## BTE Publication Summary

## Assessment of the Australian Road System: Summary Report

### Report

This Report provides a summary of the assessment of the status of the Australian Road System. Roads are divided into the categories recognised by Commonwealth road funding legislation: National Highways (16050 kilometres); rural arterials (89600 kilometres); urban arterials (15400 kilometres); local roads (677400 kilometres).







# Assessment of the Australian Road System: 1987

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Summary Report

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#### CHAPTER 1 INTRODUCTION

The Bureau of Transport Economics (BTE) has recently completed an assessment of the Australian road system. The assessment is the sixth in a series of road studies of which the first was undertaken by the Commonwealth Bureau of Roads (CBR) in 1969. Reports of subsequent studies were published by the CBR in 1973 and 1975 and by the BTE in 1979 and 1984.

While these studies have been wide-ranging, their primary purpose has been to estimate the overall funding needs of Australian roads as an aid to determining the appropriate level of the Commonwealth contribution to those needs. At present, Commonwealth road funding is provided under two sets of legislation, the Australian Bicentennial Road Development (ABRD) program which was originally scheduled to end in December 1988, and the Australian Land Transport Program (ALTP) which continues until June 1990. The ABRD program has, in fact, been extended for a further five years, but the detailed arrangements have yet to be announced. New funding provisions will, therefore, be required after 1988, and the assessment period for the current study has accordingly been set at 1989 to 2000.

Early studies in the series sought to determine road funding requirements on the basis of a fairly strict and uniform application of economic analysis to all road categories. The later studies have recognised limitations in this approach and have adopted more flexible procedures which take account, in particular, of the basic functional differences between the road categories. The methods used in the current study represent a further step in the development of these procedures.

This document provides an overview of the Assessment of the Australian Road System: 1987 and summarises its main findings. Unless otherwise noted, all funding levels are given in 1985-86 prices.

#### CHAPTER 2 AUSTRALIAN LAND TRANSPORT

Railways (infrastructure and operations)

Total

The significance of roads for land transport and the economy as a whole can be appreciated by considering some aggregate figures for the size and nature of the land transport task and the resources devoted to it. Table 2.1 shows expenditure on the main components of the land transport task.

1980-81 (CURRENT PRICES	5)	,
Type of provision	(\$ million)	(per cent)
Roads and bridges	3 099	18
Road transport services	6 033	35
Private transport	5 026	29

3 087

17 245

TABLE 2.1	ANNUAL (	COST	OF F	PROVISION	OF	LAND	TRANSPORT:	AUSTRALIA,
	1980-81	(CUR	RENT	PRICES)				

Total expenditure on road transport accounts for over 80 per cent of all resources devoted to land transport but, of this, less than one quarter is required for the provision of roads and bridges. This allocation of resources can be compared with the broad measures of the size and nature of the land transport task given in Table 2.2.

While road is clearly dominant as far as passenger travel is concerned, the modal split appears equal for freight. In fact, the figures are deceptive. Approximately 87 per cent of rail freight is accounted for by bulk freight, leaving only 13 per cent or 9500 million tonne-kilometres of general freight. On the other hand, general freight accounts for well over 50 per cent (or over 37 000 million tonne-kilometres) of total road freight.

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Mode	Passen	ger	Freight			
	(million person- kilometres)	(per cent)	(million tonne- kilometres)	(per cent)		
Road	217 000	97.4	74 300	50.3		
Rail	5 900	2.6	73 400	49.7		
Total	222 900	100.0	147 700	100.0		

TABLE	2.2	LAND	TRANSPORT	ACTIVITY:	AUSTRALIA,	1984-85

For the most part, general freight will consist of higher value commodities and require better levels of service (in terms of speed, frequency and reliability) than bulk freight. If, therefore, attention is focussed on the transport of passengers and the higher valued general freight, road is again found to be the dominant mode. Seen in this light, the crucial importance of roads for the national economy is apparent.

#### CHAPTER 3 STATUS OF THE ROAD SYSTEM, 1989

For the purposes of Commonwealth road funding legislation, Australian roads are divided into four categories:

- National Highways;
- rural arterial roads;
- urban arterial roads; and
- local roads, which, for assessment purposes, are usually further divided into rural and urban local roads.

The status of the road system at the start of the assessment period in 1989 will depend on the road works undertaken in the period to that year. For National Highways, these were assumed to be given by the projected works programs. As such programs were not available for rural arterials, a synthetic works program was generated for the period to 1989 in the same way as was done for the assessment period after 1989.

Figure 3.1 shows the National Highway system and Table 3.1 gives some basic information about the road categories. The relative traffic intensities and the proportion sealed reflect the different functions performed by each road category.

#### NATIONAL HIGHWAYS

Traffic intensity is not uniform throughout the system. Figure 3.2 shows the distribution of road length by traffic volume and road type for the National Highway system. The Commonwealth specifies uniform design and construction standards for new work on National Highways. Existing sections which have not been upgraded since the declaration of the National Highway system in 1974 may not, therefore, meet the new standards. In Figure 3.2, the seal width standard of seven metres per two lane carriageway (3.5 metres per lane) is used to specify the road types. As would be expected, dual carriageways (four lanes) are provided primarily for high traffic volumes and, as most of these have



Figure 3.1 The National Highway

Road category	Len (kilometr	gth es)	Proportion sealed (per cent)	Relative traffic intensity <sup>6</sup>
National Highways	16	054	99.5	25
Rural arterials	89	725	81.3	9
Urban arterials	15 3	385	100.0	200
Rural locals	634	200	19.0	1
Urban locals	43 2	200	91.2	18

TABLE 3.1 ROAD LENGTHS, PROPORTION SEALED AND TRAFFIC INTENSITY: AUSTRALIA, 1989

a. Traffic intensity is total travel (vehicle-kilometres per year) divided by total road length (kilometres) for each category.

#### Chapter 3

been constructed since 1974, there is very little substandard four lane road present. By contrast, there is a substantial proportion of substandard two lane road (46 per cent of total length). It should be emphasised that the fact that a road does not meet the specified width standard does not necessarily mean that it provides inadequate service. The majority of the substandard two lane National Highway caters to traffic volumes of fewer than 1000 vehicles per day, at which level a narrower seal may be perfectly adequate. However, a small proportion of this substandard two lane National Highway is carrying many thousands of vehicles per day - and will consequently have a high upgrading priority.

#### RURAL ARTERIALS

Similar information is provided in Figure 3.3 for rural arterial roads, where the boundary between narrow and wide two lane roads occurs at a seal width of 6.5 metres. Significant mismatches between traffic volumes and road provision are evident in the 4300 kilometres of unsealed road carrying more than 100 vehicles per day, and in the 13 000 kilometres of wide two lane road carrying fewer than 1000 vehicles per day.

#### URBAN ARTERIALS

The primary concern on urban arterial roads is high traffic levels, but precise assessment is complicated by the facts that:

- traffic carrying capacity is a function of the road network and its interconnections, and not only the nature of individual links; and
- . there is a strong interaction between road capacity and land use.

In inner urban areas, there has been a gradual stabilisation of network capacity, as the scope for capacity increases on individual links and further refinement of sophisticated area-wide traffic management systems has become progressively more limited. Furthermore, to the extent that capacity can be increased (or congestion alleviated), land uses may change in such a way as to generate additional traffic which takes advantage of - and eliminates - the reduced congestion. This is not to say that there are no benefits from road improvements in inner urban areas, only that those benefits may be transferred from the road users, for whom congestion levels barely change, to the occupants of the inner urban areas as a whole.



Figure 3.2 Projected distribution of National Highway length by traffic and road type, 1989

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Figure 3.3 Projected distribution of rural arterial length by traffic and road type, 1989

Chapter 3

Three quarters of Australia's population growth is occurring in the capital cities, predominantly in the outer urban areas. This growth generates an increasing need for high capacity arterials, both within and between different parts of the outer urban area, as well as for radial connections to middle and inner urban areas which are still the locations of most employment.

From the point of view of road provision, the situation is much less constrained in outer urban areas and the capacity of the arterial network can be expected to grow in response to increasing traffic demand, both through the upgrading of existing links and the construction of entirely new routes.

#### LOCAL ROADS

Assessment of local roads has always been complicated by the fact that they perform a number of sometimes conflicting functions. The situation is most complex in urban areas where, as well as providing access to properties and connections to the arterial network, local roads also constitute the residential environment. The issue of major concern here is the level of through traffic spilling over from congested arterial roads. Solutions can only be sought on an areawide basis and involve an emphasis on a functional hierarchy of roads. In practice this means increases in arterial capacity (where possible) and local street treatments which, in effect, reduce the through traffic component on local roads.

The situation on rural local roads is altogether different. These roads also provide access to properties but, because distances may be large, they also have some of the characteristics of arterial roads. The principal issue for rural local roads is to justify the expenditure to provide a socially acceptable standard of access and travel for the very low volumes of traffic which use them.

#### CHAPTER 4 FUNDING LEVELS, 1989 TO 2000

While it would obviously be desirable to base decisions on overall road funding levels on clearly stated objectives, the division of responsibility for road funding among the three levels of government has, in the past, made it difficult to articulate, let alone agree on. such objectives. Past funding levels have, therefore, simply been the sum of Commonwealth, State and local government contributions and have not been directed towards any widely understood overall The derivation and assessment of future funding needs, objective. however, can only be done in relation to stated objectives and the Bureau has, therefore, selected what seem to be the most appropriate possible objectives for each of the road categories. It must be borne in mind that, in so far as the adoption of a particular objective represents a departure from past practice, there may be a transition period during which expenditure patterns and project types may not be typical of those in the longer term. In particular, if economic objectives are adopted where they had not previously been considered of great importance, it is to be expected that there would be a backlog of projects with unusually high economic returns to be undertaken during the early years.

#### NATIONAL HIGHWAYS AND RURAL ARTERIALS

Five alternative road funding strategies for the period 1989 to 2000 were examined. Two of the strategies address a conservative objective - the preservation of the current status of the road systems - interpreted in two possible ways. The other three strategies aim to achieve economic efficiency under different budgetary constraints.

#### Preservation of the physical asset

Under this strategy, only the damaging effects of traffic and weather are made good. Each year, road works are undertaken to ensure that the physical state of the road system (as represented by the average roughness of the whole network) remains constant.

#### Preservation of operational performance

In addition to preserving the physical asset, this strategy involves undertaking such upgrading work as may be needed to ensure that the overall level of service does not decline under the impact of traffic growth.

#### Undertake all economically justified road projects

Under this strategy, all road projects showing a positive net benefit, that is, having a benefit-cost ratio greater than one, are undertaken in each year of the assessment period. Because this strategy has not been pursued in the past, there may be a backlog of projects with high benefit-cost ratios which result in high expenditures in the first few years. Expenditure would decline in later years as the backlog is reduced.

#### Maximise economic return for specified annual funding levels

Under this strategy, road projects are undertaken in order of decreasing benefit-cost ratios to the limit of the specified annual budget. Two funding levels are considered:

- upper level constant annual expenditure in real terms to the year 2000 at approximately the level of the current ALTP plus ABRD program; and
- . lower level constant annual expenditure in real terms to the year 2000 at approximately the level of the ALTP alone.

#### Results

Table 4.1 shows the costs for the alternative strategies for Australia as a whole. It must be emphasised that conclusions drawn from these aggregate figures may not apply uniformly in each State.

#### National Highways

Continuation of current funding levels (as represented, approximately, by the upper annual funding limit) is the most costly of the strategies examined. This situation does not apply uniformly to all States; in Queensland, for example, increased funding would be justified.

The conservative strategies of preserving the physical asset or the operational performance are the least costly options. Only in the Northern Territory does the cost of preserving operational performance exceed current funding. The high mean benefit-cost ratios for these strategies (and the full State by State analysis) suggest that higher physical and operational standards would be economically justified in New South Wales, Victoria, Queensland and Tasmania.

(¥ 111 + 1 + 1 )									
	Nat	ional High	ways	Rural arterials					
Strategy	1989- 2000	Annua I <sup>b</sup> average	Mean bcr	1989- 2000	Annual <sup>b</sup> average	Mean bcr			
Preserve physical asset	2 635	240	2.8	10 433	948	1.1			
Preserve operational performance	3 202	291	2.4	11 624	1 058	1.0			
Undertake all economic- ally justified work	4 307	392	1.9	9 685	880	1.1			
Undertake work in decreasing order of economic merit to: Upper annual funding	5 425	494	1.6	8 903	800	1 2			
limit Lower annual funding	5 435	494	1.0	8 802	800	1.3			
limit	3 798	345	2.3	7 922	720	1.4			

#### TABLE 4.1 COSTS AND MEAN BENEFIT-COST RATIOS (BCR) OF ROAD STRATEGIES: NATIONAL HIGHWAYS AND RURAL ARTERIALS, 1989 TO 2000 (CONSTANT 1985-86 PRICES)<sup>a</sup> (\$ million)

a. The costs include expenditure on routine maintenance and bridges which was not included in the economic analysis to which the mean benefit-cost ratios refer.

b. Some strategies necessarily result in expenditure which varies from year to year.

#### Rural arterials

In contrast to the situation on National Highways, the conservative strategies are the most costly on rural arterials and, in particular, are more costly than the strategy of undertaking all economically justified work. It follows that parts of the rural arterial network have been developed to standards which cannot be economically justified for the levels of traffic they carry.

Adoption of the strategy of undertaking all (but only) economically justified work would therefore involve the acceptance of some degree of decline of the physical road system or its operational performance. However, as the funding required for this strategy is above the current level, the rate of decline of the network would be slower than at present.

#### URBAN ARTERIALS

The complexity of the urban situation makes it difficult to relate total funding requirements to alternative strategies in the precise way which was possible for National Highways and rural arterials. The estimate of urban arterial funding needs is based on the current ratio of restorative to upgrading expenditure, and on costings of upgrading projects required to preserve operational performance. On this basis, total funding required for the period 1989 to 2000 is estimated to be \$6980 million, or \$635 million per year.

It should be noted that this is the level of funding required for upgrading to be undertaken according to current schedules established However, about two thirds of the upgrading projects by the States. have been identified as being particularly relevant to the concern as important part of the nation's economic with roads an Specifically, this group of projects comprise urban infrastructure. distributors from the termini of National Highways (described as type A projects) and links to ports, airports and major industrial areas (described as type B projects). If the Commonwealth wished these projects to proceed more rapidly, increased funding would be required.

#### LOCAL ROADS

Assessments of funding needs for local roads have always been hampered by the difficulty of specifying the objectives to be achieved. Narrow economic objectives do not appear to be appropriate, as analyses based on such objectives invariably suggest that much less should be spent on local roads than is actually the case. It would appear that there are large, intangible benefits that are not captured by these analyses. From the Commonwealth's point of view, there is, in addition to the uncertainties about overall objectives, the problem of identifying the goal of Commonwealth involvement in local road funding.

In the absence of clearer objectives, funding strategies are assessed in relation to the rate of sealing of the network. Rate of sealing is selected as one of the few measures for which data are available and whose funding implications can be estimated. It is also a factor which is clearly of interest to local authorities and communities, particularly in rural areas. Currently, new sealing of local roads is proceeding at about 0.30 per cent of their total length per year. Other factors, such as safety, comfort, convenience and accessibility, are undoubtedly of importance on local roads. They have not been separately assessed, but are assumed to improve in line with the rate of sealing. A range of funding strategies, involving different levels and conditions on Commonwealth funds, were assessed. The main results are:

- . At the current funding level (\$1630 million per year, including Commonwealth funding of \$280 million), new sealing proceeds at 0.30 per cent (of total road length) per year and the road system improves gradually.
- A strong overall improvement with double the current rate of new sealing could be achieved if Commonwealth funding were raised from \$280 million to \$770 million (other contributions remaining constant).
- . The result of absorbing Commonwealth funds into general assistance grants would depend on local government priorities. The most likely outcome is little change for urban locals and a \$110 million fall in funding for rural locals. A marginal overall improvement and new sealing at 0.22 per cent per year would still be possible.

#### CHAPTER 5 THE COMMONWEALTH CONTRIBUTION TO ROAD FUNDING

Total requirements for road funding, such as were discussed in Chapter 4, are met by contributions from all three levels of government. Table 5.1 shows average annual road expenditure by road category and level of government for the five years 1980-81 to 1984-85.

TABLE 5.1	AVERAGE ANNUAL	ROAD	EXPENDITURE:	1980-81	ΤO	1984-85
	(CONSTANT 1985-	-86 PR	RICES)			
		(	(\$ million)			

Level of government	National Highways	Rural arterials	Urban arterials	Local roads	Total
Commonwoolth	190	175		250	1 1 4 1
State	489 37	175 549	431	255	1 141
Local	-	-	6	1 106	1 112
Total	526	724	664	1 611	3 525

Options for variations to both the level and distribution among the road categories of the Commonwealth contribution were considered and are presented in Table 5.2. In these considerations, possible responses by State and local governments to changes in Commonwealth funding were not taken into account. These levels of government were assumed to continue the level and pattern of expenditure shown in Table 5.1 *except* that the \$37 million State contribution to National Highways is redirected to the rural arterials.

#### VARIATION TO COMMONWEALTH FUNDING LEVELS

The Commonwealth Government has foreshadowed total Commonwealth road expenditure in 1987-88 of \$1250 million in current prices. This corresponds to \$1084 million in 1985-86 prices and has been adopted as

		Nationa	1 Highways				
Ontion	Funding	Existing	Extonsions	Rural	Urban	Local	Tatal
Ορτιοη	source	EXISTING	Extensions	arteriais	arteriais	roads	TOLAT
1	Commonwealth	392	0	220	287	185	1 084
	State and local	0	0	586	437	1 361	2 384
-	Total	392	0	806	724	1 546	3 468
2	Commonwealth	392	0	255	331	214	1 191
	State and local	0	0	586	437	1 361	2 384
	Total	392	0	841	768	1 575	3 576
3	Commonwealth	392	0	185	242	156	975
	State and local	0	0	586	437	1 361	2 384
	Total	392	0	771	679	1 517	3 359
4	Commonwealth	392	220	0	287	185	1 084
	State and local	0	0	586	437	1 361	2 384
	Total	392	220	586	724	1 546	3 468
5	Commonwealth	392	287	220	-	185	1 084
	State and local	0	0	586	437	1 361	2 384
	Total	392	287	806	437	1 546	3 468
6	Commonwealth	392	507	0	~	185	1 084
	State and local	0	0	586	437	1 361	2 384
	Total	392	507	586	437	1 546	3 468

TABLE 5.2 ALTERNATIVE ROAD FUNDING OPTIONS (CONSTANT 1985-86 PRICES) (\$ million)

the reference level (Option 1) in Table 5.2. Options 2 and 3 illustrate variations of 10 per cent above and below the reference level.

In each of the Options 1, 2 and 3, Commonwealth funding for National Highways is set at the economically justified level discussed in Chapter 4. The balance of Commonwealth funds is then distributed among the road categories in the proportions recommended by the Inquiry into the Distribution of Federal Road Grants. This results, under all three options, in increases for rural and urban arterials but reduced funding for local roads.

#### REDISTRIBUTION OF COMMONWEALTH ROAD FUNDS

Commonwealth involvement in road funding is based on the notion that there are road transport requirements of a specifically national character which might not be taken fully into account in decisions made at the State level. Examples of such requirements are the needs to link the main centres of population, to provide for efficient interstate communications and to ensure that the needs of industry and exports are taken into account. These are clearly requirements for the arterial and National Highway networks. It is somewhat more difficult to identify the specifically national interests on local roads.

One of the features of the current funding arrangements is that they provide for joint responsibility, but make no provision for reaching agreement on joint objectives. In the past, a variety of conditions accompanied Commonwealth road grants but, at present, there are no restrictions on State and local government expenditure from their own resources. The result is that, while the Commonwealth makes substantial contributions to all road categories, it has little influence on the objectives pursued on arterial and local roads. It was, in fact, partly due to these circumstances that the National Highway system was declared in 1974. By accepting essentially full responsibility for the National Higways, the Commonwealth was able to ensure that national objectives were followed on these roads.

The success of the National Highway system has led to suggestions that the pursuit of Commonwealth road objectives might most rapidly be advanced by incorporating the principal urban and rural arterial routes of national and economic significance into an extended National Highway system. The funding needs of such National Highway extensions would be covered by a corresponding reduction in the need for Commonwealth funding to the remaining arterial roads.

Options 4, 5 and 6 in Table 5.2 illustrate limiting cases of the transfer of rural and urban arterial routes to the National Highway system. Overall funding is at the reference level and is unaffected by the transfers. In Option 4, 3750 kilometres of rural arterials linking capital cities, major provincial cities and important regional centres would be transferred to the National Highways. The transfer of the associated funding requirements of \$220 million would constitute a withdrawal of the Commonwealth from rural arterial funding. In Option 5, urban arterial routes with funding requirements of \$287 million would be transferred. This would give the Commonwealth responsibility for all the A and B type projects referred to in Chapter 4. Option 6 combines Options 4 and 5 and represents a complete withdrawal of the Commonwealth from arterial road funding.