, 1976 AND 1979

(million occupant km)

State	Year 1971	Year 1976	Year 1979	Increase 1971 to 1979 (per cent)
New South Wales[a]	53 740	61 887	66 596	30.5[b]
Victoria	41 510	53 046	55 353	33.3
Queensland	20 430	27 682	32 425	58.7
South Austraia	14 800	18 055	18 744	26.6
Western Australia	13 030	17 449	20 892	60.3
Tasmania	4 180	5 383	5 654	35.3
Northern Territory	970	1 006	1 255	29.4
Australian Capital Territory	na	3 078	3 509	na
Australia	148 660	187 586	204 428	37.5

a. Includes Australian Capital Territory.
b. Increase for New South Wales plus Australian Capital Territory.

na not available

Note: Occupant kilometres shown by State of registration. Data exclude operations of buses.

Sources: Commonwealth Bureau of Census and Statistics (1973b). Australian Bureau of Statistics (1978c and 1981a).

TABLE V.4—TOTAL LENGTH OF ROAD BY STATE; 1950-81

(km)

State	*1950*	*195*	*1960*	*1965*	*1970*	*1975*	*1978*	*1981*
New South Wales	203 172	201 189	208 771	211 310	208 760	209 271	204 571	197 914
Victoria	163 170[a]	160 840	163 235	161 001	162 694	159 148	156 701	158 075
Queensland	216 531	199 915	190 883	193 702	191 952	191 815	162 345[b]	160 981
South Australia	84 701	89 483	100 536	141 600	121 219	100 255	100 529	103 645
Western Australia	122 678	136 695	146 940	172 445	156 730	161 654	163 313[c]	138 512
Tasmania[d]	19 745	20 550	18 621	20 186	22 192	20 993	22 227	22 491
Northern Territory	15 765	19 771	20 925	18 280	19 592	20 285	20 362	21 347
Australian Capital Territory	756	910	919	1 111	1 388	1 854	2 182	2 234[e]

a. Estimate as at 1948

b. This lower estimate of road length resulted from the Local Government Grants Commission of Queensland adjustment for conformity with its definition of the roads system for statistical purposes.

c. Estimate as at 30 June 1977.

d. These figures include Hydro-Electric Commission and Forestry Commission roads, which together amounted to 5632km in 1981.

e. Estimate as at 1980.

Note: The estimates are not necessarily comparable over time because significant lengths of road have been added or deleted from the records at various points in time.

Sources: Australian Bureau of Statistics (1982b and undated). SRAs, personal communications. Supplemented by State and Australian Year Books.

TABLE V.7-LENGTH OF FORMED ROAD BY STATE; 1950-81

(km)

State	1950	1955	1960	1965	1970	1975	1978	1981
New South Wales	44 183	43 905	43 446	43 367[a]	45 337	41 920	39 188	37 928
Victoria	38 465[b]	40 298[c]	37 728	34 046	33 320	28 177	27 380	24 183
Queensland	72 383	66 815	62 099	68 766	64 644	61 322	60 193	56 362
South Australia	14 978	14 257[d]	24 792	17 506	12 291	24 401	24 225	19 555
Western Australia	45 599	58 094	64 210	72 095	43 948	45 267	46 276[e]	45 181
Tasmania[f]	1 600	4 731[g]	2 496[g]	2 124[g]	2 146[g]	788[g]	749[g]	521
Northern Territory	9 627	15 448	1 635	2 595	2 940	4 942	6 143	4 746
Australian Capital Territory	327	359	286	145	42	42	42	42[h]

a. estimate as at 1966.
b. Estimate as at 1948.
c. Estimate as at 1954.
d. Estimate as at 1956.
e. Estimated as at 30 June 1977.
f. These figures include Hydro-Electric Commission and Forestry Commission roads.
g. Total length of formed and unformed road.
h. Estimate as at 1980.

na not available

Note: The estimates are not necessarily comparable over time because significant lengths have been added or deleted from the records from time to time.

Sources: Australian Bureau of Statistics (1982b and undated). SRAs, personal communication. Supplemented by State and Australia Year Books.

TABLE V.8—LENGTH OF UNFORMED ROAD BY STATE; 1950-81

(km)

State	*1950*	*1955*	*1960*	*1965*	*1970*	*1975*	*1978*	*1981*
New South Wales	90 365	73 526	60 407	50 051[a]	42 525	34 974	28 490	21 848
Victoria	61 858[b]	49 135	42 149	36 177	32 460	29 193	25 277	22 499
Queensland	122 482	99 697	82 471	70 206	64 643	54 451	29 050	22 576
South Australia	40 588	40 184[c]	46 518	88 886	63 516	37 026	37 024	24 647
Western Australia	51 364	45 049	38 180	45 081	62 941	54 569	52 077[d]	22 014
Tasmania[e]	2 886[f]	na	na	na	na	na	na	5 256
Northern Territory	3 727	1 920	16 718	11 700	10 953	9 094	7 372	6 670
Australian Capital Territory	0	0	0	0	0	0	0	0[g]

a. Estimate as at 1966.
b. Estimate as at 1948.
c. Estimate as at 1956.
d. Estimate as at 30 June 1977.
e. These figures include Hydro-Electric Commission and Forestry Commission roads.
f. Unformed length estimated from the length of unformed plus formed road.
g. Estimate as at 1980.

na not available. Total length of formed and unformed road is shown in Table V.7.

Note: The estimates are not necessarily comparable over time because significant lengths of road have been added or deleted from the records at various points in time.

Sources: Australian Bureau of Statistics, (1982b and undated). SRAs, personal communication. Supplemented by State and Australia Year Books.

TABLE V.9-ROAD ACCIDENT DATA; NEW SOUTH WALES, 1971-82

Year	*Fatalities*	*Fatalities per 100 million VKT*	*Fatal accidents*	*Fatal accidents per 100 million VKT*	*Casualties*	*Casualty accidents*
1971	1 249	4.2	1 096	3.7	na	na
1972	1 092	3.6	981	3.3	na	na
1973	1 230	4.0	1 082	3.5	na	na
1974	1 275	4.1	1 121	3.6	na	na
1975	1 288	4.1	1 150	3.6	38 141	28 217
1976	1 264	3.9	1 119	3.5	34 419	25 265
1977	1 268	3.8	1 118	3.3	35 452	25 788
1978	1 384	4.0	1 222	3.5	37 876	27 285
1979	1 290	3.6	1 125	3.1	33 977	24 344
1980	1 303	3.5	1 152	3.1	35 693	26 266
1981	1 292	3.4	1 130	2.9	na	na
1982	1 253	3.2	1 115	2.8	na	na

na not available

Sources: Australian Bureau of Statistics, (1979b and 1983a). New South Wales, Department of Motor Transport, Traffic Accident Research Unit, personal communication.

TABLE V.10—ROAD ACCIDENT DATA; VICTORIA, 1971-82

Year	*Fatalities*	*Fatalities per 100 million VKT*	*Fatal accidents*	*Fatal accidents per 100 million VKT*	*Casualties*[a]	*Casualty*[a] *accidents*
1971	923	4.2	na	na	na	na
1972	915	4.0	814	3.6	na	na
1973	935	3.9	806	3.4	na	na
1974	806	3.2	739	3.0	na	na
1975	910	3.5	784	3.0	17 610	12 645
1976	940	3.5	828	3.1	17 678	12 695
1977	959	3.5	835	3.0	19 889	14 815
1978	856	3.1	775	2.8	21 422	15 093
1979	847	3.0	750	2.6	19 752	14 704
1980	657	2.3	608	2.1	19 943	14 965
1981	766	2.6	676	2.3	na	na
1982	709	2.4	631	2.1	na	na

a. The introduction of a new accident recording form may have increased the reporting of casualties.

na not available

Sources: Australian Bureau of Statistics (1979b and 1983a). Victoria, Country Roads Board, personal communication.

TABLE V.11—ROAD ACCIDENT DATA: QUEENSLAND, 1971-82

Year	*Fatalities*	*Fatalities per 100 million VKT*	*Fatal accidents*	*Fatal accidents per 100 million VKT*	*Casualties*	*Casualty accidents*
1971	594	5.4	na	na	na	na
1972	572	5.0	493	4.3	na	na
1973	638	5.2	533	4.5	na	na
1974	589	4.6	515	4.0	na	na
1975	635	4.7	553	4.1	11 019	8 241
1976	569	4.0	497	3.5	10 405	7 814
1977	572	3.8	515	3.4	10 002	7 696
1978	612	3.8	532	3.3	10 850	8 094
1979	613	3.6	544	3.2	10 303	7 746
1980	557	3.1	508	2.9	9 883	7 638
1981	594	3.2	510	2.7	9 968	7 768
1982	602	3.1	522	2.7	na na	

na not available

Source: Australian Bureau of Statistics (1979b and 1983a).

TABLE V.12-ROAD ACCIDENT DATA; SOUTH AUSTRALIA, 1971-82

Year	*Fatalities*	*Fatalities per 100 million VKT*	*Fatal accidents*	*Fatal accidents per 100 million VKT*	*Casualties*	*Casualty accidents*
1971	292	3.7	245	3.1	na	na
1972	312	3.8	274	3.3	na	na
1973	329	3.9	276	3.3	na	na
1974	382	4.4	342	4.0	na	na
1975	339	3.8	310	3.5	11 817	8 793
1976	307	3.4	277	3.1	10 961	8 090
1977	306	3.3	270	2.9	10 658	7 922
1978	291	3.0	254	2.6	11 162	8 160
1979	309	3.1	277	2.8	11 174	8 359
1980	269	2.6	240	2.4	9 704	7 336
1981	222	2.1	196	1.9	na	na
1982	270	2.5	239	2.2	na	na

na not available

Sources: Australian Bureau of Statistics (1979b and 1983a). South Australia. Highways Department, personal communication.

TABLE V.13—ROAD ACCIDENT DATA; WESTERN AUSTRALIA, 1971-82

Year	Fatalities	Fatalities per 100 million VKT	Fatal accidents	Fatal accidents per 100 million VKT	Casualties	Casualty accidents
1971	332	4.4	289	3.8	na	na
1972	340	4.2	305	3.8	na	na
1973	358	4.3	332	4.0	na	na
1974	334	3.8	303	3.5	na	na
1975	304	3.3	259	2.8	6 832	5 104
1976	308	3.2	255	2.7	7 059	5 287
1977	290	2.9	259	2.6	8 353	6 224
1978	344	3.2	304	2.8	10 089	7 513
1979	279	2.4	257	2.3	9 344	7 026
1980	292	2.4	268	2.2	8 390	6 461
1981	238	1.9	217	1.7	8 230	6 347
1982	236	1.8	203	1.5	na	na

na not available

Sources: Australian Bureau of Statistics (1979b and 1983a). Western Australia, Main Roads Department, personal communication.

TABLE V.14—ROAD ACCIDENT DATA; TASMANIA, 1971-82

Year	Fatalities	Fatalities per 100 million VKT	Fatal accidents	Fatal accidents per 100 million VKT	Casualties	Casualty accidents
1971	130	5.6	na	na	na	na
1972	106	4.4	95	3.9	na	na
1973	105	4.2	97	3.9	na	na
1974	111	4.3	88	3.4	na	na
1975	122	4.6	108	4.0	2 137	1 496
1976	108	3.9	97	3.5	2 323	1 603
1977	114	3.8	99	3.5	2 370	1 603
1978	106	3.7	96	3.3	2 255	1 641
1979	93	3.1	83	2.8	2 107	1 507
1980	100	3.3	96	3.1	2 099	1 571
1981	111	3.6	97	3.1	na	na
1982	96	3.0	84	2.6	na	na

na not available

Sources: Australian Bureau of Statistics (1979b and 1983a). Tasmania, Transport Commission, personal communication.

TABLE V.15—ROAD ACCIDENT DATA; NORTHERN TERRITORY, 1971-82

Year	*Fatalities*	*Fatalities per 100 million VKT*	*Fatal accidents*	*Fatal accidents per 100 million VKT*	*Casualties*	*Casualty accidents*
1971	50	9.4	na	na	na	na
1972	53	10.0	49	9.3	na	na
1973	55	10.5	50	9.6	na	na
1974	44	8.5	41	7.9	na	na
1975	64	12.3	50	9.7	789	554
1976	51	10.0	48	9.3	814	582
1977	47	8.3	39	6.9	882	634
1978	68	11.0	58	9.4	980	716
1979	53	7.9	43	6.4	982	650
1980	63	8.8	55	7.6	na	na
1981	70	9.1	63	8.2	na	na
1982	60	7.3	52	6.3	na	na

na not available

Note: Appendix I includes comments on the possible over-estimation of accident rates due to the exclusion of interstate travel.

Sources: Australian Bureau of Statistics (1979b and 1983a). Road Safety Council of the Northern Territory, personal communication.

TABLE V.16—ROAD ACCIDENT DATA; AUSTRALIAN CAPITAL TERRITORY, 1971-82

Year	*Fatalities*	*Fatalities per 100 million VKT*	*Fatal accidents*	*Fatal accidents per 100 million VKT*	*Casualties*	*Casualty accidents*
1971	20	2.0	na	na	na	na
1972	32	3.1	28	2.7	na	na
1973	29	2.6	29	2.6	na	na
1974	31	2.7	30	2.6	na	na
1975	32	2.6	32	2.6	1 124	869
1976	38	2.9	33	2.6	1 145	833
1977	29	2.2	26	2.0	1 176	868
1978	30	2.3	27	2.1	1 051	802
1979	24	1.8	24	1.8	1 094	816
1980	30	2.2	27	2.0	987	717
1981	29	2.1	24	1.7	1 000	776
1982	26	1.9	26	1.9	na	na

na not available

Source: Australian Bureau of Statistics (1979b and 1983a).

TABLE V.17—ROAD ACCIDENT DATA; AUSTRALIA, 1971-82

Year	*Fatalities*	*Fatalities per 100 million VKT*	*Fatal accidents*	*Fatal accidents per 100 million VKT*
1971	3 590	4.4	3 133	3.8
1972	3 422	4.0	3 039	3.6
1973	3 679	4.2	3 225	3.7
1974	3 572	3.9	3 179	3.5
1975	3 694	3.9	3 245	3.5
1976	3 583	3.7	3 154	3.3
1977	3 578	3.6	3 161	3.2
1978	3 705	3.6	3 268	3.1
1979	3 508	3.3	3 103	2.9
1980	3 272	2.9	2 954	2.7
1981	3 322	2.9	2 913	2.5
1982	3 252	2.7	2 872	2.4

Sources: Australian Bureau of Statistics (1979b and 1983a). Personal communications with; New South Wales, Department of Motor Transport, Traffic Accident Research Unit, Tasmania, Transport Commission; Victoria, Country Roads Board; South Australia, Highways Department; Western Australia, Main Roads Department; Road Safety Council of the Northern Territory.

TABLE V.18—TOTAL ANNUAL FUEL CONSUMPTION; AUSTRALIA, 1971, 1976, 1979 AND 1982

(Ml)

Type of fuel	*1971*	*1976*	*1979*	*1982*
Petrol	10 337[a]	12 883	14 131	15 161
Diesel or distillate	928	1 368	2 086	2 907
LPG	na	na	46 243	
Unknown	8	99	22	6
Total	11 274	14 351	16 285	18 317

a. Type of fuel not stated for cars and station wagons but assumed to be petrol.

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

Sources: Commonwealth Bureau of Census and Statistics (1973b). Australian Bureau of Statistics (1978c, 1981a and 1983c).

TABLE V.19—AVERAGE RATE OF FUEL CONSUMPTION; AUSTRALIA, 1971, 1976, 1979 AND 1982

(l/100 km)

Type of fuel	*1971*	*1976*	*1979*	*1982*
Petrol	13.3[a]	13.3	13.4	13.0
Diesel or distillate	38.3	42.2	40.3	32.8
LPG	na	na	23.6	20.0
Unknown	na	21.9	22.3	18.5
Total	14.0	14.3	14.6	14.4

na not available
a. Type of fuel not stated for cars and station wagons but assumed to be petrol.

Sources: Commonwealth Bureau of Census and Statistics (1973b). Australian Bureau of Statistics (1978c, 1981a and 1983c).

APPENDIX VI—FACTORS AFFECTING ROAD SAFETY

Road safety is affected not only by improvements in road infrastructure and changes in road usage, but also by driver and vehicle legislation, vehicle characteristics and human factors. The discussion in this Appendix concerns some of the Australian legislative provisions having a bearing on road safety and provides an indication of the ways in which changes in driver regulation, vehicle size and human factors may influence road safety.

LEGISLATION

Seat belts

Some of the major changes to legislation concerning the fitting and wearing of seat belts in Australia are listed in Table VI.1.

Herbert (1980) reported that when introduced in New South Wales, compulsory wearing laws were credited with a 25 per cent reduction in deaths among vehicle occupants in the first year of operation. He estimated that the total number of lives saved in New South Wales between 1972 and 1979 by this legislation was 2007 or 23 per cent per annum. Gerondeau (1974) reports that in France the effect of compulsory seat belt wearing was estimated to account for a 20 per cent reduction in fatalities for high speed crashes.

A number of studies suggest that seat belt legislation leads not only to a reduction in fatalities, but also to a reduction in the number and severity of injuries. Trinca (1980 pp36-38) asserts that serious and fatal injuries are reduced by 65-80 per cent and moderate injuries by 40-60 per cent through seat belt wearing. In Table VI.2 the injury status by seat belt usage is shown for car drivers as determined by the Adelaide In-Depth Accident Study 1975-79. These data suggest that the wearing of seat belts reduced both the occurrence of serious injuries (hospital admissions) and the occurrence of less serious injuries (medical attention).

Speed limits

Some of the major changes to legislation concerning speed limits are outlined in Table VI.3. Herbert (1980) concluded that 'the more severe the crash the more likely it was to have occurred in high speed zones'.

McLean (1982) reports that the reduction in speed limit from 112 km/h to 96 km/h (later 100 km/h) in Victoria in 1973 resulted in a decrease in mean travelling speed of about 4 km/h and a slight reduction in the variance of the travelling speeds. McLean also noted that fatal accident numbers declined the following year.

Drink driving

Some of the major legislative changes concerning driving with a high blood alcohol content are listed in Table VI.4.

Vulcan (1980) reported on the blood alcohol content of drivers, motor cyclists and adult pedestrians killed in road accidents in Victoria in 1975-77 and part of 1978. His figures showed that 46 per cent of the drivers tested, 36 per cent of the motorcyclists tested and 38 per cent of the adult pedestrians tested had a blood alcohol content in excess of the legal limit of 0.05 grams per 100 millilitres of blood.

Although alcohol contributes to road accidents, evaluation studies have suggested that there is little long-term reduction in the numbers of traffic collisions as a result of legislation which increases drink driver penalties (Herbert, 1980).

Other legislation

Many other legislative changes also affect road safety, as for example legislation concerning head restraints, child restraints, the compulsory wearing of crash helmets by motor cyclists and the introduction of the T-Junction give way rule. Some of the legislative changes concerning child restraints and the wearing of crash helmets are listed in Table VI.5.

VEHICLE SIZE

McLean (1982) notes a number of studies which suggest that the risk of serious injury is greater for drivers of light cars than for drivers of heavy cars. For example, McLean reported some results of the Adelaide In-Depth Accident Study which suggested that the risk of injury was greater for drivers of small cars whether or not they were wearing a seat belt (see Table VI.6).

HUMAN FACTORS

Attempts to reduce the contribution of human factors to road accidents, have included the provision of driver education and training programmes and road safety publicity campaigns.

Vulcan (1980) suggests that there is growing evidence that publicity campaigns have been successful in bringing road safety issues to the attention of road users and have led to some changes in behaviour. However, Vulcan does note that, to date, most effective safety measures have involved improvements to the vehicle or the road system rather than modification of road user behaviour. Lay (1981) asserts that there is no firm evidence that any measures aimed at altering driver behaviour will be successful in the long-term.

GENERAL COMMENT

The factors discussed above are only some of the many items that effect road safety. As these factors often change simultaneously, it is difficult to identify the effect of any one factor on the overall safety level. Consequently, it should be remembered that the changes in fatality rates and fatal accident rates in this Paper represent the net effect of changes to many factors.

TABLE VI.1—SELECTED CHANGES TO SEAT BELT LEGISLATION; 1969-72

State	Date	Change to legislation
New South Wales	1 Jan 1969	All new cars to be fitted with belts in front outer seating positions.
	1 Jan 1971	All new cars to have belts fitted in all seating positions.
	1 Oct 1971	Seat belts to be worn when fitted to cars.
Victoria	1 Jan 1969	Three point lap/sash belts to be fitted to front outer seats of cars first registered on or after that data.
	22 Dec 1970	Seat belts to be worn when fitted.
	1 Jan 1970	All new cars to have seat belts fitted to all seating positions.
Queensland	1 Jan 1969	All new cars to be fitted with belts in all front seating positions.
	1 Jan 1972	Seat belts to be worn when fitted to vehicles.
South Australia	1 Jan 1970	Cars first registered on or after this date to have seat belts fitted to all front seating positions.
	1 Feb 1971	Cars first registered on or after this date to have seat belts fitted to all seating positions.
	29 Nov 1971	Seat belts to be worn where fitted.
Western Australia	1 Jan 1969	Cars manufatured on or after this date to have seat belts fitted to front seating positions.
	1 Jan 1971	Cars manufactured on or after this date to have seat belts fitted to all rear seating positions.
Tasmania	4 Mar 1970	Prescribed vehicles registered between this date and 1 Jan 1971 to have seat belts fitted to each front seat. Prescribed vehicles registered on or after 1 Jan 1971 to have seat belts fitted in every seating position.
Northern Territory	1 Jan 1972	It became compulsory for each seat to have a seat belt. and for a person to wear a belt when sitting in a seat fitted with a seat belt.

Note: Car is taken to mean passenger car and derivatives. Vehicle is taken to mean motor vehicle.

Source: Thomson (1981).

TABLE VI.2—INJURY STATUS BY SEAT BELT USAGE FOR CAR DRIVERS

Belt Use	*No of drivers*	*Not injured or first aid at scene (per cent)*	*Medical attention (per cent)*	*Hospital admission (per cent)*
Belt available but not used	38	45	32	24
Belt used (ADR 4B/ 4C)[a]	21	71	14	14

a. Belts which comply with Australian Design Rule (ADR) 4B/4C have an inertia reel mechanism.

Notes: 1. Accidents involving a pedestrian, pedal cycle or motorcycle have been excluded.
2. Percentages do not add to 100 due to rounding.

Source: McLean and Robinson (1979).

TABLE VI.3—SELECTED CHANGES TO SPEED LIMIT LEGISLATION; 1963-83

State	*Date*	*Change to legislation*
New South Wales	1 May 1964	Urban speed limts raised from 30 mph to 35 mph.
	1 Jul 1979	Absolute speed limit of 100 km/h introduced. Previously 80 km/h 'prima facie'.
Victoria	1 Jan 1963	Urban speed limits raised from 30 mph to 35 mph.
	20 Dec 1971	Existing 50 mph 'prima facie' limit changed to 70 mph absolute.
	24 Dec 1973	Absolute speed limit lowered from 70 mph to 60 mph (96 km/h).
	1 Jul 1974	Absolute speed limit converted from 60 mph to 100 km/h.
Queensland	22 Jun 1974	Speed limit in built up areas converted from 35 mph to 60 km/h. Speed limit elsewhere converted from 60 mph to 100 km/h.
South Australia	1 Jul 1974	Township speed limit converted from 35 mph to 60 km/h. Absolute speed limit of 110 km/h replaced 60 mph 'prima facie' limit.
Western Australia	12 Oct 1967	Maximum speed 65 mph. 35 mph in control area except within a zone in which a higher speed is permitted.
	29 May 1975	Maximum speed 100 km/h. The limit for a control area is 60 km/h except for a zone in which a higher speed is permitted.
Tasmania	30 Jan 1963	City and town (urban) limit raised from 30 mph to 35 mph.
	15 Dec 1967	Absolute limit of 60 mph introduced.
	18 Sep 1968	Absolute limit increased to 65 mph.
	26 Jun 1974	Speed limits converted to 100 km/h and 60 km/h.
Northern Territory	18 Jun 1971	Speed limit 60 km/h in a municipality (No absolute limit elsewhere).

Source: Thomson (1981).

TABLE VI.4—SELECTED CHANGES TO LEGISLATION CONCERNING DRIVING WITH A HIGH BLOOD ALCOHOL CONTENT

State	*Date*	*Change to legislation*
New South Wales	16 Dec 1968	Legal blood alcohol content limited to 0.08[a].
	15 Dec 1980	Legal blood alcohol content reduced to 0.05.
Victoria	Dec 1966	Legal blood alcohol content limited to 0.05.
	1 Jul 1976	Compulsory random breath testing introduced on a limited trial basis.
Queensland	6 Jul 1968	Legal blood alcohol content reduced to 0.10.
	24 Apr 1974	Legal blood alcohol content reduced to 0.08.
	Dec 1982	Legal blood alcohol content reduced to 0.05.
South Australia	23 Nov 1967	Legal blood alcohol content limited to 0.08.
	14 Oct 1981	Compulsory random breath testing introduced.
Western Australia	7 Dec 1965	Blood alcohol content greater than or equal to 0.15 was 'prima facie' evidence that a person was under the influence of alcohol. A blood alcohol content between .05 and 0.15 to be used only with other evidence to show a person was under the influence of alcohol.
	13 Nov 1968	Legal blood alcohol content limited to 0.08.
Tasmania	20 Jul 1966	Legal blood alcohol content limited to 0.08.
	5 Jan 1983	Legal blood alcohol content reduced to 0.05.
Northern Territory	2 Dec 1974	Legal blood alcohol content limited to 0.08.
	1 Feb 1980	Compulsory random breath testing introduced.

a. Blood alcohol content defined in terms of grams of alcohol per 100 millilitres of blood.

Source: Thomson (1981).

TABLE VI.5—SELECTED CHANGES TO CHILD RESTRAINT AND MOTORCYCLE CRASH HELMET LEGISLATION; 1961-81

State	*Date*	*Change to legislation*
New South Wales	1 Aug 1971	Compulsory wearing of motorcycle crash helmets introduced.
	1 Mar 1977	Suitable child restaints to be worn if available, otherwise child must be in rear seat.
Victoria	1 Jan 1961	Compulsory wearing of motorcycle crash helmets introduced.
	17 Jan 1976	Children under 8 years of age to be suitably restrained when in front seat.
Queensland	24 Oct 1970	Compulsory wearing of motorcycle crash helmets introduced.
	3 Nov 1979	Suitable child restraints to be worn if available. Unrestrained children to occupy rear seat.
South Australia	31 Dec 1971	Compulsory wearing of motorcycle crash helmets introduced.
	1 Jun 1980	Children under 8 years of age required to wear a child restraint if available. Where not available children to sit in the rear seat.
Western Australia	15 Mar 1974	Suitable child restraints should be fitted.
	3 Oct 1974	Compulsory wearing of motorcycle crash helmets introduced.
Tasmania	15 Jan 1967	Compulsory wearing of motorcycle crash helmets introduced.
	23 Nov 1977	Offence for driver or person in charge of a private motor car to carry a child under 8 years of age unless restrained or behind the front seats.
Northern Territory	8 Nov 1972	Compulsory wearing of motorcycle crash helmets introduced.
	1981	Driver responsible for child up to 14 years of age to wear restaints or to be seated in the back seat.

Source: Thomson (1981).

TABLE VI.6—DRIVER INJURY SEVERITY BY SEAT BELT USAGE AND WEIGHT OF CAR

(per cent)

Driver injury severity	*330-950kg*		*951-1300kg*		*1300+kg*	
	Belt worn	*Not worn*	*Belt worn*	*Not worn*	*Belt worn*	*Not worn*
Uninjured	30	18	40	30	68	45
First aid at scene	15	19	35	19	8	22
Treated at hospital not admitted	36	29	15	30	12	22
Hospitalised for less than 24 hours	6	13	0	9	3	8
Hospitalised for more than 24 hours	13	21	10	12	9	3
Total	100	100	100	100	100	100

Source: McLean and Robinson (1979).

APPENDIX VII—AMENITY ON RESIDENTIAL STREETS

BACKGROUND

The assessment of operating conditions on residential streets necessarily requires consideration of a number of town planning issues related to 'amenity'.

The prime function of residential streets is to provide access to abutting property, and to link the residents' homes with the wider urban network, in particular the network of arterial roads. In addition the local network of residential streets provides for local travel to nearby facilities such as shops, schools and community centres.

The early layout of Australian cities indicates that little distinction was made between local streets and the arterial roads. For example, most major roads in Melbourne were laid out in a grid enclosing cells one mile or half a mile square in which residential streets were extended throughout the grid to provide a fine grained linkage to development. With this design, while the arterials roads in principle provided the most suitable routes for intra-city travel, the residential street network also provided large numbers of relatively convenient and direct through routes. Any distinction between the two types of street was further blurred in that the property abutting the arterial roads was, for the most part, residential.

This state of affairs gave rise to few problems while vehicle ownership and traffic volumes were low. However, during the 1950s and 1960s the rapid growth in travel led to traffic volumes approaching the capacity of the arterial road network and giving rise to the congestion problems which are discussed in Chapter 4. A side effect arising from the arterial road congestion is arising from the 'spill-over' of traffic onto residential streets. The degree to which this occurs obviously depends on the convenience of alternative routes, and we have seen that the early layouts provided an abundance of convenient through routes.

ISSUES ON RESIDENTIAL STREETS

It is principally the volume of traffic on residential streets and its detrimental impact on the residential environment which give rise to community concern. Excessive speed and parking levels also contribute to this detrimental effect. The impact on the residential environment can be discussed in terms of the following issues.

Safety

Accidents in residential streets are rare compared to elsewhere on the road network, a fact which is related mainly to the relatively low traffic volumes compared with the arterial system. Nevertheless, as residential streets constitute about 80 per cent of the length of the urban road network, the absolute number of these accidents is large and amounts to a significant percentage of the urban total, and there is evidence to suggest that the accident rate per VKT is higher on certain residential streets than on arterial roads (Commonwealth Bureau of Roads 1974b).

The contribution to the accident rate of 'through' traffic is probably the single most important problem on residential streets, and there appears to be a perception that casualty accidents on residential streets are more tragic than accidents on arterial roads. The residential street, it is felt, should be safe, not only in the performance of traffic access but, as part of the residential environment, safe for playing and walking or cycling.

Noise and vibration

The assessment of noise and vibration and of the annoyance they cause is a notoriously difficult exercise. Different aspects of the problem such as, intensity, duration and frequency, have varying effects on different people. Nevertheless in some areas, particularly where heavy vehicles make up a significant proportion of the traffic volume the level of noise or vibration may be a serious problem.

Air pollution

Levels of air pollutants in residential areas are influenced generally by emissions from vehicles on the urban road network.

Land use severance

High traffic volumes make it physically difficult and unsafe for people to cross the street, and hence the neighbourhood is divided, impeding social contact and access to local facilities.

Public open space

Although the provision of open space may not be considered a function of the residential streets, in many older inner city areas the street is the only readily accessible outdoor space, and usually provides an attractive location for children to play. To the extent that excessive traffic and parking make the streets too dangerous or unpleasant, this space is not available.

Parking

Limited on-street parking is generally viewed as an acceptable use of residential streets. In inner city areas many residential premises have inadequate off-street parking, hence residents and visitors have no option but to park their vehicles in the street. Frequently there is competition for on-street parking in inner city areas between residents and commuters from outer suburbs. Regardless of whether the vehicles are owned by residents or commuters, heavy parking detracts from the amenity and convenience of an area and contributes to the accident rate.

THE ASSESSMENT OF OPERATING CONDITIONS

The above enumeration of important issues on residential streets suggests that they be used as the basis for a set of parametric measures of operating conditions. Residential street conditions should therefore be assessed in terms of (say):

- accident rates
- noise and vibration intensities
- air pollution levels
- parking levels
- traffic volume and speeds (a measure of severance).

With the partial exception of accident rates and air pollution levels (Chapter 4) comprehensive data on these measures, to permit an assessment of the general state of residential streets in Australian cities, are not available; indeed a variety of methodological difficulties would complicate the assessment even if they were. A considerable number of studies has been undertaken, in most cases by LGAs coping with the special features of their local conditions, but this collection of data is not sufficient to form the basis for a coherent, comprehensive assessment of the problem.

One indication of the extent of the problem was obtained by the 1972 Australian Road Survey which found that 4 per cent of residential streets were carrying over

1500 vehicles per day. While this figure of 1500 vehicles per day is arbitrary, it has come to be widely used as an upper limit for environmentally acceptable traffic volumes on residential streets throughout Australia. The problem is highly localised, particularly in the inner areas of the larger cities where the proportion of streets (exceeding 1500 vehicles per day) is much higher.

Nevertheless, in spite of the difficulties in obtaining uniform data, problems have given rise to public and professional concern and to considerable activity by LGAs seeking to solve existing problems and to avoid their repetition in the future.

Although it will not constitute an assessment of conditions, an examination of this activity should give an indication of the nature and extent of the problem and of the degree to which solutions are being found. However, before proceeding to describe the various reactions to the problems described, it is as well to note one other type of information which can be used to assess conditions on residential streets.

The residential street issues described above have come to be seen as important as a result, partly of professional analysis, and partly of grass roots political pressure at the LGA level. The common feature of the issues is one of concern for the 'amenity' or 'quality of life' in the residential environment and the extent to which this is compromised by the residential streets and the traffic they carry.

Any analysis concerning itself with such questions as the 'quality of life' is clearly fraught with difficulty but an important input to the analysis would presumably be the opinion of the residents.

To some small extent these issues were touched on in the attitude surveys conducted for the former CBR in Melbourne and Sydney in 1973 and 1974 (Commonwealth Bureau of Roads 1975b, p56). Although the surveys were concerned with urban roads in general, a number of questions referred to residential streets. The most notable statistic to emerge was the 60 per cent of respondents who declared themselves 'completely dissatisfied' with safety on residential streets.

RESPONSES TO THE IMPACT OF TRAFFIC ON THE RESIDENTIAL ENVIRONMENT

There is fairly general agreement within the traffic engineering profession that the main problems on residential streets are associated with the volume, speed and composition of the traffic (particularly the through traffic) on those streets; and there is also general agreement on the broad nature of available solutions.

The generally accepted approach is the adoption of what is known as a hierarchy of roads, under which the roads of the urban network are classified according to their primary function, taking into account the abutting land use which in some cases may dominate the road function. Thus under a hierarchical system, environmentally sensitive residential areas would be protected from the effects of excessive traffic by supporting only the access functions of the streets and restricting the traffic movement function.

There have been two main responses to the problems described above. Town planners, working within the conceptual framework of the hierarcy of roads, have sought to design new residential street networks in such a way as to avoid past mistakes; and, in older areas, city engineers have attempted to impose an appropriate road hierarchy on the existing street network. The two responses are described below.

The planning of streets in new residential areas

The residential street networks in most new urban developments are very different from the traditional grid pattern. The aim in the new areas is to design a street network which limits traffic volumes and speeds to acceptable levels. In addition, a number of other safety and amenity enhancing features may be incorporated as shown in Table VII.1.

TABLE VII.1—DESIRABLE FEATURES, AND THEIR PURPOSE, FOR RESIDENTIAL STREET LAYOUTS

Feature	*Purpose*
Two level road hierarchy; boundary roads carry high traffic volumes and deny direct access to residential development; internal access roads discourage high volumes and speeds	Separation of traffic movement and access functions
No convenient through routes	Discourage through traffic
Limited size of residential area	Limits locally generated traffic
Adequate number of entry roads	Distribute local traffic and prevent bottlenecks
Many short culs-de-sac and short loops	Restricts traffic volumes and speeds
No long straight sections	Speed reduction
No cross roads	Safety
Off-street parking	Safety, appearance
Reduced pavement width; different surface material; accommodation to terrain	Encourage driver behaviour appropriate to residential area
Visibility appropriate to intended speed	Safety; speed reduction

The modification of existing residential streets

In older, inner city areas the problem is to achieve the same objectives (reduction of traffic volume and speed) within the constraints imposed by the existing street pattern. The underlying approach is to impose a road hierarchy on the older non-hierarchial system. Thus the conflicts between traffic and amenity are resolved by the separation (as far as possible) of the two functions. A variety of what are known as local area traffic management measures are directed to this end. The objectives of a number of these measures are summarised in Table VII.2.

AUSTRALIAN EXPERIENCE WITH TRAFFIC MANAGEMENT MEASURES

Brindle (1979) conducted the first comprehensive survey of Australian practice in the field of local street planning and management. In 1978 he surveyed 352 urban LGAs (those containing urban areas with populations greater than 5000) to ascertain the extent of their experience with various local street planning and management measures. The overall response rate was 78 per cent (273 out of 352) and 82 per cent (139 out of 169) from metropolitan LGAs.

The last two columns of Table VII.2 indicate the application of local area traffic management measures by LGAs is widespread. For example, 57 per cent of LGAs responding to the survey indicated that they have implemented street closures at intersections and 36 per cent of LGAs have applied truck or other selective bans.

In order to supplement Brindle's results with more recent information and to obtain a first hand appreciation of the problems, the City Engineers of 43 Melbourne LGAs were contacted by telephone. These included all 'inner' city LGAs having exclusively traditional street layouts, as well as an outer ring of 14 LGAs which contained modern developments. The outer limits of LGAs contacted were set by a subjective assessment

TABLE VII.2—PURPOSE AND EXPERIENCE WITH LOCAL AREA TRAFFIC MANAGEMENT MEASURES

Local area traffic management measure	Purpose: Reduce through traffic	Purpose: Reduce X-road hazard	Purpose: Create culs-de-sac	Purpose: Provide open space	Purpose: Reduce speed	Per cent of urban LGAs reporting use of measure: Metro-politan n=139[a]	Per cent of urban LGAs reporting use of measure: Total n=273[a]
Street closure at intersection	**	**	*	*		71	57
Midblock street closure	**		**	*		24	16
Diagonal closure	**	**			*	13	8
Use of islands or medians to restrict turns	**					56	49
Half closures at intersections	**					31	22
One way streets	**					45	34
Truck or other selective bans	**					46	36
Local speed limits	*				**	6	7
Mini-roundabouts	*	**			*	35	27
Midblock islands					**	14	12
Reduced pavement width (retaining two way flow)					**	31	25
Reduced pavement width (permitting flow one way at a time)					**	10	7
Pavement width reduction and use of indirect alignment of carriageway				**	**	24	21
Speed control devices (humps, rumble strips, etc)					**	11	9
Varied surface materials					*	10	10

a. n equals the number of LGA's responding to survey.
** Primary purpose.
* Additional benefits.

Source: The reported usage of local areas traffic management measures included in this table was obtained from Brindle (1979).

that the LGA was predominantly urban in character. The telephone discussions provided the following results:

- sixteen LGAs claimed to have implemented area-wide schemes of local traffic managment;
- ten LGAs had experience of isolated measures taken to solve problems at particular locations;
- seven LGAs claimed to be in various stages of studying the problem or of preparation for the introduction of area wide schemes;
- three LGAs claimed that the problems on arterial roads were much more serious and should be dealt with first; and
- seven LGAs claimed there were no traffic problems on their residential streets.

The figure of 16 LGAs claiming to have implemented area-wide schemes should be interpreted with some caution because of the difficulty of deciding what should count as an area-wide scheme. A series of isolated treatments may come to be seen as an area-wide scheme even though little attention had been paid to their interaction at the time of their introduction.

Nevertheless, the results indicate that 26 LGAs, or 60 per cent of LGAs contacted, have used local area traffic management measures and a further 7 LGAs, or 16 per cent, are considering implementing such measures. The fact that the use of these measures is widespread implies that there are widespread problems arising from excessive traffic volumes and speeds on residential streets.

One of the major objectives of local area traffic management measures is to reduce the volume of traffic on residential streets. However, another effect of the widespread introduction of these measures is that some of the local road traffic will be diverted to arterial roads and hence these roads will be subject to increased traffic volumes.

The discussions with the city engineers from the 14 Melbourne LGAs having newer residential developments indicated that these areas are not always free from the problems of high volumes and speed. In some of these new developments it is found desirable to implement the sort of traffic management measures used for traditional street networks. Six of the fourteen Melbourne LGAs having newer developments mentioned the problem of the 'difficult distributor'. These roads are long, gently curving roads in some new developments which provide residential access but also permit excessive speeds and volumes.

Some city engineers from Melbourne LGAs also noted that the success of traffic management measures such as road closures is dependent on acceptance by the local residents. The issues surrounding the acceptability to residents of street improvement schemes involving limitations on local access were highlighted in the adjacent municipalities of Unley and Burnside in Adelaide (Cairney and Brebner, 1980, pp10, 131-138). The Unley road closure scheme was generally well received and, after some minor modification, accepted by the community. In Burnside the road closures were extremely contentious and public opinion eventually succeeded in having the closures replaced by roundabouts.

Australian experience with traffic management techniques indicates that not only can the nature of the problems on residential streets vary from one local area to another, but also that the nature of acceptable remedies can vary for different localities.

APPENDIX VIII—ROAD FATALITIES IN SELECTED COUNTRIES

This Appendix presents road fatality data for fourteen countries including Australia. The number of road fatalities and the number of road fatalities per 100 million VKT for each country are listed in Table VIII.1.

In Australia and many of the selected countries, a road fatality is recorded if death occurs *within thirty days* of a reported road accident provided that the death is directly attributable to injury sustained in the accident. However, there are departures from this definition of road fatality among the selected countries which may be summarised as follows:

- Austria; as from 1966, persons are recorded as killed if death occurs *within 3 days* as a result of the accident; persons who die later are recorded as injured.
- Canada; persons are recorded as killed if death occurs *within 12 months* as a result of the accident; persons who die later are recorded as injured.
- France; as from 1967, persons are recorded as killed if death occurs *within 6 days* as a result of the accident; persons who die later are recorded as injured.
- Greece; persons are recorded as killed if death occurs *within 3 days* as a result of the accident; persons who die later are recorded as injured.
- Portugal; persons are recorded as killed if death occurs *at the scene of the accident or during or immediately after transport* from the scene of the accident, persons who die later are recorded as injured.
- Spain; persons are recorded as killed if death occurs *within 24 hours* as a result of the accident, persons who die later are recorded as injured.
- United States; persons are recorded as killed if death occurs *within 12 months* as a result of the accident, persons who die later are recorded as injured.

European Conference of Ministers for Transport (1982) suggest that 97 per cent of deaths resulting from road accidents occur within 30 days of the accident. Hence there is only a small percentage difference between numbers based on a definition of 30 days and those based on a definition of 12 months.

TABLE VIII.1—ROAD FATALITIES IN SELECTED COUNTRIES; 1970-80

Country	*1970*	*1971*	*1972*	*1973*	*1974*	*1975*	*1976*	*1977*	*1978*	*1979*	*1980*
Australia											
Fatalities	3 798	3 590	3 422	3 679	3 572	3 694	3 583	3 578	3 705	3 508	3 272
Fatalities per 100 million VKT	4.8	4.4	4.0	4.2	3.9	3.9	3.7	3.6	3.6	3.3	2.9
Austria[a]											
Fatalities	2 238	2 484	2 632	2 469	2 240	2 203	1 903	1 867	1 886	1 901	1 742
Fatalities per 100 million VKT	na	na	na	na	na	6.3	5.2	4.8	5.5	5.3	na
Canada[a]											
Fatalities	5 080	5 573	na	na	na	6 061	5 224	na	na	na	na
Fatalities per 100 million VKT	4.0	4.2	na	na	na	3.5	2.9	na	na	na	na
Denmark											
Fatalities	1 208	1 215	1 116	1 132	774	827	857	828	849	730	690
Fatalities per 100 million VKT	5.0	5.0	4.0	na	na	3.3	3.2	3.0	3.0	2.7	na
France[a]											
Fatalities	15 034	16 061	16 545	15 469	13 420	13 170	13 787	13 104	12 137	12 480	na
Fatalities per 100 million VKT	8.3	8.3	8.0	7.2	6.2	5.4	5.3	5.2	4.6	4.6	na
Germany (Federal Republic)											
Fatalities	19 123	18 685	18 735	16 295	14 061	14 824	14 804	14 960	14 580	13 090	13 041
Fatalities per 100 million VKT	7.1	6.6	6.3	6.0	5.8	5.0	4.7	4.9	4.7	4.0	na

TABLE VIII.1(Cont)—ROAD FATALITIES IN SELECTED COUNTRIES; 1970-80

Country	*1970*	*1971*	*1972*	*1973*	*1974*	*1975*	*1976*	*1977*	*1978*	*1979*	*1980*
Greece[a]											
Fatalities	922	1 003	1 149	1 185	1 154	1 323	1 386	1 513	1 694	1 640	na
Fatalities per 100 million VKT	na	na	na	na	na	8.4	8.1	7.8	7.8	7.5	na
Netherlands											
Fatalities	3 181	3 167	3 264	3 092	2 540	2 321	2 432	2 583	2 294	1 977	1 997
Fatalities per 100 million VKT	5.9	5.6	5.4	4.8	3.9	4.0	4.3	4.4	3.5	na	na
New Zealand											
Fatalities	655	677	713	843	na	628	609	702	654	554	na
Fatalities per 100 million VKT	4.9	4.6	4.5	5.0	na	3.7	3.6	4.2	3.8	na	na
Portugal[a]											
Fatalities	1 417	1 653	1 696	na	na	2 728	2 561	2 198	2 227	na	na
Fatalities per 100 million VKT	17.3	17.9	16.3	na	na	15.4	14.4	11.4	11.3	na	na
Spain[a]											
Fatalities	4 197	4 247	4 453	4 764	4 319	4 487	4 500	4 843	5 359	5 194	na
Fatalities per 100 million VKT	11.3	9.5	9.6	9.6	8.5	7.8	8.0	7.6	7.9	7.4	na
Sweden											
Fatalities	1 307	1 213	1 194	1 177	967	1 172	1 168	1 031	1 034	926	848
Fatalities per 100 million VKT	na	na	na	na	na	na	na	na	na	na	na

TABLE VIII.1(Cont)—ROAD FATALITIES IN SELECTED COUNTRIES; 1970-80

Country	*1970*	*1971*	*1972*	*1973*	*1974*	*1975*	*1976*	*1977*	*1978*	*1979*	*1980*
United Kingdom											
Fatalities	7 499	7 699	7 763	7 410	6 886	6 366	6 570	6 614	6 831	6 327	6 239
Fatalities per 100 million VKT	3.6	3.5	3.4	3.1	2.9	2.6	2.6	2.5	2.5	2.3	na
United States											
Fatalities	53 658	53 746	55 685	55 096	na	45 500	46 430	48 700	51 153	51 088	na
Fatalities per 100 million VKT	3.2	2.8	2.7	2.6	na	2.1	2.0	2.0	2.0	na	na

a. Differs from the 30 day definition of road fatality.

na not available

Sources: International Road Federation (1975 and 1980). Economic Commission for Europe (1975-80).

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ABBREVIATIONS

AADT	Annual Average Daily Traffic
ABS	Australian Bureau of Statistics
AGPS	Australian Government Publishing Service
ARS	Australian Roads Survey
BTE	Bureau of Transport Economics
CBCS	Commonwealth Bureau of Census and Statistics
CBD	Central Business District
CBR	Commonwealth Bureau of Roads
COMVE	Committee on Motor Vehicle Emissions
DHAE	Department of Home Affairs and Environment
DMR	Department of Main Roads
DMT	Department of Motor Transport
LGA	Local Government Authority
MMBW	Melbourne Metropolitan Board of Works
MRD	Main Roads Department
NHMRC	National Health and Medical Research Council
NAASRA	National Association of Australian State Road Authorities
NRMA	National Roads and Motorists' Association
RACQ	Royal Automobile Club Queensland
RACV	Royal Automobile Club Victoria
SRAs	State Road Authorities
SPCC	State Pollution Control Committee
SLGFS	Standardised Local Government Finance Statistics
VKT	Vehicle Kilometres of Travel
WHO	World Health Organisation