Assessment of the Australian Road System: 1984 - Summary Report

Report

The Bureau of Transport Economics (BTE) has recently completed an assessment of the Australian road system covering: recent changes in condition and performance; trends in levels and patterns of funding; economic return on road investment; and likely impacts of alternative levels and patterns of funding.

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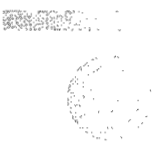
Assessment of the Australian Road System : 1984

Summary Report



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FOREWORD

This Report presents a summary of the results of a study of the Australian road system undertaken by the Bureau of Transport Economics in response to a direction in May 1982 by the then Minister of Transport.

Full details of the study and associated background research work may be found in the documents listed inside the rear cover of this Report.

G.K.R. REID
Director

Bureau of Transport Economics
Canberra
June 1984

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CHAPTER 1—INTRODUCTION

The Bureau of Transport Economics (BTE) has recently completed an assessment of the Australian road system covering:

- recent changes in condition and performance;
- trends in levels and patterns of funding;
- economic return on road investment; and
- likely impacts of alternative levels and patterns of funding.

The assessment continued the series of major road studies by the Commonwealth Bureau of Roads (CBR), which published Reports in 1969, 1973 and 1975; and by the BTE, which published a Report in 1979.

The present study places less emphasis than its predecessors on the identification of an economically warranted expenditure program. More emphasis is placed on describing the road system and its development together with historical funding patterns as a basis for forecasting probable future scenarios. However the economic justification for road investment remains a central theme of the assessment.

The assessment is complementary to that undertaken by the National Association of State Road Authorities (NAASRA) and makes use of much of the same data.

CHAPTER 2—TRENDS AND DEVELOPMENTS

ROAD FINANCE

Total real annual expenditure on roads in Australia rose five-fold from the end of the Second World War to a peak in 1975–76 at some $2800 million (1981–82 values), see Figure 2.1. There was a slight decline in expenditure from then until 1981–82, before the Australian Bicentennial Road Development (ABRD) and Jobs on Local Roads (JOLORS) programs reversed the trend. Also contained in Figure 2.1 is a curve showing the number of vehicles on register over the period 1956-57 to 1980–81. The rapid increase in annual expenditure on roads in the fifties and sixties parallelled the increase in vehicle numbers, which has continued through the seventies.

Commonwealth expenditure on roads declined in real terms over the whole period from 1972–73 to 1981–82. ABRD and JOLORS programs are expected to restore real expenditure in 1983–84 to a level slightly below that of 1972–73, see Figure 2.2.

The same figure shows that State government expenditure on roads declined from 1972–73 to 1975–76, recovered to peak in 1978–79 before declining by 1981–82 to a level very close to that of 1972–73.

Roads expenditure by local government rose to a peak in 1975–76 and then declined by 1981–82 to a level just above that of 1972–73. The introduction of Personal Income Tax Sharing (PITS) grants to local government in 1975–76 appears to have had no long term impact on roads expenditure.

Over the period 1972–73 to 1981–82 expenditure on roads as a proportion of total expenditure fell for all levels of government. For the Commonwealth the fall was from 3.06 to 1.75 per cent, for State governments from 6.72 to 4.68 per cent and for local government from 34.13 to 25.41 per cent. These falls appear to reflect a change in relative priority attached to roads by all levels of government.

State Government expenditure on roads per motor vehicle on register fell over the decade in all States, Figure 2.3, although revenue from road users grew throughout the period. Local government expenditure per head of population remained approximately constant over the decade, Figure 2.4, while overall revenue continued to rise. Figures 2.3 and 2.4 show the large differences between States in respect of road expenditure, which have been sustained over a long period.

Commonwealth funds for roads are drawn mainly from consolidated revenue, but the ABRD program is funded from a levy of two cents per litre on road fuels. In the past State funds for roads have been raised primarily by direct charges on vehicle ownership and use, but, more recently, greater reliance has been placed on fuel franchise schemes in all States except Queensland. In New South Wales loan funds have become an important source of road funds, amounting to almost 30 per cent of expenditure in 1980–81.

Expenditure on routine maintenance grew over the decade from 26 per cent of the total to 35 per cent. In the context of these financial records the term 'maintenance' excludes major works of rehabilitation and reconstruction, which are classified as 'construction', and so understates the proportion of expenditure applied to maintaining the existing road system to its planned physical standard.

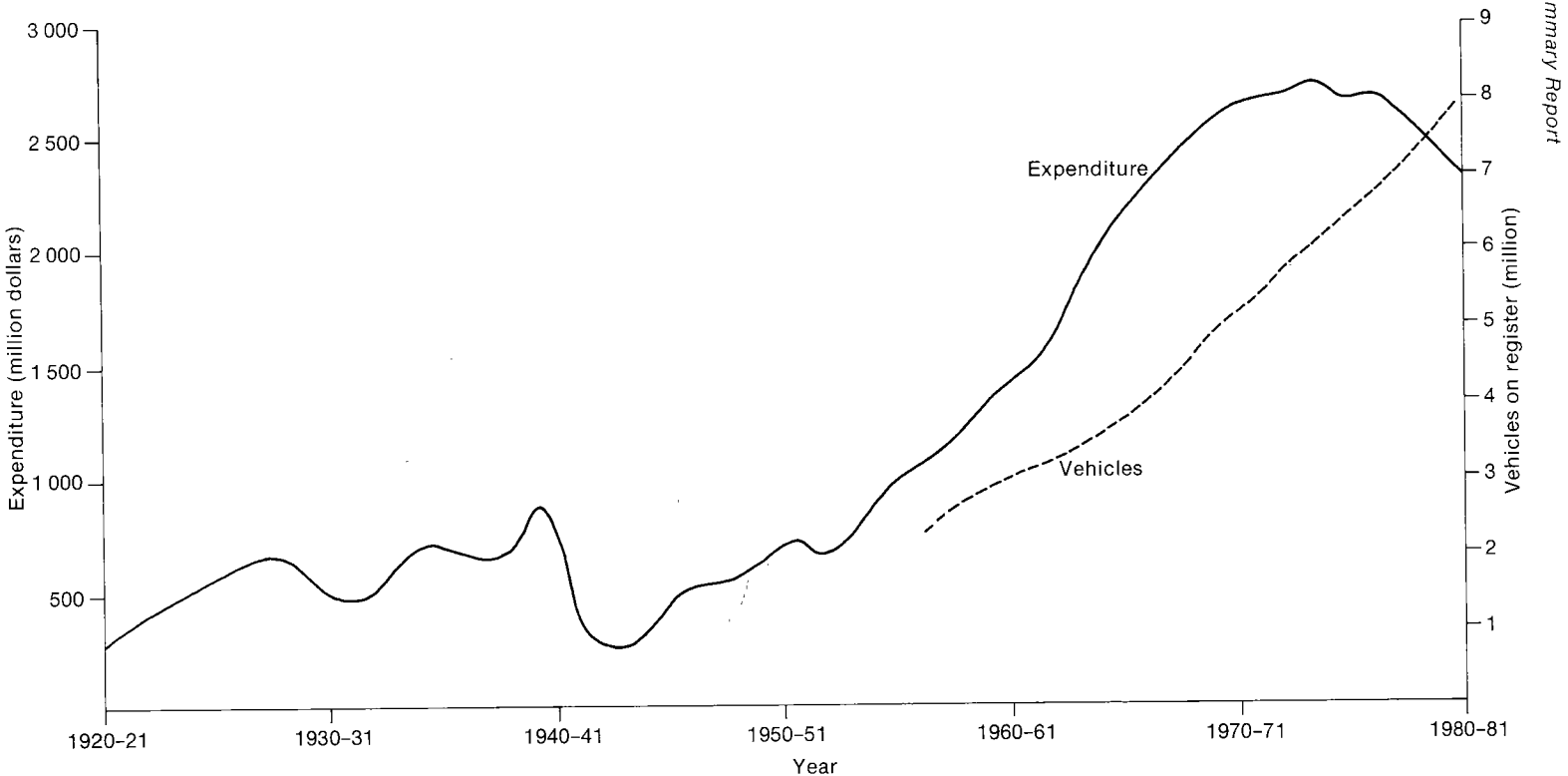


Figure 2.1—Total annual expenditure on roads in Australia, 1920–21 to 1980–81 (constant 1981–82 values) and number of vehicles on register 1955–56 to 1980–81

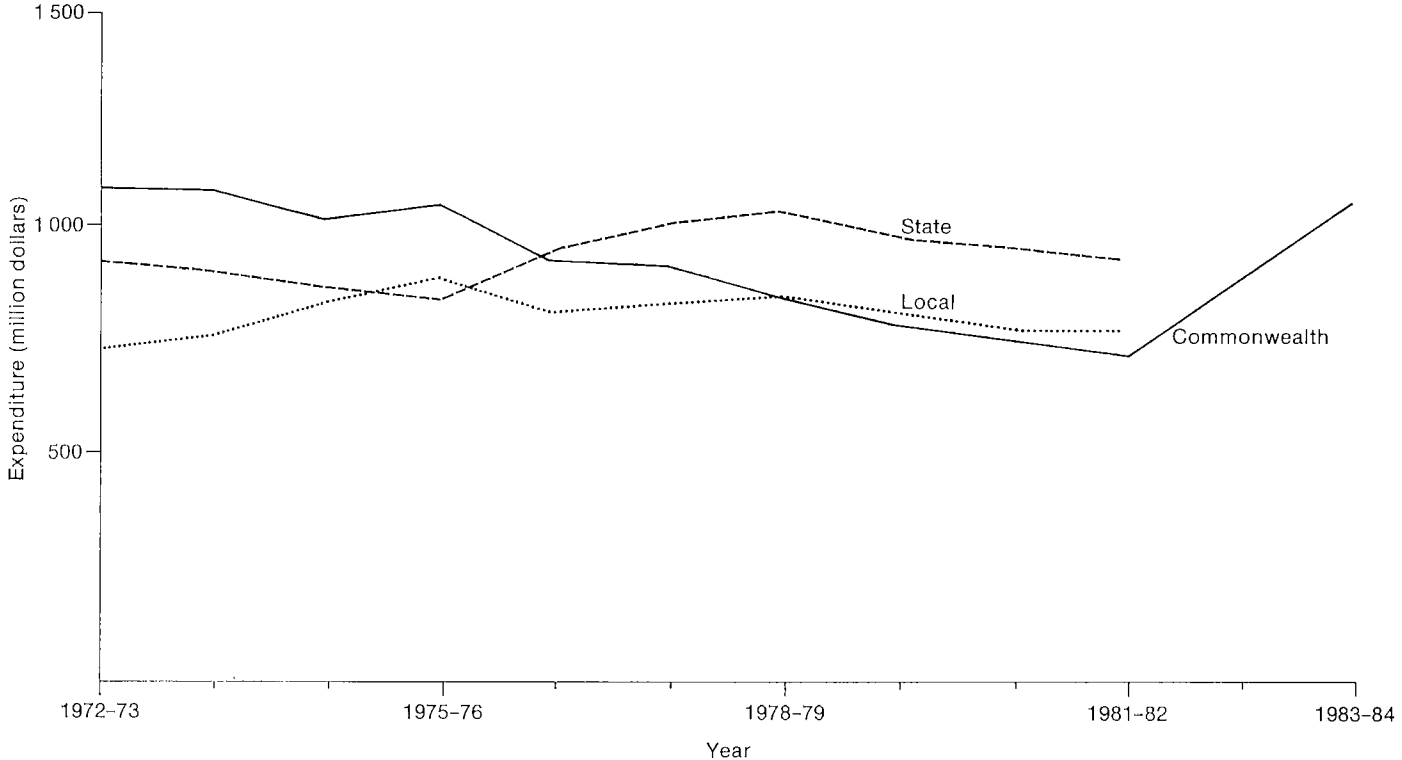


Figure 2.2—Commonwealth, State and local government annual expenditure on roads, 1972–73 to 1983–84 (constant 1981–82 values)

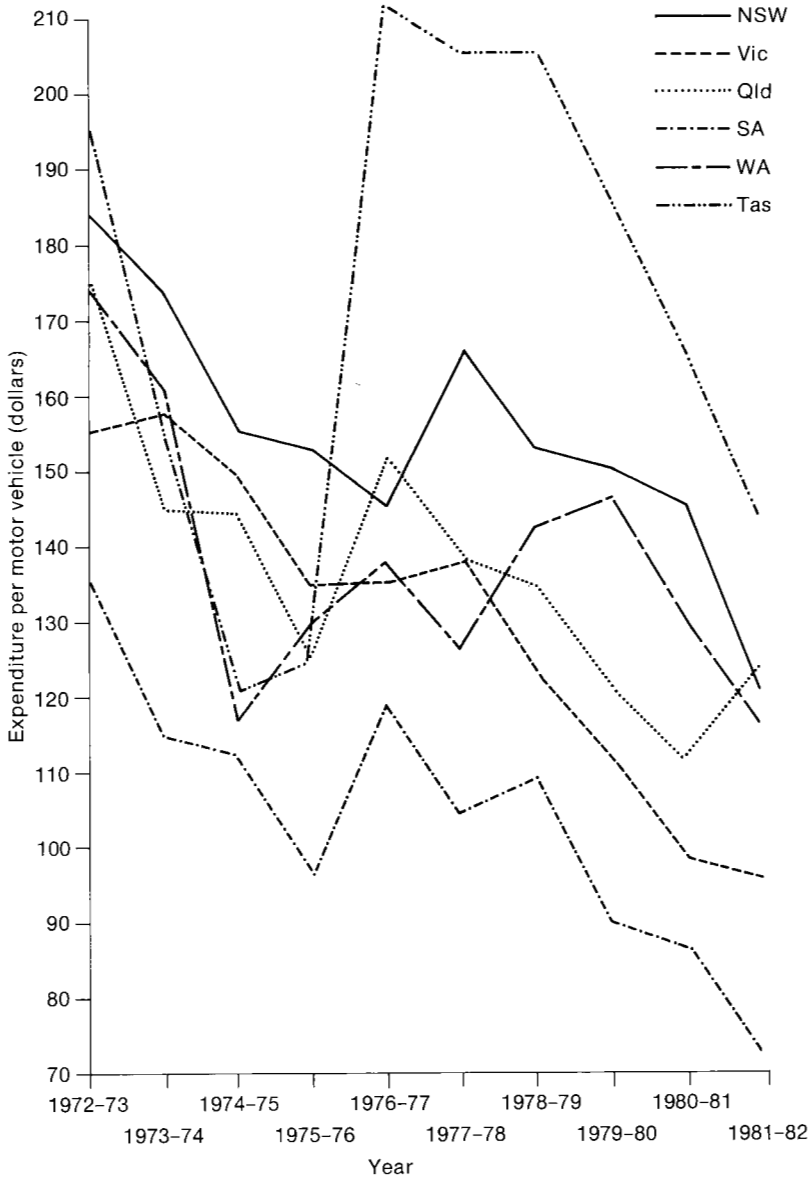


Figure 2.3—State expenditure on roads per motor vehicle on register, 1972–73 to 1981–82 (constant 1981–82 values)

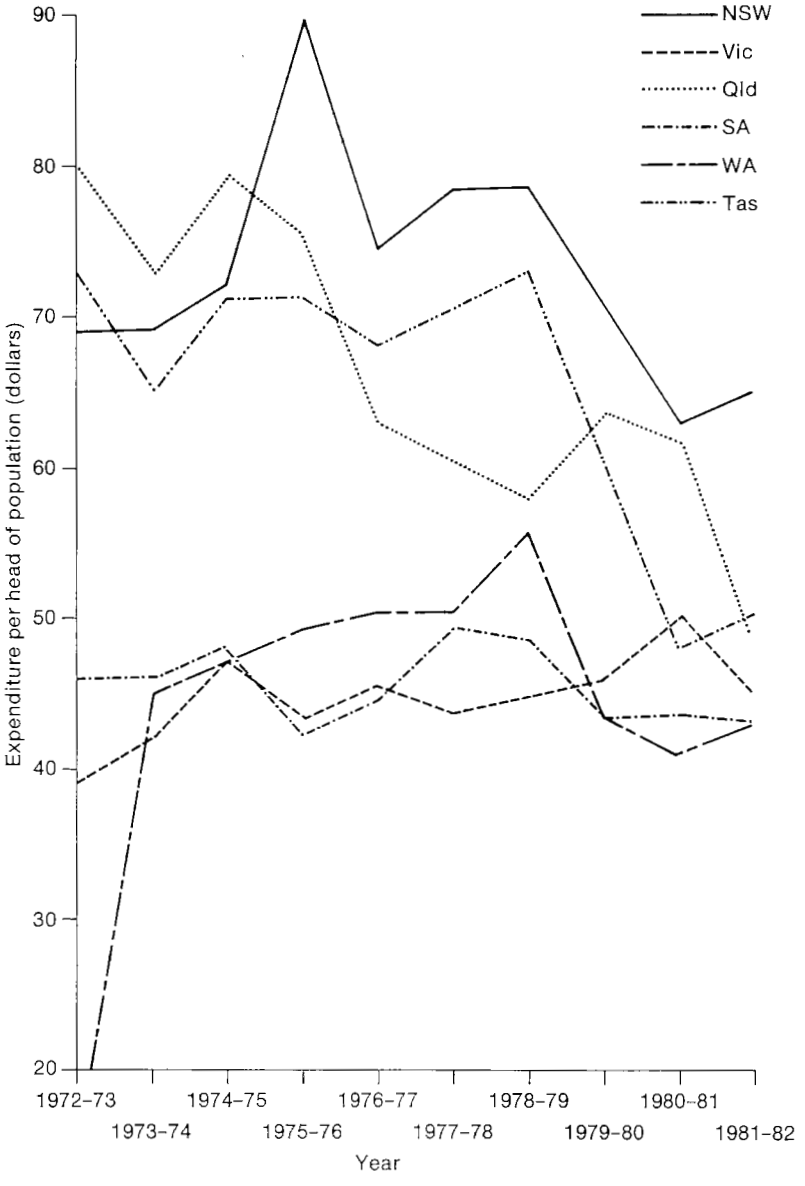


Figure 2.4—Local government expenditure on roads per head of population, 1972–73 to 1981–82 (constant 1981–82 values)

ROAD TRAFFIC

Since the Second World War the number of vehicles in Australia has grown at a rate well above that for population, Figure 2.5. At the same time, Surveys of Motor Vehicle Usage (SMVU), conducted over the last decade by the Australian Bureau of Statistics (ABS), show continuing growth in total vehicle kilometres of travel, Figure 2.6. This growth continued in spite of recent large fuel price increases, suggesting a strong commitment to road transport.

Australians have developed a lifestyle based on the personal mobility provided by the motor car. This, in turn, has produced a workforce with great mobility so that

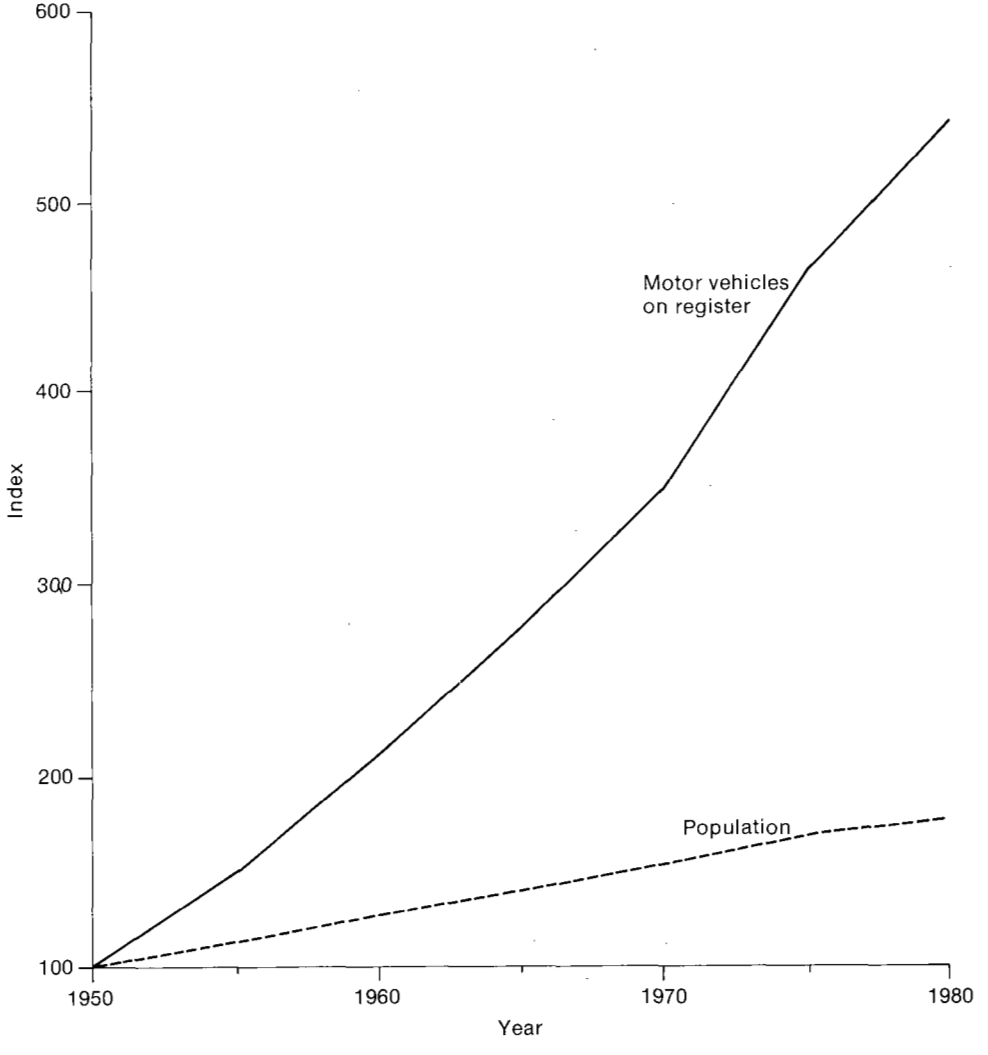


Figure 2.5—Index of growth in population and registered vehicles, 1950–80

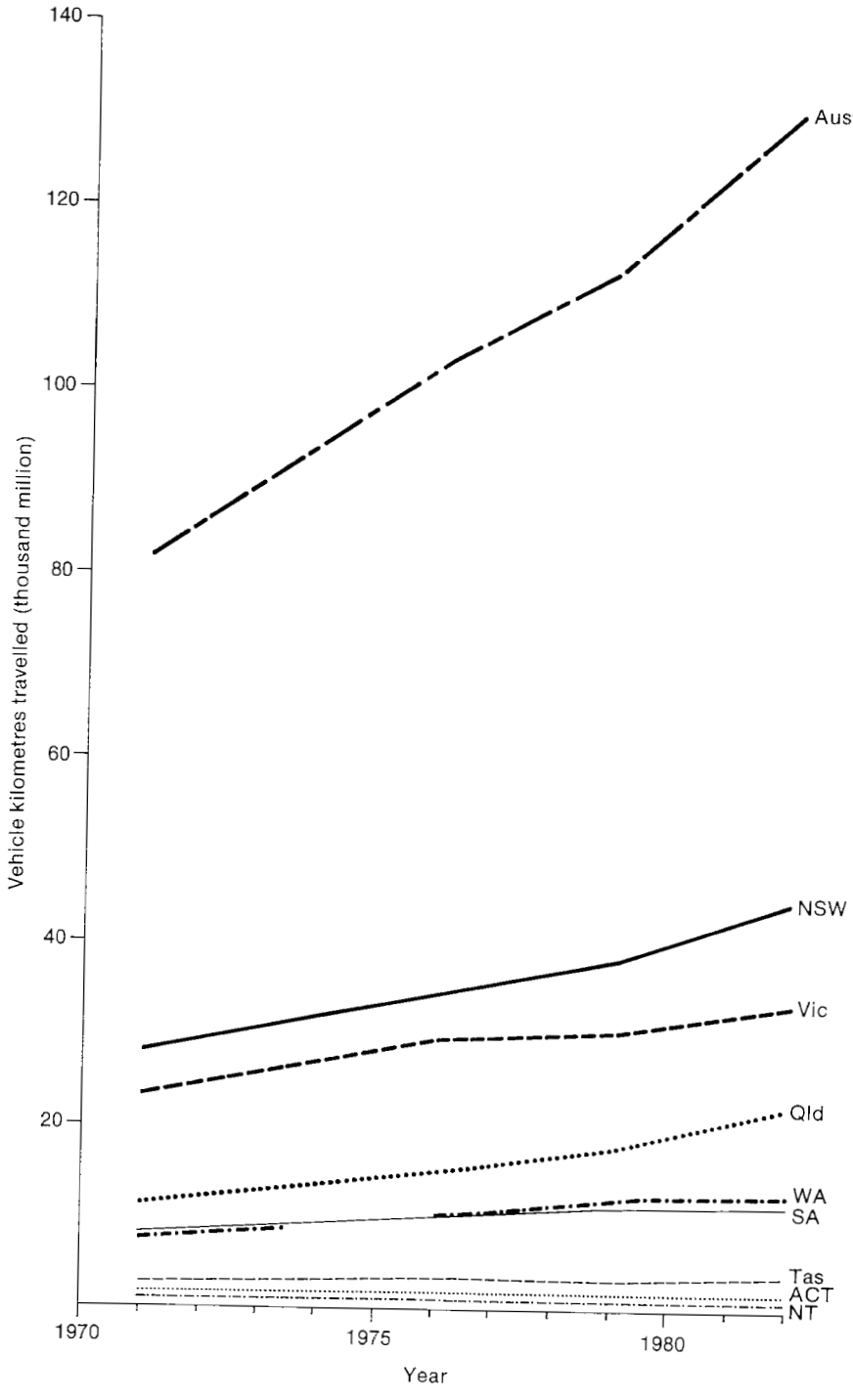


Figure 2.6—Annual VKT on Australian roads, 1971–82

decentralisation of employment has become a reality in large urban centres. This has made public transport less competitive so that an increasing proportion of metropolitan journeys to work are by private car. On the freight side, the road transport industry has continued to hold and increase its competitive edge over rail transport for general goods in almost all circumstances.

There are no signs that these conditions will change in the immediate future and continuing strong growth in road traffic appears certain.

ROAD CONDITIONS

The high annual expenditure on roads in Australia over recent years has produced a rapid rise in general standards.

The increasing proportion of road length sealed is shown in Figure 2.7. By 1981 approximately 32 per cent of the almost 800 000 kilometres of road in Australia had been sealed. This included almost all urban roads, 77 per cent of rural arterial roads and 19 per cent of rural local roads. Generally speaking by 1981 unsealed roads were limited to those carrying very low traffic volumes.

Taken together, the sealed road system of national highways and rural arterial roads

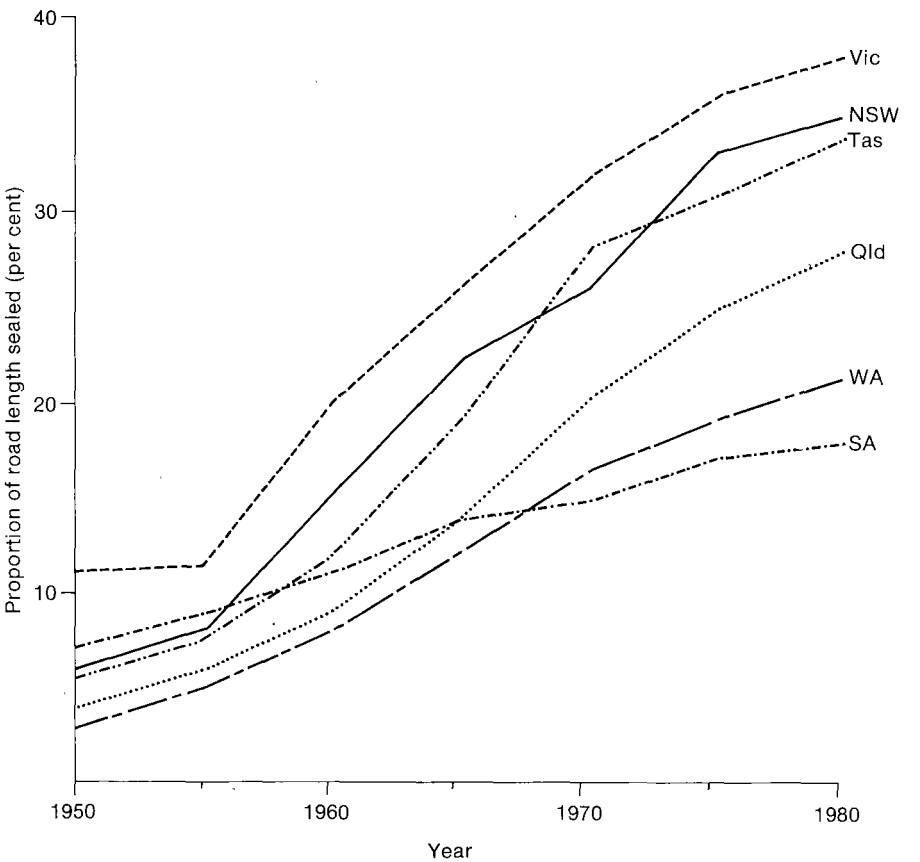


Figure 2.7—Proportion of road length in each State sealed, 1950–80

now serves a large majority of population centres. Only in the Northern Territory, Western Australia and Queensland are a significant proportion of communities of 200 or more people not connected to the sealed road network (72 per cent, 11 per cent and 11 per cent respectively). Even in those States absolute numbers of such communities are low, being 13, 11 and 17 respectively.

Travelling conditions on national highways improved significantly between 1972–73 and 1981–82. Physical improvements (sealing, widening, realignment, duplication, etc) were reflected in reduced travel times and fatal accident rates.

Travel conditions on rural arterial roads showed similar overall improvements with reductions in both travel times and accident rates. In addition, Figure 2.8 shows that a much greater proportion of travel took place on higher standard roads in 1981–82 than in 1972–73.

Changes in conditions on urban arterial roads are less clear cut. Traffic volumes on urban arterial roads continued to increase throughout the decade with Sydney exhibiting the highest total traffic per lane of arterial road. Of the smaller State capital cities Adelaide and Perth appear to have a slightly lower loading than does Brisbane.

Improvements to the urban arterial road system during the decade appear to have been just about sufficient to maintain existing levels of service in the smaller capital cities, while Sydney and Melbourne appear to have experienced some 'spreading' of the peak traffic conditions and diversion of arterial traffic to local roads appears to be a growing problem. Accident statistics (available for the second half of the decade) show a downward trend in fatal accidents per vehicle kilometre for urban areas as a whole. The use of traffic management methods (ranging from parking bans to linked, computer controlled traffic signals) has undoubtedly had a strong impact, but these solutions appear to be reaching their limit in many areas.

Because of their primary role as access and feeder links, local roads generally carry much lower traffic volumes than do arterial roads. In some cases, however, local roads serve as de facto arterials, carrying much more than purely local traffic. A survey of rural local government authorities revealed a belief that about 2.5 per cent of rural local roads should be reclassified as arterial. No equivalent survey has been made of urban local government, but 1981 data reveals that some 2 per cent of urban local roads carried over 1000 vehicles per day. A number of such roads would be among the group which must, because of network characteristics, operate as sub-arterials, but the relatively high percentage does imply that a significant number of residential streets are carrying over 1500 vehicles per day which is usually regarded as the acceptable upper limit.

Most problems associated with local roads tend to be area-specific in nature, although they may exhibit some generic characteristics. In the case of rural local roads problems tend to be associated with the use of heavy vehicles on lightly constructed roads. This can lead to major physical road damage especially after periods of wet weather. On the other hand, problems in urban areas tend to be the result of high traffic volumes and associated safety questions. The concern over safety tends to be related to either the presence of heavy vehicles in general traffic of moderate to high volume (for example the Wollongong coal trucks), or to overspill of high traffic volumes from congested arterial roads onto local streets.

In recent years steps have been taken to tackle the latter problem by the application of Local Area Traffic Management (LATM) measures. In the long term, however, this problem can only be resolved by improving the traffic flow on the offending arterial road, thus removing the problem at source.

A statistical analysis of roads in local government areas revealed a high degree of consistency in the supply of roads in areas with similar demographic and socio-economic characteristics. In only about 8 per cent of areas was the road system found to be significantly different from that applying to the majority of areas with

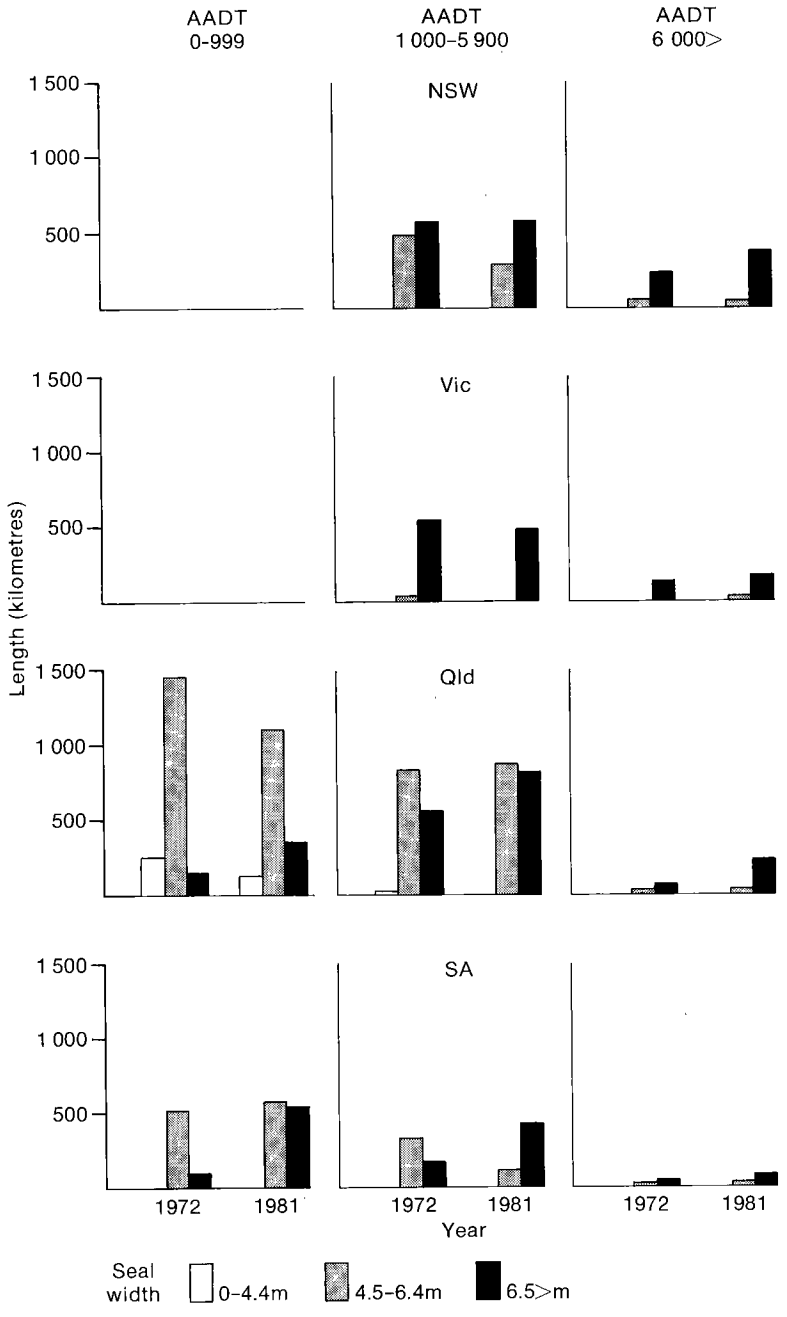


Figure 2.8—Length of seal width by AADT distribution for rural arterial roads, 1972 and 1981

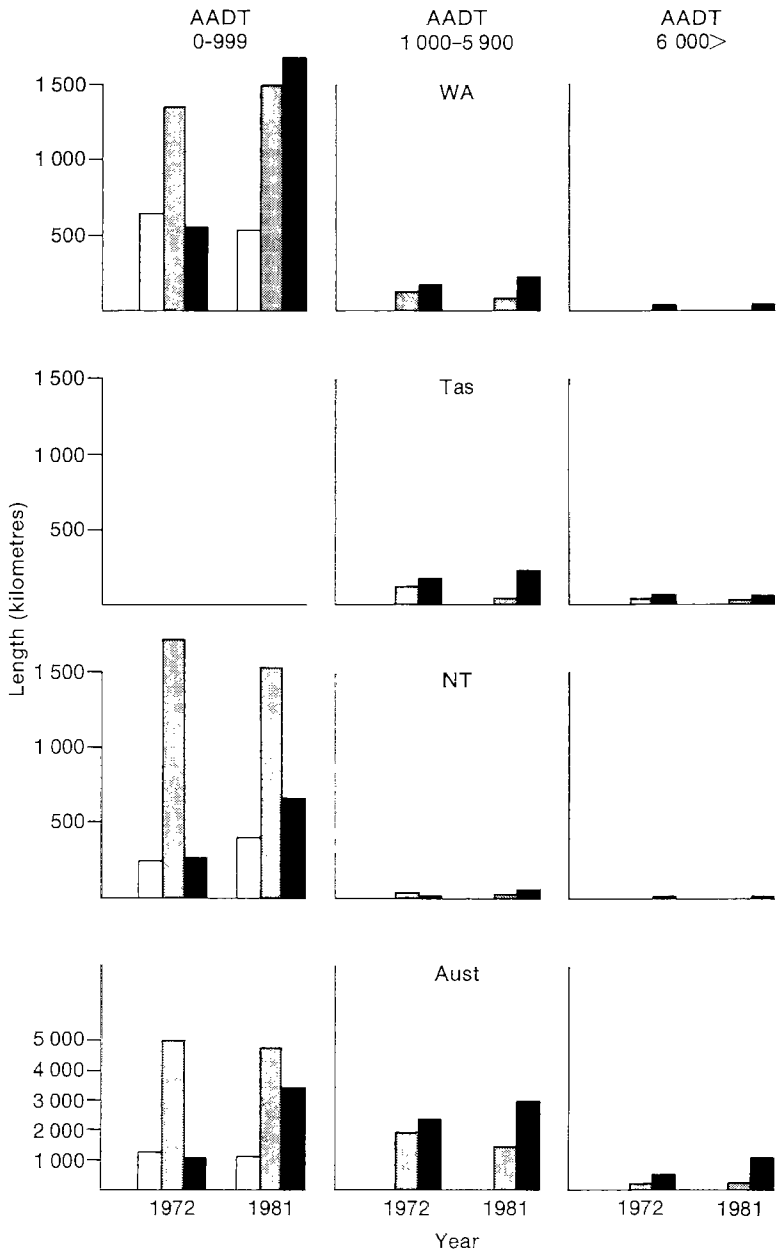


Figure 2.8(Cont)—Length of seal width by AADT distribution for rural arterial roads, 1972 and 1981

similar characteristics. Most of the differences appear to stem from fairly rapid changes in circumstances (development of new resources, amalgamation of small properties, overspill from metropolitan areas, etc) which would not be matched by relatively slow adjustments to the road system. Changes to the road system must, of necessity, be relatively slow, but existing institutional structures tend to inhibit changes in the pattern of distribution of funds which exacerbates the problem. The existing formulae for the distribution of roads funds seem not to provide a satisfactory mechanism for response to changing circumstances.

A very limited survey of public opinion revealed no major general issues of widespread concern. A majority of people interviewed regarded roads in general as 'good' except in the case of rural local roads, which were regarded as sub-standard. This seems to reflect the fact that a certain minimum physical standard for roads is regarded as appropriate to the day and age, and that rural local roads have not reached that standard. The lack of all-weather capability is the main concern about rural roads, whereas high traffic volumes and safety (especially child safety) are the primary concerns of urban dwellers.

CHAPTER 3—ECONOMICS OF ROAD INVESTMENT

Previous roads reports have focussed almost exclusively on the question of economic efficiency as measured by benefit cost analysis. In practice, however, the provision of roads appears to have been directed towards two sets of objectives:

- the provision of a basic infrastructure to a (gradually rising) *socially acceptable standard;* and
- improvement of the basic system to provide an *economically justified level of service.*

The provision of the basic infrastructure is founded in equity considerations, with each citizen, wherever he may be, entitled to a basic road link to serve his needs. What is considered appropriate varies with location and has never been explicitly defined, but it is implicit in the actions of governments and road building authorities. Such considerations apply only in the case of low traffic roads, since, once traffic volume rises significantly standards may be applied which reflect economic warrant and often produce a level of service above the basic social standard. This does not alter the fact, however, that some roads have been built to a standard well above the basic level without economic warrant. The rapid extension of seal on low volume roads in the sixties and seventies is a good example of this.

A useful perspective on particular road investments may be obtained from Figure 3.1. This shows the notional 'toll' which would have to be imposed on traffic if costs were to be recovered directly from users. For example, if $20 000 per kilometre was spent on sealing a road carrying 300 vehicles per day the notional toll would be 1.0 cent per vehicle kilometre. If the same expenditure was made on a road carrying 50 vehicles per day the toll would be near to 8.0 cents per vehicle kilometre.

Benefit cost ratios (BCRs) for typical road upgrading projects were calculated for different initial traffic volumes and growth rates, for high and low cost projects and for high and low discount rates.

Overall this analysis tends to support the broad criteria adopted by road construction authorities for identifying sub-standard levels of service. For example, sealing of roads at about 120 vehicles per day, widening narrow two lane roads at about 1000 vehicles per day and adding additional lanes as traffic rises above 5000 vehicles per day all appear to provide a positive economic return. In practice it does appear that in many cases the addition of lanes or duplication of roads tends to be delayed until traffic volumes are considerably higher than 5000 vehicles per day with the result that BCRs for such projects tend to be very high when they are finally undertaken. The high unit cost of such works and constraints on the geographical distribution of funds seem to have a bearing on this matter.

In most instances the upgrading actually increases the overall long term maintenance cost to the constructing authority, but this is outweighed by the benefits to road users in the form of reduced travel time, reduced vehicle operating costs and reduced accident costs. Thus in most instances the notional toll represents a useful way of judging the total value of a project.

The exception of this is the case of sealing a previously unsealed road. The cost of maintaining an unsealed road increases rapidly at high traffic volumes (above about 140 vehicles per day) and so significant benefits accrue to the construction

authority when a high volume unsealed road is sealed. At low traffic volumes (below about 80 vehicles per day), however, an unsealed road has a lower long term maintenance cost than a sealed road once resealing costs are taken into account. This explains the problems faced by some local government authorities who sealed roads at low traffic volumes and find that long term maintenance costs are higher than for unsealed roads. This difficulty is aggravated by the fact that maintenance costs for sealed roads are more 'lumpy' in nature and cannot be spread over time as easily as can maintenance costs for unsealed roads.

Evaluation of a sample of road expenditure programs for rural arterial roads over the period 1985-90 produced the distribution of BCRs shown in Figures 3.2, 3.3 and 3.4. The strongly bi-modal distributions for Victoria and Queensland shown in Figure 3.4 make clear the dangers in using average BCR as a basis for interstate

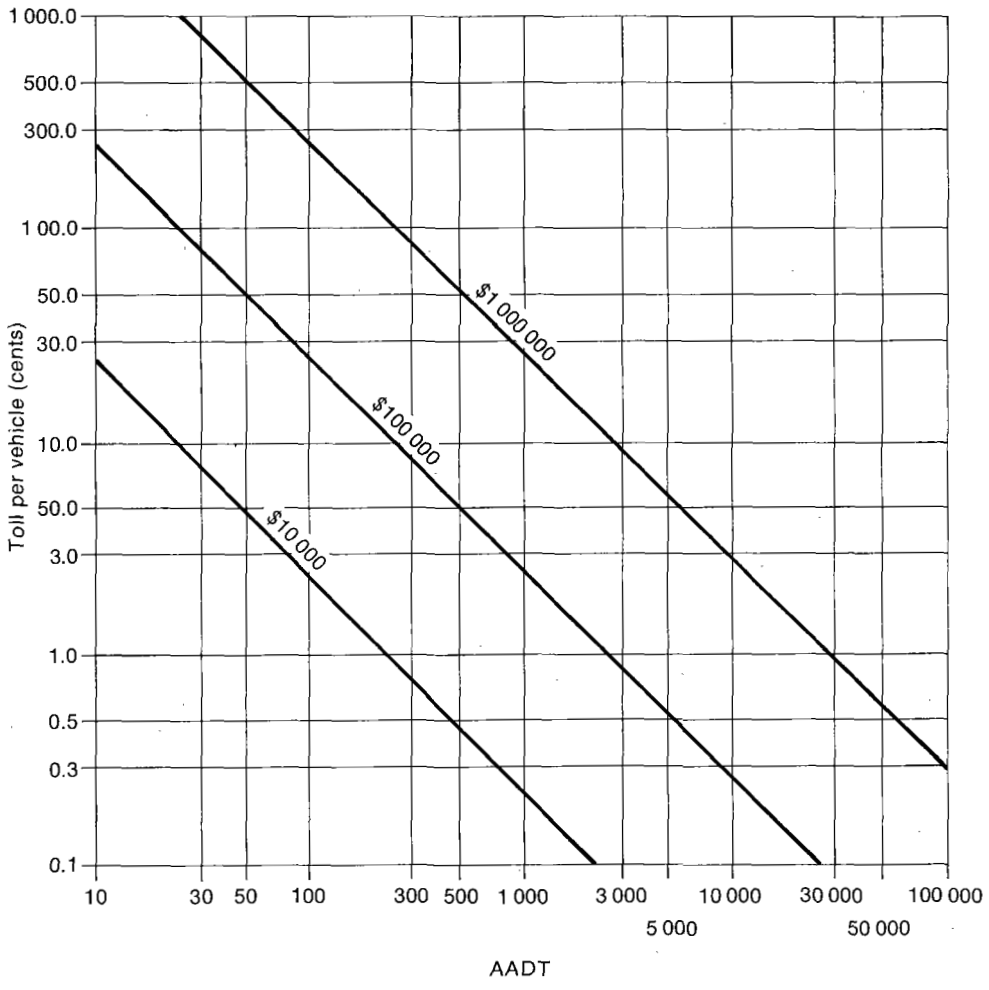
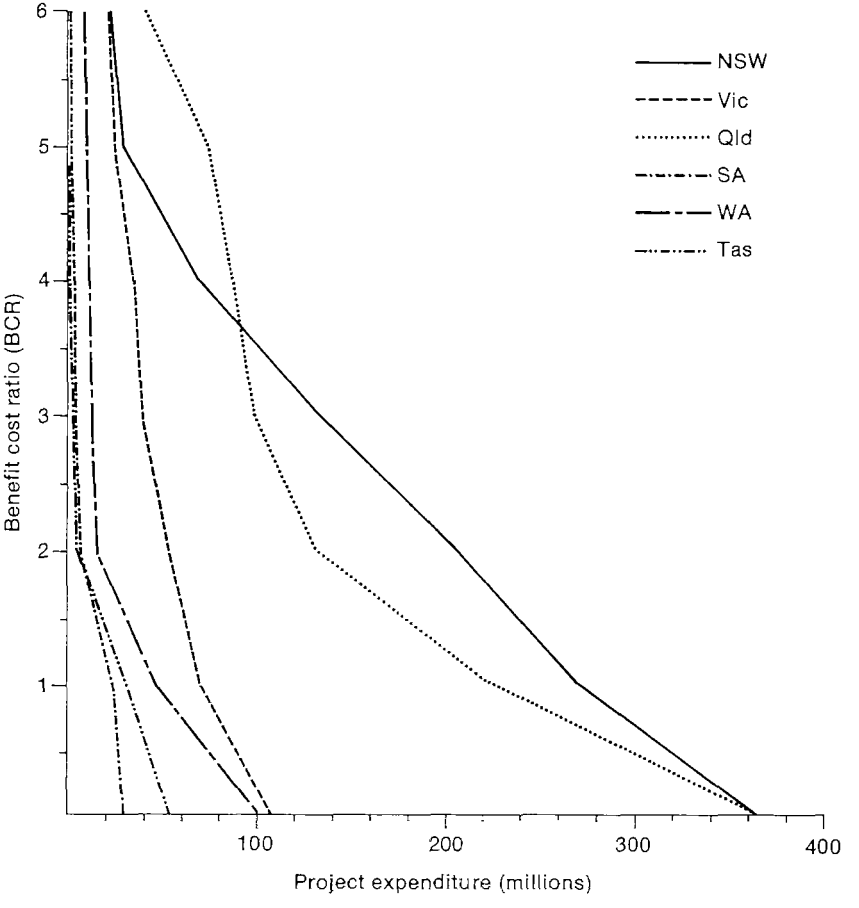


Figure 3.1—Notional toll per vehicle for different capital investments

comparisons. In those two States a few projects with very high BCRs have a strong influence on the average. In some cases the projects showing very high returns are on roads which may be more appropriately assessed as urban rather than rural.

In these cases the application of rural road criteria, especially vehicle speed, may be inappropriate. However, another factor which may help produce programs with some projects exhibiting very high BCRs is the setting of assessment standards at high traffic volumes for projects involving additional traffic lanes. For the case where assessment standards were set to produce expenditure levels approximately equal to current expenditure and work programs similar to current programs, the criteria for developing projects to seal unsealed roads were set at much lower traffic levels in Victoria and Queensland than in New South Wales, while the criteria for developing projects to add lanes to existing sealed roads were set at much higher

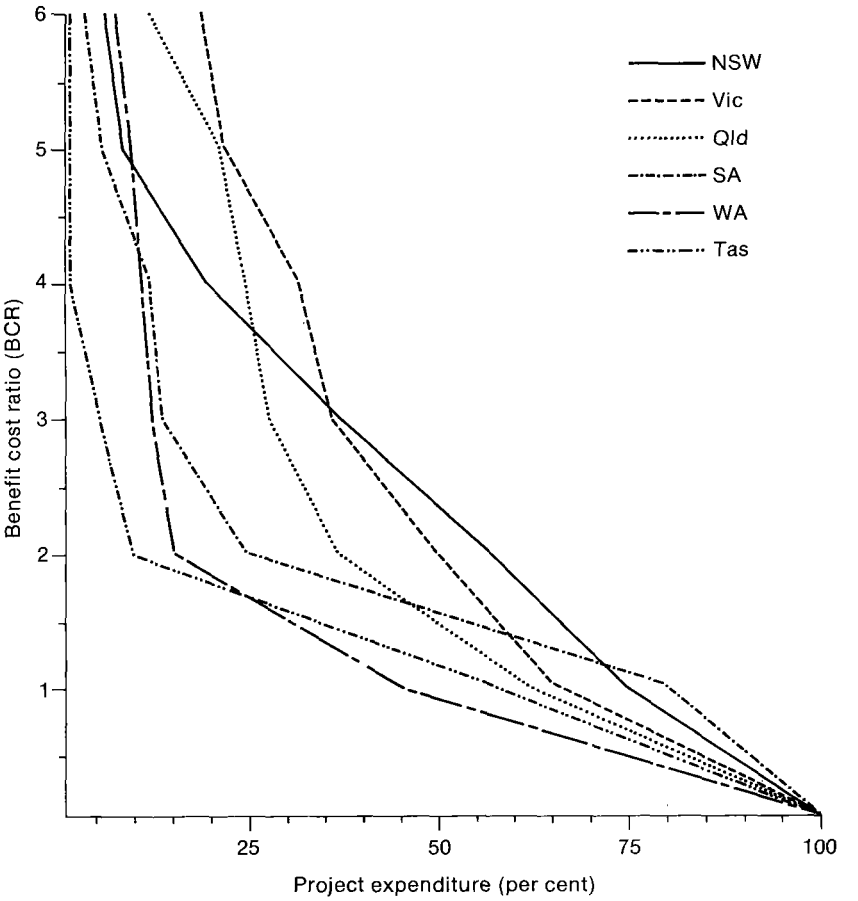


Notes: 1. Cumulative project expenditure. 1985-86 to 1989-90 in 1980-81 prices (million dollars).
2. The expenditure at each BCR value is the cumulative expenditure for all projects with a BCR greater than the given BCR value.

Figure 3.2—Distribution of BCR by total program expenditure 1985-90, all States (F100 standards, 7 per cent pa discount rate)

traffic levels in the former two States. This means that road sealing projects were generated in Victoria and Queensland showing a low BCR while addition of lanes on high volume roads were delayed and, when finally generated, gave very high BCRs.

The application of different standards for different funding levels produces a different mix of projects in each case. This reflects the fact that, in practice, projects are not undertaken primarily in order of descending BCR, but rather on the basis of a number of different criteria. Thus as funds are reduced it is possible for projects with high BCRs to be eliminated, while as funds are increased projects with quite low BCRs may be added to the program. Overall this has the effect that average BCRs change little as funding levels are altered. The use of assessment standards



Notes: 1. *Cumulative project expenditure, 1985–86 to 1989–90 in 1980–81 prices (per cent).*
2. The expenditure at each BCR value is the cumulative expenditure for all projects with a BCR greater than the given BCR value.

Figure 3.3—Distribution of BCR by proportion of program expenditure 1985–90, all States (F100 standards, 7 per cent pa discount rate)

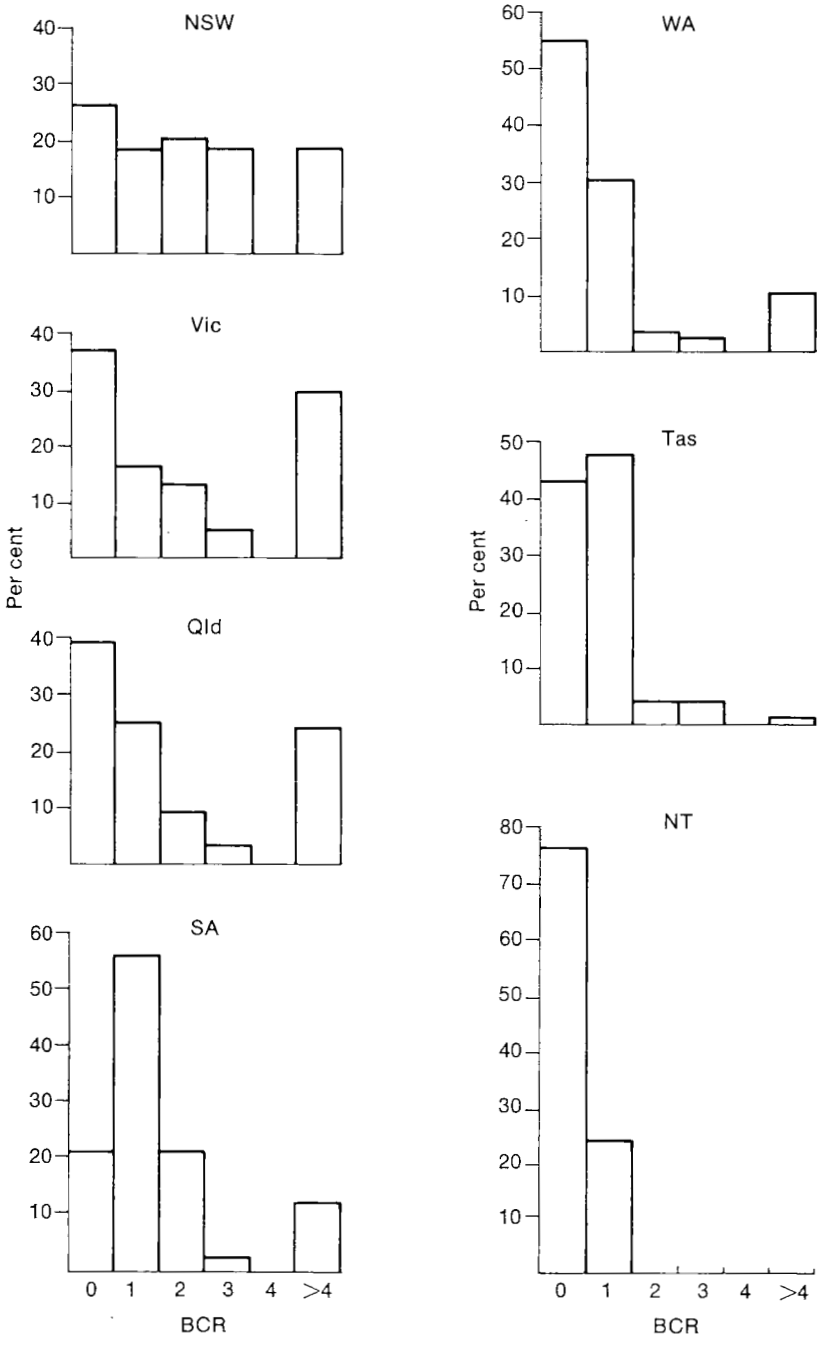


Figure 3.4—Distribution of expenditure by BCR for rural arterial roads, 1985-90 (F100 standards, 7 per cent pa discount rate)

based more heavily on BCRs generated by different project types would produce a higher economic return on road investment.

Overall a higher economic return could be expected if a greater proportion of funds were assigned to rural arterial roads in New South Wales, Queensland and Victoria than has been the case in the past. This reflects the higher traffic volumes in the two most populous States, and the rapid growth in traffic in Queensland combined with a less well developed existing system. Some change in expenditure patterns in this direction has occurred in the last few years, but the change has been slow.

Investment in national highway development shows a very mixed economic return. Instances of high returns (BCRs greater than two) are balanced by projects with very low returns (BCRs less than one half). The standards applying in the latter case can be justified only on the grounds of national prestige, or other non-economic, criteria. No single type of project provides consistently high or low BCRs. Duplication projects in the vicinity of Sydney, Melbourne, Brisbane and Albury-Wondonga all show high returns as do similar projects in the Sydney-Goulburn and Burnie-Launceston corridors. However, duplication projects near Adelaide, Darwin and Rockhampton produce low BCRs, as do similar projects between Yass and Albury and in northern Victoria.

National highway reconstruction and widening projects in the vicinity of Perth, and in the Melbourne-Sydney, Sydney-Brisbane, Adelaide-Melbourne, Launceston-Hobart and Rockhampton-Cairns corridors all produce high returns. However, in the sparsely populated areas of northern Western Australia, Northern Territory and Western Queensland upgrading to even the lowest national highway standards produce BCRs less than one.

In the case of urban arterial roads analysis suggests that additional funding applied to Sydney or Brisbane would produce the highest economic return. Upgrading in urban areas is a high cost operation and the magnitude of individual projects seems to have inhibited some activity in the past. The introduction of ABRD funds has had a beneficial effect in this regard, and further development of arrangements for funding very large individual projects would seem to be desirable in the case of urban arterial roads.

Overall, investment in local roads tends to produce a lower economic return simply because traffic volumes are lower than for arterial roads. In many cases the provision of local roads is based on the current view of appropriate standards. The basic criteria for upgrading which are applied in the case of arterial roads could equally well be applied to local roads, but this is rarely done in practice.

Overall spending on roadworks in Australia is expected to approach $3000 million in 1983–84. However, private expenditure on new vehicles alone is expected to reach $6000 million while a similar amount is expected to be spent on fuel. If private motoring costs of some 14 per cent of household expenditure are added to commercial vehicle operating costs, it is clear that quite a small unit operating cost saving can produce high overall benefits. Hence good economic returns can still be obtained from selected road investments.

CHAPTER 4—FUTURE DEVELOPMENTS

Traffic volumes on Australian roads are expected to continue to rise throughout the remainder of this century. Traffic projections were made, based on high and low growth in economic factors judged to influence vehicle numbers and usage, and the results are shown in Figure 4.1. The high growth scenario assumes a strong and continuing economic recovery and would produce a vehicle ownership rate for Australia in the year 2000 close to that currently experienced in parts of the United States of America. For the purpose of assessing road conditions to 1990, however, it would seem prudent to assume a growth rate slightly above the low growth scenario, that is, a growth similar to that in the latter part of the 1970s. This would involve an overall growth rate of about 3 per cent per annum with higher rates in New South Wales, Queensland and Western Australia and lower rates in Victoria, South Australia and Tasmania. By 1990 this growth rate would produce an annual vehicle travel of over 161 thousand million kilometres compared with just over 127 thousand million in 1982.

Traffic growth is unlikely to be spread evenly across the country and it is probable that the greatest strain will be placed on roads in the inner areas of major cities, in the north coastal regions of New South Wales, on the Gold Coast and in the mid-north coast region of Queensland, and in the Pilbara area of Western Australia.

If existing trends in road funding patterns continue, the total expenditure on roads is likely to fall somewhat following the profile shown in Figure 4.2. The expenditure profile in Figure 4.2 is based on a number of assumptions. Firstly it is assumed that the ABRD revenue will continue at two cents per litre and that the program will end in 1988–89 when the present legislation expires. Similarly it is assumed that the JOLOR program will cease in 1984–85. The ABRD Act requires State Governments to maintain their own funding at levels based on the five years preceding the introduction of ABRD and it is assumed that those levels are maintained. It is assumed also that Commonwealth expenditure under the next Roads Grants Act and local government road expenditure will continue to decline in accordance with the trends established prior to 1981–82. Finally, it is assumed that road construction and maintenance costs will continue to increase at about 10 per cent per annum.

Clearly a change in any of those assumptions would produce a change in the expenditure profile shown in Figure 4.2 but changes sufficient to produce a major variation in overall expenditure level seem unlikely to occur.

Given this overall expenditure profile and assuming that there are no significant changes in distribution among States and road categories, expenditure patterns, by work type, over the period 1985–90 may be estimated.

If expenditure is split between restorative and improvement work, where the former involves work aimed at physically maintaining roads to a given standard while the latter involves upgrading to a higher standard, then the expected expenditure pattern, by road category, would be as shown in Table 4.1

Only in Western Australia is overall expenditure on improvement projected to be greater than on restorative roadworks. In New South Wales, Victoria, Queensland and Western Australia expenditure on improving national highways is projected to exceed restorative expenditure. In all States urban arterial improvement expenditure is likely to exceed restorative work as long as ABRD is in force. Overall the proportion

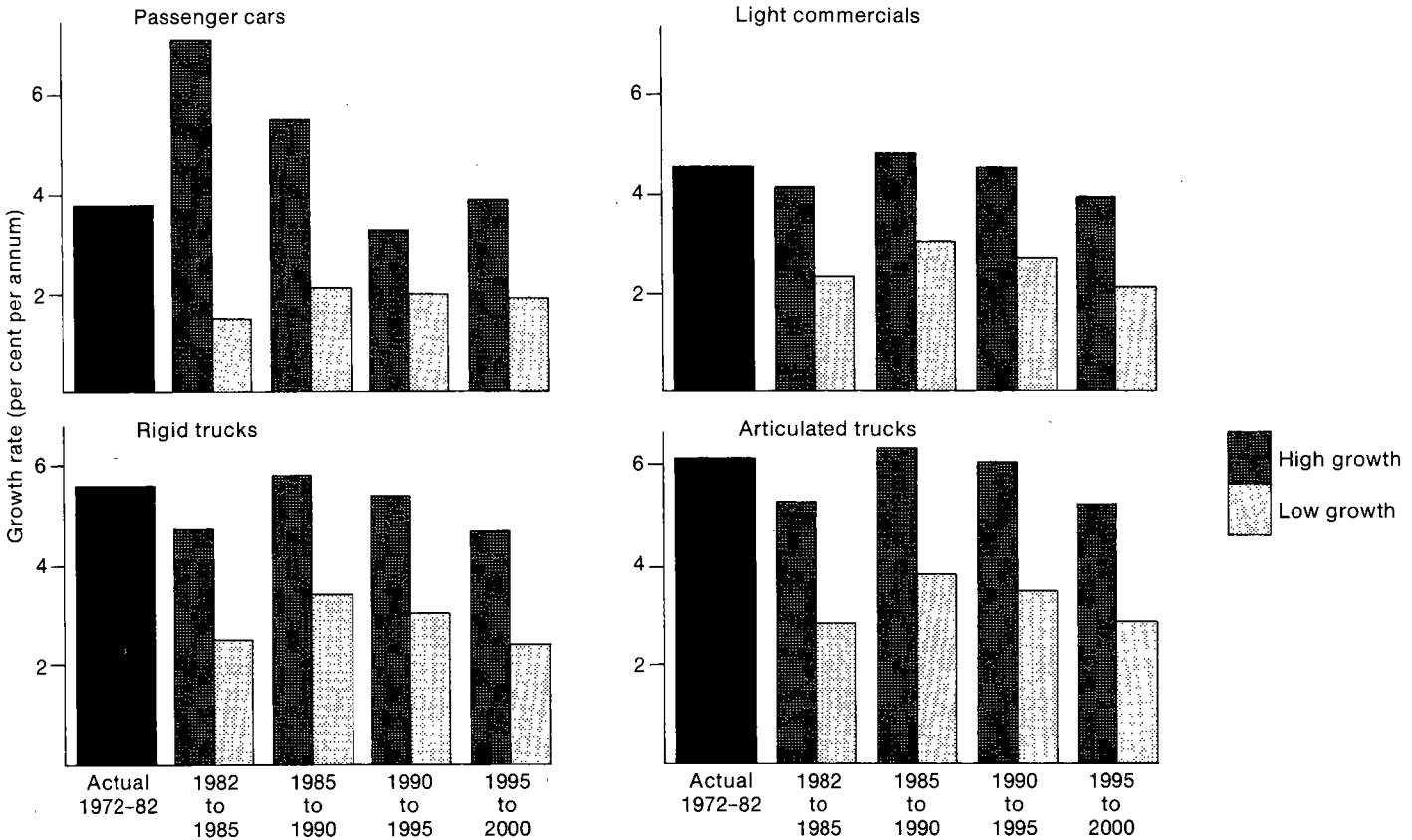


Figure 4.1—Projected total VKT growth rates for passenger cars, light commercial vehicles, rigid trucks and articulated trucks, 1985–2000

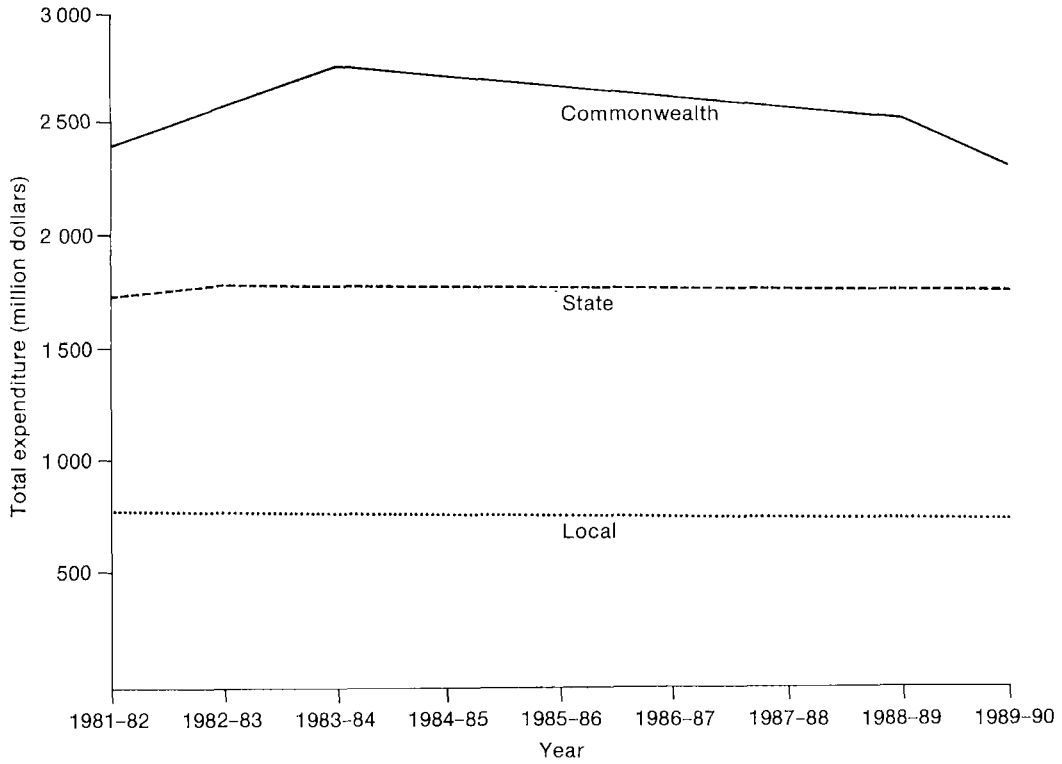


Figure 4.2—Projected annual roads expenditure 1981–82 to 1989–90 (constant 1981–82 values)

TABLE 4.1—ANTICIPATED DIVISION OF EXPENDITURE BETWEEN RESTORATION AND IMPROVEMENT PROJECTS; 1985–90

(per cent)

	Expenditure split	
Road category	*Restoration*	*Improvement*
National highway	40	60
Rural arterial	67	33
Rural local	51	49
Urban arterial	46	54
Urban local	56	44
All	53	47

of expenditure on improvement is projected to fall as the total expenditure falls.

Funding at this level and with existing distribution patterns would be expected to improve the level of service provided by national highways. For rural arterial roads existing levels of service would probably be just about maintained as increased traffic would generally tend to offset physical improvements. In both cases the level of service in Queensland would continue to lag behind that in other States.

Rural local roads would continue to be improved at this funding level. However, without some significant re-allocation of resources between geographical regions serious localised problems may develop. The existing formulae for fund distribution seem unable to cope with relatively rapid changes in circumstances.

Improvement in urban local roads would be expected to continue at this funding level. Local problems in large urban areas caused by diversion of arterial traffic onto local roads may be expected to increase unless a greater share of resources is applied to urban arterial road projects.

With the projected level of funding, levels of service on urban arterial roads are expected to fall and greater pressures will then be placed on the urban local road system. The very high cost of urban arterial road upgrading projects means that large expenditures are required to produce relatively small changes on the ground.

Overall, it is clear that increased levels of expenditure on roads is economically justified in that it could produce relatively high economic returns (BCRs greater than two). However, there is no certainty of this outcome because of non-economic factors which enter into road program development. Some redistribution of existing resources, in the direction of putting greater weight on traffic volume as a basis for project/program selection, would increase the returns obtained. However, such redistribution is constrained by institutional rigidities which tend to inhibit changes in proportions of funds allocated among States, categories, divisions, local government areas and projects.

Although Commonwealth funding plays a substantial part in the development and maintenance of the Australian road system; only in the case of national highways does the Commonwealth exercise control over standards and programs. Overall it would seem more efficient for the Commonwealth to concentrate its efforts on development of the national highways system and, perhaps, on the funding of major projects which show high social and economic returns but which are often difficult to fund under current arrangements.